Places of Employment

About 20,000 biochemists were employed in 1978. About one-half worked for colleges and universities and about one-fourth for private industry, primarily in companies manufacturing drugs, insecticides, and cosmetics. Some work for nonprofit research institutes and foundations; others, for Federal, State, and local government agencies. Most government biochemists do health and agricultural research for Federal agencies. A few self-employed biochemists are consultants to industry and government.

Training, Other Qualifications, and Advancement

The minimum educational requirement for many beginning jobs as a biochemist, especially in research or teaching, is an advanced degree. A Ph. D. degree is a virtual necessity for persons who hope to contribute significantly to biochemical research and advance to many management and administrative jobs. A bachelor's degree with a major in biochemistry or chemistry, or with a major in biology and a minor in chemistry, may qualify some persons for entry jobs as research assistants or technicians.

About 100 schools award the bachelor's degree in biochemistry, and nearly all colleges and universities offer a major in biology or chemistry. Persons planning careers as biochemists should take undergraduate courses in chemistry, biology, biochemistry, mathematics, and physics.

About 150 colleges and universities offer graduate degrees in biochemistry. Graduate students generally are required to have a bachelor's degree in biochemistry, biology, or chemistry. Many graduate programs emphasize one specialty in biochemistry because of the facilities or the research being done at that particular school. Graduate training requires actual research in addition to advanced science courses, so students should select their schools carefully. For the doctoral degree, the student does intensive research and a thesis in one field of biochemistry.

Persons planning careers as biochemists should be able to work independently or as part of a team. Biochemists should have analytical ability and curiosity, as well as the patience and perseverance needed to complete the hundreds of experiments necessary to solve a single problem. They should also express themselves clearly when writing and speaking to communicate the findings of their research effectively.

Graduates with advanced degrees may begin their careers as teachers or researchers in colleges or universities. In private industry, most begin in research jobs and with experience may advance to positions in which they plan and supervise research.

New graduates with a bachelor's degree usually start work as research assistants or technicians. These jobs in private industry often involve testing and analysis. In the drug industry, for example, research assistants analyze the ingredients of a product to verify and maintain its purity or quality.

Employment Outlook

Job opportunities for biochemists with advanced degrees should be favorable through the 1980's. The employment of biochemists is expected to grow slightly faster than the average for all occupations during this period. Some additional job openings will result each year as biochemists retire, die, or transfer to other occupations.

The anticipated growth in this field should result from the effort to find cures for cancer, heart disease, and other diseases, and from public concern with environmental protection. Colleges and universities may need additional teachers if biochemistry enrollments continue to increase.

Earnings

Average earnings of biochemists were about twice the average for all nonsupervisory workers in private industry, except farming. According to a 1978 survey by the American Chemical Society, salaries for experienced biochemists averaged about $17,000 for those with a bachelor's degree; $21,000 for those with a master's degree; and $28,000 for those with a Ph. D.

Starting salaries of biochemists employed in colleges and universities are comparable to those for other faculty members. (See statement on college and university faculty elsewhere in the *Handbook*.)

Related Occupations

Biochemistry is closely related to biology and chemistry. Medical laboratory workers often use biochemical procedures in their work, and physicians, pharmacists, and other health practitioners need to know a great deal about biochemistry.

Sources of Additional Information

For general information on careers in biochemistry, contact:

American Society of Biological Chemists, 9650 Rockville Pike, Bethesda, Md. 20014.

Life Scientists

(D.O.T. 040.061, except -034, -046, -054 and -058; 041.061 except -026; and 041.261-010)

Nature of the Work

Life scientists, who study all aspects of living organisms, emphasize the relationship of animals and plants to their environment.

About one-third of all life scientists are primarily involved in research and development. Many conduct basic research to increase our knowledge of living organisms which can be applied in medicine, in increasing crop yields, and in improving the natural environment. When working in laboratories, life scientists must be familiar with research techniques and laboratory equipment such as electron microscopes. Knowledge of computers also is useful in conducting experiments. Not all research, however, is performed in laboratories. For example, a botanist who explores the volcanic Alaskan valleys to see what plants grow there also is doing research.

More than one-fifth of all life scientists work in management or administration ranging from planning and administering programs for testing foods and drugs to directing activities at zoos or botanical gardens. About one-fifth teach in colleges or universities; many also do independent research. Some life scientists work as consultants to business firms or to government in their areas of specialization. Others write for technical publications or test and inspect foods, drugs, and other products. Some work in technical sales and services jobs for industrial companies where, for example, they demonstrate the proper use of new chemicals or technical products.

Scientists in many life science areas often call themselves *biologists* (D.O.T. 041.061-030). However, the majority are classified by the type of organism they study or by the specific activity they perform.

Botanists (D.O.T. 041.061-038) deal primarily with plants and their environment. Some study all aspects of plant life, while others work in specific areas such as identifying and classifying plants or studying the structure of plants and plant cells. Other botanists concentrate on causes and cures of plant diseases.

Agronomists (D.O.T. 040.061-010), who are concerned with the mass development of plants, improve the quality and yield of crops, such as corn, wheat, and cotton, by developing new growth methods or by controlling diseases, pests, and weeds. They also analyze soils to determine ways to increase acreage yields and decrease soil erosion. *Horticulturists* (D.O.T. 040.061-038) work with orchard and garden plants such as fruit and nut trees, vegetables, and flowers. They seek to improve plant culture methods for the beautification of communities, homes, parks, and other areas as well as for increasing crop quality and yields.

Zoologists (D.O.T. 041.061-090) study various aspects of animal life—its origin, behavior, and life processes. Some conduct experimental studies with live animals in controlled or natural surroundings while others dissect animals to study the structure of their parts. Zoologists are usually identified by the animal group studied—ornithologists (birds), entomologists (insects), and mammalogists (mammals).

Animal scientists (D.O.T. 040.061-014) do research on the breeding, feeding, and diseases of domestic farm animals. *Veterinarians* (D.O.T. 073-061) study diseases and abnormal functioning in animals. (See statement on veterinarians elsewhere in the *Handbook*.)

Anatomists (D.O.T. 041.061-010) study the structure of organisms, from cell structure to the formation of tissues and organs. Many specialize in human anatomy. Research methods may entail dissections or the use of electron microscopes.

Some life scientists apply their specialized knowledge across a number of areas, and may be classified by the functions performed. *Ecologists*, for example, study the relationship between organisms and their environments, particularly the effects of environmental influences such as rainfall, temperature, and altitude on organisms. For example, ecologists extract samples of plankton (microscopic plants and animals) from bodies of water to determine the effects of pollution, and measure the radioactive content of fish.

Embryologists study the development of an animal from a fertilized egg through the hatching process or gestation period. They investigate the causes of healthy and abnormal development in animals.

Microbiologists (D.O.T. 041.061-058) are life scientists who investigate the growth and characteristics of microscopic organisms such as bacteria, viruses, and molds. They isolate and grow organisms for close examination under a microscope. *Medical microbiologists* are concerned with the relationship between bacteria and disease or the effect of antibiotics on bacteria. Other microbiologists may specialize in soil bacteriology (effect of microorganisms on soil fertility), virology (viruses), or immunology (mechanisms that fight infections).

Physiologists (D.O.T. 041.061-078) study how the various life functions of plants and animals work under normal and abnormal conditions. Physiologists may specialize in functions such as growth, reproduction, respiration, or movement, or in the physiology of a certain body area or system.

Pharmacologists (D.O.T. 041.061-074) and *toxicologists* conduct tests on animals such as rats, guinea pigs, and monkeys to determine the effects of drugs, gases, poisons, dusts, and other substances on the functioning of tissues and organs. Pharmacologists may develop new or improved drugs and medicines.

Pathologists specialize in the effects of diseases, parasites, and insects on human cells, tissues, and organs. Others may investigate genetic variations caused by drugs.

Biochemists and biological oceanographers, who are also life scientists, are included in separate statements elsewhere in the *Handbook*.

Working Conditions

Life scientists generally work regular hours in offices, laboratories, or classrooms and usually are not exposed to unsafe or unhealthy conditions. Some life scientists such as botanists, ecologists, and zoologists may take field trips which may involve strenuous physical labor and primitive living conditions.

Places of Employment

An estimated 215,000 persons worked as life scientists in 1978. Almost 40,000 were agricultural scientists, over 110,000 were biological scientists, and about 65,000 were medical scientists.

Colleges and universities employ nearly three-fifths of all life scientists, in both teaching and research jobs. Medical schools and hospitals also employ large numbers of medical investigators. Sizable numbers of specialists in agronomy, horticulture, animal husbandry, entomology, and related areas work for State agricultural colleges and agricultural experiment stations.

About 15,000 life scientists worked for the Federal Government in 1978. Of these, almost half worked for the Department of Agriculture, with large numbers also in the Department of the Interior and in the National Institutes of Health. State and local governments combined employed about 22,000 life scientists.

Approximately 40,000 life scientists worked in private industry, mostly in the pharmaceutical, industrial chemical, and food processing industries in 1978. About 6,000 worked for nonprofit research organizations and foundations; a few were self-employed.

Life scientists are distributed fairly evenly throughout the United States, but employment is concentrated in some metropolitan areas—for example, nearly 6 percent of all agricultural and biological scientists work in the Washington, D.C., metropolitan area. Life science teachers are concentrated in communities with large universities.

Training, Other Qualifications, and Advancement

Persons seeking a career in the life sciences should plan to obtain an advanced degree. The Ph. D. degree generally is required for college teaching, for independent research, and for many administrative jobs. A master's degree is sufficient for some jobs in applied research and college teaching. A health science degree is necessary for some jobs in medical research. (See section on health occupations elsewhere in the *Handbook*.)

The bachelor's degree is adequate preparation for some beginning jobs, but promotions often are limited for those who hold no higher degree. New graduates with a bachelor's degree can start their careers in testing and inspecting jobs, or become technical sales and service representatives. They also may become advanced technicians, particularly in medical research or, with courses in education, a high school biology teacher. (See statement on secondary school teachers elsewhere in the *Handbook*.)

Most colleges and universities offer life science curriculums. However, different schools may emphasize only certain areas of life science. For example, liberal arts colleges may emphasize the biological sciences, while many State universities and land-grant colleges offer programs in agricultural science.

Students seeking careers in the life sciences should obtain the broadest possible undergraduate background in biology and other sciences. Courses taken should include biology, chemistry, physics, and mathematics.

Many colleges and universities confer advanced degrees in the life sciences. Requirements for advanced degrees usually include field work and laboratory research as well as classroom studies and preparation of a thesis.

Prospective life scientists should be able to work independently or as part of a team and must be able to communicate their findings in clear and concise language, both orally and in writing. Some life scientists, such as those conducting field research in remote areas, must have stamina.

Life scientists who have advanced degrees usually begin in research or teaching jobs. With experience, they may advance to jobs such as supervisors of research programs.

Employment Outlook

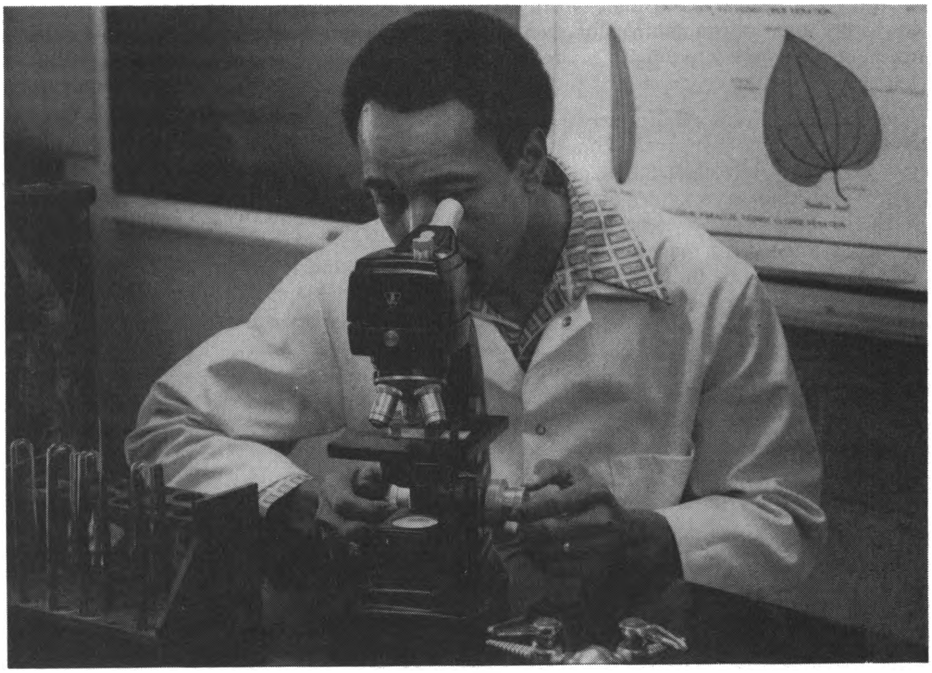
Employment opportunities for life scientists are expected to be good for those with advanced degrees through the 1980's, but those with lesser degrees may experience competition for available jobs. However, a life science degree also is useful for entry to occupations related to life science such as laboratory technology and the health care occupations. Employment in the life sciences is expected to increase faster than the average for all occupations over this period. In addition, job openings will occur as life scientists retire, die, or transfer to other occupations.

Employment in the life sciences is expected to grow as a result of increased attention to preserving the natural environment and a continuing interest in medical research. Employment opportunities in industry and government should grow as environmental research and development increase and new laws and standards protecting the environment are enacted. The Toxic Substances Control Act is creating many new openings for toxicologists and other life scientists who are skilled in testing for cancer-causing substances. Additional life science teachers will be needed if college and university enrollments increase as expected.

Earnings

Life scientists receive relatively high salaries; their average earnings are more than twice those of nonsupervisory workers in private industry, except farming.

According to the College Placement Council surveys, beginning salary offers in private industry in 1978 averaged $11,500 a year for bachelor's degree recipients in



Life scientists study living organisms and their life processes.

agricultural science and $12,400 a year for bachelor's degree recipients in biological science.

In the Federal Government in 1979, life scientists having a bachelor's degree could begin at $10,507 or $13,014 a year, depending on their college records. Life scientists having the master's degree could start at $13,014 or $15,920, depending on their academic records or work experience. Those having the Ph. D. degree could begin at $19,263 or $23,087 a year. Agricultural and biological scientists in the Federal Government averaged $23,800 a year.

Salaries paid to college and university life science teachers are comparable to those paid to other faculty members. (See statement on college and university faculty elsewhere in the *Handbook.)* Life scientists who have the M.D. degree generally earn more than other life scientists but less than physicians in private practice.

Related Occupations

Many occupations are related in some way to life science since they deal with living organisms. These occupations include the conservation occupations of forester, forestry technician, range mananger and soil conservationist, as well as biochemist, soil scientist, oceanographer, and life science technician. The wide array of health occupations are all related to life science, as are occupations dealing with raising plants and animals such as farmer and farm worker, florist, and nursery worker.

Sources of Additional Information

General information on careers in the life sciences is available from:

American Institute of Biological Sciences, 1401 Wilson Boulevard, Arlington, Va. 22209.

American Society for Horticultural Science, 70 North Saint Asaph St., Alexandria, Va. 22314.

American Physiological Society, Education Office, 9650 Rockville Pike, Bethesda, Md. 20014.

Information on Federal job opportunities is available from State Employment Service offices or from U.S. Office of Personnel Management area offices or Federal Job Information Centers located in various large cities throughout the country.

Soil Scientists

(D.O.T. 040.061-058)

Nature of the Work

Soil scientists study the physical, chemical, biological, and behavioral characteristics of soils, one of our most valuable resources. After investigating the soil at various places within an area and analyzing samples in the laboratory, the soil scientist prepares a map, usually based on aerial photographs, which shows soil types throughout the area as well as landscape features, such as streams or hills, and physical features, such as roads.

Because different types of soil are better suited for some uses than others, soil type maps are invaluable for urban and regional planners concerned with land use. A planner who may wish to locate large buildings, such as factories or apartment buildings, on a secure base would look for firm soils containing clay. In contrast, sandy soils drain much better than clays, and thus are better suited for uses that require good drainage, such as farming. In addition, a small but increasing number of States require certified soil scientists to examine soils and determine their drainage capacities before issuing building permits for lots on which residences using septic systems are to be built.

Besides the many soil scientists who are employed mapping soils, some conduct research into the chemical and biological properties of soils to determine their agricultural uses. With the assistance of agricultural technicians, they set up experiments in which they grow crops in different types of soils to determine which are most productive for certain crops. They also may test and develop fertilizers for particular soils and try to find ways to improve less productive soils. Other soil scientists, who have backgrounds in the biological sciences, may investigate and study the effect of organic materials in soils on plant growth.

In recent years, research spurred by mounting concern over water pollution has found that sediment, or soil runoff, is responsible for much of the problem. To meet standards of Federal anti-pollution laws, many States now employ soil scientists to inspect large highway and building sites where vegetation has been removed, and agricultural lands where fertilizers have been applied, to make sure proper erosion control methods have been followed.

Working Conditions

Soil scientists spend much time outdoors. Their work requires a good deal of travel within an assigned area—usually a county. Their employers generally provide a car. During bad weather, soil scientists do their office work, such as preparing maps and writing reports. Research scientists conduct experiments in fields, greenhouses, and laboratories much of the time.

Places of Employment

The estimated 3,500 soil scientists employed in 1978 worked in every State and nearly every county. About half were employed by the Soil Conservation Service of the U.S. Department of Agriculture. Some worked for other agencies of the Federal Government, State agricultural experiment stations, and colleges of agriculture. Others were employed in a wide range of other public and private institutions, including fertilizer companies, private research laboratories, insurance companies, banks and other lending agencies, real estate firms, land appraisal boards, State conservation departments, and farm management agencies. A few were independent consultants, and others worked for consulting firms. In addition, some soil scientists worked in foreign countries as research leaders, consultants, and agricultural managers.

Training, Other Qualifications, and Advancement

Training in a college or university is important to obtain employment as a soil scientist. For Federal employment, the minimum qualification for entrance is a bachelor's degree with a major in soil science or in a

Construction companies hire soil scientists to evaluate soils for their suitability for various kinds of buildings.

closely related field of study, with 30 semester hours of course work in the biological,physical, and earth sciences, including a minimum of 12 semester hours in soils. For students interested in working in the Soil Conservation Service, one of the best courses of study is agronomy, the study of how plants and soils interact. Also, a major in agriculture may enable an applicant to find employment with the Soil Conservation Service.

Soil scientists trained in both field work and laboratory research may have the edge in obtaining the best jobs, and an advanced degree—especially a doctorate degree—may be needed to advance to more responsible and better paying research jobs. Also, a strong background in chemistry may be necessary to obtain research positions.

Many colleges and universities offer fellowships and assistantships for graduate training, or employ graduate students for part-time teaching or research.

A few States now require certification of soil scientists who inspect soil conditions before construction is started. One program requires that candidates for certification have a bachelor's degree and 3 years of experience as a soil scientist, or a master's degree and 2 years of experience. In addition, candidates must complete a written examination to demonstrate their knowledge of soil science.

Soil scientists often can transfer to other occupations that require a knowledge of soil and land, such as land appraiser or farm management advisor.

Employment Outlook

A major objective of the Soil Conservation Service is to complete the classification of soils of all rural lands in the United States. Although the number of soil scientists working on this project has not changed over the past decade, about 100 openings arise each year to replace those scientists who retire, die, or leave the Soil Conservation Service for other reasons.

Some additional employment of soil scientists may be expected in State and local government agencies as concern for pollution and destruction of our soil resources increases. Growth also is expected in businesses such as fertilizer manufacturers, and in institutions that make loans for farm lands, such as banks, mortagage companies, and life insurance companies.

Earnings

In 1978, soil scientists in the Federal Government—the major employer of these workers—had estimated average annual salaries of $22,000. The incomes of soil scientists, however, depend upon their education, professional experience, and individual abilities. The entrance salary in the Federal service for graduates having a B.S. degree was $10,507 in early 1979. They may expect advancement to $13,014, after 1 year of satisfactory performance. Those who had outstanding records in college, or a master's degree, started at $13,014, and could advance to $15,920 after 1 year. Further promotion depends upon the individual's ability to do high quality work and to accept responsibility. Well-qualified Federal soil scientists with several years of experience earned between $19,263 and $32,442 a year.

Related Occupations

Workers in other occupations who are concerned with improving the productivity of agriculture through science include agronomists, animal scientists, aquatic biologists, botanists, geneticists, parasitologists, plant pathologists, range managers, and soil conservationists. Other occupations that require a knowledge of soil and land include land appraisers and farm management advisors.

Sources of Additional Information

Additional information may be obtained from the U.S. Department of Agriculture, Office of Personnel, Washington, D.C. 20250; any office of the Department's Soil Conservation Service; any college of agriculture; or the Soil Society of America, 677 S. Segoe Rd., Madison, Wis. 53711.

Information on soil scientists jobs in the Federal Government also is available from Federal Job Information Centers operated by the U.S. Office of Personnel Management. These centers, located throughout the country, are listed in the telephone directory.

See also the statements on chemists, life scientists, and soil conservationists elsewhere in the *Handbook*.

Mathematics Occupations

Mathematics is both a science and a tool essential for many kinds of work. As a tool, mathematics is necessary for understanding and expressing ideas in science, engineering, and, increasingly, in human affairs. The application of mathematical techniques in these fields has increased greatly because of the widespread use of computers, which enable mathematicians to solve complex problems rapidly and efficiently. As a result, persons trained in mathematics are employed in all sectors of the economy including private industry, government, and colleges and universities.

Persons considering careers in mathematics should be good at understanding and working with abstract concepts—ideas that cannot be easily understood in terms of everyday events and objects. They should enjoy working independently with ideas and solving problems and must be able to present their findings in written reports.

This section describes two occupations—mathematician and statistician. A statement on actuaries, a closely related mathematics occupation, is discussed in the section on insurance occupations. Entrance into any of these fields requires college training in mathematics. For many types of work, graduate education is necessary.

Many other workers in the natural and social sciences and in data processing use mathematics extensively, although they are not primarily mathematicians. These occupations are discussed elsewhere in the *Handbook*.

Mathematicians

(D.O.T. 020.067-014)

Nature of the Work

Mathematicians work in one of the oldest and most vital of all sciences. Mathematicians today are engaged in a wide variety of activities, ranging from the creation of new theories to the translation of scientific and managerial problems into mathematical terms.

Mathematical work falls into two broad classes: Theoretical (pure) mathematics; and applied mathematics. However, these classes are not sharply defined and often overlap.

Theoretical mathematicians advance mathematical science by developing new principles and new relationships between existing principles of mathematics. Although they seek to increase basic knowledge without necessarily considering its practical use, this pure and abstract knowledge has been instrumental in producing many scientific and engineering achievements. For example, in 1854 Bernard Riemann invented a seemingly impractical non-Euclidian geometry that was to become part of Albert Einstein's theory of relativity. Years later, this theory contributed to the creation of atomic power.

Applied mathematicians use mathematics to develop theories, techniques, and approaches to solve practical problems in business, government, engineering, and the natural and social sciences. Their work ranges from analysis of the mathematical aspects of launching Earth satellites to studies of the effects of new drugs on disease.

Much work in applied mathematics, however, is carried on by persons other than mathematicians. In fact, the number of workers who depend upon mathematical expertise is many times greater than the number actually designated as mathematicians.

Working Conditions

Mathematicians work almost exclusively in offices and classrooms. Most work regular hours and travel infrequently.

Places of Employment

About 33,000 persons worked as mathematicians in 1978. Roughly three-fourths of all mathematicians worked in colleges and universities. Most were teachers; some worked mainly in research and development with few or no teaching duties.

Most other mathematicians worked in private industry and government. In the private sector, major employers were the aerospace, communications, machinery, and electrical equipment industries. The Department of Defense and the National Aeronautics and Space Administration employed most of the mathematicians working in the Federal Government.

Mathematicians work in all States, but are concentrated in those with large industrial areas and large college and university enrollments.

Training, Other Qualifications, and Advancement

An advanced degree is the basic requirement for beginning teaching jobs, as well as for most research positions. In most colleges and universities, the Ph. D. degree is necessary for full faculty status.

Although the bachelor's degree may be adequate preparation for some jobs in private industry and government, employers usually require an advanced degree. Those bachelor's degree holders who find jobs usually assist senior mathematicians by performing computations and solving less advanced problems in applied mathematics. However, advancement often depends on achieving an advanced degree. Other bachelor's degree holders work as research or teaching assistants in colleges and universities while studying for an advanced degree. Many bachelor's degree holders work in related fields.

The bachelor's degree in mathematics is offered by most colleges and universities. Mathematics courses usually required for a degree are analytical geometry, calculus, differential equations, probability and statistics, mathematical analysis, and modern algebra. Many colleges and universities urge or even require students majoring in mathematics to take several courses in a field closely related to mathematics, such as computer science, operations research, a physical science, or economics. A prospective college mathematics student should take as many mathematics courses as possible while still enrolled in high school.

More than 400 colleges and universities have programs leading to the master's degree in mathematics; about 150 also offer the Ph. D. In graduate school, students build upon the basic knowledge acquired in earlier studies. They usually concentrate on a specific field of mathematics, such as algebra, mathematical analysis, or geometry, by conducting research and taking advanced courses.

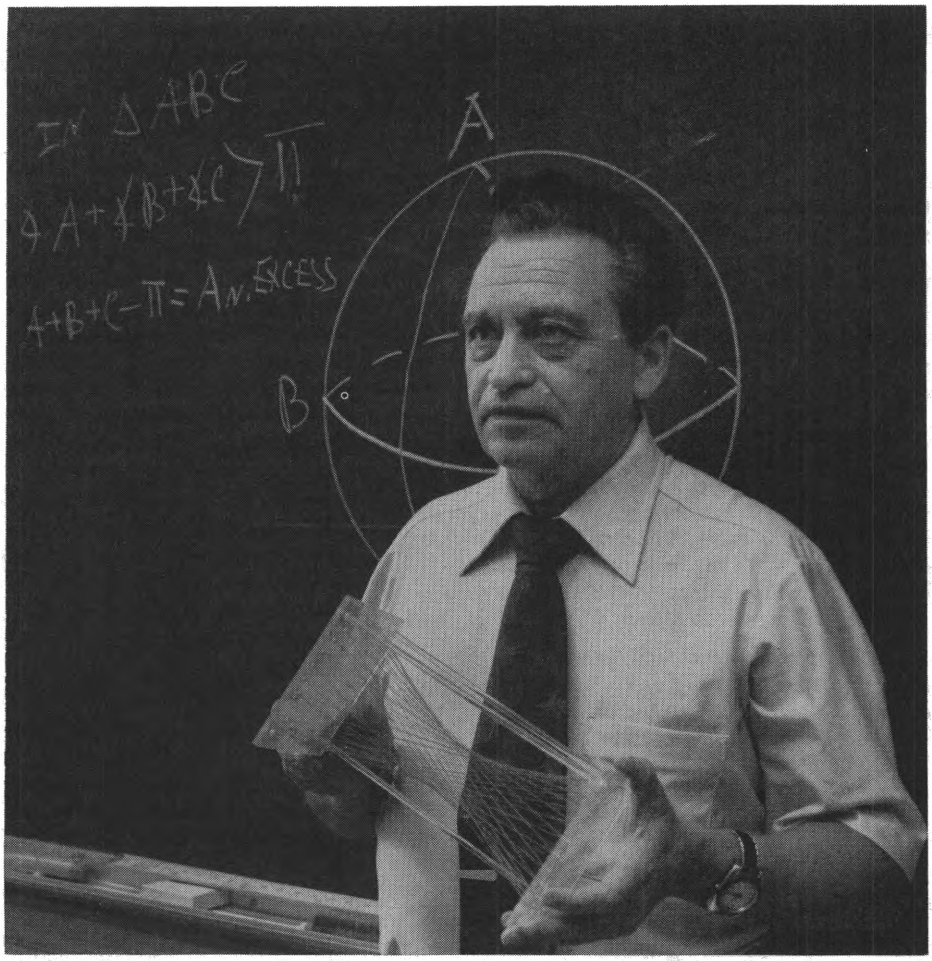
For work in applied mathematics, training in the field in which the mathematics will be used is very important. Fields in which applied mathematics is used extensively include physics, engineering, and operations research; of increasing importance are business and industrial management, economics, statistics, chemistry and life sciences, and the behavioral sciences.

Mathematicians should have a good knowledge of computer programming since most complex mathematical computation is done by computer.

Mathematicians need good reasoning ability, persistence, and the ability to apply basic principles to new types of problems. They must be able to communicate well with others since they often must listen to a nonmathematician describe a problem in general terms, and check and recheck to make sure they understand the mathematical solution that is needed.

Employment Outlook

Employment of mathematicians is expected to increase more slowly than the aver-



About three-fourths of all mathematicians work in colleges and universities.

age for all occupations through the 1980's because the majority of mathematicians work in colleges and universities where little employment growth is expected. Although the number of degrees granted in mathematics each year is expected to decline, the number of people seeking employment is expected to exceed job openings. As a result, persons seeking employment as mathematicians are likely to face keen competition throughout the period. Individuals with Ph. D. degrees will have better prospects than those with bachelor's or master's degrees, but some Ph. D.'s may have to seek employment in other than the traditional academic areas.

Theoretical mathematicians, who have traditionally found jobs in colleges and universities, are expected to experience the most difficulty in finding employment because colleges and universities are not expected to increase their employment of mathematicians much, if any, beyond present levels. Mathematicians hired by colleges and universities may find it increasingly difficult to acquire tenure because large proportions of many faculties already have this status but are years from retirement age. Those who do not attain tenure usually will not advance and in some schools may be forced to resign.

Holders of advanced degrees in applied mathematics should have the least difficulty in finding satisfactory employment. Although some limited opportunities may be available to theoretical mathematicians in nonacademic areas, most nonacademic employers will seek applied mathematicians who are capable of applying their special mathematical skills to practical problems. Private industry and governmental agencies will need applied mathematicians for work in operations research, numerical analysis, computer systems programming, applied mathematical physics, market research, and commercial surveys, and as consultants in industrial laboratories.

Although mathematician jobs may be difficult to obtain, college graduates with degrees in mathematics should find their background helpful for careers in other areas. Many jobs rely heavily on the application of mathematical theories and methods. Mathematics majors are likely to find openings as statisticians, actuaries, computer programmers, systems analysts, economists, engineers, and physical and life scientists. Employment opportunities in these fields will probably be best for those who combine a major in mathematics with a minor in one of these subjects.

New graduates may also find openings as high school mathematics teachers after completing professional education courses and other requirements for a State teaching certificate. (See statement on secondary school teachers elsewhere in the *Handbook*.)

Earnings

In 1978, mathematicians earned about twice the average for nonsupervisory workers in private industry, except farming. Starting salaries for mathematicians with a bachelor's degree averaged about $14,800 a year. Those with a master's degree could start at about $17,000 annually. Salaries for new graduates having the Ph. D., most of whom had some experience, averaged over $22,500.

In the Federal Government in early 1979, mathematicians having the bachelor's degree and no experience could start at either $10,507 or $13,014 a year, depending on their college records. Those with the master's degree could start at $15,920 or $19,263; and persons having the Ph. D. degree could begin at either $19,263 or $23,087. The average salary for all mathematicians in the Federal Government was about $25,900 in early 1979.

Salaries paid to college and university mathematics teachers are comparable to those for other faculty members. (See statement on college and university faculty elsewhere in the *Handbook*.)

Related Occupations

The occupations of actuary, statistician, computer programmer, systems analyst, and operations research analyst are closely related to mathematics. In addition, workers in many fields such as natural and social science, engineering, and finance use mathematics extensively.

Sources of Additional Information

Several brochures are available that give facts about the field of mathematics, including career opportunities, professional training, and colleges and universities with degree programs.

Seeking Employment in the Mathematical Sciences is available for 50 cents from:

American Mathematical Society, P.O. Box 6248, Providence, R.I. 02940.

Professional Opportunities in Mathematics is available for $1.50 from:

Mathematical Association of America, 1225 Connecticut Ave. NW., Washington, D.C. 20036.

For specific information on careers in applied mathematics, contact:

Society for Industrial and Applied Mathematics, 33 S. 17th St., Philadelphia, Pa. 19103.

Information on Federal job opportunities is available from State employment service offices or from U.S. Office of Personnel Management area offices or Federal Job Information Centers located in various large cities throughout the country.

Statisticians

(D.O.T. 020.067-022 and .167-026)

Nature of the Work

Statistics are numbers that help describe the characteristics of the world and its inhabitants. Statisticians devise, carry out, and interpret the numerical results of surveys and experiments. In doing so, they apply their knowledge of statistical methods to a particular subject area, such as economics, human behavior, natural science, or engineering. They may use statistical techniques to predict population growth or economic conditions, develop quality control tests for manufactured products, or help business managers and government officials make decisions and evaluate the results of new programs.

Often statisticians are able to obtain accurate information about a group of people or things by surveying a small portion, called a sample, rather than the whole group. For example, television rating services ask only a few thousand families, rather than all viewers, what programs they watch to determine the size of the audience. Statisticians decide where to get the data, determine the type and size of the sample group, and develop the survey questionnaire or reporting form. They also prepare instructions for workers who will tabulate the returns. Statisticians who design experiments prepare mathematical models and written reports. Some statisticians, called mathematical statisticians, use mathematical theory to design and improve statistical methods.

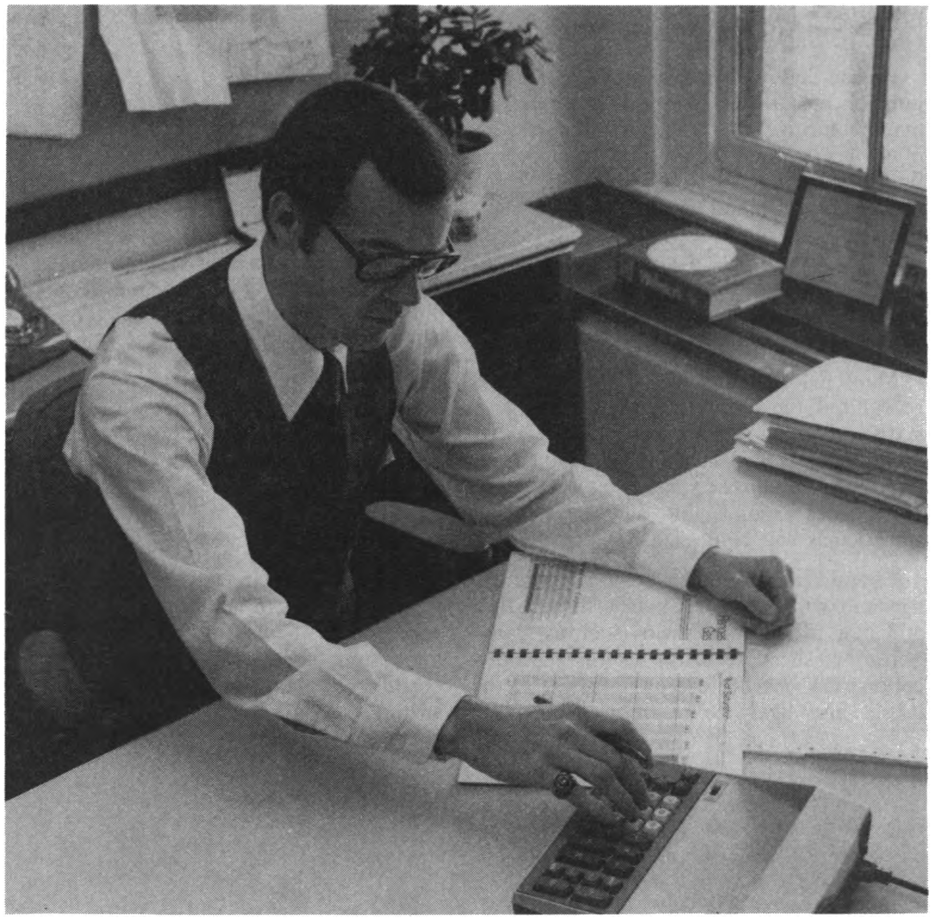
Because the field of statistics has such a wide application, it sometime is difficult to distinguish statisticians from specialists in other fields who use statistics. For example, a statistician working with data on economic conditions may have the title of economist.

Working Conditions

Statisticians usually work regular hours in offices. Some statisticians may travel occasionally to supervise or set up a survey, or to gather statistical data. Some statisticians spend all day at their desk doing fairly repetitive tasks, while others may be involved in a variety of tasks.

Places of Employment

Approximately 23,000 persons worked as statisticians in 1978. Over half of all statisticians were in private industry, primarily in manufacturing, finance, and insurance companies. Roughly one-fifth worked for the Federal Government, primarily in the Departments of Commerce; Health, Education, and Welfare; Agriculture; and Defense. Others worked in State and local government and in colleges and universities.



Statisticians devise, carry out, and interpret the numerical results of surveys and experiments.

Although statisticians work in all parts of the country, most are in metropolitan areas, and about one-fourth work in three areas—New York City; Washington, D.C.; and Los Angeles-Long Beach, Calif.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in statistics or mathematics is the minimum educational requirement for many beginning jobs in statistics. For other beginning statistical jobs, however, a bachelor's degree with a major in an applied field such as economics or natural science and a minor in statistics is preferable. A graduate degree in mathematics or statistics is essential for college and university teaching. Most mathematical statisticians have at least a bachelor's degree in mathematics and an advanced degree in statistics.

Over 100 colleges and universities offered statistics as a concentration for a bachelor's degree in 1978. Many schools also offer either a degree in mathematics or a sufficient number of courses in statistics to qualify graduates for beginning positions. Required subjects for statistics majors include mathematics through differential and integral calculus, statistical methods, and probability theory. Courses in computer uses and techniques, if not required, are highly recommended. For quality-control positions, training in engineering or physical or biological science and in the application of statistical methods to manufacturing processes is desirable. For many market research, business analysis, and forecasting jobs, courses in economics and business administration are helpful.

Nearly 90 colleges and universities offered graduate degrees in statistics in 1978, and many other schools offered one or two graduate level statistics courses. Acceptance into graduate programs does not require an undergraduate degree in statistics although a good mathematics background is essential.

Beginning statisticians who have only the bachelor's degree often spend much of their time performing routine work under the supervision of an experiened statistician. Through experience, they may advance to positions of greater technical and supervisory responsibility. However, opportunities for promotion are best for those with advanced degrees.

Employment Outlook

Employment opportunities for persons who combine training in statistics with knowledge of a field of application are expected to be favorable through the 1980's. Besides the faster-than-average growth expected in this field, additional statisticians will be needed to replace those who die, retire, or transfer to other occupations.

Private industry will require increasing numbers of statisticians for quality control in manufacturing. Statisticians with knowledge of engineering and the physical sciences will find jobs working with scientists and engineers in research and development. Business firms will rely more heavily than in the past on statisticians to forecase sales, analyze business conditions, modernize accounting procedures, and help solve management problems.

Many fields such as law and history have recognized the usefulness of statistics, and statistical techniques are being used increasingly to determine such things as the effects of pollution and toxic substances. As the use of statistics expands into new areas, more statisticians will be needed.

Federal, State, and local government agencies will need statisticians for existing and new programs in fields such as transportation, social security, health, and education. The broader use of statistical methods is also likely to result in a need for more teachers of statistics in colleges and universities.

Earnings

In the Federal Government in 1979, statisticians who had the bachelor's degree and no experience could start at either $10,507 or $13,014 a year, depending on their college grades. Beginning statisticians with the master's degree could start at $15,920 or $19,263. Those with the Ph. D. could begin at $19,263 or $23,087. The average annual salary for statisticians in the Federal Government was about $26,000 in 1979.

Salaries in private industry were comparable to those in the Federal Government, according to the limited data available.

Statisticians employed by colleges and universities generally receive salaries comparable to those paid other faculty members. (See the statement on college and university faculty.) In addition to their regular salaries, statisticians in educational institutions sometimes earn extra income from outside research projects, consulting, and writing.

Related Occupations

Workers in the following occupations use statistics to such an extent their job is similar to that of a statistician: marketing research workers, urban planners, engineers, environmental scientists, life scientists, physical scientists, and social scientists. Others who work with numbers are actuaries, mathematicians, financial analysts, computer programmers, and systems analysts.

Sources of Additional Information

For information about career opportunities in statistics, contact:

American Statistical Association, 806 15th St. NW., Washington, D.C. 20005.

Information on Federal job opportunities is available from State employment service offices or from U.S. Office of Personnel Management area offices or Federal Job Information Centers located in various large cities throughout the country.

For information on a career as a mathematical statistician, contact:

Institute of Mathematical Statistics, 3401 Investment Blvd. #6, Hayward, Calif. 94545.

Physical Scientists

Physical scientists investigate the structure and composition of the earth and the universe. Three physical science occupations are described in this section: Astronomers, chemists, and physicists. Astronomers study the nature of the universe, while chemists examine the composition and interaction of substances in the world around us. Physicists study the interaction of matter and energy. A knowledge of the physical sciences is also required by engineers, environmental scientists, and life scientists; these occupations are described in separate sections elsewhere in the *Handbook*.

Many physical scientists perform research directed toward increasing our knowledge of the universe. Physical scientists also employ the results of research in the development of new products and production processes. Some physical scientists teach in colleges and universities. Others, particularly chemists, work in production and sales-related activities in industry.

Many high level jobs in the physical sciences require graduate education and often a Ph. D. degree.

Astronomers

(D.O.T.021.067-010)

Nature of the Work

Astronomers seek answers to questions about the fundamental nature of the universe, such as its origin and history and the evolution of our solar system. Astronomers —sometimes called *astrophysicists*—use the principles of physics and mathematics to study and determine the behavior of matter and energy in distant galaxies. One application of the information they gain is to prove or disprove theories of the nature of matter and energy such as Einstein's theory of relativity.

To make observations of the universe, astronomers use large telescopes, radiotelescopes, and other instruments that can detect electromagnetic radiation from distant sources. Astronomers of today seldom observe stars visually through telescopes because photographic and electronic light-detecting equipment is more effective with dim or distant stars and galaxies. By using spectroscopes to analyze light from stars, astronomers can determine their chemical composition. Astronomers also use radiotelescopes and other electronic means to observe radio waves, X-rays, and cosmic rays. Computers are used to analyze data and to solve complex mathematical equations that astronomers develop to represent various theories. Computers also are useful for processing astronomical data to calculate orbits of asteroids or comets, guide spacecraft, and work out tables for navigational handbooks.

Astronomers usually specialize in one of the many branches of the science such as instruments and techniques, the Sun, the solar system, and the evolution and interiors of stars or galaxies.

Astronomers who work on observational programs begin their studies by deciding what stars or other objects to observe and the methods and instruments to use. They may need to design optical measuring devices to attach to the telescope to make the required measurements. After completing their observations, they analyze the results, present them in precise numerical form, and explain them on the basis of some theory. Astronomers usually spend relatively little time in actual observation and relatively more time in analyzing the large quantities of data that observatory facilities collect.

Some astronomers concentrate on theoretical problems and seldom visit observatories. They formulate theories or mathematical models to explain observations made earlier by other astronomers. These astronomers develop mathematical equations using the laws of physics to compute, for example, theoretical models of the internal structure of stars, and how stars change as they grow older and exhaust the energy sources deep in their interiors.

Almost all astronomers do research or teach; those in colleges and universities often do both. In schools that do not have separate departments of astronomy or only small enrollments in the subject, they often teach courses in mathematics or physics as well as astronomy. Some astronomers administer research programs, develop and design astronomical instruments, and do consulting work.

Working Conditions

Most astronomers spend the majority of their time working in offices or classrooms, although astronomers who make observations may need to travel to the observing facility and frequently work at night. Astronomers are often under considerable pressure to produce research results which are of publishable quality. In some universities, relatively new astronomers who do not produce significant research results are not granted tenure, which is in effect a permanent, secure position. Those not granted tenure face the possibility of losing their jobs.

Places of Employment

Astronomy is the smallest physical science; fewer than 2,000 persons worked as astronomers in 1978. Most astronomers work in colleges and universities. Some work in observatories operated by universities, nonprofit organizations, and the Federal Government.

The Federal Government employed almost 550 astronomers and space scientists in 1978. Most worked for the National Aeronautics and Space Administration. Others worked for the Department of Defense, mainly at the U.S. Naval Observatory and the U.S. Naval Research Laboratory. A few astronomers worked for firms in the aerospace field, or in museums and planetariums.

Training, Other Qualifications, and Advancement

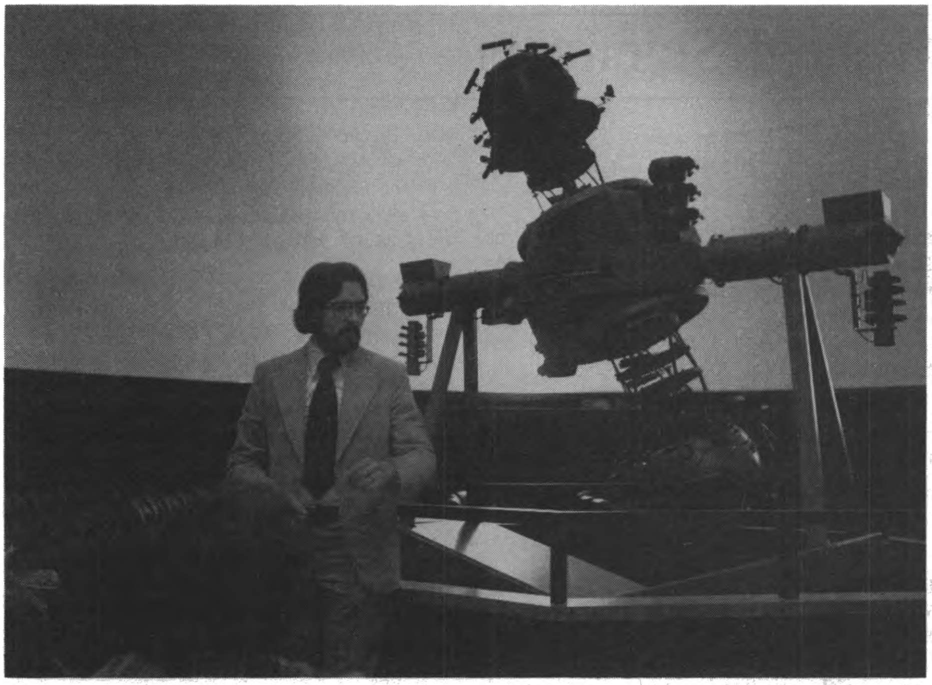
The usual requirement for a job in astronomy is a Ph. D. degree. Persons with less education may qualify for some jobs related to astronomy, but higher level positions in teaching and research and advancement in most areas are open only to those with the doctorate.

Many students who undertake graduate study in astronomy have a bachelor's degree in astronomy. In 1978, about 50 colleges and universities had programs leading to the bachelor's degree in astronomy. However, students with a bachelor's degree in physics, or in mathematics with a physics minor, usually also can qualify for graduate programs in astronomy.

About 50 universities offer the Ph. D. degree in astronomy. These programs include advanced courses in astronomy, physics, and mathematics. Some schools require that graduate students spend several months working at an observatory. In most institutions, the work program leading to the doctorate is flexible and allows students to take courses in their own area of interest.

Persons planning careers in astronomy should have great interest and ability in science and mathematics, as well as imagination and an inquisitive mind. Perseverance and the ability to concentrate on detail and to work independently also are important.

New graduates with a doctorate may work for several years on a postdoctoral fellowship, doing research and gaining further research experience before obtaining a permanent position. A postdoctoral fellowship provides an opportunity to gain additional qualification in astronomical research. It also provides employment while looking for a permanent job. Other new Ph. D.'s, however,



Astronomer giving lecture in a planetarium.

enter teaching or research jobs immediately after attaining their degree.

Employment Outlook

Persons seeking positions as astronomers will face keen competition for the few available openings expected through the 1980's. Employment of astronomers is expected to grow slowly, if at all, because the funds available for basic research in astronomy, which come mainly from the Federal Government, are not expected to increase enough to create many new positions. Most openings will occur as replacements for those who die or retire. Since astronomy is such a small profession, there will be few openings arising from the need for replacements. There will be keen competition for these openings because the number of degrees granted in astronomy probably will continue to exceed available openings.

Earnings

Astronomers have relatively high salaries, with average earnings more than twice the average earnings for nonsupervisory

In the Federal Government in 1979, astronomers holding the Ph. D. degree could begin at $19,263 or $23,087, depending on their college record. The average annual salary for astronomers and space scientists in the Federal Government was over $33,000 in 1978. Astronomers teaching in colleges and universities received salaries equivalent to those of other faculty members. (See statement on college and university faculty elsewhere in the *Handbook*.)

Related Occupations

Astronomy is closely related to physics, and often is thought of as a branch of physics. Astronomy is also related to other physical sciences and mathematics.

Sources of Additional Information

For information on careers in astronomy and on schools offering training in the field, contact:

Education Office, American Astronomical Society, University of Delaware, Newark, Del. 19711.

Chemists

(D.O.T. 022.061-010 and -014, .137-010, .161-010, and .281-014)

Nature of the Work

The clothes we wear, the foods we eat, the houses in which we live—in fact most things that help make our lives better, from medical care to a cleaner environment—result, in part, from the work done by chemists.

Chemists search for and put into practical use new knowledge about substances. Their research has resulted in the development of a tremendous variety of synthetic materials, such as nylon and polyester fabrics, ingredients that have improved other substances, and processes which help save energy and reduce pollution, such as improved oil refining methods.

Nearly one-half of all chemists work in research and development. In basic research, chemists investigate the properties and composition of matter and the laws that govern the combination of elements. Basic research often has practical uses. For example, synthetic rubber and plastics have resulted from research on small molecules uniting to form larger ones (polymerization). In research and development, new products are created or improved. The process of developing a product begins with descriptions of the characteristics it should have. If similar products exist, chemists test samples to determine their ingredients. If no such product exists, experimentation with various substances yields a product with the required specifications.

Nearly one-eighth of all chemists work in production and inspection. In production, chemists prepare instructions (batch sheets) for plant workers that specify the kind and amount of ingredients to use and the exact mixing time for each stage in the process. At each step, samples are tested for quality control to meet industry and government standards. Records and reports show results of tests.

Others work as marketing or sales representatives to obtain technical knowledge of products sold. A number of chemists teach in colleges and universities. Some chemists are consultants to private industry and to government agencies.

Chemists often specialize in one of the subfields of chemistry. *Analytical chemists* determine the structure, composition, and nature of substances, and develop new techniques. An outstanding example was the analysis of moon rocks by an international team of analytical chemists. *Organic chemists* at one time studied the chemistry of only living things, but this area has been broadened to include all carbon compounds. When combined with other elements, carbon forms a vast number of substances. Many modern commercial products, including plastics and other synthetics, have resulted from the work of organic chemists. *Inorganic chemists* study compounds other than carbon. They may, for example, develop materials to use in solid state electronic components. *Physical chemists* study energy transformations to find new and better energy sources. Increasingly, however, chemists consider themselves members of new specialties that include two or more of the preceding fields. *Biochemists*, often considered as either chemists or life scientists, are discussed elsewhere in the *Handbook*. Some chemists specialize in the chemistry of foods. (See statement on food technologists elsewhere in the *Handbook*.)

Working Conditions

Chemists usually work in offices, laboratories, or classrooms. Some are exposed to health or safety hazards when handling certain chemicals, but there is little risk if proper procedures are followed. Chemists usually work regular hours and seldom travel.

Places of Employment

Over 140,000 persons worked as chemists in 1978. About one-half of all chemists work for manufacturing firms—about one-half of them are in the chemical manufacturing industry, with the rest scattered throughout other manufacturing industries.

Colleges and universities employed about

25,000 chemists in 1978. Chemists also work for State and local governments, primarily in health and agriculture, and for Federal agencies, chiefly the Department of Defense; Health and Human Services; Agriculture; and Interior. Smaller numbers worked for nonprofit research organizations.

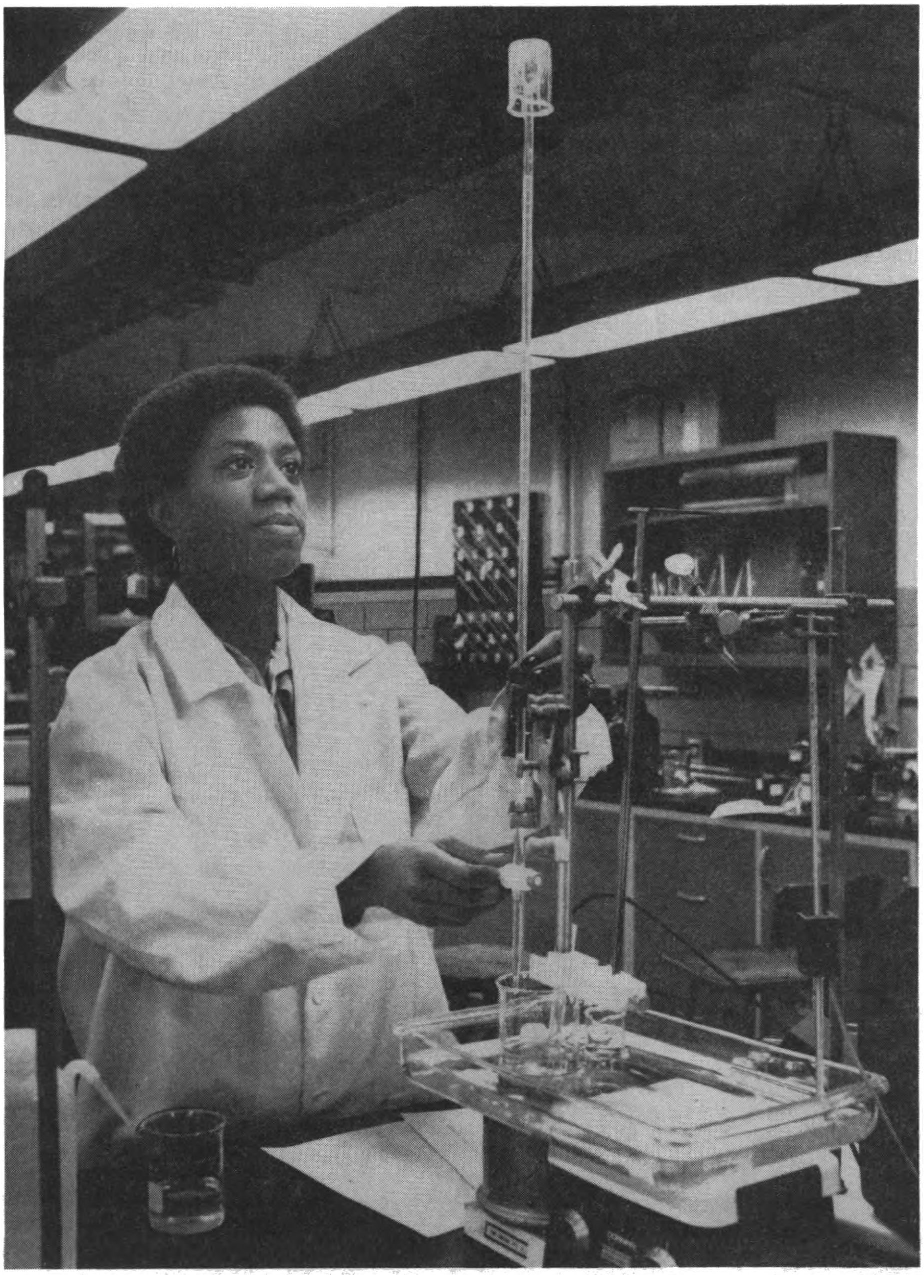
Chemists are employed in all parts of the country, but they are concentrated in large industrial areas. Nearly one-fifth of all chemists were located in four metropolitan areas—New York, Chicago, Philadelphia, and Newark.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in chemistry or a related discipline is sufficient for many beginning jobs as a chemist. However, graduate training is required for many research jobs and most college teaching jobs require a Ph. D. degree. Beginning chemists should have a broad background in chemistry, with good laboratory skills.

About 1,175 colleges and universities offer a bachelor's degree in chemistry. In addition to required courses in analytical, inorganic, organic, and physical chemistry, undergraduates usually study mathematics and physics.

More than 350 colleges and universities award advanced degrees in chemistry. In graduate school, students generally specialize in a particular subfield of chemistry. Requirements for the master's and doctor's degree usually include a thesis based on independent research.



Although many chemists spend much of their time in laboratories, chemists also work in offices, classrooms, and industrial plants.

Students planning careers as chemists should enjoy studying science and mathematics, and should like working with their hands building scientific apparatus and performing experiments. Perseverance and the ability to concentrate on detail and to work independently are essential. Other desirable assets include an inquisitive mind and imagination.

Graduates with the bachelor's degree generally begin their careers in government or industry by analyzing or testing products, working in technical sales or service, or assisting senior chemists in research and development laboratories. Some employers have special training and orientation programs which provide special knowledge needed for the employer's type of work. Candidates for an advanced degree often teach or do research in colleges and universities while working toward advanced degrees.

Beginning chemists with the master's degree can usually go into applied research in government or private industry. They also may qualify for teaching positions in 2-year colleges and some universities.

The Ph. D. generally is required for basic research, for teaching in colleges and universities, and for advancement to many administrative positions.

Employment Outlook

Employment opportunities in chemistry are expected to be good for graduates at all degree levels through the 1980's. The employment of chemists is expected to grow about as fast as the average for all occupations during this period, creating many job openings. In addition, openings will result each year as chemists retire, die, or transfer to other occupations.

This outlook for chemists is based on the assumption that research and development expenditures of government and industry will increase through the 1980's, although at a slower rate than during the 1960's. If actual expenditures differ significantly from those assumed, the outlook for chemists would be altered.

Approximately three-fourths of total employment is expected to be in private industry, primarily in the development of new products. In addition, industrial companies and government agencies will need more chemists to help solve problems related to energy shortages, pollution control, and health care.

Little growth in college and university employment is expected, and competition for teaching positions will be keen. (See statement on college and university faculty elsewhere in the *Handbook*.)

Some graduates will find openings in high school teaching after completing professional education courses and other requirements for a State teaching certificate. They usually are then regarded as teachers rather than chemists. (See statement on secondary school teachers elsewhere in the *Handbook*.)

Earnings

Earnings of chemists averaged more than twice as much as those of nonsupervisory workers in private industry, except farming. According to the American Chemical Society, salaries of experienced chemists having a bachelor's degree averaged $23,900 a year in 1978; for those with a master's degree, $25,400; and for those with a Ph. D., $29,200.

Private industry paid chemists with the bachelor's degree starting salaries averaging $13,500 a year in 1978; those with the master's degree, $15,600; and those with the Ph. D., $21,500.

In colleges and universities, the average salary of those with the master's degree was $18,100 and of those with the Ph. D., $23,400. In addition, many experienced chemists in educational institutions supplement their regular salaries with income from consulting, lecturing, and writing.

Depending on a person's college record, the annual starting salary in the Federal Government in early 1979 for an inexperienced chemist with a bachelor's degree was either $10,507 or $13,014. Those who had 2 years of graduate study could begin at $15,920 a year. Chemists having the Ph. D. degree could start at $19,263 or $23,087. The average salary for all chemists in the Federal Government in early 1979 was $26,000 a year.

Related Occupations

The occupations of biochemist, life scientist, food scientist, and chemical technician are closely related to chemistry. Other physical science and environmental science occupations are also related to chemistry.

Sources of Additional Information

General information on career opportunities and earnings for chemists is available from:

American Chemical Society, 1155 16th St. NW., Washington, D.C. 20036.

Chemical Manufacturers Association, 1825 Connecticut Ave. NW., Washington D.C. 20009.

Information on Federal job opportunities is available from State employment service offices or from U.S. Office of Personnel Management area offices or Federal Job Information Centers located in various large cities throughout the country.

Physicists

(D.O.T. 023.061-014 and .067-010)

Nature of the Work

The flight of astronauts through space, the probing of ocean depths, and even the safety of the family car depend on research by physicists. Through systematic observation and experimentation, physicists describe in mathematical terms the structure of the universe and interaction of matter and energy. Physicists develop theories that describe the fundamental forces and laws of nature. Determining the basic laws governing phenomena such as gravity, electromagnetism, and nuclear interaction leads to discoveries and innovations. For instance, the development of irradiation therapy equipment which destroys harmful growths in humans without damaging other tissues resulted from what physicists know about nuclear radiation. Physicists have contributed to scientific progress in recent years in areas such as nuclear energy, electronics, communications, aerospace, and medical instrumentation.

The majority of all physicists work in research and development. Some do basic research to increase scientific knowledge. For example, they investigate the structure of the atom or the nature of gravity. The equipment that physicists design for their basic research can often be applied to other areas. For example, lasers (devices that amplify light and emit electromagnetic waves in a narrow, intense light beam) are utilized in surgery; microwave devices are used for ovens; and measurement techniques and instruments can detect and measure the kind and number of cells in blood or the amount of mercury or lead in foods.

Some engineering-oriented physicists do applied research and help develop new products. For instance, their knowledge of solid-state physics led to the development of transistors and microcircuits used in electronic equipment that ranges from hearing aids to missile guidance systems.

Many physicists teach and do research in colleges and universities. A small number work in inspection, quality control, and other production-related jobs in industry. Some do consulting work.

Most physicists specialize in one branch or more of the science—elementary-particle physics; nuclear physics; atomic, electron, and molecular physics; physics of condensed matter; optics, acoustics, and plasma physics; and the physics of fluids. Some specialize in a subdivision of one of these branches. For example, solid-state physics subdivisions include ceramics, crystallography, and semiconductors. However, since all physics involves the same fundamental principles, several specialties may overlap.

Growing numbers of physicists are specializing in fields that combine physics and a related science—such as astrophysics, biophysics, chemical physics, and geophysics. Furthermore, the practical applications of physicists' work increasingly have merged with engineering.

Working Conditions

Physicists generally work regular hours in laboratories, classrooms, and offices. Most physicists do not encounter unusual hazards in their work.

Places of Employment

Over 40,000 people worked as physicists in 1978. Private industry employed over one-half of all physicists, primarily in companies manufacturing chemicals, electrical equipment, and aircraft and missiles. Many others worked in hospitals, commercial laboratories, and independent research organizations.

Almost one-half of all physicists taught or did research in colleges and universities; some did both. About 5,000 physicists were employed by the Federal Government in 1978, mostly in the Departments of Defense and Commerce.

Although physicists are employed in all

Physicist "growing" germanium crystals in a laboratory.

parts of the country, their employment is greatest in areas that have heavy industrial concentrations and large college and university enrollments. Nearly one-fourth of all physicists work in four metropolitan areas—Washington, D.C.; Boston, Mass.; New York, N.Y.; and Los Angeles-Long Beach, Calif., and more than one-third are concentrated in three States—California, New York, and Massachusetts.

Training, Other Qualifications, and Advancement

Graduate training in physics or a closely related field is almost essential for most entry level jobs in physics and for advancement in all types of work. The doctorate usually is required for full faculty status at colleges and universities and for industrial or government jobs administering research and development programs.

Those having master's degrees qualify for many research jobs in private industry and in the Federal Government. In colleges and universities, some teach and assist in research while studying for their Ph. D.

Those having bachelor's degrees may qualify for some applied research and development jobs in private industry and in the Federal Government. Some are employed as research assistants in colleges and universities while studying for advanced degrees. Many work in engineering and other scientific fields. (See statements on engineers, geophysicists, programmers, and systems analysts elsewhere in the *Handbook*.)

Over 800 colleges and universities offer a bachelor's degree in physics. In addition, many engineering schools offer a physics major as part of the general curriculum. The undergraduate program provides a broad background in the science and serves as a base for later specialization either in graduate school or on the job. Some typical physics courses are mechanics, electricity and magnetism, optics, thermodynamics, and atomic and molecular physics. Students also take courses in chemistry and many courses in mathematics.

About 275 colleges and universities offer advanced degrees in physics. In graduate school, the student, with faculty guidance, usually works in a specific field. The graduate student, especially the candidate for the Ph. D. degree, spends a large portion of his or her time in research.

Students planning a career in physics should have an inquisitive mind, mathematical ability, and imagination. They should be able to work on their own, since physicists, particularly in basic research, often receive only limited supervision.

Physicists often begin their careers doing routine laboratory tasks. After some experience, they are assigned more complex tasks and may advance to work as project leaders or research directors. Some work in top management jobs. Physicists who develop new products sometimes form their own companies or join new firms to exploit their own ideas.

Employment Outlook

Employment opportunities in physics are expected to be favorable through the 1980's for persons with graduate degrees in physics. Although employment of physicists is projected to grow more slowly than the average for all occupations over the period, fewer physics graduates are expected to enter the labor force than in the past. The number of graduate degrees awarded annually in physics has been declining since 1970, and may remain at about the current level through 1990. Most job openings will arise as physicists retire, die, or transfer to other occupations.

Many physicists work in research and development (R&D). The anticipated increase in R&D expenditures through the 1980's should result in increased requirements for physicists. If actual R&D expenditure levels and patterns differ significantly from those assumed, however, the outlook would be altered.

Some physicists with advanced degrees will be needed to teach in colleges and universities, but competition for these jobs is expected to be keen. Since employment growth is not anticipated in this area, most openings will occur to replace physicists who retire, die, or transfer to other occupations.

Persons with only a bachelor's degree in physics are expected to face keen competition for physicist jobs through the 1980's. Some new graduates will find employment as engineers or technicians. Others will find opportunities as high school physics teachers after completing the required educational courses and obtaining a State teaching certificate. However, they are usually regarded as teachers rather than as physicists. (See statement on secondary school teachers elsewhere in the *Handbook*.)

Earnings

Physicists have relatively high salaries, with average earnings more than twice those of nonsupervisory workers in private industry, except farming. According to an American Institute of Physics Survey in 1978, starting salaries for physicists in manufacturing industries averaged about $17,400 for those with a master's degree and $23,000 for those with a Ph. D.

Depending on their college records, physicists with a bachelor's degree could start in the Federal Government in 1977 at either $10,507 or $13,014 a year. Beginning physicists having a master's degree could start at $13,014 or $15,920, and those having the Ph. D. degree could begin at $19,263 or $23,087. Average earnings for all physicists in the Federal Government in 1978 were $30,200 a year.

Starting salaries on college and university faculties for physicists having a master's degree averaged $12,900 in 1978, and for those having the Ph. D., $13,900, according to the American Institute of Physics. (See statement on college and university faculty elsewhere in the *Handbook*.) Many faculty physicists supplement their regular incomes by working as consultants and taking on special research projects.

Related Occupations

Physics is closely related to astronomy and other scientific occupations such as chemists, geologists, and geophysicists. Engineers and engineering and science technicians also use a knowledge of the principles of physics in their work.

Sources of Additional Information

General information on career opportunities in physics is available from:

American Institute of Physics, 335 East 45th St., New York, N.Y. 10017.

Broadcast Technicians

(D.O.T. 003.167-030 and -034; 193.167-014, .262-018 and -038; 194.262-010 and -018, .282, .362, and .382-014; 822.281-030; 962.162, .167-010, .281-014 and -018, .362-014, .384, and .665)

Nature of the Work

Broadcast technicians operate and maintain the electronic equipment used to record and transmit radio and television programs. They work with microphones, sound recorders, light and sound effects, television cameras, video tape recorders, and other equipment.

In the control room, broadcast technicians operate equipment that regulates the quality of sounds and pictures being recorded or broadcast. They also operate controls that switch broadcasts from one camera or studio to another, from film to live programming, or from network to local programs. By means of hand signals and, in television, by use of telephone headsets, they give technical directions to personnel in the studio.

When events outside the studio are to be broadcast, technicians may go to the site and set up, test, and operate the equipment. After the broadcast, they dismantle the equipment and return it to the station.

As a rule, broadcast technicians in small stations perform a variety of duties. In large stations and in networks, on the other hand, technicians are more specialized, although specific job assignments may change from day to day. *Transmitter technicians* monitor and log outgoing signals and are responsible for transmitter operation. *Maintenance technicians* set up, maintain, and repair electronic broadcasting equipment. *Audio control technicians* regulate sound pickup, transmission, and switching, and *video control technicians* regulate the quality, brightness, and contrast of television pictures. The lighting of television programs is directed by *lighting technicians*. For programs originating outside the studio, *field technicians* set up and operate broadcasting equipment. *Recording technicians* operate and maintain sound recording equipment; *video recording technicians* operate and maintain video tape recording equipment. Some technicians operate equipment designed to produce special effects. Sometimes the term "operator" or "engineer" is substituted for "technician."

Supervisory personnel with job titles such as *chief engineer* or *transmission engineer* direct activities concerned with the operation and maintenance of studio broadcasting equipment.

Working Conditions

Broadcast technicians generally work indoors in pleasant surroundings. Many stations are air-conditioned since transmitters and other electronic equipment must be operated at cool temperatures. Broadcasts outside the studio, however, may require technicians to work out of doors under less favorable conditions.

Network technicians may ocasionally have to work long hours under great pressure to meet broadcast deadlines.

Places of Employment

About 40,000 broadcast technicians were employed in radio and television stations in 1978. Television stations employ, on the average, many more technicians than radio stations. Although broadcast technicians are employed in every State, most are located in large metropolitan areas. The highest paying and most specialized jobs are concentrated in New York City, Los Angeles, and Washington, D.C.—the originating centers for most of the network programs.

Training, Other Qualifications, and Advancement

While broadcast technicians have some duties that do not require a high degree of training in electronics, employers prefer applicants who can handle the full range of technical duties. A person interested in becoming a broadcast technician therefore should plan to get a first class radiotelephone operator license from the Federal Communications Commission (FCC). Federal law requires that anyone who operates broadcast transmitters in television stations must hold such a license. In radio stations, technicians who maintain, repair, or adjust transmitters also need the first class license; however, in most cases, those involved in the most routine operation of transmitters only need a restricted radiotelephone operator permit, for which no examination is required. Applicants for an FCC license, however, must pass a series of written examinations. These cover construction and operation of transmission and receiving equipment; characteristics of electromagnetic waves; and regulations and practices, both Federal and international, which govern broadcasting.

Among high school courses, algebra, trigonometry, physics, electronics, and other sciences provide valuable background for persons anticipating careers in this occupation. Building and operating a radio also are good training. Taking an electronics course in a technical school is still another good way to acquire the knowledge for becoming a broadcast technician. Some persons gain work experience as temporary employees while filling in for regular broadcast technicians who are on vacation.

Many schools give courses especially designed to prepare the student for the FCC's first class license test. Technical school or college training is an advantage, particularly for those who hope to advance to supervisory positions or to the more specialized jobs in large stations and in the networks.

Broadcast technicians must have an aptitude for working with electrical and mechanical systems and equipment. Manual dexterity, the ability to perform tasks requiring precise hand skills, is necessary for success in this occupation.

Persons with FCC first class licenses who get entry jobs are instructed and advised by the chief engineer, or by other experienced technicians, concerning the work procedures of the station. They begin their careers in small stations, operating the transmitter and handling other technical duties, after a brief instruction period. As they acquire more experience and skill, they are assigned to more responsible jobs. Those who demonstrate above-average ability may move into top level technical positions such as supervisory technician or chief engineer. A college degree in engineering is becoming increasingly important for advancement to supervisory and executive positions. (See the statement on occupations in the radio and television broadcasting industry elsewhere in the *Handbook*.)

Employment Outlook

People seeking beginning jobs as broadcast technicians face strong competition, especially in major metropolitan areas where the number of qualified jobseekers greatly exceeds the number of openings. Prospects for entry level positions are best in smaller cities for people with appropriate training in electronics. As is the case with other occupations in the radio and television broadcasting industry, stations in major metropolitan areas seek highly experienced personnel.

Employment of broadcast technicians is expected to increase about as fast as the average for all occupations through the 1980's. Some job openings also will result from the need to replace experienced technicians who retire, die, or transfer to other occupations.

Some new job opportunities for technicians will arise as new radio and television stations go on the air. Demand for broadcast technicians also will increase as cable television stations broadcast more of their own programs. At the same time, technological developments are likely to limit future de-

Broadcast technicians must have an aptitude for working with electrical and mechanical equipment.

mand; such laborsaving technical advances as automatic programming and remote control of transmitters will hold down demand for additional technicians. Technological developments such as these have shifted the emphasis from operations to maintenance work, which calls for a strong technical background.

Earnings

In 1978, technicians generally started at $140 to $150 a week in small stations, according to the limited information available. Earnings of experienced technicians were much higher. Licensed technicians who can perform the full range of tasks are, of course, the highest paid. As a rule, technicians' wages are highest in large cities and in large stations. Technicians employed by television stations usually are paid more than those who work for radio stations because television work is generally more complex. Technicians employed by educational broadcasting stations generally earn less than those who work for commercial stations.

Most technicians in large stations work a 40-hour week with overtime pay for additional hours. Broadcast technicians in small stations generally work a considerable amount of overtime. Evening, night, and weekend work frequently is necessary since many stations are on the air 24 hours a day, 7 days a week.

Related Occupations

Broadcast technicians need the knowledge and hand coordination to operate technical equipment; they generally complete specialized postsecondary training programs, including courses in science and engineering. Others whose jobs have similar requirements include drafters, engineering and science technicians, surveyors, air traffic controllers, radiologic technologists, respiratory therapy workers, electrocardiograph technicians, electroencephalographic technicians, and medical laboratory technicians.

Sources of Additional Information

For information about radiotelephone operator permits and licenses, and examination study guides, write to:

Federal Communications Commission, Policy Analysis Branch, 1919 M St. NW., Washington, D.C. 20554.

For information on careers for broadcast technicians, write to:

National Association of Broadcasters, 1771 N St. NW., Washington, D.C. 20036.

For a list of schools that offer programs or courses in broadcasting, contact:

Broadcast Education Association, National Association of Broadcasters, 1771 N St. NW., Washington, D.C. 20036.

Drafters

(D.O.T. 001.261-010 and -014; 002.261-010; 003.281-010 and 014; 005.281-010 and -014; 007.261-010, -014, -018, -022, and .281-010; 010.281-010, -014, -018; 014.281-010; and -017)

Nature of the Work

When building a satellite, television set, or bridge, workers follow drawings that show the exact dimensions and specifications of the entire object and each of its parts. Workers who draw these plans are drafters.

Drafters prepare detailed drawings based on rough sketches, specifications, and calculations made by scientists, engineers, architects, and designers. They also calculate the strength, quality, quantity, and cost of materials. Final drawings contain a detailed view of the object from all sides as well as specifications for materials to be used, procedures followed, and other information to carry out the job.

In preparing drawings, drafters use compasses, dividers, protractors, triangles, and other drafting devices. They also use technical handbooks, tables, and calculators to help solve problems.

Drafters are classified according to the work they do or their level of responsibility. *Senior drafters* translate an engineer's or architect's preliminary plans into design "layouts" (scale drawings of the object to be built). *Detailers* draw each part shown on the layout, and give dimensions, materials, and other information to make the drawing clear and complete. *Checkers* carefully examine drawings for errors in computing or recording dimensions and specifications. Under the supervision of experienced drafters, *tracers* make minor corrections and trace drawings for reproduction on paper or plastic film.

Drafters usually specialize in a particular field of work, such as mechanical, electrical, electronic, aeronautical, structural, or architectural drafting.

Working Conditions

Although drafters usually work in well-lighted and well-ventilated rooms, they often must sit and do very detailed work for long periods of time. This work may cause eye strain.

Places of Employment

About 296,000 persons worked as drafters in 1978—more than 9 out of 10 worked in private industry. Engineering and architectural firms were the single largest employers of drafters. Other major employers included the fabricated metals, electrical equipment, machinery, and construction industries.

About 20,000 drafters worked for Federal, State, and local governments in 1978. Most drafters in the Federal Government worked for the Defense Department; those in State and local governments were mainly in highway and public works departments. Some drafters worked for colleges and universities and nonprofit organizations.

Training, Other Qualifications, and Advancement

Persons interested in becoming drafters can acquire the necessary training in technical institutes, junior and community colleges, extension divisions of universities, and vocational and technical high schools. Some persons receive training and experience in the Armed Forces. Others qualify through on-the-job training programs combined with part-time schooling or 3- to 4-year apprenticeship programs.

Training for a career in drafting, whether in a high school or post-high school program,

In preparing drawings, drafters use rulers, triangles, and other drafting devices.

should include courses in mathematics, physical sciences, mechanical drawing, and drafting. Shop practices and shop skills also are helpful since most higher level drafting jobs require knowledge of manufacturing or construction methods. Many technical schools offer courses in structural design, architectural drawing, and engineering or industrial technology.

Those planning careers in drafting should be able to do freehand drawings of three-dimensional objects and also detailed work requiring a high degree of accuracy. They should have good eyesight and manual dexterity. In addition, they should be able to function as part of a team since they work directly with engineers, architects, and craft workers. Artistic ability is helpful in some specialized fields.

High school graduates usually start out as tracers. Those having post-high school technical training may begin as junior drafters. After gaining experience, they may advance to checkers, detailers, senior drafters, or supervisors. Some may become independent designers. Courses in engineering and mathematics sometimes enable drafters to transfer to engineering positions.

Employment Outlook

Employment of drafters is expected to increase about as fast as the average for all occupations through the 1980's because of industrial growth and the increasingly complex design problems of products and processes. Openings also will result from the need to replace drafters who retire, die, or move into other fields of work.

Holders of an associate (2-year) degree in drafting will have the best prospects. Many large employers already require post-secondary technical education, though well-qualified high school graduates who have studied drafting may find opportunities in some types of jobs. Photoreproduction of drawings and the expanding use of electronic drafting equipment and computers, however, will reduce the need for less skilled drafters.

Earnings

In private industry, tracers averaged about $9,800 a year in 1978, while more experienced drafters averaged between $11,200 and $13,700 a year. Senior drafters averaged about $16,900 a year in 1978.

The Federal Government paid drafters having an associate degree starting salaries of $9,391 a year in 1979. Those with less education or experience generally started at $8,366. The average Federal Government salary for all drafters was about $12,200 a year in 1978.

Related Occupations

Other occupations in which workers are required to prepare or understand detailed drawings, make accurate and precise calculations and measurements, and use various measuring devices include architects, engineering technicians, engineers, landscape architects, photogrammetrists, and surveyors.

Sources of Additional Information

General information on careers for drafters is available from:

American Institute for Design and Drafting, 3119 Price Rd., Bartlesville, Okla. 74003.

International Federation of Professional and Technical Engineers, 1126 16th St. NW., Washington, D.C. 20036.

See Sources of Additional Information in the statement on engineering and science technicians elsewhere in the *Handbook*.

Engineering and Science Technicians

Nature of the Work

Knowledge of science, mathematics, industrial machinery, and technical processes enables engineering and science technicians to work in all phases of business and government, from research and design to manufacturing, sales, and customer service. Although their jobs are more limited in scope and more practically oriented than those of engineers or scientists, technicians often apply the theoretical knowledge developed by engineers and scientists to actual situations. Technicians frequently use complex electronic and mechanical instruments, experimental laboratory equipment, and drafting instruments. Almost all technicians described in this statement must be able to use technical handbooks and calculators, and some must work with computers.

In research and development, one of the largest areas of employment, technicians set up experiments and calculate the results, sometimes with the aid of computers. They also assist engineers and scientists in developing experimental equipment and models by making drawings and sketches and, frequently, by doing routine design work.

In production, technicians usually follow the plans and general directions of engineers and scientists, but often without close supervision. They may prepare specifications for materials, devise tests to insure product quality, or study ways to improve the efficiency of an operation. They often supervise production workers to make sure they follow prescribed plans and procedures. As a product is built, technicians check to see that specifications are followed, keep engineers and scientists informed on progress, and investigate production problems.

As sales workers or field representatives for manufacturers, technicians give advice on installation and maintenance of complex machinery, and may write specifications and technical manuals. (See statement on technical writers elsewhere in the *Handbook*.)

Technicians may work in engineering, physical science, or life science. Within these general fields, job titles may describe the level (biological aide or biological technician), duties (quality control technician or time study analyst), or area of work (mechanical, electrical, or chemical).

An engineering technician might work in any of the following areas:

Aeronautical Technology. Technicians in this area work with engineers and scientists to design and produce aircraft, rockets, guided missiles, and spacecraft. Many aid engineers in preparing design layouts and models of structures, control systems, or equipment installations by collecting information, making computations, and performing laboratory tests. For example, a technician might estimate weight factors, centers of gravity, and other items affecting load capacity of an airplane or missile. Other technicians prepare or check drawings for technical accuracy, practicability, and economy.

Aeronautical technicians frequently work as manufacturers' field service representatives, serving as the link between their company and the military services, commerical airlines, and other customers. Technicians also prepare technical information for instruction manuals, bulletins, catalogs, and other literature. (See statements on aerospace engineers, airplane mechanics, and occupations in aircraft, missile, and spacecraft manufacturing elsewhere in the *Handbook*.)

Air-Conditioning, Heating, and Refrigeration Technology. Air-conditioning, heating, and refrigeration technicians design, manufacture, sell, and service equipment to regulate interior temperatures. Technicians in this field often specialize in one area, such as refrigeration, and sometimes in a particular type of activity, such as research and development.

When working for firms that manufacture temperature-controlling equipment, technicians generally work in research and engineering departments, where they assist engineers and scientists in the design and testing of new equipment or production methods. For example, a technician may construct an experimental model to test its durability and operating characteristics. Technicians also work as sales workers for equipment manufacturers or dealers, and must be able to supply engineering firms and other contractors that design and install systems with information on installation, maintenance, operating costs, and the performance specifications of the equipment. Other technicians work for contractors, where they help design and prepare installation instructions for air-conditioning, heating, or refrigeration systems. Still others, in customer service, are responsible for supervising the installation and maintenance of equipment. (See statement on refrigeration and air-conditioning mechanics elswhere in the *Handbook*.)

Civil Engineering Technology. Technicians in this area assist civil engineers in planning, designing, and constructing highways, bridges, dams, and other structures. They often specialize in one area, such as highway or structural technology. During the planning stage, they estimate cost, prepare specifications for materials, or participate in surveying, drafting, or designing. Once construction begins, they assist the contractor or superintendent in scheduling construction activities or inspecting the work to assure conformance to blueprints and specifications. (See statements on civil engineers, drafters, and surveyors elsewhere in the *Handbook*.)

Electronics Technology. Technicians in this field develop, manufacture, and service electronic equipment and systems. The types of equipment range from radio, radar, sonar, and television to industrial and medical measuring or control devices, navigational equipment, and computers. Because the field is so broad, technicans often specialize in one area, such as automatic control devices or electronic amplifiers. Furthermore, technological advancement is constantly opening up new areas of work such as integrated circuit technology.

When working in design, production, or customer service, electronic technicians use sophisticated measuring and diagnostic devices to test, adjust, and repair equipment. In many cases, they must understand the field in which the electronic device is being used. To design equipment for space exploration, for example, they must consider the need for minimum weight and volume and maximum resistance to shock, extreme temperature, and pressure. Some electronics technicians also work in technical sales, while others work in the radio and television broadcasting industry. (See statements on broadcast technicians and occupations in radio and television broadcasting elsewhere in the *Handbook*.)

Industrial Production Technology. Technicians in this area, usually called industrial or production technicians, assist industrial engineers on problems involving the efficient use of personnel, materials, and machines to produce goods and services. They prepare layouts of machinery and equipment, plan the flow of work, make statistical studies, and analyze production costs. Industrial technicians also conduct time and motion studies (analyze the time and movements a worker needs to accomplish a task) to improve the production methods and procedures in manufacturing plants.

Many industrial technicians acquire experience that enables them to qualify for other jobs. For example, those specializing in machinery and production methods may move into industrial safety. Others, in job analysis, may set job standards and interview, test, hire, and train personnel. Still others may move into production supervision. (See statements on personnel workers and industrial engineers elsewhere in the *Handbook*.)

Mechanical Technology. Mechanical technology is a broad term that covers a large number of specialized fields including automotive, diesel, and production technology and tool and machine design.

Technicians assist engineers in design and development work by making freehand sketches and rough layouts of proposed ma-

An electronics technician works on solid-state components in the production of TV parts.

chinery and other equipment and parts. This work requires knowledge of mechanical principles involving tolerance, stress, strain, friction, and vibration factors. Technicians also analyze the costs and practical value of designs.

In planning and testing experimental machines and equipment for performance, durability, and efficiency, technicians record data, make computations, plot graphs, analyze results, and write reports. They sometimes recommend design changes to improve performance. Their job often requires skill in the use of complex instruments, test equipment, and gauges, as well as in the preparation and interpretation of drawings.

When a product is ready for production, technicians help prepare layouts and drawings of the assembly process and of parts to be manufactured. They frequently help estimate labor costs, equipment life, and plant space. Some mechanical technicians test and inspect machines and equipment in manufacturing departments or work with engineers to eliminate production problems. Others are technical sales workers.

Tool designers are among the better known specialists in mechanical engineering technology. Tool designers prepare sketches of designs for cutting tools, jigs, dies, special fixtures, and other devices used in mass production. Frequently, they redesign existing tools to improve their efficiency. They also make, or supervise others who make detailed drawings of tools and fixtures.

Machine drafting with some designing, another major area often grouped under mechanical technology, is described in the statement on drafters. (Also see statements on mechanical engineers, automobile mechanics, and manufacturers' sales workers elsewhere in the *Handbook*.)

Instrumentation Technology. Automated manufacturing and industrial processes, oceanographic and space exploration, weather forecasting, satellite communication systems, environmental protection, and medical research have helped to make instrumentation technology a fast-growing field. Technicians help develop and design complex measuring and control devices such as those in a spacecraft that sense and measure changes in heat or pressure, automatically record data, and make necessary adjustments. These technicians have extensive knowledge of physical sciences as well as electrical-electronic and mechanical engineering.

Several areas of opportunity exist in the physical sciences: *Chemical technicians* work with chemists and chemical engineers to develop, sell, and utilize chemical and related products and equipment.

Most chemical technicians do research and development, testing, or other laboratory work. They often set up and conduct tests on processes and products being developed or improved. For example, a technician may examine steel for carbon, phosphorus, and sulfur content or test a lubricating oil by subjecting it to changing temperatures. The technician measures reactions, analyzes the results of experiments, and records data that will be the basis for decisions and future research.

Chemical technicians in production generally put into commerical operation those products or processes developed in research laboratories. They assist in making the final design, installing equipment, and training and supervising operators on the production line. Technicians in quality control test materials, production processes, and final products to insure that they meet the manufacturer's specifications and quality standards. Many also sell chemicals or chemical products as technical sales personnel.

Many chemical technicians use computers and instruments, such as a dilatometer (which measures the expansion of a substance.) Because the field of chemistry is so broad, chemical technicians frequently specialize in a particular industry, such as food processing or pharmaceuticals. (See statements on chemists, chemical engineers, and occupations in the industrial chemical industry elsewhere in the *Handbook*.)

Meteorological technicians support meteorologists in the study of atmospheric conditions. Technicians calibrate instruments, observe, record, and report meteorological occurrences, and assist in research projects and the development of scientific instruments.

Geological technicians assist geologists in evaluating earth processes. Currently much research is being conducted in seismology, petroleum and mineral exploration, and ecology. These technicians install and record measurements from seismographic instruments, assist in field evaluations of earthquake damage and surface displacement, or assist geologists in earthquake prediction research. In petroleum and mineral exploration, they help conduct tests and record sound wave data to determine the likelihood of successful drilling, or use radiation detection instruments and collect core samples to help geologists evaluate the economic possibilities of mining a given resource.

Hydrologic technicians gather data to help hydrologists predict river stages and water quality levels. They monitor instruments that measure water flow, water table levels, or water quality, and record and analyze the data obtained. (See statement on environmental scientists elsewhere in the *Handbook*.)

Technicians in the life sciences generally are classified in either of two broad categories:

Agricultural technicians work with agricultural scientists in food production and processing. Plant technicians conduct tests and experiments to improve the yield and quality of crops, or to increase resistance to disease, insects, or other hazards. Technicians in soil science analyze the chemical and physical properties of various soils to help determine the best uses for these soils. Animal husbandry technicians work mainly with the breeding and nutrition of animals. Other agricultural technicians are employed in the food industry as food processing technicians. In quality control or in food science research they help scientists develop better and more efficient ways of processing food material for human consumption. (See statement on food technologists elsewhere in the *Handbook*.)

Biological technicians work primarily in laboratories where they perform tests and experiments under controlled conditions. Microbiological technicians study microscopic organisms and may be involved in immunology or parasitology research. Laboratory animal technicians study and report on the reaction of laboratory animals to certain physical and chemical stimuli. They also study and conduct research to help biologists develop cures for human diseases. By conducting experiments and reporting the results to a biochemist, technicians assist in analyzing biological substances (blood, other body fluids, foods, and drugs). A biological technician also might work with insects to study insect control, develop new insecticides, or determine how to use insects to control other insects or undesirable plants. (See statements on life scientists elsewhere in the *Handbook*.)

Technicians also specialize in fields such as metallurgical (metal), electrical, and optical technology. In the atomic energy field, technicians work with scientists and engineers on problems of radiation safety, inspection, and decontamination. (See statement on occupations in the atomic energy field elswhere in the *Handbook*.) New areas of work include environmental protection, where technicians study the problems of air and water pollution, and industrial safety.

Working Conditions

Technicians work under a wide variety of conditions. Most work regular hours in laboratories and industrial plants. Others work part or all of their time outdoors. Some occasionally are exposed to safety or health hazards from equipment or materials.

Places of Employment

Over 600,000 persons worked as engineering and science technicians in 1978. About two-thirds of all technicians worked in private industry. In the manufacturing sector, the largest employers were the electrical equipment, chemical, machinery, and aerospace industries. In nonmanufacturing, large numbers worked in wholesale and retail trade, communications, and in engineering and architectural firms.

In 1978, the Federal Government employed about 90,000 technicians, chiefly as engineering and electronics technicians, biological technicians, cartographic (mapmaking) technicians, meteorological technicians, and physical science technicians. The largest number worked for the Department of Defense; most of the others worked for the Departments of Transportation, Agriculture, Interior, and Commerce.

State government agencies employed nearly 50,000 engineering and science technicians, and local governments about 11,500. The remainder worked for colleges and universities and nonprofit organizations.

Training, Other Qualifications, and Advancement

Although persons can qualify for technician jobs through many combinations of work experience and education, most employers prefer applicants who have had some specialized technical training. Specialized training is available at technical institutes, junior and community colleges, area vocational-technical schools, extension divisions of colleges and universities, and vocational-technical high schools. Some engineering and science students who have not completed the bachelor's degree and others who have degrees in science and mathematics also are able to qualify for technician positions.

Persons also can qualify for technician jobs by less formal methods. Workers may learn through on-the-job training, apprenticeship programs, or correspondence schools. Some qualify on the basis of experience gained in the Armed Forces. However, postsecondary training is becoming increasingly necessary for advancement to more responsible jobs.

Some of the types of postsecondary and other schools that provide technical training are discussed in the following paragraphs:

Technical Institutes. Technical institutes offer training to qualify students for a job immediately after graduation with a minimum of on-the-job training. In general, students receive intensive technical training but less theory and general education than in engineering schools or liberal arts colleges. A few technical institutes and community colleges offer cooperative programs in which students spend part of the time in school and part in paid employment related to their studies.

Some technical institutes operate as regular or extension divisions of colleges and universities. Other institutions are operated by States and municipalities, or by private organizations.

Junior and Community Colleges. Curriculums in junior and community colleges which prepare students for technician occupations are similar to those in technical institutes but emphasize theory and liberal arts. After completing the 2-year programs, some graduates qualify for technician jobs while others continue their education at 4-year colleges.

Area Vocational-Technical Schools. These postsecondary public institutions serve students from surrounding areas and emphasize training in skills needed by employers in the local area. Most require a high school degree or its equivalent for admission.

Other Training. Some large corporations conduct training programs and operate private schools to meet the needs of technically trained personnel in specific jobs; such training rarely includes general studies. Training for some technician occupations, for instance tool designers and electronic technicians, is available through formal 2- to 4-year apprenticeship programs. The apprentice gets on-the-job training under the close supervision of an experienced technician and related technical knowledge in classes, usually after working hours.

The Armed Forces have trained many technicians, especially in electronics. Although military job requirements generally differ from those in the civilian economy, military technicians often find employment with only minimal additional training.

Many private technical and correspondence schools often specialze in a single field of technical training such as electronics. Some of these schools are owned and operated by large corporations that have the resources to provide up-to-date training in a technical field.

Those interested in a career as a technician should have an aptitude for mathematics and science and enjoy technical work. An ability to do detailed work with a high degree of accuracy is necessary; for design work, creative talent also is desirable. Technicians are part of a scientific team, and often work closely with engineers and scientists as well as other technicians and skilled workers. Some technicans, such as repair and maintenance technicians, should be able to work independently and to deal effectively with customers.

Engineering and science technicians usually begin work as trainees in routine positions under the direct supervision of an experienced technician, scientist, or engineer. As they gain experience, they receive more responsibility and carry out a particular assignment under only general supervision. Technicians may eventually move into supervisory positions. Those who have the ability and obtain additional education occasionally may be promoted to positions as scientists or engineers.

Employment Outlook

Employment opportunities for engineering and science technicians are expected to be favorable through the 1980's. Opportunities will be best for graduates of postsecondary school technician training programs. Besides openings resulting from the slightly faster than average growth expected in this field, additional technicians will be needed to replace those who die, retire, or leave the occupation.

Industrial expansion and the increasing complexity of modern technology underlie the anticipated increase in demand for technicians. Many will be needed to work with the growing number of engineers and scientists in developing, producing, and distributing new and technically advanced products. Automation of industrial processes and continued growth of new areas of work such as environmental protection and energy development will add to the demand for technical personnel.

The anticipated growth of research and development expenditures in industry and government also should increase requirements for technicians.

Earnings

In private industry in 1977, technicians who completed a 2-year post-high school program earned starting salaries of about $10,500 a year, according to a survey by the Engineering Manpower Commission; those who did not complete a 2-year program started at about $9,000 a year. Graduates of 2-year programs with 5 years' experience earned about $12,800 a year in 1977, while nongraduates with some experience earned about $11,100. Senior technicians averaged about $18,700 a year in 1978, according to a Department of Labor survey.

Starting salaries for all technicians in the Federal Government were fairly uniform in 1979. A high school graduate with no experience could expect $8,366 annually to start. With an associate degree, the starting salary was $9,391, and with a bachelor's, $10,507 or $13,014. With more experience, however, earnings are significantly higher. The average annual salary for all engineering technicians employed by the Federal Government in 1978 was $19,617; for physical science technicians, $15,935; and for life science technicians, about $11,375.

Related Occupations

Engineering and science technicians apply scientific principles in their work. Other occupations whose work activities involve the application of scientific principles include foresters, forestry technicians, range managers, soil conservationists, engineers, environmental, life, and physical scientists, broadcast technicians, drafters, surveyors, television and radio service technicians, dental laboratory technicians, and medical technologists and technicians.

Sources of Additional Information

For information on careers in engineering and technology contact:

Engineers Council for Professional Development, 345 East 47th St., New York, N.Y. 10017.

Information on schools offering technician programs is available from:

National Association of Trade and Technical Schools, 2021 K St. N.W., Washington, D.C. 20006.

State departments of education also have information about approved technical institutes, junior colleges, and other educational institutions within the State offering post-high school training for specific technical occupations. Other sources include:

American Association of Community and Junior Colleges, One Dupont Circle, Suite 410, Washington, D.C. 20036.

National Home Study Council, 1601 18th St. NW., Washington, D.C. 20009.

Food Technologists

(D.O.T. 041.081-010)

Nature of the Work

In the past, consumers processed most food in the home, but today industry processes almost all foods. A key worker involved in the development and processing of the large variety of foods available today is the *food technologist*.

Food technologists investigate the chemical, physical, and biological nature of food and apply this knowledge to processing, preserving, packaging, distribution, and storing an adequate, nutritious, wholesome, and economical food supply. Over one-third of all food technologists work in research and development. Others work in quality assurance laboratories or in production or processing areas of food plants. Some teach or do basic research in colleges and universities, and others work in sales or management positions.

Food technologists in basic research study the structure and composition of food and the changes it undergoes in storage and processing. For example, they may develop new sources of proteins, study the effects of processing on micro-organisms, or search for factors that affect the flavor, texture, or appearance of foods. Food technologists who work in applied research and development create new foods and develop new processing methods. The also work to improve existing foods by making them more nutritious and enhancing their flavor, color, and texture.

Food technologists seek to have each product retain its characteristics and nutritive value during processing and storage. They also conduct chemical and microbiological tests to see that products meet industry and government standards, and they may determine the nutritive contents of products in order to comply with Federal nutritional labeling requirements.

In quality control laboratories, food technologists check raw ingredients for freshness, maturity, or suitability for processing. They may use machines that test for tenderness by finding the amount of force necessary to puncture the item. Periodically, they inspect processing line operations to insure conformance with government and industry standards. For example, they test processed foods for sugar, starch, protein, fat, vitamin, and mineral content. They make sure that, after processing, various enzymes are inactive and microbial levels are adequately low so that the food will not spoil during storage or present a safety hazard. Other food technologists are involved in developing and improving packaging and storage methods.

Food technologists in processing plants prepare production specifications, schedule processing operations, maintain proper temperature and humidity in storage areas, and supervise sanitation operations, including the efficient and economical disposal of wastes. To increase efficiency, they advise management on the purchase of equipment and recommend new sources of materials.

Some food technologists apply their knowledge in areas such as market research, advertising, and technical sales. Others teach in colleges and universities.

Working Conditions

Food technologists work under a variety of conditions. Most work regular hours in offices, laboratories, or classrooms. Food technologists who work in production or quality control positions work in or near food processing areas, sometimes under noisy, hot, or cold conditions, but they usually do not encounter unhealthy or unsafe conditions.

Places of Employment

An estimated 15,000 persons worked as food technologists in 1978. Food technologists work in all sectors of the food industry and in every State. The types of products and processes with which they work may depend on the locality. For example, in Maine and Idaho, they work with potato processing; in the Midwest, with cereal products and meatpacking; and in Florida and California, with citrus fruits and vegetables.

Some food technologists do research for Federal agencies such as the Food and Drug Administration and the Departments of Agriculture and Defense; others work in State regulatory agencies. A few work for private consulting firms and international organizations such as the United Nations. Some teach or do research in colleges and universities. (See statement on college and university faculty elsewhere in the *Handbook*.)

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in food technology or in one of the physical or life sciences, such as chemistry or biology, is the usual minimum requirement for beginning jobs in food techology. An advanced degree is necessary for many jobs, particularly research and college teaching and for some management jobs in industry.

Over 60 colleges and universities offered programs leading to the bachelor's degree in food technology in 1978. Undergraduate students majoring in food technology usually take courses in physics, chemistry, mathematics, biology, the social sciences and humanities, and business administration, as well as a variety of food technology courses. Food technology courses cover areas such as preservation, processing, sanitation, and marketing of foods.

Most of the colleges and universities that provide undergraduate food technology programs also offer advanced degrees. Graduate students usually specialize in a particular area of food technology. Requirements for the master's or doctor's degree vary by institution, but usually include extensive research. A thesis, which is a report of original research findings, is required for the doctor's

Many food technologists work in quality control laboratories.

degree and, in some institutions, for the master's degree.

People planning careers as food technologists should have analytical minds and like details and technical work. Food technologists must be able to express their ideas clearly to others.

Food technologists with a bachelor's degree might start work as quality assurance chemists or as assistant production managers. After gaining experience, they can advance to more responsible management jobs. A food technologist might also begin as a junior food chemist in a research and development laboratory of a food company, and be promoted to section head or another research management position.

People who have master's degrees may begin as food chemists in a research and development laboratory. Those who have the Ph. D. degree usually begin their careers doing basic research or teaching.

Employment Outlook

Employment of food technologists is expected to grow more slowly than the average for all occupations through the 1980's. Most openings will result from the need to replace those who die, retire, or transfer to other fields, although some openings will arise from growth in demand for these workers.

Employment is expected to grow somewhat as the food industry responds to the challenge of providing wholesome and economical foods that can meet changing consumer preferences and food standards. In addition, both private households and food service institutions that supply customers such as airlines and restaurants will demand a greater quantity of processed convenience foods. However, the expected slow growth of the food processing industry will result in the slower than average growth in employment of food technologists.

An increasing number of food technologists are expected to find jobs in research and product development. In recent years, expenditures for research and development in the food industry have increased moderately and probably will continue to rise. Through research, new foods are being produced from modifications of wheat, corn, rice, and soybeans. For example, food scientists are working to improve "meat" products made from vegetable proteins. There will be an increased need for food scientists in quality control and production because of the complexity of products and processes and the application of higher processing standards and new government regulations.

Earnings

Food technologists had relatively high earnings in 1978, about twice the average for all nonsupervisory workers in private industry, except farming. According to a survey of the Institute of Food Technologists in 1977, food technologists with the bachelor's degree had average starting salaries of about $12,000 a year. Those with a master's degree started at about $15,000, and those with the Ph. D. degree at about $18,000.

In the Federal Government in 1978, food technologists with a bachelor's degree could start at $10,507 or $13,014 a year, depending on their college grades. Those with a master's degree could start at $13,014 or $15,920, and those with a Ph. D. could begin at $19,263 or $23,087. The average salary for experienced food technologists in the Federal Government was about $26,600 a year in 1978.

Related Occupations

Food technology is closely related to chemistry and, to a lesser extent, to biology. Other occupations in which the work is related to food technology are life and environmental scientists, engineers, and engineering and science technicians.

Sources of Additional Information

For information on careers in food technology contact:

Institute of Food Technologists, Suite 2120, 221 North LaSalle St., Chicago, Ill. 60601.

Surveyors and Surveying Technicians

(D.O.T. 018.167-010, -018, and -034 through -050)

Nature of the Work

Surveyors with the assistance of surveying technicians establish official land boundaries, research deeds, write descriptions of land to satisfy legal requirements, assist in setting land valuations, measure construction and mineral sites, and collect information for maps and charts.

Surveys are usually conducted by a survey party that determines the precise measurement of distances, directions, and angles between points and of elevations, of points, lines, and contours on the earth's surface. *Land surveyors* (D.O.T. 018.167-018), who may head one or more survey parties, are directly responsible for the party's activities and the accuracy of its work. They plan the fieldwork, select survey reference points, and determine the precise location of natural and constructed features of the survey project area. They record the information disclosed by the survey, verify the accuracy of the survey data, and prepare sketches, maps, and reports.

A typical survey party is made up of the party chief (D.O.T. 018.167-010) and one to six assistants and helpers. The party chief leads the day-to-day work activities of the party. *Instrument assistants* (D.O.T. 018.-167-034) adjust and operate surveying instruments such as the theodolite (used to measure horizontal and vertical angles) and electronic equipment used to measure distances. These workers also compile notes, sketches, and records of the data obtained from using these instruments. *Suveyor helpers* (D.O.T. 869.567-010) use a steel tape to measure distances between surveying points and use a level rod, a stadia rod, range pole, or other equipment to aid instrument assistants in determining elevations, distances, and directions. Surveyor helpers also may clear brush and trees from the survey line and assist in setting survey markers.

Surveyors may specialize in a particular type of survey. Many perform land surveys to locate boundaries of a particular tract of land. They then prepare maps and legal descriptions for deeds, leases, and other documents. Surveyors doing topographic surveys determine elevations, depressions, and contours of an area, and indicate the location of distinguishing surface features such as farms, buildings, forests, roads, and rivers. *Geodetic surveyors* (D.O.T. 018.167-038) make precise, broad-area measurements which take into account the earth's curvature and its geophysical characteristics. *Geophysical prospecting surveyors* (D.O.T. 018.167-042) mark sites for subsurface exploration, usually petroleum related. *Marine surveyors* (D.O.T. 018.167-046) survey harbors, rivers, and other bodies of water to determine shorelines, topography of the bottom, depth, and other features.

Several closely related occupations are geodesy and photogrammetry. Geodesists (D.O.T. 024.061-014) study the size, shape, and gravitational field of the earth. They make the measurements and computations necessary for accurate mapping of the earth's surface. (See statement on geophysicists elsewhere in the *Handbook*.) Photogrammetrists (D.O.T. 018.261-026) measure and interpret photographic images to determine the various physical characteristics of natural or constructed features of an area. By applying analytical processes and mathematical techniques to photographs obtained from aerial, space, ground, and underwater locations, photogrammetrists are able to make detailed maps of areas that are inaccessible or difficult to survey by other methods. Control surveys on the ground are made to insure the accuracy of maps derived from photogrammatic techniques.

Working Conditions

Surveyors and surveying technicians usually work an 8-hour day, 5-day week. Sometimes they work longer hours during the summer months when weather conditions are most suitable for surveying.

The work of a survey party is active and sometimes strenuous. Party members often stand for long periods and walk long distances or climb hills with heavy packs of instruments and equipment. They also are exposed to all types of weather. Occasionally they must commute long distances or find temporary housing near the site.

Surveyor measures land boundaries before construction starts.

Surveyors spend considerable time performing office duties, such as planning surveys, preparing reports and computations, and drawing maps.

Places of Employment

About 62,000 persons worked as surveyors or surveying technicians in 1978. Federal, State, and local government agencies employ about 1 out of every 10 of these workers. Among the Federal Government agencies are the U.S. Geological Survey, the Bureau of Land Management, the Army Corps of Engineers, the Forest Service, the National Ocean Survey, and the Defense Mapping Agency. Most surveyors and surveying technicians in State and local government agencies work for highway departments and urban planning and redevelopment agencies.

Nearly three-fourths of all surveyors and surveying technicians work for construction companies and for engineering and architectural consulting firms. A sizable number either work for or own firms that conduct surveys for a fee. Surveyors and surveying technicians also work for crude petroleum and natural gas companies and for public utilities.

Training, Other Qualifications, and Advancement

Most persons prepare for surveying work by combining postsecondary school courses in surveying with extensive on-the-job training. Some prepare by obtaining a college degree. Junior and community colleges, technical institutes, and vocational schools offer 1-, 2-, and 3-year programs in surveying. A few 4-year colleges offer bachelor's degrees specifically in surveying, while many others offer several courses in the field.

High school students interested in pursuing a career in surveying should take courses in algebra, geometry, trigonometry, drafting, and mechanical drawing.

High school graduates with no formal training in surveying usually start as surveyor helpers. After several years of on-the-job experience and some formal training in surveying, it is possible to advance to instrument assistant, then to party chief, and finally to licensed surveyor.

Beginners with postsecondary school training in surveying can generally start as instrument assistants. After gaining experience, they usually advance to party chief, and may later seek to become a licensed surveyor. In many instances, promotions to higher level positions are based on written examinations as well as experience.

For those interested in a career as a photogrammetrist, a bachelor's degree in engineering or the physical sciences is usually needed. Most photogrammetry technicians have had some specialized postsecondary school training.

All 50 States require licensing of land surveyors. Licensing requirements are generally quite strict, because once licensed, surveyors can be held legally responsible for their work. Requirements for licensure vary among the States. Generally, the quickest route to licensure is a combination of 4 years of college, 2 to 4 years of experience, and passage of a State licensing exam. In most States, persons also may qualify to take the licensing exam after 5 to 12 years of surveying experience. A few States now require a bachelor's degree, emphasizing surveying, as a prerequisite to licensure.

Surveyors and surveying technicians should have the ability to visualize and understand objects, distances, sizes, and other abstract forms. Also, because surveying mistakes can be very costly, surveyors must perform mathematical calculations quickly and accurately while paying close attention to the smallest detail. Leadership qualities also are important as surveyors must supervise the work of others.

Members of a survey party must be in good physical condition to work outdoors and carry equipment over difficult terrain. They also need good eyesight, coordination, and hearing to communicate over great distances by hand or voice signals.

Employment Outlook

Employment of surveyors and surveying technicians is expected to grow about as fast as the average for all occupations through the 1980's. In addition to the openings resulting from employment growth, many will result from the need to replace those who die, retire, or transfer to other fields of work.

The anticipated rapid growth in construction should create additional jobs for surveyors and surveying technicians to lay out streets, shopping centers, housing developments, factories, office buildings, and recreation areas. In addition, as the value of land and thus the need for accurate surveys increase, more jobs will arise. Construction and improvement of the Nation's roads and highways also will create many new surveying positions. However, employment may fluctuate from year to year because construction activity in sensitive to changes in economic conditions.

Earnings

In the Federal Government in 1979, high school graduates with little or no training or experience started as surveyor helpers with an annual salary of $7,422. Those with 1 year of related postsecondary training earned $8,366. Those with an associate degree that included courses in surveying generally started as instrument assistants with an annual salary of $9,391. In 1978, surveying technicians who worked as party chiefs in the Federal Government earned between $11,000 and $15,000 per year. Land surveyors in the Federal Government averaged about $20,400 per year in 1978.

Although salaries in private industry vary by geographic area, limited data indicate that salaries are generally comparable to those in Federal service and are above the average earnings of nonsupervisory workers in private industry, except farming.

Related Occupations

Other occupations concerned with accurate measurement and delineation of land areas, coastlines, and natural and constructed features include cartographic drafters, field-map editors, geodesists, map editors, mosaicists, photogrammetric engineers, photogrammetrists, and topological drafters.

Sources of Additional Information

Information about training and career opportunities in surveying is available from:

American Congress on Surveying and Mapping, 210 Little Falls St., Falls Church, Va. 22046.

General information on careers in photogrammetry is available from:

American Society of Photogrammetry, 105 North Virginia Ave., Falls Church, Va. 22046.

MECHANICS AND REPAIRERS

In the technologically advanced society we live in today, mechanical equipment of one type or another touches almost all aspects of our lives. Transportation equipment such as cars, trucks, buses, and airplanes carry both goods and people anywhere in the world. Telephones and other communication equipment enable messages to be conveyed quickly and efficiently. Household appliances and machinery such as air-conditioners make our lives easier and more comfortable. Mechanics and repairers keep these and other types of machinery in good working order.

Approximately 4 million people worked as mechanics and repairers in 1978; one-third worked on motor vehicles in occupations such as automobile mechanic, truck or bus mechanic, and automobile body repairer. Other large occupations—each employing more than 100,000 workers—were appliance repairer, industrial machinery repairer, airplane mechanic, and television and radio service technician. Employment in some occupations, including vending machine mechanic, electric sign repairer, and piano technician, was relatively small.

Almost one-fourth of the mechanics and repairers worked in manufacturing industries—the majority in plants that produce durable goods such as steel, automobiles, and aircraft. About one-fifth worked in retail trade—mainly in firms that sell and service automobiles, household appliances, farm implements, and other mechanical equipment. Another one-fifth worked in shops that service such equipment. Most of the remaining mechanics and repairers worked for transportation, construction, and public utilities industries, and all levels of government.

Mechanics and repairers work in every section of the country, but most employment opportunities are in populous and industrialized areas.

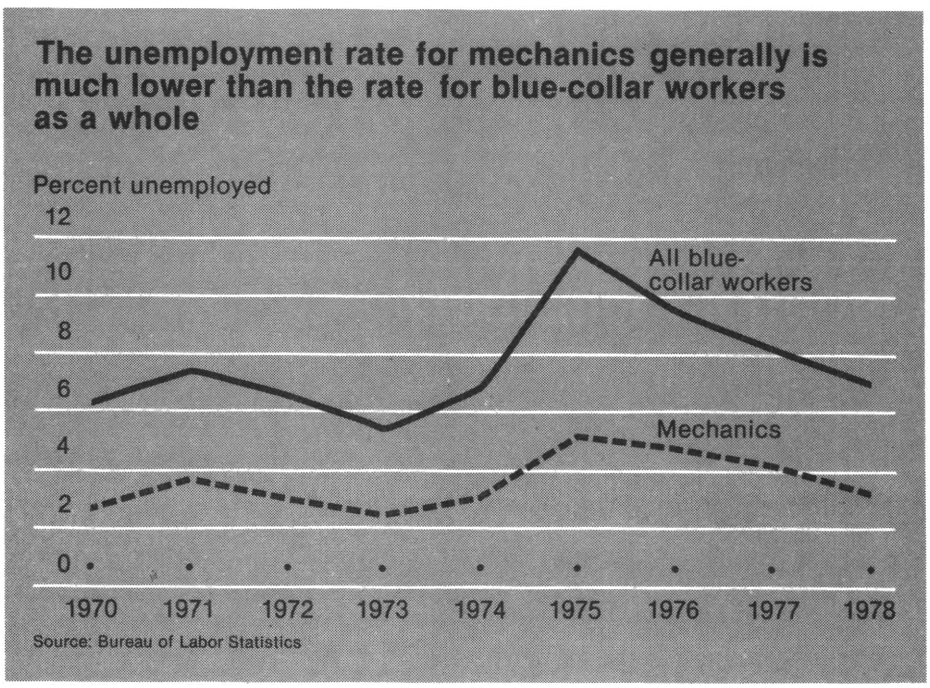
Training, Other Qualifications, and Advancement

Many mechanics and repairers learn their skills on the job or through apprenticeship training. Some acquire basic training or increase their skills in vocational schools; others take correspondence courses. Training and experience in the Armed Forces also may help people prepare for some of these occupations, including television and radio service technician, airplane mechanic, and telephone craft worker.

Employers look for applicants who have mechanical aptitude and like to work with their hands. A high school education often is required, and employers generally prefer applicants who have had courses in mathematics, chemistry, physics, blueprint reading, and shop.

Physical requirements for work in this field vary greatly among occupations. For example, telephone lineworkers should be strong and agile to climb poles, lift heavy equipment, and work in awkward positions. Jewelers and watch repairers need patience, finger dexterity, and good vision.

Many maintenance and repair workers advance to supervisory jobs; others to sales jobs. Some open their own businesses.



The unemployment rate for mechanics generally is much lower than the rate for blue-collar workers as a whole

Employment Outlook

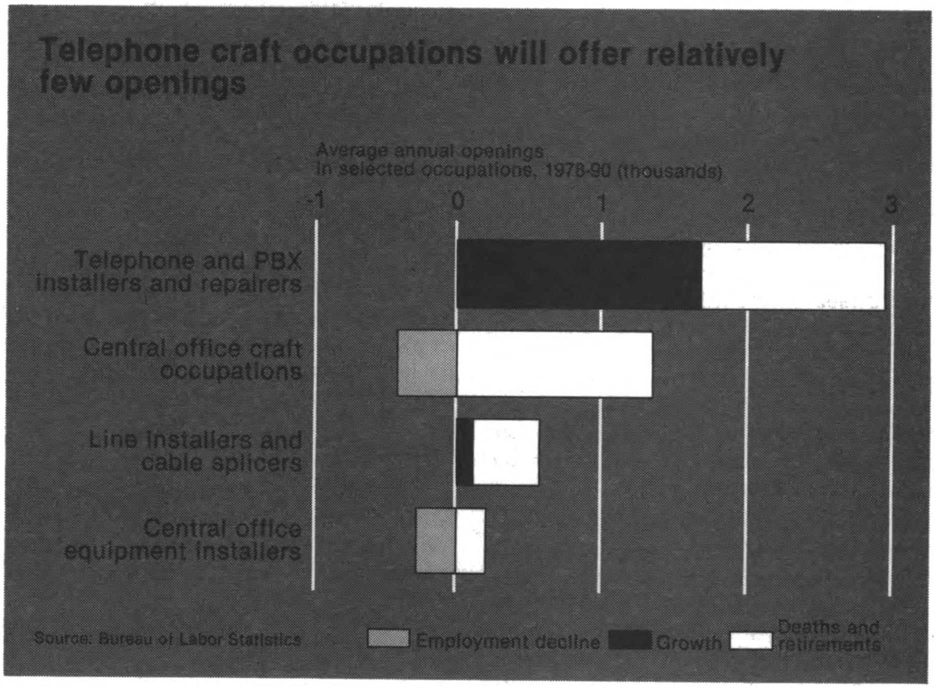
Employment in maintenance and repair occupations as a whole is expected to increase about as fast as the average for all occupations through the 1980's. In addition to jobs created by employment growth, many thousands of openings will arise in this relatively large occupational category as experienced workers retire, die, or transfer to other fields.

Many factors are expected to contribute to the growing need for mechanics and repairers, including increased demand for household appliances, automobiles, and other consumer items, and increased use of complex machinery in industry.

This chapter includes statements on many maintenance and repair occupations. Other maintenance and repair workers are discussed in other sections of the *Handbook*. For example, airplane mechanics are discussed with air transportation occupations and millwrights with industrial production and related occupations.

Telephone Craft Occupations

More than 1 out of every 3 employees in the telephone industry is a craft worker who installs, repairs, and maintains phones, cables, and related equipment. This section discusses the four groups of telephone craft occupations: Central office craft occupations, central office equipment installers, line installers and cable splicers, and telephone installers and repairers.



Central Office Craft Occupations

Nature of the Work

Telephone companies employed about 135,000 craft workers in 1978 to maintain and repair the complex equipment in their central offices. Most worked as frame wirers, central office repairers, and trouble locators. In small telephone companies, central office craft workers must perform a variety of jobs, but most specialize in one of these three areas.

Frame wirers (D.O.T. 822.684-010) connect and disconnect wires that run from telephone lines and cables to equipment in central offices. This equipment consists of a frame having many terminal lugs mounted on it, each of which is assigned a specific telephone number. It also contains one pair of wires for each customer's telephone that is connected to that central office. To connect a new telephone, the frame wirer solders the customer's pair of wires to a set of terminal lugs. To disconnect a telephone, a frame wirer melts off the solder and removes the wires from the terminal. Frame wirers occasionally change a customer's phone number by reconnecting the customer's pair of wires to a different set of terminal lugs.

Frame wirer solders a pair of wires to a set of terminal lugs.

Central office repairers (D.O.T. 822.281-014) maintain the switching equipment that automatically connects lines when customers dial numbers. Electromechanical switching systems contain moving parts that must be cleaned and oiled periodically. Also, electronic switching circuits must be checked occasionally for breakages.

When customers report trouble with their telephones, *trouble locators* (D.O.T. 822.361-030) work at special switchboards to find the source of the problem. To do this, they communicate with telephone installers and repairers as they attempt to connect a portable telephone through the customer's service line to the central office. The trouble shooter locates the problem by having the telephone repairer connect the portable phone at various places on the customer's line until a connection can be made through to the central office. For a problem at the central office, the trouble locator repeats this procedure with a central office repairer. In addition, trouble locators must also test new equipment to make sure installations are made correctly. They also work with other employees, such as central office repairers and cable splicers, who help find the cause of trouble and make repairs.

Working Conditions

Because the telephone industry gives continuous service to its customers, central offices operate 24 hours a day, 7 days a week. Some central office craft workers, therefore, have work schedules that include shifts, weekends, and holidays. Central office craft workers work in clean, well-lighted, air-conditioned surroundings. Depending on their particular job, they may have to stand for long periods, climb ladders, and do some reaching, stooping, and light lifting.

Training, Other Qualifications, and Advancement

Telephone companies give classroom instruction and on-the-job training to new central office craft employees. In addition, telecommunications equipment manufacturers often train central office craft workers to use, maintain, and repair equipment that they sell to telephone companies. Some vocational schools, particularly in rural areas served by small independent telephone companies, also train persons interested in becoming central office craft workers. A few people may learn these crafts through apprenticeship programs designed by State employment agencies in conjunction with local telephone companies. Sometimes classrooms are supplied with equipment similar to that which the trainee will be using on the job.

Trainee jobs generally are filled by employees already with the company, such as telephone operators or line installers. Occasionally, workers are hired from outside. Usually, trainees are assigned to the starting job of frame wirer, and take basic courses in telephone communications. They gain practical experience by observing and helping experienced frame wirers under the direction of supervisors. With additional training and experience, a frame wirer can advance to central office repairer or trouble locator. Usually it takes at least 5 years for an inexperienced worker to advance to the top pay rate in either of these two jobs.

Because electrical wires are usually color coded, persons who are considering careers in central office crafts should not be color blind. They also should be able to work closely with others, because teamwork often is essential in solving complex problems. A basic knowledge of electricity and electronics and telephone training in the Armed Forces are helpful.

Telephone companies give central office craft employees continued training throughout their careers to keep them abreast of the latest developments. As new types of equipment and tools and new maintenance methods are introduced, employees are sent to schools to learn about them.

Central office craft workers who have managerial ability can advance to supervisory positions.

Employment Outlook

Employment of central office craft workers will be subject to conflicting trends. As the population grows and becomes more mobile and is offered a wider array of telecommunications services, demand should rise for workers to handle the growing number of telephone installations and disconnections. However, central office workloads are not expected to rise as fast as productivity. Electromechanical switching systems are being replaced with electronic switching systems to increase call- carrying capacity and to provide improved service to remote areas. This substitution will slow the rate of construction of new central offices. Because the new, electronically equipped central offices utilize sophisticated, self-diagnosing test equipment that requires fewer maintenance personnel, employment of central office craft workers should decline slightly over the next decade.

While overall employment in central office craft occupations is expected to drop slightly through the 1980's, job openings will arise as experienced workers retire, die, or transfer to other occupations. Although many job openings for central office craft workers are filled by the advancement of other workers already employed by telephone companies, some entry-level positions—frame wirers, for example—should be available for new employees.

Earnings

In late 1978, average hourly rates were $8.80 for trouble locators and $8.30 for central office repairers compared with $5.69 for nonsupervisory workers in all private industries, except farming.

Earnings increase considerably with length of service. Under a major union contract in effect in late 1978, frame wirers started at $4.96 an hour and could work up to a maximum of $8.36 an hour after 4 years. Central office repairers and trouble locators could earn a maximum of $9.18 an hour after 5 years.

Central office craft workers are covered by the same provisions governing overtime pay, vacations, holidays, and other benefits that apply to telephone workers generally.

Related Occupations

Other workers who have the skills needed to do technical, manual work with tools and machines include automobile mechanics, carpenters, cement masons, electricians, machinists, plumbers, toolmakers, and welders.

See the statement on the telephone industry elsewhere in the *Handbook* for sources of additional information and for general information on fringe benefits.

Central Office Equipment Installers

(D.O.T. 822.361-014)

Nature of the Work

Central office equipment installers set up the complex switching and dialing equipment used in central offices of telephone companies. They may install equipment in new central offices, add equipment in an expanding office, or replace outdated equipment.

On a job, installers follow blueprints, diagrams, and floor plans in order to position the equipment properly and wire it correctly. They often use hoists to lift heavy items into place and use handtools, such as screwdrivers or soldering guns, to connect equipment once it is in place. Recently developed equipment sometimes comes in preassembled components and often requires only simple plug-in connections.

After the new equipment has been put in place, installers connect the outgoing and incoming telephone trunklines, often consulting diagrams to ensure that connections are made correctly. Once this is completed, installers then test the system, using electrical testing equipment, such as electrical pulse repeaters and ohmmeters, to measure the strength and consistency of the current flow. If installers discover that the system is not functioning properly, they must check the equipment and all connections to determine the cause, and then correct it.

Working Conditions

Central office equipment installers often work in buildings under construction. They have to lift and carry heavy tools, climb ladders, and do a lot of stooping, crouching, and reaching. They face certain hazards, such as falls from ladders, injuries from falling objects, and cuts from tools.

Places of Employment

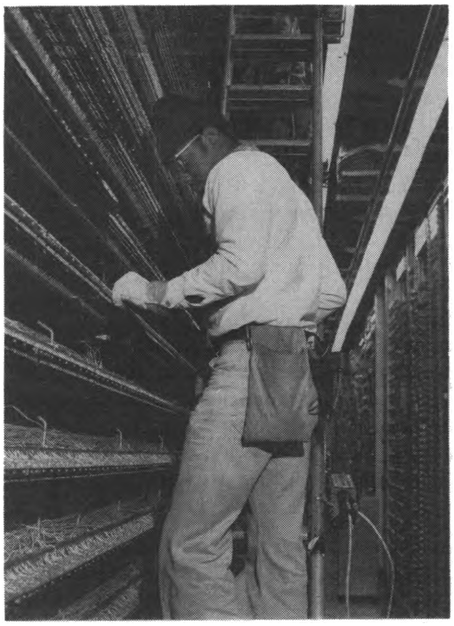
About 21,400 installers were employed in 1978. Most worked for manufacturers of central office equipment. Others worked directly for telephone companies or for private contractors who specialize in large-scale installations.

Most central office equipment installers work in metropolitan areas, where large central offices are found. Hundreds of installers may be required to work on large jobs such as a long-distance toll center in a big city. Other installers are assigned areas that include several States, and, therefore, they must travel frequently to small towns within their area. Installing equipment in small communities often requires only two or three installers.

Training, Other Qualifications, and Advancement

Individuals considering careers as central office equipment installers should have manual dexterity, good eyesight, and, because electrical wires are generally color coded, should not be colorblind. They should be able to work with others, for teamwork often is essential to solving a complex problem. Although manufacturers generally provide all the necessary training to perform this job, courses in blueprint reading and electronic theory are helpful to those interested in this career.

New employees attend classes the first few weeks to learn basic installation and then begin on-the-job training. Often trainees will



Installers must not be color blind because electrical wires generally are color coded.

be transported to the plant where the equipment is manufactured to receive training.

Workers who have several years of experience may qualify as skilled installers. Training continues, however, even after they become skilled; additional courses are given from time to time to improve skills and to teach new techniques in installing telephone equipment. Also, technological innovations are constantly resulting in changes in equipment. When manufacturers develop new equipment, installers must be trained to install it.

Installers who have managerial ability can advance to supervisory positions.

Employment Outlook

Employment of central office equipment installers is expected to decline through the 1980's. However, a few hundred openings will arise each year to replace experienced installers who transfer to other work, retire, or die.

The introduction of remote switching systems is expected to slow the rate of construction of new central offices during the next decade. Although obsolete manual and dial switching equipment will be replaced with more efficient electronic switching systems (ESS), this new equipment is manufactured in components and modules that greatly reduce the time needed for installation. This greater efficiency should offset the demand stemming from new construction and conversion of existing equipment, resulting in an overall reduction in employment through the 1980's.

Employment may fluctuate from year to year because investment in central office equipment is subject to changes in business conditions and availability of funds. Thus, when the economy is prospering, installations and modernization of central offices may occur at an above-average pace. Conversely, when the economy slows down, there may be a reduction of this activity.

Earnings

Under the terms of a major union contract in effect in late 1978, covering most central office equipment installers, starting rates for inexperienced installers ranged from $4.66 to $4.99 an hour. The contract provided for periodic increases, and employees could reach rates of $8.21 to $8.97 an hour after 5 years' experience. Travel and expense allowances also were provided. The average earnings of experienced central office equipment installers are above the average for all nonsupervisory workers in private industry, except farming.

The Communications Workers of America union represents most central office equipment installers, including those with theBell System. The International Brotherhood of Electrical Workers represents some installers employed by various telephone companies, by manufacturers supplying the independent segment of the telephone industry, and by large installation contractors.

Related Occupations

Workers in other occupations in which skill training is needed to do technical, manual work with tools and machines include automobile mechanics, carpenters, cement masons, electricians, machinists, plumbers, toolmakers, and welders.

Sources of Additional Information

See the statement on the telephone industry elsewhere in the *Handbook* for sources of additional information and for general information on fringe benefits.

Line Installers and Cable Splicers

Nature of the Work

The vast network of wires and cables that connect telephone central offices to each other and to customers' telephones and switchboards is constructed and maintained by line installers and cable splicers and their helpers. Telephone companies employed almost 59,000 of these workers in 1978, including about 24,000 cable splicers, 33,000 line installers, and 2,000 helpers, laborers, and other workers.

To construct new telephone lines, *line installers* (D.O.T. 822.381-014) place wires and cables that lead from the central office to customers' premises. They use power-driven equipment to dig holes and set in telephone poles that support cables. Line installers climb the poles to attach the cables, usually leaving the ends free for cable splicers to connect later. In cities where telephone lines are below the streets, installers place cables in underground conduits. On construction jobs, installers work in crews of two persons or more. A supervisor may direct the work of several crews.

When wires or cables break or a pole is knocked down, line installers often are called upon to make emergency repairs. These repairs are most common in parts of the country that have hurricanes, tornadoes, and heavy snowfalls. The linecrew supervisor keeps in radio contact with the central office, which directs the crew to problem locations on the lines. Some installers periodically inspect sections of lines in rural areas and make minor repairs.

After line installers place cables on poles or in underground conduits, *cable splicers* (D.O.T. 829.361-010) generally complete the line connections. Splicers work on poles, on aerial ladders and platforms, in manholes, or in basements of large buildings. They connect individual wires within the cable and rearrange wires when lines have to be changed. At each splice, they place insulation over the spliced conductor, and seal the joint with a lead sleeve or cover the splice with some other type of closure. Sometimes, they fill the cable sheathing with compressed air to keep out moisture.

Splicers also install terminal boxes that connect customers' telephones to outside cables. An innovation in telephone connecting, these terminal boxes are often placed in the basements of apartment buildings or other buildings containing multiple telephone customers. When a telephone installer wishes to connect or disconnect a customer's telephone, it can be done quickly at the terminal box.

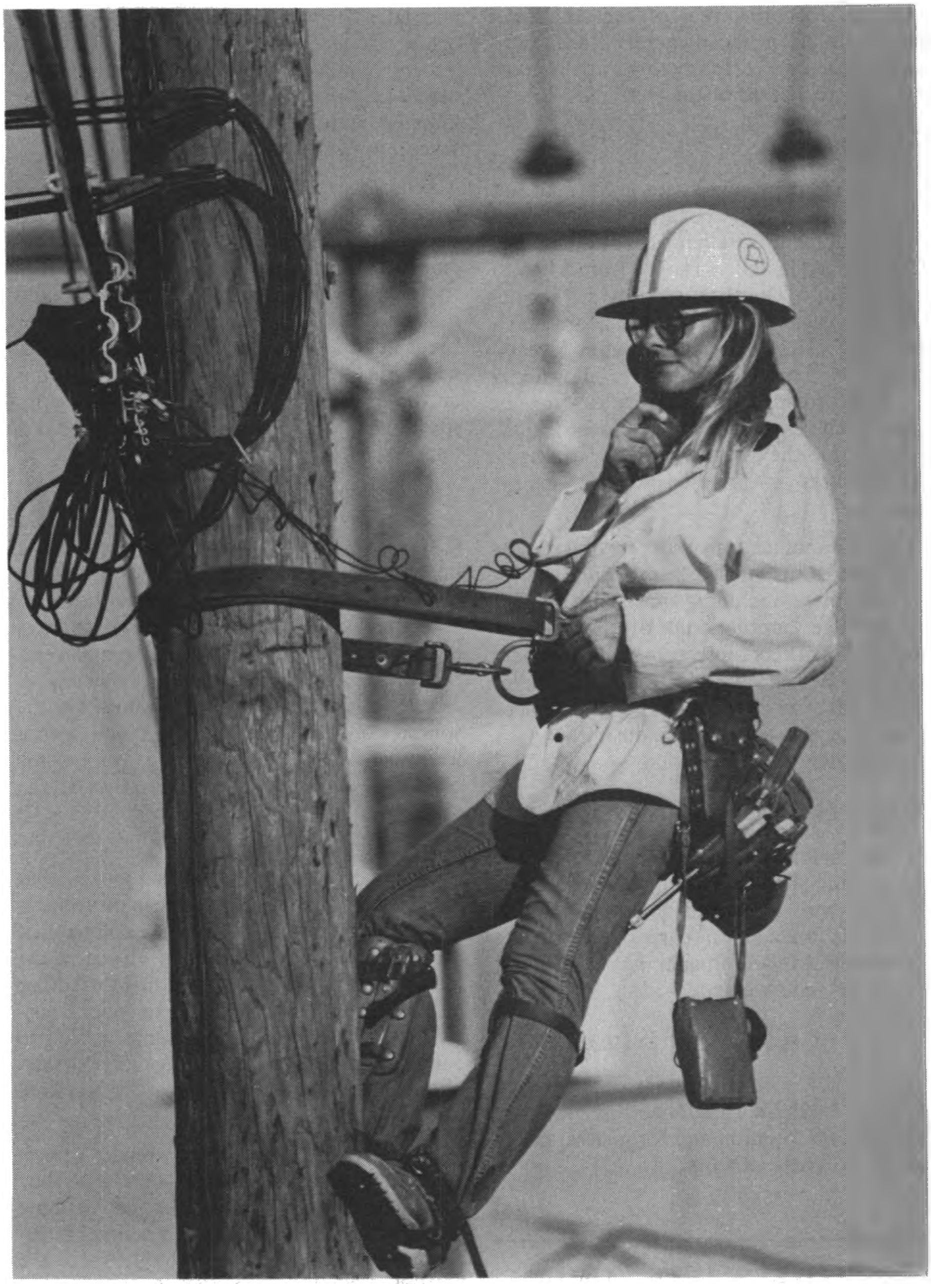
Splicers also maintain and repair cables. The preventive maintenance work that they do is extremely important, because a single defect in a cable may cause a serious interruption in service. Many trouble spots are located through air pressure or electric tests.

Working Conditions

Line installers and cable splicers usually work outdoors. When severe weather damages telephone lines, line installers and cable splicers may be called upon to work long and irregular hours to restore service. They must do a lot of climbing and lifting, and often work in stooped and cramped positions. They face certain hazards such as falls and electric shocks, but these have been greatly reduced by safety standards developed over the years by telephone companies, in cooperation with labor unions.

Training, Other Qualifications, and Advancement

Telephone companies hire inexperienced workers to train for jobs as line installers or cable splicers. Knowledge of the basic principles of electricity and training in installing telephone systems with the Armed Forces



Line installers must be agile.

are helpful. Physical examinations usually are given to prospective employees, since line and cable work is strenuous, requiring workers to climb poles and lift heavy cables and equipment. The ability to distinguish colors is necessary because wires usually are coded by color.

Telephone companies have training programs for line installers and cable splicers that include classroom instruction as well as on-the-job training. Classrooms are equipped with actual telephone apparatus, such as poles, cable-supporting clamps, and other fixtures to simulate working conditions as closely as possible. Trainees learn to climb poles and are taught safe working practices to avoid falls and contact with power wires. After a short period of classroom training, some trainees are assigned to a crew to work with experienced line installers and cable splicers under the supervision of a line supervisor.

In addition to the training provided by the telephone companies, some manufacturers of cable installation equipment also train line installers and cable splicers in the use of equipment that the manufacturers sell to telephone companies. Often a telephone company will send its line and cable workers to the manufacturer's training school. At other times, manufacturers send their instructors to the job site.

Some small independent telephone companies, particularly those in rural areas, do not have adequate facilities to train their employees. Therefore, they may rely on local vocational and technical schools to provide classroom training to craft employees. A few apprenticeships also are available for line and cable workers. In these cases, employees receive classroom training in courses such as mathematics and electronic theory sponsored by outside agencies—for example, State employment agencies—while they receive on-the-job training. Apprenticeships generally last 4 years.

Line installers and cable splicers continue to receive training throughout their careers, to qualify for more difficult assignments and to keep up with technological changes. Due to the strenuous nature of the job, some line installers and cable splicers find it necessary to transfer to other occupations as they advance in age. Those having the necessary qualifications find advancement opportunities in the telephone industry. For example, a line installer may be transferred to telephone installer and later to telephone repairer or to another higher rated job.

Employment Outlook

Employment of cable splicers is expected to show little or no change through the 1980's. Technological developments, such as new kinds of splices and the telephone splicing van that uses the truck engine to heat and ventilate manholes and drive power tools and equipment, will improve the efficiency of splicers, thus limiting the need for additional workers. Nevertheless, many job openings will arise due to the need to replace experienced splicers who retire, die, or transfer to other occupations.

Little or no change is expected in the number of line installers because the increasing use of mechanical improvements, such as plows that can dig a trench, lay cable, and cover it in a single operation, have eliminated much of the heavier physical work of the linecrews and have caused reductions in crew size. Also, satellites are expected to carry an increasing volume of telephone traffic, thus slightly reducing the emphasis on cable installation. On the other hand, some employment opportunities for line installers and cable splicers may be created by the need to modernize old cables or replace them with new waterproof ones. In addition, some job openings will occur as experienced line installers retire, die, or transfer to other occupations.

Earnings

In late 1978, wage rates of cable splicers averaged $8.60 an hour, line installers averaged $8.46, and cable splicers' helpers, $6.22. By comparison, nonsupervisory workers in all private industries, except farming, averaged $5.69 an hour.

Pay rates for cable splicers and line installers depend to a large extent upon length of service and geographic location. For example, under the terms of a major union contract in effect in late 1978, new workers in line construction jobs in the highest pay-scale cities began at $4.96 an hour and could reach a maximum of $9.64 after 5 years of service. The maximum hourly rate for cable splicers also was $9.64. Line installers and cable splicers are covered by the same contract provisions governing overtime pay, vacations, holidays, and other benefits that apply to telephone workers generally.

Related Occupations

Workers in other occupations in which skill training is needed to do technical, manual work with tools and machines include automobile mechanics, carpenters, cement masons, electricians, machinists, plumbers, toolmakers, and welders.

Sources of Additional Information

See the statement on the telephone industry elsewhere in the *Handbook* for sources of additional information and for general information on fringe benefits.

Telephone and PBX Installers and Repairers

Nature of the Work

About 1 in every 3 telephone craft workers is a telephone installer or repairer. About 115,000 were employed in 1978. They install and service telephones and switchboard systems on customers' property, such as PBX and CENTREX, and make repairs when trouble develops. These workers generally travel to customers' homes and offices in trucks equipped with telephone tools and supplies. When customers move or request new types of service, installers relocate telephones or make changes on existing equipment. For example, they may install a switchboard in an office, or change a two-party line to a single-party line in a residence. Installers also may fill a customer's request to add an extension in another room, or to replace an old telephone with a new model. Most installers and repairers specialize in one or two of the jobs described below; however, installers and repairers employed at small telephone companies may perform all of these jobs.

Telephone installers (D.O.T. 822.261-022), sometimes called station installers, install and remove telephones in homes and business places. They connect telephones to outside service wires and sometimes must climb poles to make these connections. Occasionally, especially in apartment buildings, the service wires or terminals are in the basement of the building.

PBX installers (D.O.T. 822.381-018) perform the same duties as telephone installers, but they specialize in more complex telephone system installations. They connect wires from terminals to switchboards and make tests to check their installations. Some PBX installers also set up equipment for mobile radiotelephones, data processing equipment, and telephone switchboard systems for radio and television broadcasts that involve receiving phone calls from the audience.

Telephone repairers (D.O.T. 822.281-022), with the assistance of trouble locators in the central office, locate trouble on customers' equipment. A repairer finds the source of the problem by connecting a portable telephone to the customer's telephone cord and then dialing the trouble locator in the central office. If the proper connection is made, the problem is in the customer's telephone. If a connection cannot be completed, the problem is in the service line between the phone and the central office, and the repairer repeats this procedure at various points along the service line until the problem is located. The repairer then makes the necessary repairs to restore service.

PBX repairers (D.O.T. 822.281-022), with the assistance of trouble locators, locate trouble on customers' PBX, CENTREX, or other complex telephone systems and make the necessary repairs. They also maintain associated equipment such as batteries, relays, and powerplants. Some PBX repairers maintain and repair equipment for radio and television broadcasts, mobile radiotelephones, and data processing equipment.

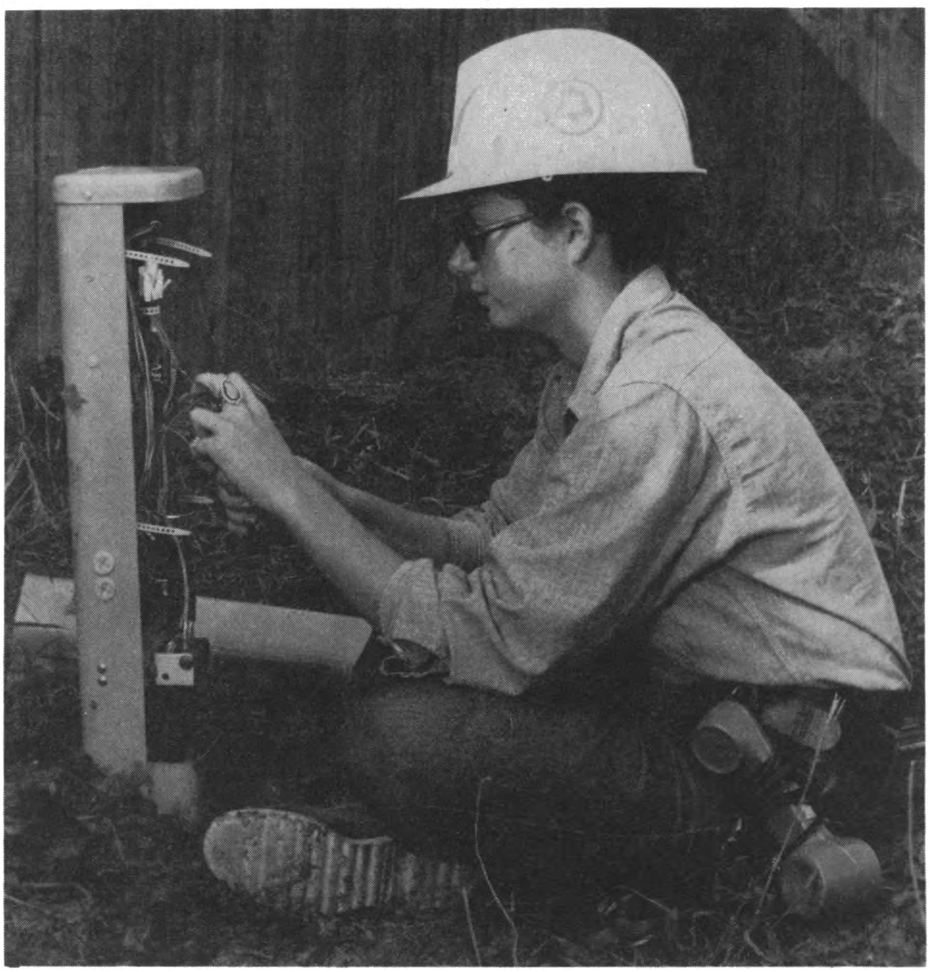
Working Conditions

Telephone and PBX installers and repairers work indoors and outdoors in all kinds of weather. Their work involves lifting, climbing, reaching, stooping, crouching, and crawling. They may have to work extra hours when breakdowns occur in lines or equipment.

Training, Other Qualifications, and Advancement

Telephone companies give new service workers classroom instruction in subjects such as mathematics and electrical and electronic theory. Trainees supplement their classroom instruction with on-the-job training. Often additional training is conducted in classrooms that simulate actual working conditions. For example, telephone installer trainees are instructed in classrooms equipped with telephone poles, lines and cables, terminal boxes, and other equipment. They practice installing telephones and connecting wires just as they would on the job. After a few weeks in the classroom, trainees are assigned to the field for on-the-job training by experienced workers, often supervisors.

Many small, independent telephone companies, especially those located in rural areas, do not have the facilities, such as simulated



Telephone installers sometimes work outdoors.

work sites, necessary to train their employees. Therefore, vocational and technical schools may provide training for installers and repairers employed by telephone companies in the area. A few installers and repairers may enter apprenticeship programs conducted jointly by State employment agencies and telephone companies. In these programs, apprentices receive on-the-job training at the company where they are employed. At the same time, they receive classroom instruction from the State agencies. Generally apprenticeships last 4 years.

Applicants must have good eyesight and must not be color blind. Physical examinations are sometimes required because the work may involve strenuous activity such as climbing poles. In addition, applicants may have to pass an aptitude test. Often trainees are chosen from telephone company employees, such as operators or line installers.

Telephone service workers receive training throughout their careers to qualify for more responsible assignments and to keep up with technical changes. Those who have managerial ability can advance to supervisory jobs.

Employment Outlook

Employment of telephone installers and repairers is expected to increase about as fast as the average for all occupations through the 1980's. Most job openings will result from industry growth, but many openings will arise from the need to replace workers who retire, die, or transfer to other occupations. These openings usually are filled by workers in other telephone jobs, such as operators, service representatives, line installers, or cable splicers, but some should be available to new employees.

Employment will increase due to the growing demand for telephones and PBX and CENTREX systems. Employment of installers will increase most rapidly in areas where the population is growing rapidly, thus creating a large demand for telephone installations. Also, areas that have a large influx or outflow of people, such as those with military bases or colleges nearby, will have a relatively large demand for telephone installations and removals.

On the other hand, technological improvements may limit the demand for installers and repairers. For example, terminal boxes allow a number of installations to be connected at one central location and make it unnecessary for installers to climb telephone poles.

Earnings

In late 1978, the average hourly rate for PBX repairers was $8.58, and the average for telephone and PBX installers was $8.90. In comparison, nonsupervisory workers in all private industries, except farming, had average earnings of $5.69 an hour.

Earnings increase considerably with length of service. Under the terms of a major union contract in effect in late 1978, telephone installers and repairers in one of the higher pay-scale cities earned a starting rate of $4.96 an hour, with periodic pay increases up to a maximum of $9.64 an hour after 5 years of service. Installers and repairers are covered by the same provisions governing overtime pay, vacations, holidays, and other benefits that apply to telephone workers generally.

Related Occupations

Other skilled workers who do technical, manual work with tools and machines include automobile mechanics, carpenters, cement masons, electricians, machinists, plumbers, toolmakers, and welders.

Sources of Additional Information

See the statement on the telephone industry elsewhere in the *Handbook* for sources of additional information and for general information on fringe benefits.

Other Mechanics and Repairers

Air-Conditioning, Refrigeration, and Heating Mechanics

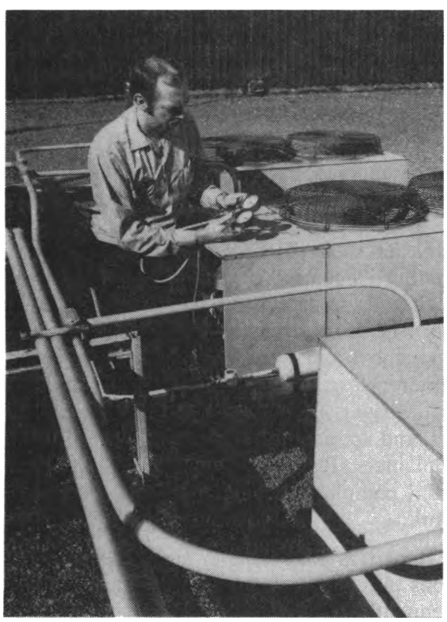
(D.O.T. 637.261-010, -014, -018, -026, and .381-010; 827.464-010; 862.281-018, .361-010; and 869.281-010)

Nature of the Work

People always have sought ways to make the buildings they live, work, and play in more comfortable. Today air-conditioning and heating systems control the temperature, the humidity, and even the cleanliness of the air in homes, offices, factories, and schools. In addition, refrigeration equipment makes it possible to safely store food, drugs, and other perishable items. Air-conditioning, heating, and refrigeration mechanics are skilled workers who install, maintain, and repair such systems and equipment.

Air-conditioning, heating, and—in some cases—refrigeration is not done by a single machine. Central air-conditioning, for example, requires fans, compressors, condensers, evaporators, and other components. Metal ducts or special piping are needed to distribute cooled air or chilled water throughout a building. Mechanics must be able to work with the complete system—the machinery, and the ducts and the pipes.

Mechanics may specialize in installation or in service—maintenance and repair. Some work only with certain equipment, such as gas furnaces or commercial refrigerators. However, it is not uncommon for mechanics to do installations and service and to work with cooling, heating, and refrigeration equipment. The following are some specific jobs in this field.



Air-conditioning mechanics work with both electrical and mechanical equipment.

Air-conditioning and refrigeration mechanics (D.O.T. 637.261-010, 014, 026 and 827.-464-010) install and service central air-conditioning systems and a variety of refrigeration equipment. When installing air-conditioning or refrigeration systems, mechanics put the motors, compressors, condensing units, evaporators, and other components in place, following blueprints and design specifications. They connect this equipment to the duct work, refrigerant lines, and electrical power source. After making the connections, they charge the system with refrigerant and check it for proper operation.

When air-conditioning and refrigeration equipment breaks down, mechanics diagnose the cause and make repairs. To find defects they inspect parts such as relays and thermostats. During the winter, air-conditioning mechanics inspect the systems and do required maintenance, such as overhauling compressors recharging the system's refrigerant, or adusting the air flow in the ducts. Some mechanics service heating systems.

Furnace installers (D.O.T. 862.361-010 and 869.281-010), also called heating equipment installers, follow blueprints or other specifications to install oil, gas, and electric heating systems. After setting the furnace in place, they install fuel supply lines, air ducts, pumps, and other components. They then connect electrical wiring and controls, and check the unit for proper operation.

Oil burner mechanics (D.O.T. 862.281-018) keep oil-fueled heating systems in good operating condition. During the fall and winter, when the system is needed most, they service and adjust oil burners. If a burner is not operating properly, mechanics check the thermostat, burner nozzles, controls, and other parts to locate the problem. The mechanic corrects the problem by adjusting or replacing broken parts. During the summer, mechanics do maintenance work, such as replacing oil and air filters and vacuum-cleaning vents, ducts, and other parts of the heating system that accumulate soot and ash.

Gas burner mechanics (D.O.T. 637.261-018), also called gas appliance servicers, have duties similar to those of oil burner mechanics. During the winter, they locate malfunctions in gas-fueled heating systems and make necessary repairs and adjustments. During the summer they inspect and clean the heating system to prepare it for the heating season. Mechanics also repair cooking stoves, clothes dryers, hot water heaters, and outdoor lights and grills.

Air-conditioning, refrigeration, and heating mechanics use a variety of tools. Hammers, wrenches, metal snips, electric drills, pipe cutters and benders, and acetylene torches and other tools are used to work with refrigerant lines and air ducts. Volt-ohmmeters, manometers, and other testing devices are used to check electrical circuits, burners, and other components.

Cooling and heating systems sometimes are installed or repaired by other craft workers. For example, on a large air-conditioning installation job, especially where workers are covered by union contracts, duct work might be done by sheet-metal workers; electrical work by electricians; and installation of piping, condensers, and other components by pipefitters. Additional information about these occupations appears elsewhere in the *Handbook*.

Working Conditions

Mechanics work in homes, office buildings, factories—anywhere their is air-conditioning or heating equipment. They bring the tools and parts they need to the job sites. During the repair season, mechanics may do considerable driving. Radios may be used to dispatch them to the jobs. If major repairs are necessary, mechanics will transport broken machinery or parts to a repair shop.

Mechanics may work outside in cold or hot weather. The buildings that they work in may be uncomfortable because the air-conditioning or heating equipment is broken. Mechanics often work in awkward or cramped positions and sometimes are required to work in high places. Other hazards in this trade include electrical shock, torch burns, muscle strains, and other injuries from handling heavy equipment.

Places of Employment

Approximately 210,000 persons worked as air-conditioning, refrigeration, and heating mechanics in 1978. Cooling and heating contractors employed most air-conditioning and refrigeration mechanics and furnace installers. Fuel oil dealers employed most oil burner mechanics, and gas utility companies, most gas burner mechanics. Mechanics also work for foodstore chains, school systems, manufacturers, and other organizations that operate large air-conditioning, refrigeration, or heating systems. Approximately 1 out of 7 mechanics was self-employed.

Air-conditioning and refrigeration mechanics and furnace installers work in all parts of the country. Generally, the geographic distribution of these workers is similar to that of our population. Oil burner mechanics are concentrated in States where oil is a major heating fuel. Similarly, gas burner mechanics are concentrated in States where gas is a major heating fuel.

Training, Other Qualifications, and Advancement

Most air-conditioning, refrigeration, and heating mechanics start as helpers and acquire their skills by working for several years with experienced mechanics. New workers usually begin by assisting experienced mechanics and doing simple jobs. They may carry materials, insulate refrigerant lines, or clean furnaces. In time, they do more difficult jobs, such as cutting and soldering pipes and sheet metal and checking electrical circuits. In 4 to 5 years the new mechanics are capable of doing all types of repairs and installations.

Apprenticeship programs are run by unions and air-conditioning and heating contractors. In addition to on-the-job training, apprentices receive 144 hours of classroom instruction each year in related subjects, such as the use and care of tools, safety practices, blueprint reading, and air-conditioning theory. Applicants for apprenticeships must have a high school diploma and are given a mechanical aptitude test. Apprenticeships last 4 years.

Many high schools, private vocational schools, and junior colleges offer programs in air-conditioning and refrigeration. Students study air-conditioning and refrigeration theory and the design and construction of the equipment. They also learn the basics of installation, maintenance, and repair. Employers may prefer to hire graduates of these programs because they require less on-the-job training.

When hiring helpers, employers prefer high school graduates with mechanical aptitude who have had courses in mathematics, mechanical drawing, electricity, physics, and blueprint reading. Good physical condition also is necessary because workers sometimes have to lift and move heavy equipment.

To keep up with changes in technology and to expand their skills, experienced mechanics may take courses offered by associations such as the Refrigeration Service Engineers Society, the Petroleum Marketing Education Foundation, and the Air-conditioning Contractors of America.

Mechanics can advance to positions as supervisors. Some open their own contracting businesses. However, it is becoming difficult for one-person operations to operate successfully.

Employment Outlook

Employment of air-conditioning, refrigeration, and heating mechanics is expected to increase about as fast as the average for all occupations through the 1980's. Many openings will occur as experienced mechanics transfer to other fields of work, retire, or die.

Opportunities for air-conditioning, heating, and refrigeration mechanics are expected to follow trends in residential and commercial construction. Even during periods of slow growth, many mechanics will be needed to service existing air-conditioning and heating systems. Installations of new energy-saving heating and air-conditioning systems also will cause employment of mechanics to grow. In addition, more refrigeration equipment will be needed in the production, storage, and marketing of food and other perishables. Because these trades have attracted many people, beginning mechanics may face competition for jobs as helpers or apprentices.

Earnings

Hourly rates for skilled air-conditioning, refrigeration, and heating mechanics ranged from about $8 to $13 in 1978. Apprentices receive a percentage of the wage paid experienced workers, about 40 percent at the beginning of their training and about 80 percent during the fourth year. In comparison, the average hourly rate for production and nonsupervisory workers in private industry, except farming, was $5.69. Mechanics who worked on both air-conditioning and heating equipment frequently had higher rates of pay than those who worked on only one type of equipment.

Mechanics usually work a 40-hour week. However, during seasonal peaks they often work overtime or irregular hours. Most employers try to provide a full workweek the year round, but they may temporarily reduce hours or lay off some mechanics when seasonal peaks end. Employment in most shops that service both air-conditioning and heating equipment is fairly stable throughout the year.

Related Occupations

Air-conditioning, heating, and refrigeration mechanics need many skills. For example, they work with sheet metal and piping. They also repair machinery, such as electrical motors, compressors, and burners. Other workers who have similar skills are boilermakers, electrical appliance servicers, electricians, pipefitters, plumbers, and sheet metalworkers.

Sources of Additional Information

For more information about employment and training opportunities, contact the local office of the State employment service or firms that employ air-conditioning, refrigeration, and heating mechanics.

For pamphlets on career opportunities and training, write to:

Air-Conditioning and Refrigeration Institute, 1815 N. Fort Myer Dr., Arlington, Va. 22209. (The Institute prefers not to receive individual requests for large quantities of pamphlets.)

Air-Conditioning Contractors of America, 1228 17th St. NW., Washington, D.C. 20036.

For information about training in oil heating systems, write to:

Petroleum Marketing Education Foundation, P. O. Box 11187, Columbia, S.C. 29211.

Appliance Repairers

(D.O.T. 637.261-018, 723.381-010, and 827.261-010)

Nature of the Work

In the past, most household chores such as cooking and cleaning were performed by hand and often involved a great deal of time and physical effort. Today, a variety of labor-saving appliances make many household jobs much simpler to do. Microwave ovens cook meals in minutes. Washers and dryers clean clothes with little physical effort. Indeed, the number of household jobs machines can do is almost limitless. Even simple tasks such as cooking a hamburger or opening a can are done with appliances made specifically for those purposes. Servicing these machines is the job of the appliance repairer.

Appliance repairers usually specialize in servicing either portable appliances such as toasters and irons or major appliances such as refrigerators and ranges. In large repair shops, they may specialize in particular items such as clothes washers and dryers or refrigerators and freezers.

Portable appliances are worked on in shops. Major appliances usually are repaired in customers' homes by appliance repairers who carry their tools and a number of commonly used parts with them in a truck.

To determine why an appliance is not working properly, repairers operate it to detect unusual noises, overheating, or excess vibration. They look for common sources of trouble, such as faulty electrical connections, and consult service manuals and troubleshooting guides. They may disassemble the appliance to examine its parts. To check electric systems, repairers follow wiring diagrams and use testing devices, such as ammeters, voltmeters, and ohmmeters.

After locating the trouble, the repairer makes the necessary repairs or replacements according to the type of appliance and defect involved. To fix a portable appliance such as a toaster, the repairer may replace a defective heating element. To fix a major appliance such as a washer, the repairer may replace worn bearings, transmission belts, or gears. To remove old parts and install new ones, repairers use common handtools, including screwdrivers, soldering irons, files, and pliers, and special tools designed for particular appliances. Repairers operate the appliance after completing a repair to check their work.

Repairers may answer customers' questions and complaints about appliances and frequently advise customers about the care and use of the appliance. For example, they may show the owners how to load automatic

An appliance repairer cleaning the burner of a gas range.

washing machines or arrange dishes in dishwashers.

Appliance repairers may estimate and collect the cost of repairs. They also keep records of parts used and hours worked on each job.

Working Conditions

Repair shops generally are quiet, well lighted, and adequately ventilated. Working conditions outside the shop vary. For example, repairers sometimes work in narrow spaces and uncomfortable positions amidst dirt and dust. Those who repair appliances in homes may spend several hours a day driving, although the use of 2-way radios has decreased this time.

Although the work generally is safe, repairers could have an accident while handling electrical parts and lifting and moving large appliances. Inexperience workers are shown how to use tools safely and how to avoid electric shock.

Appliance repairers usually work with little or no direct supervision. This feature of the job appeals to many people.

Places of Employment

About 145,000 people were employed as appliance repairers in 1978, mostly in independent appliance stores and repair shops. Others worked for service centers operated by appliance manufacturers, department stores, wholesalers, and gas and electric utility companies.

Appliance repairers are employed in almost every community, but are concentrated in the more highly populated States and metropolitan areas.

Training, Other Qualifications, and Advancement

Formal training in appliance repair and related subjects is available from some high schools, private vocational schools, and community colleges. The programs in these schools provide the background in electrical and mechanical repair that is needed to enter this occupation. However, graduates usually receive additional training from their employer.

The type of training provided by employers varies among companies. In shops that fix portable appliances, new employees work on a single type of appliance, such as vacuum cleaners, until they master its repair. Trainees then move on to work on a different type of appliance; this process continues until they can repair a variety of appliances. In companies that repair major appliances, beginners may be trained by experienced repairers during house calls. In other cases, they are taught while working in the shop rebuilding used parts such as washing machine transmissions. Up to 3 years of on-the-job training may be needed to become skilled in all aspects of repairing some of the more complex appliances.

Some large companies such as appliance manufacturers and department store chains have formal training programs, which include home study courses and shop classes, where trainees work with demonstration appliances and other training equipment.

Many repairers receive supplemental instruction through seminars that are conducted periodically by appliance manufacturers. These seminars usually last 1 or 2 weeks and deal with the repair of one of the manufacturer's appliances. To become familiar with new appliances and the proper ways to repair them, experienced repairers attend training classes or study service manuals.

Persons who want to become appliance repairers generally must have a high school diploma. Courses in electricity are essential because most repairs involve work with electrical equipment. Mechanical aptitude is also desirable. Appliance repairers who work in customers' homes must be able to get along with people.

Appliance repairers in large shops or service centers may be promoted to supervisor, assistant service manager, or service manager. A few may advance to managerial positions such as regional service manager or parts manager for appliance manufacturers. Preference is given to those who show ability to get along with coworkers and customers. Experienced repairers who have sufficient funds may open their own appliance stores or repair shops.

Employment Outlook

Employment of appliance repairers is expected to grow about as fast as the average for all occupations through the 1980's. In addition to the jobs created by growth of this occupation, many openings will arise each year from the need to replace experienced repairers who retire, die, or transfer to other occupations.

The number of appliances in use is expected to increase very rapidly as the number of households grows and new and improved appliances are introduced. Maintaining this large number of appliances will increase the need for qualified repairers.

People who enter the occupation should have steady work because the appliance repair business is not very sensitive to changes in economic conditions.

Earnings

Hourly earnings of appliance repairers ranged from $5 to $10 in 1978, based on the limited data available. The starting rate for inexperienced trainees was about $3.75 an hour. The wide variations in wages reflect differences in repairers' skill and experience, geographic location, and the type of equipment serviced.

Some appliance repairers belong to the International Brotherhood of Electrical Workers.

Related Occupations

Other workers who service electrical and electronic equipment include air-conditioning mechanics, bowling-pin-machine mechanics, business machine repairers, electric sign repairers, electronic organ technicians, television and radio repairers, and vending machine mechanics.

Sources of Additional Information

For further information about jobs in the appliance service field, contact local appliance repair shops, appliance dealers and utility companies, or the local office of the State employment service.

Information about training programs or work opportunities also is available from:

Association of Home Appliance Manufacturers, 20 N. Wacker Dr., Chicago, Ill. 60606.

Automobile Body Repairers

(D.O.T. 807.281-010, .381-010, and .684-010)

Nature of the Work

Every day thousands of motor vehicles are damaged in traffic accidents. Although some are wrecked, most can be made to look and drive like new. Automobile body repairers straighten bent frames, remove dents, and replace crumpled parts that are beyond repair. Usually, they can fix all types of vehicles, but most repairers work mainly on cars and small trucks. A few specialize in working on large trucks, buses, or tractor trailers.

When a damaged vehicle is brought into the shop, body repairers generally receive instructions from their supervisors, who have determined which parts are to be restored or replaced and how much time the job should take.

Automobile body repairers use special machines to restore damaged frames and body sections to their original shape and location. They chain or clamp the frames and sections to alignment machines that usually use hydraulic pressure to align the damaged metal.

Body repairers remove badly damaged sections of body panels with a pneumatic metal-cutting gun or acetylene torch, and weld in new sections to replace them. Sometimes, dented sections can be repaired rather than replaced; repairers push dents out with a hydraulic jack or hand prying bar, or knock them out with a handtool or pneumatic hammer. Small dents and creases can be smoothed out by holding a small anvil against one side of the damaged area while hammering the opposite side. Very small pits and dimples are removed with pick hammers and punches.

Body repairers use plastic or solder to fill small dents which cannot be worked out of the metal. Then they file or grind the hardened filler to the original shape and sand it before painting. In many shops, automobile painters do the painting. (These workers are discussed elsewhere in the *Handbook*.) In smaller shops workers often do both body repairing and painting.

Body repair work has variety—each damaged vehicle presents a different problem. Therefore, in addition to having a broad knowledge of automobile construction and repair techniques, repairers must develop appropriate methods for each job. Most of these skilled people find their work challenging and take pride in being able to restore automobiles.

Automobile body repairers fill small dents with plastic and then sand the surface smooth.

Body repairers usually work by themselves with only general directions from supervisors. In some shops, they may be assisted by helpers or apprentices. In large shops, body repairers may specialize in one type of repair, such as straightening bent frames or repairing doors or fenders.

Working Conditions

Automobile body repairers work indoors in body shops. Automobile body shops are noisy because of the banging of hammers against metal and the whir of power tools. Most shops are well ventilated, but often they are dusty and have the odor of paint. Body repairers often work in awkward or cramped positions, and much of their work is strenuous and dirty. Hazards include cuts from sharp metal edges, burns from torches and heated metal, and injuries from power tools.

Places of Employment

About 185,000 persons worked as automobile body repairers in 1978. Most worked for shops that specialized in body repairs and painting, and for automobile and truck dealers. Other employers included organizations that maintain their own motor vehicles, such as trucking companies and buslines. Motor vehicle manufacturers employed a small number of these workers.

Automobile body repairers work in every section of the country, with jobs distributed in about the same way as population.

Training, Other Qualifications, and Advancement

Most automobile body repairers learn the trade on the job. They usually start as helpers and pick up skills from experienced workers. Helpers begin by assisting body repairers in tasks such as removing damaged parts and installing repaired parts. They gradually learn to remove small dents and make other minor repairs, and progress to more difficult tasks such as straightening frames. Generally 3 to 4 years of on-the-job training are needed to become skilled in all aspects of body repair. Most training authorities recommend a 3- or 4-year formal apprenticeship program as the best way to learn the trade, but relatively few of these programs are available. Apprenticeship includes both on-the-job and classroom instruction. Apprentices spend most of their time learning on the job, but they also are expected to attend classes in related subjects such as mathematics, job safety procedures, and business management.

Persons who want to learn this trade should be in good physical condition and know how to use tools. Courses in automobile body repair offered by high schools, vocational schools, and private trade schools provide helpful experience, as do courses in automobile mechanics. Although completion of high school generally is not a requirement, many employers believe graduation indicates that the person has at least some of the qualities of a good worker, such as the ability to see a task through to its completion. The latter is especially important to employers who spend a good deal of time and money on training.

Automobile body repairers must buy their own tools, but employers sometimes furnish power tools. Trainees generally accumulate tools as they gain experience. Many workers invest hundreds of dollars in tools.

An experienced automobile body repairer with supervisory ability may advance to shop supervisor. Many workers open their own body repair shops. In fact, about 1 of every 8 automobile body repairers is self-employed.

Employment Outlook

Employment of automobile body repairers is expected to increase faster than the average for all occupations through the 1980's.

Employment is expected to increase as a result of the rising number of motor vehicles damaged in traffic. Accidents are expected to increase as the number of motor vehicles grows, even though improved highways, driver training courses, lower speed limits, and improved bumpers and safety features on new vehicles may slow the rate of increase.

In addition to new jobs arising from increased demand for these workers, many openings are expected each year as experienced repairers retire or die. Also openings will occur as some workers transfer to other occupations.

Most persons who enter the occupation may expect steady work since the automobile repair business is not very sensitive to changes in economic conditions.

Earnings

Body repairers employed by automobile dealers in 36 large cities had estimated average hourly earnings of $9.85 in 1978, about one and three-fourths times the average for all nonsupervisory workers in private industry, except farming. Skilled body repairers usually earn between two and three times as much as inexperienced helpers and trainees.

Many body repairers employed by automobile dealers and repair shops are paid a commission, usually about half of the labor cost charged to the customer. Under this method, earnings depend on the amount of work assigned to the repairer and how fast it is completed. Employers frequently guarantee their commissioned workers a minimum weekly salary. Helpers and trainees usually receive an hourly rate until they are skilled enough to work on commission. Body repairers who work for trucking companies, buslines, and other organizations that maintain their own vehicles usually receive an hourly wage. Most body repairers work 40 to 48 hours a week.

Many automobile body repairers are members of unions, including the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.). Most body repairers who are union members work for large automobile dealers, trucking companies, and buslines.

Related Occupations

Restoring damaged motor vehicles often involves repainting and repair of both mechanical components and bodies. Automobile body repairers often work closely with the following related occupations: Automobile service advisors, mechanics, painters and body customizers, and truck and bus mechanics.

Sources of Additional Information

More details about work opportunities may be obtained from local employers, such as automobile body repair shops and automobile dealers; locals of the unions previously mentioned; or the local office of the State employment service. The State employment service also may be a source of information about apprenticeship and other programs that provide training opportunities.

For general information about the work of automobile body repair workers and apprenticeship training, write to:

Automotive Service Industry Association, 444 North Michigan Ave., Chicago, Ill. 60611.

Automotive Service Councils Inc., 188 Industrial Dr., Suite 112, Elmhurst, Ill. 60126.

National Automobile Dealers Association, 8400 Westpark Dr., McLean, Va. 22102.

Automobile Mechanics

(D.O.T. 620.261-010; .281-010, -026, -034, -038, -062 and -066; .381-010 and -022; .684-018; and 865.684-010)

Nature of the Work

Anyone whose car has broken down knows how important the automobile mechanic's job is. The ability to make a quick and accurate diagnosis, one of the mechanic's most valuable skills, requires good reasoning ability and a thorough knowledge of automobiles. In fact, many mechanics consider diagnosing "hard to find" troubles one of their most challenging and satisfying duties.

When mechanical or electrical troubles occur, mechanics first get a description of the symptoms from the owner or, if they work in a dealership, the service advisor who wrote the repair order. The mechanic may have to test drive the car or use testing equipment, such as motor analyzers, spark plug testers, or compression gauges, to locate the problem. Once the cause of the problem is found, mechanics make adjustments or repairs. If a part cannot be fixed, they replace it.

Most automobile mechanics perform a variety of repairs; others specialize. For example, *automatic transmission specialists* work on gear trains, couplings, hydraulic pumps, and other parts of automatic transmissions. Because these are complex mechanisms, their repair requires considerable experience and training, including a knowledge of hydraulics. *Tune-up mechanics* adjust the ignition timing and valves, and adjust or replace spark plugs, distributor points, and other parts to ensure efficient engine performance. They often use scientific test equipment to locate malfunctions in fuel and ignition systems.

Automobile air-conditioning specialists install air-conditioners and service components such as compressors and condensers. *Front-end mechanics* align and balance wheels and repair steering mechanisms and suspension systems. They frequently use special alignment equipment and wheel-balancing machines. *Brake mechanics* adjust brakes, replace brake linings, repair hydraulic cylinders, and make other repairs on brake systems. Some mechanics specialize in both brake and front-end work.

Automobile-radiator mechanics clean radiators with caustic solutions, locate and solder leaks, and install new radiator cores. They also may repair heaters and air-conditioners, and solder leaks in gasoline tanks. *Automobile-glass mechanics* replace broken windshield and window glass and repair window operating mechanisms. They install preformed glass to replace curved windows, and they use window patterns and glass-cutting tools to cut replacement glass from flat sheets. In some cases they may repair minor damage, such as pits, rather than replace the window.

To prevent breakdowns, most car owners have their cars checked regularly and parts adjusted, repaired, or replaced before they go bad. This responsibility of the mechanic is vital to safe and trouble-free driving. When doing preventive maintenance, mechanics may follow a checklist to be sure they examine all important parts. The list may include distributor points, spark plugs, carburetor, wheel balance, and other potentially troublesome items.

Working Conditions

Generally, mechanics work indoors. Modern automobile repair shops are well ventilated, lighted, and heated, but older shops may not have these advantages. Mechanics frequently work with dirty and greasy parts, and in awkward positions. Many of the automobile parts and tools that they must lift are heavy. Minor cuts and bruises are common, but serious accidents can be avoided by keeping the shop clean and orderly and observing other safety practices.

Places of Employment

More than 860,000 persons worked as automobile mechanics in 1978. Most worked for automobile dealers, automobile repair shops, gasoline service stations, and department stores that have automobile service facilities. Others were employed by Federal, State, and local governments, taxicab and automobile leasing companies, and other organizations that repair their own automobiles. Some mechanics employed by automobile manufacturers make final adjustments and repairs at the end of the assembly line.

Most automobile mechanics work in shops that employ from one to five mechanics, but some of the largest shops employ more than 100. Generally, automobile dealer shops employ more mechanics than independent shops.

Automobile mechanics work in every section of the country. Geographically, employment is distributed about the same as population.

Training, Other Qualifications, and Advancement

Most automobile mechanics learn the trade on the job. Beginners usually start as helpers, lubrication workers, or gasoline station attendants, and gradually acquire skills by working with experienced mechanics. Although a beginner can make simple repairs after a few months' experience, it usually takes 3 to 4 years to become familiar with all types of repairs. An additional year or two is necessary to learn a difficult specialty, such as automatic transmission repair. In contrast, radiator mechanics, glass mechanics, and brake specialists, who do not need an all-round knowledge of automobile repair, may learn their jobs in about 2 years.

Most training authorities recommend a 3- or 4-year formal apprenticeship program. Apprenticeship programs are offered through many auto dealers and independent repair shops. These programs include both on-the-job training and classroom instruction. On-the-job training includes instruction in basic service procedures, such as engine tune-up, as well as instruction in special procedures such as overhauling transmissions. Classroom instruction includes courses in related theory such as mathematics and physics and other areas such as shop safety practices and customer relations.

For entry jobs, employers look for young persons with mechanical aptitude and a knowledge of automobiles. Generally, a driver's license is required as mechanics occasionally have to test drive or deliver cars. Working on cars in the Armed Forces or as a hobby is valuable experience. Completion of high school is an advantage in obtaining an entry job because to most employers graduation indicates that a young person has at least some of the traits of a good worker, such as perseverance and the ability to learn, and has potential for advancement. Courses in automobile repair offered by many high schools, vocational schools, and private trade schools also are helpful. In particular, courses in physical science and mathematics can help a person better understand how an automobile operates.

Mechanics usually buy their handtools and beginners are expected to accumulate tools as they gain experience. Many experienced mechanics invest hundreds of dollars in tools. Employers furnish power tools, engine analyzers, and other test equipment.

Employers sometimes send experienced mechanics to factory training centers to learn to repair new models or to receive special training in automatic transmission or air-conditioning repair. Manufacturers also send representatives to local shops to conduct short training sessions. Automobile dealers may select promising beginners to attend factory-sponsored mechanic training programs.

Experienced mechanics who have leadership ability may advance to shop supervisor or service manager. Mechanics who like to work with customers may become service advisors. Many mechanics open their own repair shops or gasoline service stations and about 1 out of 7 automobile mechanics is self-employed.

Employment Outlook

Job opportunities for automobile mechanics will be plentiful in the years ahead. Replacement needs are high in this large occupation. Thus, in addition to openings created by the growing need for these workers, thousands of jobs will arise each year as experienced mechanics retire, die, or change jobs.

Employment of automobile mechanics is expected to increase about as fast as the average for all occupations through the 1980's. The number of mechanics is expected to increase because expansion of the driving age population and consumer purchasing power will increase the number of automobiles on the road. Employment also is expected to grow because a greater number of automobiles will be equipped with pollution control and safety devices, air-conditioning, and other features that increase maintenance requirements.

Most persons who enter the occupation may expect steady work because the automobile repair business is not much affected by changes in economic conditions.

Earnings

Skilled automobile mechanics employed by automobile dealers in 36 cities had estimated average hourly earnings of $9.32 in 1978, about two-thirds more than the average for all nonsupervisory workers in private industry, except farming.

Many experienced mechanics employed by automobile dealers and independent repair shops receive a commission related to the labor cost charged to the customer. Under this method, weekly earnings depend on the amount of work completed by the mechanic. Employers frequently guarantee commissioned mechanics a minimum weekly salary. Skilled mechanics usually earn between two and three times as much as inexperienced helpers and trainees.

Most automobile mechanics start as helpers and gradually aquire skills by working with experienced mechanics.

Most mechanics work between 40 and 48 hours a week, but many work even longer hours during busy periods. Mechanics paid by the hour frequently receive overtime rates for hours over 40 a week.

Some mechanics are members of labor unions. Among the unions organizing these workers are the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.).

Related Occupations

Automobile mechanics repair and service automobiles. Other related occupations that also repair and service motor vehicles include automobile body repairers, customizers, painters, and service advisors as well as truck and bus mechanics.

Sources of Additional Information

For more details about work opportunities, contact local employers such as automobile dealers and repair shops; locals of the unions previously mentioned; or the local office of the State employment service. The State employment service also may have information about apprenticeship and other training programs.

For general information about the work of automobile mechanics, and apprenticeship training, write to:

Automotive Service Industry Association, 444 North Michigan Ave., Chicago, Ill. 60611.

Automotive Service Councils, Inc., 188 Industrial Dr., Suite 112, Elmhurst, Ill. 60126.

National Automobile Dealers Association, 8400 Westpark Dr., McLean, Va. 22102

Boat-Engine Mechanics

(D.O.T. 623.281-026, -038, and -042)

Nature of the Work

Engines in boats and automobile have many things in commmon, including unannounced breakdowns. A reliable engine is particularly essential in boating. Breakdowns far from shore can leave a boater stranded for hours—a frustrating and potentially dangerous predicament, particularly if the weather turns bad.

To minimize the possibility of breakdowns, engine manufacturers recommend periodic inspections of engines by qualified mechanics to have worn or defective parts replaced. Also, at periodic intervals the mechanic may replace ignition points, adjust valves, and clean the carburetor. Routine maintenance jobs normally make up most of the mechanic's workload.

When breakdowns occur, mechanics diagnose the cause and repair or replace faulty parts. A quick and accurate diagnosis—one of the mechanic's most valuable skills—requires problem-solving ability as well as a thorough knowledge of the engine's operation. Some jobs require only the replacement of a single item, such as a fuel pump, and may be completed in less than an hour. In contrast, tearing down and reassembling an engine to replace worn valves, bearings, or piston rings may take a day or more.

Mechanics may specialize in either outboard or inboard engines, although many repair both. Most small boats have portable gasoline-fueled outboard engines. Larger craft such as cabin cruisers and commercial fishing boats are powered by inboard engines (located inside the boat) and are similar to automobile engines. Some inboards burn diesel fuel.

In large boat yards, mechanics usually work only on engines and other running gear. In small marinas, they also may repair and paint hulls, rig masts, and install and repair steering mechanisms, lights, and other boat equipment, such as refrigerators, marine toilets, two-way radios, and depth finders. In addition, some mechanics may repair motorcycles, minibikes, snowmobiles, lawnmowers, and other machines which have small gasoline engines that are similar to outboard engines.

Mechanics use common handtools such as screwdrivers and wrenches; power and machine tools, including drills and grinders; and hoists to lift engines and boats. Engine analyzers, compression gauges, and other testing devices help mechanics locate faulty parts. Mechanics refer to service manuals for assistance in assembling and repairing engines.

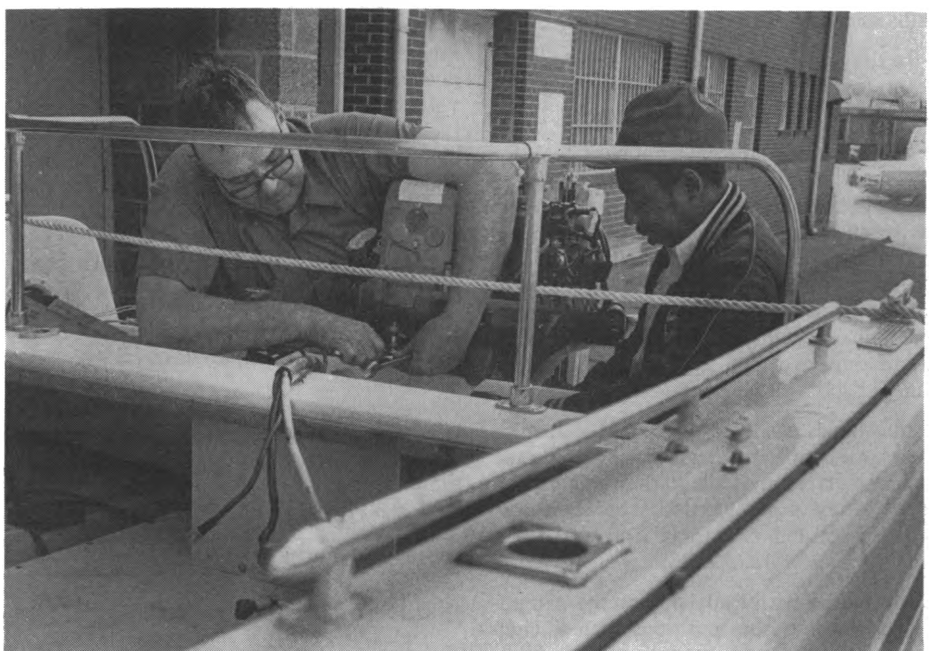
Working Conditions

Boat-engine mechanics usually work in repair shops, but often work outdoors aboard boats in all weather. Shop working conditions vary from clean and spacious to dingy and cramped. All shops are noisy when engines are being tested. The work is not hazardous, but mechanics sometimes suffer cuts, bruises, and other minor injuries. Mechanics occasionally must work in awkward positions to adjust or replace parts. For many however, these disadvantages are outweighed by the variety of assignments and the satisfaction that comes from solving problems. Moreover, mechanics may enjoy working near water recreation areas.

Boating activity increases sharply as the weather grows warmer. Consequently, many mechanics work more than 40 hours a week in spring, summer, and fall. During the peak season, some mechanics may work 7 days a week. However, in the winter, they may work less than 40 hours a week; a relatively small number are laid off. In northern States, some of the winter slack is taken up by repair work on snowmobiles.

Places of Employment

Most of the 20,000 full-time boat-engine mechanics employed in 1978 worked in the shops of boat dealers and in boat yards and private marinas. The next largest area of employment was in boat manufacturing plants where mechanics install engines and make adjustments at the end of assembly lines. A small number of mechanics worked for boat rental firms. Marinas operated by Federal,



When breakdowns occur, boat-engine mechanics diagnose the cause and repair or replace faulty parts.

State, and local governments also employed mechanics.

Dealer and marina shops typically employ 1 to 3 mechanics; a few boat yards employ more than 10. Some small dealers and marinas do not employ mechanics; owners do the repair work or send it to larger marinas and boat yards.

Boat-engine mechanics work in every State, but employment is concentrated along coastal areas in New England, Florida, Texas, New York, California, Louisiana, Washington, and New Jersey, and near the numerous lakes and rivers in Michigan, Minnesota, Wisconsin, Illinois, Ohio, Indiana, and Missouri. Mechanics who specialize in outboard engines work in all areas. Those who specialize in inboard engines generally work near oceans, bays, and large lakes.

Training, Other Qualifications, and Advancement

Boat-engine mechanics learn the trade on the job. At first, trainees clean boats and engines and do other odd jobs. Then, under the guidance of experienced mechanics, trainees learn to do other routine mechanical tasks such as replacing ignition points and spark plugs. As trainees gain experience, they progress to more difficult tasks such as diagnosing the cause of breakdowns and overhauling engines. Generally, an inexperienced beginner needs 2 to 3 years on the job to become skilled in repairing both outboard and inboard gasoline engines. A capable mechanic can learn to repair diesels in an additional year or two.

Employers sometimes send trainees and mechanics to factory-sponsored courses for 1 to 2 weeks. Trainees learn the fundamentals of engine repair. Mechanics upgrade their skills and learn to repair new models.

In the past few years, several schools have begun to offer formal training courses in marine engine repair and maintenance.

When hiring trainees, employers look for persons who have mechanical aptitude, are in good physical condition, and have an interest in boating. High school graduates are preferred, but many employers will hire people with less education. High school courses in small engine repair, automobile mechanics, machine shop, and science are helpful. Before graduating, a person may be able to get a summer job as a mechanic trainee.

Mechanics usually are required to furnish their own handtools. Beginners are expected to accumulate handtools as they gain experience. Many experienced mechanics invest hundreds of dollars in tools. Employers provide power tools and test equipment.

Mechanics with leadership ability can advance to supervisory positions such as shop supervisor or service manager. Some boat-engine mechanics transfer to jobs as automobile mechanics. Others may become sales workers for boat dealers. Mechanics who have the capital may open their own dealerships or marinas.

Employment Outlook

Employment of boat-engine mechanics is expected to grow about as fast as the average for all occupations through the 1980's. In addition to new positions, a few hundred openings will arise each year as experienced mechanics retire, die, or transfer to other occupations.

Employment is expected to increase due to the growth in the number of boats. The number of boats is expected to increase at about the same rate as the economy as a whole. As population grows, and people have more time for recreation, boating, like other leisure activities, will probably expand.

Employment opportunities will be particularly favorable for mechanics who have a knowledge of electricity and electronics. Electrical equipment on boats is becoming more common and many new boats have two-way radios and depth finders.

Earnings

According to a nationwide survey of boat dealers and marinas, estimated hourly earnings of experienced mechanics ranged from about $4 to $10 in 1978. Trainees earned somewhat less.

Most mechanics are paid an hourly rate or weekly salary. Others are paid a percentage —usually 50 percent—of the labor charge for each repair job. If mechanics are paid on a percentage basis, their weekly earnings depend on the amount of work they are assigned and on the length of time they take to complete it.

Related Occupations

Boat-engine mechanics repair and service inboard and outboard motors of recreational and commercial boats. Other occupations involved with the repair and service of engines include aircraft mechanics, automobile mechanics, diesel mechanics, motorcycle mechanics, and ship-engine maintenance mechanics.

Sources of Additional Information

For details about training or work opportunities, contact local boat dealers and marinas or local State employment offices.

Bowling-Pin-Machine Mechanics

(D.O.T. 638.261-022)

Nature of the Work

An important piece of machinery in the modern bowling center is the automatic pinsetter. It returns the ball to the bowler, clears the fallen pins from the lane, and resets pins for the next ball. When this complex machine fails to work properly, the game is held up and the bowling center's customers are inconvenienced. Keeping pinsetters running properly is the job of bowling-pin-machine (or automatic pinsetter) mechanics.

Pinsetters are a complex combination of electrical and mechanical parts that require regular service to operate correctly. Pinsetters must be cleaned, gears and other moving parts must be lubricated, and motors must be adjusted. Mechanics perform these jobs according to a schedule suggested by the pinsetter's manufacturer. They also inspect the machines for faulty parts and wiring that may cause breakdowns.

When a pinsetter malfunctions, mechanics must find the cause of the trouble and make repairs. To locate the problem, mechanics may refer to troubleshooting manuals and diagrams of electrical circuits. Often they can find the trouble relying only on the knowledge of the machine that they have gained through experience. To fix the pinsetter, mechanics repair, replace, or adjust broken mechanical or electrical parts, such as gears, bearings, and motors.

Mechanics use many different types of tools, such as wrenches, screwdrivers, soldering irons, portable hoists, and lubricating guns, to repair and service the parts. They occasionally use ohmmeters, voltmeters, and other devices to test electrical circuits, relays, transformers, and motors.

Mechanics often supervise one or more assistant mechanics or pinchasers. Mechanics train these workers to correct minor problems, such as jammed pins and balls, by explaining how the machine operates and by demonstrating how to make repairs. Assistant mechanics or the pinchasers maintain the pinsetters when the mechanic is off duty.

In some bowling centers, mechanics perform other maintenance, such as conditioning lanes and pins, and repairing seats and tables. Mechanics do some clerical work. They order replacement parts and keep an inventory of parts in stock. They also may keep records of pinsetter malfunctions and estimate maintenance costs.

Working Conditions

Mechanics work in a long, relatively narrow corridor at the end of bowling lanes where the automatic pinsetters are located. The work area has space for a workbench and usually is well lighted and well ventilated but quite noisy when the lanes are operating. When making repairs and adjustments, mechanics frequently have to climb and balance on the work platform of the pinsetter and to stoop, kneel, crouch, and crawl around the machines. Those who install and service machines for manufacturers must travel to the various bowling centers in their area.

The job generally is not dangerous but workers are subject to common shop hazards, such as cuts, falls, and bruises.

Mechanics repair both electrical and mechanical parts of automatic pinsetters.

Places of Employment

About 6,200 bowling-pin-machine mechanics were employed in 1978. Almost all worked in bowling centers. A small number were employed by manufacturers of automatic pinsetters to install the machines and service those in bowling centers that did not employ full-time mechanics.

Bowling-pin-machine mechanics are employed in every State, but employment is concentrated in heavily populated areas, where there are many bowling centers.

Training, Other Qualifications, and Advancement

Generally, there are no education or experience requirements for a job as a pinsetter mechanic. Some employers, however, prefer to hire applicants who are high school graduates and who have completed courses in electricity, machine repair, blueprint reading, and shop math. Employers also prefer applicants who have experience repairing some type of machinery.

Pinsetter mechanics usually begin work as assistant mechanics and are trained on the job. Trainees learn about the pinsetter's operation and maintenance by observing head mechanics and working on the machines under their supervision. Trainees are taught how to lubricate and clean pinsetters and to perform other preventive maintenance. Trainees also learn to diagnose and repair various kinds of machine breakdowns. Usually, 1 to 2 years of on-the-job training and experience are needed to acquire mechanics' skills.

Some mechanic trainees are sent to training courses conducted by pinsetter manufacturers. To take these training courses, a mechanic must work at a bowling center. The bowling center usually pays the tuition.

The courses, which last 2 to 4 weeks, include classroom lectures and shopwork with demonstration machines. Trainees study the structure and operation of machines made by the firm operating the school and learn to locate typical sources of trouble. They learn to perform preventive maintenance, to read wiring diagrams, and to use the tools of the trade. After attending these courses, trainees usually need several months of on-the-job experience to qualify as mechanics.

People who want to become bowling-pin machine mechanics should have mechanical ability and like to work with their hands. They also should have good eyesight (including normal color vision), good eye-hand coordination, and average physical strength.

Advancement opportunities for pinsetter mechanics are limited. Some mechanics become managers or owners of bowling establishments. Those who work for manufacturers may advance to service manager.

Employment Outlook

Employment of bowling-pin-machine mechanics is expected to grow more slowly than the average for all occupations through the 1980's. The demand for bowling facilities is likely to grow as the population increases. Since the growth in bowling facilities will be slower than in past years, most job openings will arise because of the need to replace experienced mechanics who retire, die, or leave the occupation for other reasons. However, because this occupation is very small, only a limited number of openings will become available.

Earnings and Working Conditions

Hourly earnings in 1978 ranged from $3 for mechanic trainees up to $8.50 for head mechanics, according to the limited information available. Wages vary greatly by area and with the experience of the mechanic.

Related Occupations

The smooth operation of a bowling center depends on the ability of the mechanic to keep all the electrical and mechanical parts of the pinsetter operating normally. Other mechanics who do all the maintenance and repair work for a specific machine include bakery machine mechanics, laundry machine mechanics, refrigeration mechanics, sewing-machine mechanics, and vending-machine mechanics.

Sources of Additional Information

People who want further information about work opportunities in this occupation should contact bowling centers in their area or the local bowling proprietors' association. The local office of the State employment service is another source of information about employment and training opportunities.

Business Machine Repairers

(D.O.T. 633)

Nature of the Work

Business machine repairers maintain and repair the machines that are used to speed paperwork in business and government. These machines include typewriters, adding and calculating machines, cash registers, dictating machines, postage meters, and duplicating and copying equipment. (Computer service technicians, who work on computer equipment, are discussed in a separate statement elsewhere in the *Handbook*.)

Business machine repairers (often called field engineers or customer engineers) make regular visits for preventive maintenance to the offices and stores of customers in their assigned area. The frequency of these service calls depends upon the type of equipment being serviced. For example, an electric typewriter may require preventive maintenance only three or four times a year, while a complex copier probably would require more frequent attention. During these calls, the engineer inspects the machine for unusual wear and replaces any worn or broken parts. Then the machine is cleaned, oiled, and adjusted to ensure peak operating efficiency and to prevent future breakdowns. The engineer also may advise machine operators how to use the equipment more efficiently and how to spot a problem in its early stages.

Despite frequent maintenance, business machines do occasionally malfunction. When a field engineer is notified by the supervisor of a breakdown, he or she will promptly examine the machine and speak to the customer to determine the cause of the malfuction. Once the problem has been isolated, repairs can be made. Minor repairs generally can be made on the spot; for more serious repairs, however, the entire machine or a component of the machine will be taken to the repair shop where a specialist will work on it.

Business machine repairers generally specialize in one type of machine. Those employed by manufacturing companies or dealers usually are familiar only with the brand produced or sold by their employer. Repairers who work for small independent repair shops must be able to work on equipment from several different manufacturers.

Repairers use common handtools, such as screwdrivers, pliers, and wrenches, as well as other tools especially designed to fit certain kinds of business machines. In addition, they use meters and other types of test equipment to check for malfunctions in electronic circuits.

Working Conditions

Servicing business machines is cleaner and less strenuous than the work in most other mechanical trades. Repairers generally wear business clothes and do most of their work in the customer's office.

Workers travel a great deal because they usually visit a number of customers each workday. They generally use their own cars and are reimbursed on a mileage basis. Injuries are uncommon.

Places of Employment

About 63,000 people worked as business machine repairers in 1978. Most worked on typewriters, calculators, adding machines, copiers, and duplicators. Others serviced proof machines in banks, accounting-bookkeeping machines, cash registers, and postage and mailing equipment. A small number repaired dictating machines.

Almost 8 of 10 repairers worked for business machine manufacturers; for firms that provide maintenance services to businesses; or for repair shops. The remainder worked for organizations large enough to justify employing their own staff of full-time repairers.

Business machine repairers work throughout the country. Even relatively small communities usually have at least one or two repair shops. Most repairers, however, work in large cities.

Training, Other Qualifications, and Advancement

The amount of formal education required for entry jobs as business machine repairers varies widely among employers. Some employers hire applicants with a high school education, while many others require at least 1 year of technical training in basic electricity or electronics. Employers agree that electronics training received in the Armed Forces is valuable.

Applicants for entry jobs may have to pass tests that measure mechanical aptitude, knowledge of electricity or electronics, manual dexterity, and general intelligence. Good eyesight, including color vision, is needed to inspect and work on small, delicate parts. Persons considering this type of work should have good hearing to detect malfunctions revealed by sound.

Employers seek applicants who have a pleasant, cooperative manner. Because most machine servicing is done in customers' offices, the ability to work without interrupting the office routine is very important. A neat appearance and ability to communicate effectively are essential.

Some employers require that business machine repairers be bonded. Applicants for these jobs must be honest and trustworthy because they sometimes are exposed to large sums of money and other valuables in banks and offices. In addition, these workers must be able to work without direct supervision. They must be able to set up a maintenance schedule for their customers' equipment and arrange their own schedule so that they can meet service deadlines and also handle emergency repairs.

Trainees who work in a manufacturer's branch office or for a franchised dealer usually attend a school sponsored by the manufacturer. Training programs at company schools usually last several weeks to several months, depending on the type of machine the repairer will service. Trainees then receive from 1 to 3 years of practical experience and on-the-job training before they become fully qualified repairers. These workers generally learn to service only the company's line of equipment.

Training offered by independent repair shops usually is less formal. Trainees generally complete a self-study course coupled with on-the-job training under the supervision of an experienced repairer. Because small repair shops usually do not specialize in the more sophisticated types of equipment, their repairers are expected to be familiar with the more common machines produced by many manufacturers. For example, business machine repairers in small shops should be able to repair several different makes of typewriters, adding machines, and calculators.

Wherever they work, business machine repairers frequently attend training seminars sponsored by business equipment manufacturers for special instruction in new business developments. Also, business machine repairers are encouraged to broaden their technical knowledge during nonworking hours. Many companies pay the repairer's tuition for work-related courses in college and technical schools.

Because of their familiarity with equipment, business machine repairers are particularly well qualified to advance to sales jobs as manufacturers' sales workers, for example. Repairers who show management abilities also may become service managers or supervisors. Experienced repairers sometimes open their own repair shops; those who work in manufacturers' branch offices sometimes become independent dealers or buy sales franchises from the company.

Employment Outlook

Employment of business machine repairers is expected to grow much faster than the average for all occupations through the 1980's. In addition to the jobs that result from employment growth, many openings

Repairers must be familiar with a wide range of tools and testing methods.

will arise as experienced repairers retire, die, or change occupations.

Employment opportunities for qualified beginners are excellent. Business and government will continue to buy more machines to handle the growing volume of paperwork and more people will be needed to maintain and repair these machines. In recent years, many technical changes have occurred in business machines. Electronic calculating machines have replaced mechanical models, for example, and electronic cash registers are replacing mechanical registers. Because of the greater use of such equipment, opportunities will be particularly favorable for repairers who have training in electronics. In fact, training in basic electronics is almost always required for business machine repair jobs.

Business machine repairers work year round and have steadier employment than many other skilled workers. Office machines must be maintained even when business slackens, since records must be kept, correspondence carried on, and statistical reports prepared.

Earnings

Information from a limited number of employers in 1978 indicated that trainees started at over $150 a week. Even during training, salaries often are increased as workers sharpen their skills and advance to more complicated assignments. People who have previous electronics training in the Armed Forces or civilian technical schools generally receive somewhat higher beginning wages than high school gradutates.

Experienced repairers and specialists earned from $200 to over $300 a week. Repairers who can work on more than one type of equipment normally earn substantially more than those who are familiar with only one type of machine.

In many areas, earnings for business machine repairers are comparable to those of computer service technicians with similar skills, responsibilities, and experience. (See the statement on computer sevice technicians, a closely related occupation, elsewhere in the *Handbook*.)

Related Occupations

Other workers also service complicated electronic and mechanical equipment. These include appliance repairers, automotive electricians, computer service technicians, electronic organ technicians, instrument repairers, radio repairers, radar mechanics, and television service technicians.

Sources of Additional Information

For more details about job opportunities, contact local firms that sell and service business machines and the local office of the State employment service. The State department of education in your State capital can furnish information about approved technical institutes, junior colleges, and other institutions offering postsecondary training in basic electronics. Additional information about these schools is available from:

Division of Vocational Technical Education, U.S. Department of Education, Washington, D.C. 20202.

Computer Service Technicians

(D.O.T. 828.261-014 and .281-010)

Nature of the Work

Computer systems play a vital role in our lives. They help us make telephone calls, receive paychecks on time, and reserve tickets for travel, hotels, and entertainment. In business and industry, computer systems perform countless tasks—from maintaining business records to controlling manufacturing processes.

A computer system is the combination of a central processing unit and additional equipment such as remote terminals and high speed printers. Keeping this intricate set of machines in good working order is the job of the computer service technician.

At regular intervals, computer service technicians (often called field engineers or customer engineers) service machines or systems to keep them operating efficiently. They routinely adjust, oil, and clean mechanical and electromechanical parts. They also check electronic equipment for loose connections and defective components or circuits.

When computer equipment breaks down, technicians must find the cause of the failure and make repairs. Determining where in the system the malfunction has occurred is the most difficult part of the technician's job, and requires a logical, analytical mind as well as technical knowledge. As computer systems have grown larger and more complex, the potential for malfunctions also has grown.

The problem can be in the central processing unit itself, in one of the peripheral machines, such as a reader or a printer, or in the cables connecting these machines. Technicians use several kinds of tools to test equipment, including voltmeters, ohmmeters, and oscilloscopes to check for electronic failures. They run special diagnostic programs that help pinpoint certain malfunctions. Although it may take several hours to locate a problem, fixing the equipment may take just a few minutes. To replace a faulty circuit board, solder a broken connection, or repair a mechanical part, technicians use a variety of handtools, including needle-nosed pliers, wirestrippers, and soldering equipment. The employer supplies tools and test equipment, but technicians are responsible for keeping them in good working order.

Computer technicians often help install new equipment. They lay cables, hook up electrical connections between machines, thoroughly test the new equipment, and correct any problems before the customer uses the machine.

Some technicians specialize in maintaining a particular computer model or system, or in doing a certain type of repair. For example, some technicians are experts in correcting problems caused by errors in the computer's internal programming.

Besides knowing how to use specialized tools and test equipment, computer technicians must be familiar with technical and repair manuals for each piece of equipment. They also must keep up with the technical information and revised maintenance procedures issued periodically by computer manufacturers.

Technicians keep a record of preventive maintenance and repairs on each machine they service. In addition, they fill out time and expense reports, keep parts inventories, and order parts.

Although technicians spend most of their time working on machines, they work with people also. They listen to customers' complaints, answer questions, and sometimes offer technical advice on ways to keep equipment in good condition. Experienced technicians often help train new technicians and sometimes have limited supervisory duties.

Working Conditions

Computer installations generally run around the clock and working time lost because of a breakdown can be very expensive. For this reason, technicians must be available to make emergency repairs at any time, day or night. Although the normal workweek is 40 hours, overtime is standard. The method of assigning overtime varies by employer. Some technicians are on call 24 hours a day. Others work rotating shifts—days one week, nights the next.

For most technicians, travel is local; they usually are not away from home overnight. Employers pay for travel, including reimbursement for job-related uses of the technician's car, as well as work-related education expenses.

Although some bending and lifting is necessary, the job is not strenuous. Work hazards are limited mainly to burns and electric shock, but these can be avoided if safety practices are followed.

Places of Employment

In 1978, about 63,000 persons worked as computer service technicians. Most were employed by firms that provide maintenance services for a fee and by manufacturers of computer equipment. A small number were employed directly by organizations that have large computer installations.

Computer technicians generally work out of regional offices located in large cities, where computer equipment is concentrated. Most are assigned to several clients, depending on the technician's specialty and the type

Technicians must examine mechanical as well as electronic components
to diagnose computer malfunctions.

of equipment the user has. Workers with several accounts must travel from place to place to maintain these systems and to make emergency repairs. In some cases, more than one technician will share an account and service different parts of a system. In other cases, an experienced technician may be assigned to work full time at a client's installation in order to maintain all phases of that operation. Technicians who work for a nationwide organization must sometimes transfer to another city or State.

Training, Other Qualifications, and Advancement

Most employers require applicants for technician trainee jobs to have 1 to 2 years' post-high school training in basic electronics or electrical engineering. This training may be from a public or private vocational school, a college, or a junior college. Basic electronics training offered by the Armed Forces is excellent preparation for technician trainees.

A high school student interested in becoming a computer service technician should take courses in mathematics and physics. High school courses in electronics and computer programming also are helpful. Hobbies that involve electronics, such as operating ham radios or building stereo equipment, also provide valuable experience.

Besides technical training, applicants for trainee jobs must have good close vision and normal color perception to work with small parts and color-coded wiring. Normal hearing is needed since some breakdowns are diagnosed by sound. Because technicians usually handle jobs alone, they must have the initiative to work without close supervision. Also important are a pleasant personality and neat appearance, since the work involves frequent contact with customers. Patience is an asset, because some malfunctions occur infrequently and are very difficult to pinpoint. In some companies, applicants must pass a physical examination. In others, a security clearance may be required because technicians work on machines located in restricted buildings.

Trainees usually attend company training centers for 3 to 6 months to learn elementary computer theory, computer math, and circuitry theory and to further their study of electronics. Classroom work is accompanied by practical training in operating computer equipment, doing basic maintenance, and using test equipment to locate malfunctions.

In addition to formal instruction, trainees must complete 6 months to 2 years of on-the-job training. At first, they work closely with experienced technicians, learning to maintain card readers, printers, and other machines that are relatively simple, but that have the basic mechanical and electronic features of a large computer system. As trainees gain experience, they work on more complex equipment.

Because manufacturers continually redesign equipment and develop new uses for computers, experienced technicians frequently must attend training sessions to keep up with these changes and to broaden their technical skills. Many technicians take advanced training to specialize in a particular computer system or type of repair. Instruction also may include programming, systems analysis, and other subjects that improve the technician's general knowledge of the computer field.

Experienced technicians with advanced training may become specialists or "troubleshooters" who help technicians throughout their territory diagnose difficult problems. They also may work with engineers in designing equipment and developing maintenance procedures. Technicians with leadership ability may become supervisors or service managers.

Most computer equipment operates on the same basic principles, but machines built by different companies may be unique in design and construction. For this reason, technicians may find it difficult to transfer between companies that maintain different brands of equipments. However, because of the pressing need for experienced technicians, many opportunities exist for well-qualified workers to transfer to other firms that handle the same type of computer hardware.

Training and experience in computer maintenance may also help qualify a technician for a job in equipment sales, programming, or management. (See the statements on programmers, manufacturers' sales workers, and the office machine and computer manufacturing industry elsewhere in the *Handbook*.)

Employment Outlook

Employment of computer technicians is expected to grow much faster than the average for all occupations through the 1980's. As the Nation's economy expands, more computer equipment will be used and many more technicians will be needed to install and maintain it. Business, government, and other organizations will buy, lease, or rent additional equipment to manage vast amounts of information, control manufacturing processes, and aid in scientific research. The development of new uses for computers in fields such as education, medicine, and traffic control also will spur demand.

The very strong demand for computer technicians is related to the growing number of computers in operation and the geographic distribution of these computers. Continued reductions in the size and cost of computer hardware will bring the computer within reach of a rapidly increasing number of small organizations. As more and more of these small systems are installed, the amount of time technicians must spend traveling between clients will increase. Most openings will continue to occur in metropolitan areas, however.

Employment of computer service technicians is much less likely to be affected by downturns in business activity than is the case in other fields.

Earnings

Average weekly earnings of computer service technician trainees were about $220 a week in 1978, according to a private survey of computer manufacturing firms. Fully trained workers earned about $240 a week, while senior technicians with several years' experience earned between $250 and $350. Highly skilled specialists averaged from $300 to $400 a week.

Related Occupations

Workers in other occupations repair and maintain the circuits and mechanical parts of electronic equipment. These include appliance repairers, automotive electricians, business machine repairers, electronic organ technicians, instrument repairers, radio repairers, radar mechanics, and television service technicians.

Sources of Additional Information

For general information on careers in computer maintenance, contact the personnel department of computer manufacturers and computer maintenance firms in your area. The State department of eduction in your State capital can furnish information about approved technical institutes, junior colleges, and other institutions offering postsecondary training in basic electronics. Additional information about these schools is available from:

Division of Vocational Technical Education, U.S. Department of Education, Washington, D.C. 20202.

The State employment service office in your area may also be able to provide information about local job opportunities.

Electric Sign Repairers

(D.O.T. 824.281-018)

Nature of the Work

A common form of advertising for many businesses and products is the electric sign. Electric sign repairers maintain and repair neon and illuminated plastic signs so that they retain their "eye appeal" and attract maximum attention.

When a sign requires service, repairers drive to its location in a truck, carrying tools and a number of replacement parts. Repairers' trucks are equipped with ladders and boom cranes so they can work on tall signs or those placed high above the ground. Common sources of sign trouble, such as burned-out bulbs, are easy to fix. However, in some cases, the problem may not be obvious and repairers may need to use electronic test equipment to determine the cause of a breakdown. Although simple repairs such as replacing bulbs or transformers, are done at the site, major repairs of faulty parts, such as neon tubing are made in sign shops.

Repairers also do preventive maintenance and periodic inspection of signs to locate and correct defects before breakdowns occur. They check signs and remove debris such as birds' nests and accumulated water. Repairers also tighten or weld parts that have been loosened by winds and repaint beams, columns, and other framework. They may repaint portions of neon tubing to make the sign more readable. Motors, gears, bearings, and other parts of revolving signs may be checked, adjusted, and lubricated.

During periods with few service calls, repairers who work for sign manufacturing companies may help assemble signs. Some repairers also install signs.

Repairers use common handtools and power tools, such as screwdrivers, pliers, saws, and electric drills. They also use ammeters, voltmeters, and other testing devices to locate malfunctioning electric parts. When replacing burned-out parts, such as lamps or flashers in illuminated plastic signs, repairers may refer to wiring diagrams and charts.

Repairers usually must fill out reports noting the date, place, and nature of service calls. They also may estimate the cost of service calls and sell maintenance contracts to sign owners.

Working Conditions

Because most signs are out-of-doors, repairers are exposed to all kinds of weather. They sometimes make emergency repairs at night, on weekends, and on holidays. They may spend much time traveling to the site of a service call. In some large cities, repairers patrol areas at night to locate and fix improperly operating signs. The work can be dangerous; hazards include electric shocks, burns, and falls from high places. Training programs emphasizing safety and equipment, such as baskets on boomtrucks, which allow easy access to signs, have reduced the frequency of accidents.

Places of Employment

About 15,000 persons worked as electric sign repairers in 1978, primarily in small shops that manufacture, install, and service electric signs. Some worked for independent sign repair shops.

Electric sign repairers work throughout the country. However, employment is concentrated in large cities and in populous

Repairers often work on boom cranes to reach tall signs.

States, where large numbers of electric signs are used.

Training, Other Qualifications, and Advancement

Most electric sign repairers are hired as trainees and learn the trade informally on the job. Initially, they perform the various phases of signmaking in the shop to obtain a general knowledge of such tasks as cutting and assembling metal and plastic signs, mounting neon tubing, wiring signs, and installing electric parts. After they have acquired a thorough knowledge of sign construction, trainees accompany experienced repairers on service calls to learn repair and maintenance techniques. At least 4 years of on-the-job training and experience are required to become a fully qualified repairer.

Some people learn the trade through sign repairer or electrician apprenticeship programs conducted by union locals and sign manufacturing shops. The apprenticeships usually last 4 years, emphasize on-the-job training, and include classroom instruction in subjects such as the theory of electricity and blueprint reading. Apprentices generally must be at least 18 years old with a high school diploma. Attempts are being made by unions and the National Electric Sign Association to increase the number of apprenticeship programs, so the availability of this type of training should increase in the future.

Employers prefer to hire high school or vocational school graduates, although many repairers have less education. Courses in mathematics, science, electronics, and blueprint reading are helpful to young people who are interested in learning this trade.

Repairers need good color vision because electric wires are frequently identified by color. They also need manual dexterity to handle tools and physical strength to lift transformers and other heavy equipment. Because much of their work is done on ladders or from the baskets of boomtrucks, repairers cannot be afraid of heights.

All electric sign repairers must be familiar with the National Electric Codes. Many cities require repairers to be licensed. Licenses can be obtained by passing an examination in local electric codes, and electric theory and application.

Highly skilled repairers may become supervisors. Because of their experience in servicing signs and dealing with customers, repairers sometimes become sign sales representatives. Those with sufficient funds may also open their own sign manufacturing or repair shops.

Employment Outlook

Employment of electric sign repairers is expected to increase as fast as the average for all occupations through the 1980's. A rapid increase in the number of signs in use will spur demand for these workers. More signs will be needed as new businesses open and old ones expand and modernize their facilities. Signs already in use also will continue to require service because well-maintained signs are good for business and also because many State and local governments require owners to keep their signs attractive. In addition to new jobs created by employment growth, some openings will arise as experienced workers retire, die, or leave the occupation for other reasons.

Earnings

The earnings of electric sign repairers compare favorably with those of other skilled workers. It is estimated that the hourly wage rate of experienced repairers was about $8.70 in 1978, based on a survey of union wages and fringe benefits throughout the country. Apprentice rates usually range from $3.00 to $7.80 an hour.

Most electric sign repairers work an 8-hour day, 5 days a week, and receive premium pay for overtime. They also may receive extra pay for working at heights in excess of 30 feet.

Many electric sign repairers belong to one the following unions: The International Brotherhood of Electrical Workers, the Sheet Metal Workers International Association, and the International Brotherhood of Painters and Allied Trades.

Related Occupations

Electric sign repairers use their knowledge of electric theory and electric codes and their skills in the use of handtools and electric testing equipment to service and repair electric signs. Workers in other occupations that require these skills include coin-machine servicers and repairers, conveyor maintenance mechanics, electrical appliance repairers, household applicance installers, laundry machine mechanics, aircraft accessory mechanics, and automatic pinsetter mechanics.

Sources of Additional Information

For further information on work opportunities, contact local sign manufacturing shops, the local office of the State employment service, or locals of the unions previously mentioned.

General information on job opportunities, wages, and the nature of the work is available from:

National Electric Sign Association, 2625 Butterfield Rd., Oak Brook, Ill. 60521.

Farm Equipment Mechanics

(D.O.T. 624.281, .361, .381, and .684)

Nature of the Work

Years ago farmers planted, cultivated, and harvested their crops using only handtools and simple, animal-drawn equipment. Few repairs were required, and if a stray rock or stump broke a plow blade, the metal pieces could be hammered back together by the local blacksmith. Even when tractors began to replace animals as the prime source of power, their simplicity made it possible for most farmers to do their own repair work.

But in the last quarter century, farm equipment has grown enormously in size, complexity, and variety. Many farms have both diesel and gasoline tractors, some equipped with 300-horsepower engines. Other machinery, such as harvesting combines, hay balers, corn pickers, crop dryers, and elevators, also is common. In today's world of mechanized agriculture, few if any types of farming can be done economically without specialized machines.

As farm machinery grew more complex, it became important for the sellers of farm equipment to be able to service and repair the machines they sold. Almost every dealer employs farm equipment mechanics to do this work and to maintain and repair the smaller lawn and garden tractors dealers sell to surburban homeowners.

In addition, some mechanics who work for dealers and equipment wholesalers assemble new implements and machinery and sometimes do body work, repairing dented or torn sheet metal on the tractors or other machinery.

Mechanics spend much of their time repairing and adjusting malfunctioning diesel- and gas-powered tractors that have been brought to the shop. But during planting and harvesting seasons, they may travel to the farm to make emergency repairs so that crops can be harvested before they spoil.

Mechanics also perform preventive maintenance. Periodically, they test, adjust, and clean parts and tune engines. In large shops, mechanics may specialize in certain types of work, such as engine overhaul or clutch and transmission repair. Others specialize in repairing the air-conditioning units often included in the cabs of modern tractors and combines, or in repairing certain types of equipment such as hay balers. Some mechanics also repair plumbing, electrical, irrigation, and other equipment on farms.

Mechanics use many basic handtools including wrenches, pliers, hammers, and micrometers. They also may use more complex testing equipment, such as a dynamometer to measure engine performance, or a compression tester to find worn piston rings or leaking cylinder valves. They may use welding equipment or power tools to repair broken parts.

Working Conditions

Generally, farm equipment mechanics work indoors. Modern farm equipment repair shops are well ventilated, lighted, and heated, but older shops may not have these advantages. During planting and harvesting seasons, mechanics may have to make emergency repairs in the field. To do so, mechanics may have to travel many miles and work in all types of weather. Farm equipment mechanics come in contact with grease, gasoline, rust, and dirt, and there is danger of injury when they repair heavy parts supported on jacks or by hoists. Engine burns and cuts from sharp edges of machinery also are possible.

Places of Employment

Most of the over 60,000 farm equipment mechanics employed in 1978 worked in service departments of farm equipment dealers. Others worked in independent repair shops, in shops on large farms, and in service departments of farm equipment wholesalers and manufacturers. Most farm equipment repair shops employ fewer than five mechanics, although a growing number of dealerships employ more than 10. A small proportion of farm equipment mechanics are self-employed.

Because some type of farming is done in nearly every area of the United States, farm equipment mechanics are employed throughout the country. As employment is concentrated in small cities and towns, this may be an attractive career choice for people who do not wish to live the fast-paced life of an urban environment. However, many mechanics work in the rural fringes of metropolitan areas, so farm equipment mechanics who prefer city life need not live in rural areas.

Training, Other Qualifications, and Advancement

Most farm equipment mechanics are hired as helpers and learn the trade on the job by assisting qualified mechanics. The length of training varies with the helper's aptitude and prior experience. At least 2 years of on-the-job training usually are necessary before a mechanic can do most types of repair work, and additional training and experience are required for highly specialized repair and overhaul jobs.

Many farm equipment mechanics enter this occupation from a related occupation. For instance, they may gain experience as farmers and farm laborers, or as heavy equipment mechanics, auto mechanics, or air-conditioning mechanics. People who enter from related occupations also start as helpers, but they may not require as long a period of on-the-job training.

More and more mechanics who enter the trade have had vocational training in rural high schools, in junior and technical colleges, or in the Armed Forces. With the development of more complex farm implements, technical training in electronics has become more important.

A few farm equipment mechanics learn the trade by completing an apprenticeship program, which lasts from 3 to 4 years and includes on-the-job as well as classroom training in all phases of farm equipment repair and maintenance. Applicants for these programs usually are chosen from shop helpers.

Some farm equipment mechanics and trainees receive refresher training in short-term programs conducted by farm equipment manufacturers. These programs usually last several days. A company service representative explains the design and function of equipment and teaches maintenance and repair on new models of farm equipment. In addition, some dealers may send employees to local vocational schools that teach special weeklong classes in subjects such as air-conditioning repair or hydraulics.

Employers prefer applicants who have an aptitude for mechanical work. A farm background is an advantage since growing up on a farm usually provides experience in basic farm equipment repairs. Employers also prefer high school graduates, but some will hire applicants who have less education. In general, employers stress previous experience or training in diesel and gasoline engines, the maintenance and repair of hydraulics, and welding—subjects that may be learned in many high schools and vocational schools. Some employers also may require mechanics to be skilled at blueprint reading, because mechanics may have to refer to diagrams of machinery when making complex repairs to electrical and other systems.

Persons considering careers in this field should have the manual dexterity needed to handle tools and equipment. Occasionally, strength is required to lift, move, or hold in place heavy parts. Difficult repair jobs may require problem-solving abilities, so experienced mechanics should be able to work independently with minimum supervision.

Farm equipment mechanics may advance to shop supervisor or manager of a farm equipment dealership. Some mechanics open their own repair shops. A few farm equipment mechanics earn 2-year associate degrees in agricultural mechanics and advance to service representatives for farm equipment manufacturers.

Employment Outlook

Employment of farm equipment mechanics is expected to increase about as fast as the average for all occupations through the 1980's. In addition to jobs from employment growth, several hundred job opportunities will arise each year as experienced mechanics retire, die, or transfer to other occupations. Opportunities will be best for applicants who have lived or worked on farms and know how to operate farm machinery and make minor repairs.

The development of more technically ad-

The trend toward larger and more complex farm machinery has created a need for more farm equipment.

vanced farm equipment, some of which will require greater maintenance, will increase the demand for mechanics. For instance, many newer tractors have much larger engines, and feature advanced transmissions of up to 24 speeds. More complex electrical systems also are used to operate the great variety of gauges and warning devices now used to alert the operator to problems such as brake wear, low oil pressure in the transmission, or insufficient coolant in the radiator. Advances such as these and air-conditioned cabs, which have improved the comfort of the operator, have made it more difficult for farmers to do their own repairs. Thus farmers will have to rely more on skilled mechanics in the future.

In addition to the larger and more complex farm machinery, sales of smaller lawn and garden equipment have increased vastly over the past decade and are expected to continue to do so. Most of the large manufacturers of farm equipment now produce a line of these smaller tractors and sell them through their established dealerships. More mechanics will be needed to service this additional equipment.

Earnings

Farm equipment mechanics employed by dealerships had average hourly wages of over $6 in 1978, according to the limited information available. Most farm equipment mechanics also have the opportunity for overtime work, for which they are paid time and one-half. Farm equipment mechanics usually work a 44-hour week, which includes 4 hours on Saturday. During planting and harvesting seasons, however, they often work 6 to 7 days a week, 10 to 12 hours daily. In winter months, they may work fewer than 40 hours a week, and some may be laid off.

Very few farm equipment mechanics belong to labor unions, but those who do are members of the International Association of Machinists and Aerospace Workers.

Related Occupations

Two distinguishing characteristics of farm equipment mechanics are: 1) They work on large machinery, and 2) they often can find jobs in small towns and other nonmetropolitan areas. Other craft workers whose jobs have these same characteristics include automobile mechanics, diesel mechanics, truck mechanics, oilfield equipment mechanics, compressed gas equipment service mechanics and tractor mechanics.

Sources of Additional Information

Details about work opportunities may be obtained from local farm equipment dealers and local offices of the State employment service. For general information about the occupation, write to:

National Farm and Power Equipment Dealers Association, 10877 Watson Road, St. Louis, Mo. 63127.

Furniture Upholsterers

(D.O.T. 780.381-018)

Nature of the Work

Whether restoring a treasured antique or simply giving an old living room couch a facelift, upholsterers combine artistic flair and manual skill to recondition sofas, chairs, and other upholstered furniture. These craft workers replace worn and damaged fabrics, springs, and padding. (Workers employed in the manufacture of upholstered furniture are not included in this statement.)

All custom upholstery involves two steps: Removing the old cover, padding, and springs; and rebuilding the piece. However, because of differences in the way furniture is built, each job is unique. The following is an explanation of some of the typical tasks involved in upholstering a piece of furniture.

As the first step, upholsterers usually place the furniture on padded wooden benches or some other type of support so that they may work at a convenient level. Using hammers and tack pullers, they remove tacks or staples that hold the old fabric to the wooden frame. After stripping the old fabric, they remove the burlap and padding that cover the arms, back, sides, and seat of the piece. Upholsterers examine the springs and remove broken or bent ones. The springs sit on a mat woven from strips of nylon or cotton cloth called webbing that is attached to the frame. If the webbing is worn, upholsterers remove all the springs and all the webbing.

To rebuild the furniture, upholsterers may reglue loose sections of the frame and refinish exposed wooden parts. If the mat that holds the springs was removed, they replace it. They tack webbing to one side of the frame, stretch it tight, and tack it to the opposite side. Other webbing is woven across the first and attached to the frame to form a new mat. After putting springs on the mat so they compress evenly, upholsterers sew or staple each spring to the webbing or frame and tie each spring to the ones next to it. Burlap then is stretched over the springs, cut and smoothed, and tacked to the frame. To form a smooth rounded surface over the springs and other parts of the frame, upholsterers cover each section of the furniture—seat, back, arms—with cotton pads or other filling material. After sewing the padding to the burlap, they cover it with heavy cloth and tack the cloth to the frame. Finally, upholsterers put on the new fabric cover, which has been cut to size for a section, such as an arm or the back, and temporarily stitched together for fitting. After checking that the cover fits tightly and smoothly—or noting where adjustments are necessary—they remove the cover and sew it together and attach it to the frame. To complete the job, upholsterers sew or tack on fringe, buttons, or other ornaments and make pillow covers.

Upholsterers use a variety of common handtools, including hammers, tack and staple removers, pliers, and shears, and special tools such as webbing stretchers and upholstery needles. They also use sewing machines.

Working Conditions

Working conditions in upholstery shops vary—many shops are spacious, adequately lighted, well-ventilated, and well-heated; others are small and dusty. Upholsterers stand while they work and do a considerable amount of stooping and bending and some heavy lifting.

Sometimes upholsterers pick up and deliver furniture. Shop owners and managers order supplies and equipment and keep business records. Upholsterers often work with interior designers. They upholster furniture with fabrics selected by the designer. However, some upholsterers help customers select new furniture covers on their own.

Places of Employment

About 27,000 people worked as furniture upholsterers in 1978. Over three-fourths of all furniture upholsterers own and operate, or work in small upholstery shops. These shops generally have fewer than three workers. Some upholsterers are employed by furniture stores. A few work for businesses, such as hotels, that maintain their own furniture.

Upholsterers work in all parts of the country. However, employment is concentrated in metropolitan areas, where the large population provides the greatest demand for the upholsterer's service.

Training, Other Qualifications, and Advancement

The best way to enter this trade is to start as a helper in an upholstery shop and learn on the job. Helpers learn by upholstering furniture under the direction of experienced workers. Much time and practice are needed to learn complex tasks such as measuring and cutting the new fabric and sewing and attaching it to the frame with a minimum of waste. Usually about 3 years of on-the-job training are required to become a fully skilled upholsterer.

Inexperienced persons may get basic training in upholstery from vocational or high school courses. However, additional training and experience in a shop usually are required before these workers can work as quickly and efficiently as experienced upholsterers.

Persons interested in becoming upholsterers should have good manual dexterity, coordination, and be able to do occasional heavy lifting. An eye for detail and flair for creative use of fabrics are helpful in making upholstered furniture as attractive as possible.

The major form of advancement for upholsterers is opening their own shop. It is easy to open a shop because only a small investment in handtools and a sewing machine is needed. However, the upholstery business is

Sewing is one of the manual skills needed by furniture upholsterers.

extremely competitive, so operating a shop successfully is difficult.

Employment Outlook

Little or no change is expected in employment of upholsterers through the 1980's. Most job openings will arise because of the need to replace experienced workers who retire, die, or transfer to other occupations.

More upholstered furniture will be used as population, personal income, and business expenditures grow. However, the demand for upholsterers will be limited because more people are buying less expensive furniture and replacing rather than upholstering it. Inexperienced workers probably will have difficulty getting a job in upholstery shops. Most shop owners will not take time from their work to supervise trainees.

Earnings

Hourly wages for experienced furniture upholsterers ranged from $6.45 to $10 in 1978. Some highly skilled upholsterers earned over $10 an hour. Wages for inexperienced trainees ranged from $3.25 to $4.50 an hour. Upholsterers usually by their own handtools.

Upholsterers generally work 40 hours a week. The peak season in upholstery shops is the last 4 months of the year. However, upholsterers usually do not work overtime and they rarely are laid off during the slack season.

Some upholsterers are members of the Upholsterers' International Union of North America.

Related Occupations

Other workers who combine manual skills and a knowledge of materials such as fabrics and wood to repair things are automobile upholsterers, fur cutters, furniture finishers, piano technicians, rug repairers, and shoe repairers.

Sources of Additional Information

For details about work opportunities for upholsterers in your area, contact local upholstery shops, the local office of the State employment service, or a local of the Upholsterers' International Union.

Industrial Machinery Repairers

(D.O.T. 626 through 630)

Nature of the Work

When a machine breaks down in a plant or factory, not only is the machine idle, but raw materials and human resources are wasted. It is the industrial machinery repairer's job to prevent these costly breakdowns and to make repairs as quickly as possible.

Industrial machinery repairers—often called maintenance mechanics—spend much time doing preventive maintenance. This includes keeping machines well oiled and greased, and periodically cleaning parts. The repairer regularly inspects machinery and checks performance. Tools such as micrometers, calipers, and depth gauges are used to measure and align all parts. For example, treadles on sewing machines in the apparel industry may need adjustment and gears and bearings may have to be aligned. By keeping complete and up-to-date records, mechanics try to anticipate trouble and service machinery before the factory's production is interrupted.

When repairs become necessary, the maintenance mechanic must first locate the specific cause of the problem. This challenge requires knowledge reinforced by experience. For example, after hearing a vibration from a machine, the mechanic must decide whether it is due to worn belts, weak motor bearings, or any number of other possibilities. Repairers often follow blueprints and engineering specifications in maintaining and fixing equipment.

After correctly diagnosing the problem, the maintenance mechanic disassembles the equipment, and then repairs or replaces the necessary parts. Hand and power tools usually are needed. The repairer may use a screwdriver and a wrench to take the door off an oven, or a crane to lift a printing press off the ground. Electronic testing equipment often is included in the mechanic's tools. Repairers use catalogs to order replacements for broken or defective parts. When parts are not readily available, or when a machine must be quickly returned to production, repairers may sketch a part that can be fabricated by the plant's machine shop.

The repairer reassembles and tests each piece of equipment after it has been serviced, for once it is back in operation, the machine is expected to work as if it were new.

Many of the industrial machinery repairer's duties often are performed by millwrights. (See statement on millwrights elsewhere in the *Handbook*.)

Working Conditions

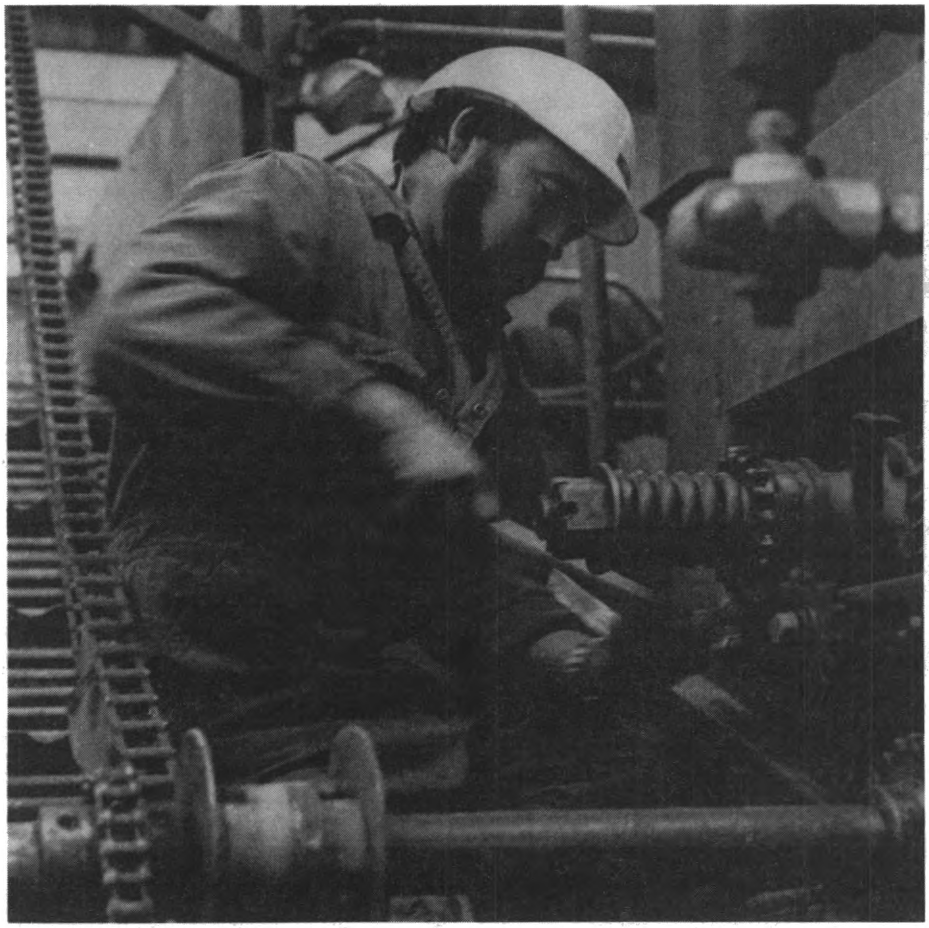
Industrial machinery repairers are not usually affected by seasonal changes in production. During slack periods, when some plant workers are laid off, repairers often are retained to do major overhaul jobs. In addition to their regular work schedule, industrial machinery repairers may be called to the plant at night or on weekends for emergency repairs.

Repairers may work in stooped or cramped positions to reach the underside of a generator, for example. They also may work from the top of ladders when repairing a large machine. These workers are subject to common shop injuries such as cuts and bruises. Goggles, metal-tip shoes, safety helmets, and other protective devices help prevent injuries.

Places of Employment

Industrial machinery repairers work in almost every industry in which a great deal of machinery is used. Many of the 655,000 repairers employed in 1978 worked in the following manufacturing industries: Food products, primary metals, machinery, chemicals, fabricated metal products, transportation equipment, paper, and rubber.

Because industrial machinery repairers work in a wide variety of plants, they are employed in every section of the country.



Industrial machinery repairers need agility.

Employment is concentrated, however, in heavily industrialized areas.

Training, Other Qualifications, and Advancement

Graduation from high school is preferred, but not always required, for entry into this occupation. High school courses in mechanical drawing, mathematics, blueprint reading, and physics are useful for those interested in entering this trade.

Most workers who become industrial machinery repairers start as helpers and pick up the skills of the trade informally. Some learn the trade through apprenticeship programs. Apprenticeship training usually lasts 4 years and consists of on-the-job training and related classroom instruction in subjects such as shop mathematics, blueprint reading, welding, and safety.

Mechanical aptitude and manual dexterity are important qualifications for workers in this trade. Good physical condition and agility are also necessary because repairers sometimes have to lift heavy objects or climb to reach equipment located high above the floor.

Examinations may be administered periodically to determine the repairer's ability to maintain more advanced machinery. Some repairers are promoted to machinists or tool-and-die makers or become master mechanics.

Table 1. Average hourly earnings of industrial machine repairers in selected areas, 1978

Area	Hourly rate
Detroit	$9.04
Indianapolis	8.78
Baltimore	8.61
Houston	7.99
Chicago	7.75
New York	7.55
New Orleans	7.52
Cincinnati	7.47
Minneapolis–St. Paul	7.36
St. Louis	7.17
Worcester, Mass.	6.31
Greenville–Spartanburg, S.C.	5.55

SOURCE: Bureau of Labor Statistics.

Employment Outlook

Employment of industrial machinery repairers is expected to increase much faster than the average for all occupations through the 1980's. More repairers will be needed as manufacturers invest in more industrial machinery. Also, as machinery becomes more complex, repair work and preventive maintenance will become more time consuming. In addition, many openings will result from the need to replace repairers who retire, die, or transfer to other occupations.

Earnings

According to a survey of metropolitan areas, hourly wages for industrial machinery repairers averaged $7.74 in 1978—about one-third higher than the average for all nonsupervisory workers in private industry, except farming. Average hourly earnings of industrial machinery repairers in 12 areas that represent various regions of the country are shown in the accompanying tabulation.

Labor unions to which most industrial machinery repairers belong include the United Steelworkers of America; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the International Association of Machinists and Aerospace Workers; and the International Union of Electrical, Radio and Machine Workers.

Related Occupations

Other occupations which involve repairing machinery include: Aircraft mechanics, automobile mechanics, bowling-pin-machine mechanics, machinists, millwrights, tool-and-die makers, and vending machine mechanics.

Sources of Additional Information

Information about employment and apprenticeship opportunities in this field may be available from local offices of the State employment service or the following organizations:

International Union, United Automobile, Aerospace, and Agricultural Implement Workers of America, 8000 East Jefferson Ave., Detroit, Mich. 48214.

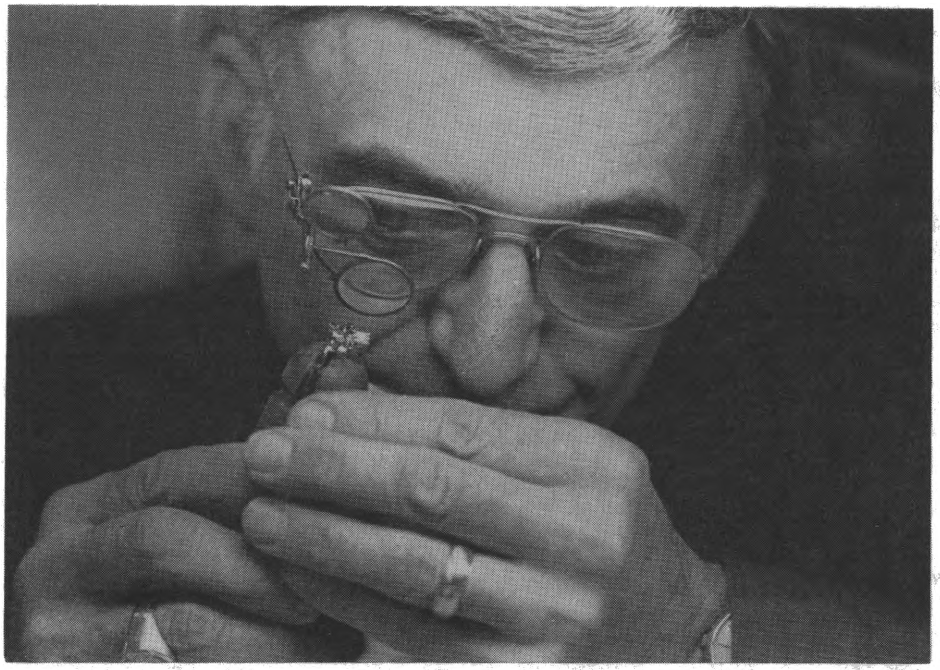
International Union of Electrical, Radio and Machine Workers, 1126-16th St. NW., Washington, D.C. 20036.

Jewelers

(D.O.T. 700.281 and .381)

Nature of the Work

For thousands of years people have worn and admired jewelry, especially jewelry made from precious metals and stones, such as gold and diamonds. Jewelers use such materials to



A jeweler examines a ring setting before repairing it.

make and repair rings, necklaces, earrings, and other jewelry.

Jewelers work in jewelry factories, stores, and repair shops. In factories they specialize, while in stores and repair shops they have a variety of duties.

Most jewelry is mass produced by assembly line methods. Jewelers generally have one job in the manufacturing process. For example, some make molds to cast jewelry or dies to stamp it. Others do finishing work, such as setting stones and engraving.

In jewelry stores and repair shops jewelers generally offer many services to their customers. Much of their time is spent repairing jewelry. Typical repair jobs are enlarging or reducing rings, resetting stones, and replacing broken clasps and mountings. Jewelers may repair watches and do hand engraving. Some are qualified gemologists and appraise the quality and value of diamonds and other gemstones.

Highly skilled jewelers—in stores and in factories—make jewelry by hand. Following their own designs or those created by designers, they shape the metal with pliers or other handtools or cast it in molds. Individual parts are soldered to form the finished piece. Designs may be carved in metal, and diamonds or other stones mounted.

Jewelers use pliers, files, saws, hammers, torches, soldering irons, and a variety of other small handtools. They use chemicals and polishing compounds, such as jeweler's rouge, for soldering and finishing. Because the work is very detailed, jewelers often wear magnifying glasses.

Jewelers who own stores or shops have additional responsibilities. Besides working on jewelry, these small business people hire employees, order and sell merchandise, and handle other managerial duties.

Working Conditions

Jewelers usually work in comfortable surroundings and the trade involves few physical hazards. However, doing delicate work with small, valuable objects such as gemstones can cause mental stress.

Jewelers generally work alone with little supervision. However, in retail stores they may talk with customers about repairs and even do some sales work.

Places of Employment

About 32,000 people had jobs as jewelers in 1978. About two-fifths of all jewelers are self-employed, operating jewelry stores or repair shops.

Most jewelers employed in precious jewelry production work in or near New York City. The production of costume jewelry is centered in Rhode Island and Massachusetts. Although jewelry stores and repair shops are located throughout the country, most jobs in these establishments are in metropolitan areas.

Training, Other Qualifications, and Advancement

Jewelers' skills usually are learned through informal on-the-job training and technical schools.

In the precious jewelry industry, the Amalgamated Jewelry, Diamond and Watchcase Workers Union and the manufacturers have established apprenticeships for many skilled occupations. Individuals who work in jewelry factories have the best chance to get such apprenticeships. Depending on the particular skill, apprenticeship programs involve 3 to 4 years of on-the-job training. To overcome labor shortages in modelmaking, moldmaking, and other occupations, some manufacturers sponsor training courses in local vocational schools or in academies owned by the manufacturers. The employer usually pays the tuition.

Some technical schools offer instruction for 6 months to 3 years in jewelry repair and jewelry making. These schools are a good source of training for someone outside the jewelry industry who wants a job in a jewelry store or repair shop. Graduates of these courses usually need on-the-job training to refine their manual skills and to learn more about repair work.

A high school education is desirable for young people entering the trade. Courses in art, mechanical drawing, and chemistry are useful, depending on which aspect of the trade one chooses to follow.

The precise and delicate nature of jewelry work requires finger and hand dexterity, good eye-hand coordination, patience, and concentration. Artistic ability is a major asset, because jewelry is primarily a form of adornment.

In manufacturing, jewelers sometimes advance to supervisory jobs. Some jewelers open their own jewelry stores or repair shops. Others become salaried managers of jewelry stores.

A substantial financial investment is required to operate a jewelry store, because an inventory of expensive merchandise must be obtained. The jewelry business also is highly competitive. Jewelers who plan to open their own stores should have experience in selling.

Employment Outlook

Employment of jewelers is expected to grow as fast as the average for all occupations through the 1980's. The demand for jewelry will increase as population grows, and as rising incomes enable people to spend more on luxuries. Many job openings will occur each year as experienced workers retire, die, or transfer to other occupations. Because of a shortage of skilled jewelers, opportunities for people with training in jewelry construction, design, or repair should exist throughout the industry.

Earnings

According to the limited information available, earnings of experienced jewelry workers in manufacturing ranged from about \$5 to \$7 an hour in 1978. Apprentices received \$2.90 an hour to start. They get periodic raises up to the minimum union wage for their job. In jewelry stores jewelers typically earn between \$10,000 and \$14,000 a year.

In some precious jewelry factories the workweek is 35 hours. Most jewelers in stores and repair shops work 40 to 48 hours a week. During peaks sales seasons, such as Christmas, they often work over 50 hours a week.

Related Occupations

Jewelers are important craft workers in the growing jewelry industry. Other skilled workers in this industry include gem cutters, gemologists, hand engravers, model makers, silversmiths, and watch repairers.

Sources of Additional Information

For information on job opportunities in jewelry stores, contact:

Retail Jewelers of America, Time-Life Building, Suite 650, 1271 Avenue of the Americas, New York, N.Y. 10020.

Locksmiths

(D.O.T. 709.281-010)

Nature of the Work

Locksmithing is an ancient trade. Locksmiths made key-operated wooden locks for Egyptian royalty as early as 2000 B.C. For many centuries, locksmiths only worked for the relatively few people who could afford the expensive locks that the smiths made by hand. In 1861, an effective lock was invented that could be mass produced, and locks became nearly as common as doors themselves. Making locks by hand was no longer economical. With so many locks to service, however, more locksmiths were needed than ever before.

Making duplicate keys is one of the jobs done by locksmiths.

Today's locksmiths do a variety of work with locks, keys, safes and alarm systems. Several of their jobs are described below.

Locksmiths spend much of their time helping people get into cars, buildings, or safes that have been locked accidentally or that have broken locks. If a key has been left inside a car, for example, they may simply pick the lock. If, on the other hand, the keys are lost, new ones must be made. To do this, locksmiths first will try to obtain identifying key code numbers. The key code numbers show the locksmith where to cut and notch a key blank to make a duplicate key. Keys also can be duplicated by impression. To do this, locksmiths place a key blank in the lock and, by following marks left on the blank, file notches in it until the lock opens.

Combination locks, such as those on safes, offer a special challenge. Locksmiths sometimes open them by touch, that is, by rotating the dial and listening for the contact points when the wheels come into place. If all else fails, a hole may be drilled through the lock to open it.

Locksmiths also fix damaged locks. They disassemble the lock and replace or repair worn tumblers, springs, and other parts.

Another important part of the locksmith's work is helping customers maintain security devices. For example, they may rekey the door locks in a warehouse, change the combination of an office safe, or install dead-bolt locks in a home. To rekey, locksmiths change the tumblers to fit a new key. Tumblers are the part of the lock that releases the bolt when the key is turned. Rekeying a masterkey system is one of the most complicated and time-consuming jobs handled by a locksmith. In a masterkey system, some keys must open all doors; others open various combinations (for example, all doors on one floor of a building); still others are individual keys for each door. Some locksmiths install and repair electronic burglar alarms and surveillance systems that signal police or firefighters when break-ins or fires occur.

Locksmiths use files, screwdrivers, pliers, tweezers, and electric drills in their work, as well as special tools such as lockpicks. They make original and duplicate keys on keycutting machines. To guide them in their work, they refer to manuals that describe the construction of various locks.

Working Conditions

Locksmiths often specialize in one aspect of their trade and working conditions vary with the area of specialization. Locksmiths who handle emergency calls do considerable driving from job to job. They work evenings and weekends and sometimes work outside in bad weather. Some locksmiths have contracts with businesses to change safe combinations and rekey locks periodically. These locksmiths also travel frequently but have regular rounds and hours. Other locksmiths only work in shops specializing in repair work, key duplicating, and sales. All locksmiths occasionally work in awkward positions for long periods. Locksmithing generally is clean and safe, however.

Locksmiths who own their own shops have managerial duties, such as keeping records, purchasing supplies, and supervising other workers.

Places of Employment

An estimated 15,000 people worked as locksmiths in 1978. Most worked for locksmith shops. Many operated their own businesses. Some locksmiths worked in hardware and department stores that offered locksmith services to the public. Others worked in establishments that had a large number of locks that had to be maintained, such as goverment agencies, schools, and large industrial plants. A small number worked for safe and lock manufacturers.

Locksmiths work in virtually every part of the country. Locksmithing in small towns may be a part-time job, combined with other work, such as fixing lawnmowers, guns, and bicycles.

Training, Other Qualifications, and Advancement

On-the-job training under the supervision of experienced locksmiths is the recommended way to learn this trade. Trainees first do simple jobs, such as duplicating keys on keycutting machines and making keys from number codes. As trainees gain experience, they learn to open, repair, and install locks. Generally a trainee needs about 4 years of on-the-job training to acquire the skills of the trade. Additional training is needed to service electronic security systems.

A small number of vocational and correspondence schools offer 1- to 2-year programs in locksmithing and business management. At some schools, students may specialize in safe repair or alarm systems. Although completion of a locksmithing course does not assure a job, employers generally prefer to hire people with some knowledge of the trade.

Employers look for people who have mechanical aptitude, good hand-eye coordination, and manual dexterity. A neat appearance and a friendly, tactful manner also are important, since the locksmith has frequent contact with the public. Employers usually will not hire applicants who have been convicted of serious crimes.

Although high school graduates are preferred, many employers will hire applicants with less education. High school courses in machine shop, mechanical drawing, and mathematics are helpful. Courses in business administration are useful for those who wish to open locksmith shops.

Some cities have licensing requirements. Applicants may have to be fingerprinted, pay a fee, or pass a written or practical examination. Information on licensing may be obtained from local governments.

To keep up with new developments in their field, locksmiths read monthly technical journals and attend training classes at national and regional conventions such as those of the Associated Locksmiths of America.

Locksmiths can advance to shop supervisors. Experienced locksmiths can go into business for themselves with relatively little capital. Many do business from their homes.

Employment Outlook

Employment in this relatively small occupation is expected to grow about as fast as the average for all occupations through the 1980's. In addition, openings will arise each year as experienced locksmiths retire, die, or transfer to other occupations.

Employment of locksmiths is expected to increase as a result of population growth and greater concern about security among businesses and individuals. Many individuals feel that conventional locks are not adequate and are having better locks installed. Many businesses have adopted measures to strengthen security such as periodically changing safe combinations. Opportunities will be particularly favorable for locksmiths who know how to install and service electronic security systems. Use of such systems has expanded greatly in recent years, and still greater growth is expected in the future. Opportunities also will be favorable for locksmiths who are willing to work at night to handle emergencies, such as people locked out of their cars or homes.

Earnings

Experienced locksmiths earned from $200 to $300 a week in 1978, according to the limited information available. Self-employed locksmiths can earn more. Trainees usually started at about $2.90 an hour and received periodic raises during training.

Most locksmiths receive an hourly rate or weekly salary, although some work on a commission basis, receiving a percentage of the sales and service work they handle. Their earnings depend on the amount of work available and how quickly they complete it.

Most locksmiths work 40 to 48 hours a week; even longer hours are common among the self-employed. The locksmith may be called at night to handle emergencies, though in many shops the responsibility to be "on call" is rotated among the staff. Locksmith shops generally are busy year round.

Related Occupations

In their work, locksmiths combine special technical knowledge and manual skills to open, install, and repair locks. A closely related occupation is safe-and-vault service mechanic. Gunsmiths, jewelers, and watch repairers also do a variety of service and repair jobs. These workers generally need more training than locksmiths.

Sources of Additional Information

Details about training and work opportunities may be available from local locksmith shops, locksmith associations, and offices of the State employment service. For a list of schools offering courses in locksmithing and general information about the occupation, contact:

Associated Locksmiths of America, Inc., 3003 Live Oak St., Dallas, Tex. 75204.

Maintenance Electricians

(D.O.T. 822.261-010, -018; 825.281-014, -018, -022, -026, and -030, .381-014, -030, and -034; 829.281-014, .361-010, and -014; and 962.381-014)

Nature of the Work

Maintenance electricians keep lighting systems, transformers, generators, and other electrical equipment in good working order. They also may install new electrical equipment.

Duties vary greatly, depending on where the electrician is employed. Electricians who work in large factories may repair particular items such as motors and welding machines. Those in office buildings and small plants usually fix all kinds of electrical equipment. Regardless of location, electricians spend much of their time doing preventive maintenance—periodic inspection of equipment to locate and correct defects before breakdowns occur. When trouble occurs, they must find the cause and make repairs quickly to prevent costly production losses. In emergencies, they advise management whether continued operation of equipment would be hazardous.

Maintenance electricians make repairs by replacing items such as a lamp, fuse, switch, or wire. When replacing a wire, they first make sure the power is off. Workers then pull the old wire from the conduit (a pipe or tube) and pull the new wire through to replace the old. Once the new wire is connected, they test to make sure the circuit is complete and functioning properly.

Maintenance electricians sometimes work from blueprints, wiring diagrams, or other specifications. They use meters and other testing devices to locate faulty equipment. To make repairs they use pliers, screwdrivers, wirecutters, drills, and other tools.

Working Conditions

During a single day, an electrician may repair equipment both in a clean, air-conditioned office and on a factory floor, surrounded by the noise, oil, and grease of machinery. Electricians often climb ladders or work on scaffolds in awkward or cramped positions.

Because maintenance electricians work near high-voltage industrial equipment, they must be alert and accurate. Errors in wiring installations could endanger both the electrician and other employees. Safety principles, which are a part of all electrician training programs, have reduced the frequency of accidents. Electricians are taught to use protective equipment and clothing, to respect the destructive potential of electricity, and to fight small electrical fires.

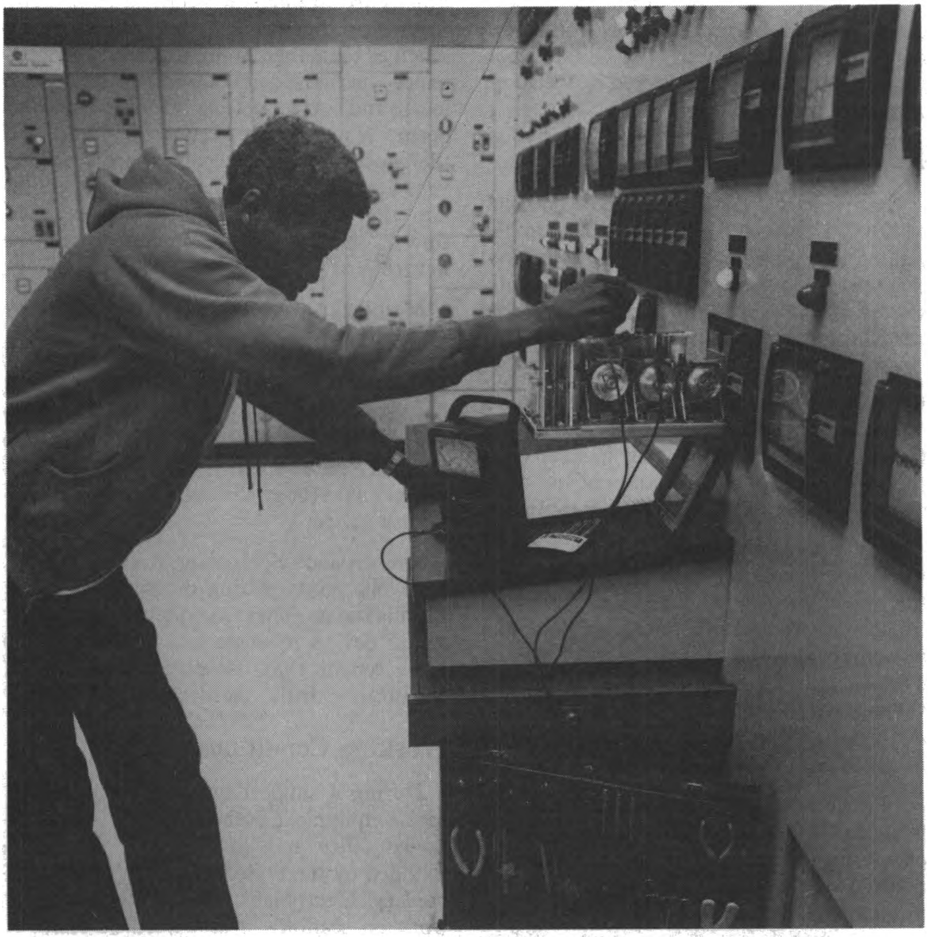
Places of Employment

An estimated 300,000 maintenance electricians were employed in 1978. More than half of them worked in manufacturing industries; large numbers worked in plants that make automobiles, machinery, chemicals, aluminum, and iron and steel. Many maintenance electricians also were employed by public utilities, mines, railroads, and Federal, State, and local governments.

Maintenance electricians are employed in every State. Large numbers work in heavily industrialized States such as California, New York, Pennsylvania, Illinois, and Ohio.

Training, Other Qualifications, and Advancement

Most maintenance electricians learn their trade on the job or through formal apprenticeship programs. A relatively small number learn the trade in the Armed Forces. Train-



Maintenance electricians frequently use instruments to check equipment.

ing authorities generally agree that apprenticeship gives trainees more thorough knowledge of the trade and improved job opportunities during their working life. Because the training is comprehensive, people who complete apprenticeship programs may qualify either as maintenance or construction electricians. Apprenticeship usually lasts 4 years, and consists of on-the-job training and related classroom instruction in subjects such as mathematics, electrical and electronic theory, and blueprint reading. Training may include motor repair, wire splicing, installation and repair of electronic controls and circuits, and welding and brazing.

Although apprenticeship is the preferred method of training, many people learn the trade informally on the job by serving as helpers to skilled maintenance electricians. Helpers begin by doing simple jobs such as replacing fuses or resetting switches and, with experience, advance to more complicated jobs such as splicing and connecting wires. They eventually get enough experience to qualify as electricians. This method of learning the trade, however, may take considerably longer than 4 years.

Persons interested in becoming maintenance electricians can obtain a good background by taking high school or vocational school courses in electricity, electronics, algebra, mechanical drawing, shop, and science. To qualify for an apprenticeship program, an applicant must be at least 18 years old and usually must be a high school or vocational school graduate with 1 year of algebra.

Although physical strength is not essential, manual dexterity, agility, and good health are important. Good color vision is necessary because electrical wires frequently are identified by color.

All maintenance electricians should be familiar with the National Electric Code and local building codes. Many cities and counties require maintenance electricians to be licensed. Electricians can get a license by passing an examination that tests their knowledge of electrical theory and its application.

Some maintenance electricians become supervisors. Occasionally, they advance to jobs such as plant electrical superintendent or plant maintenance superintendent.

Employment Outlook

Employment of maintenance electricians is expected to increase faster than the average for all occupations through the 1980's. Growth will stem from increased use of electrical and electronic equipment by industry. In addition to new jobs arising from the increased need for these workers, a few thousand openings will arise each year to replace experienced electricians who retire, die, or transfer to other occupations.

Growth in the number of job openings is expected to be fairly steady in the years ahead since the demand for maintenance electricians is not very sensitive to ups and downs in the economy. At times when construction activity is depressed, however, beginners may face competition for job openings because some unemployed construction electricians apply for these openings.

Earnings

Earnings of maintenance electricians compare favorably with those of other skilled workers. In 1978, based on a survey of metropolitan areas, maintenance electricians averaged about $8.44 an hour or about one and one-half times the earnings of all nonsupervisory workers in private industry except farming. Earnings of maintenance electricians varied by location, ranging from a low of $6.17 an hour in Jackson, Miss., to a high of $9.35 an hour in Detroit, Mich.

Apprentices start at about 60 percent of the skilled electrician's hourly pay rate and receive increases every 6 months.

Among unions organizing maintenance electricians are the International Brotherhood of Electrical Workers; the International Union of Electrical, Radio and Machine Workers; the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America (Ind.); and the United Steelworkers of America.

Related Occupations

Maintenance electricians combine manual skill and a knowledge of electricity to clean, repair, and replace electrical devices. Other workers who have similar skills are air-conditioning installers, construction electricians, electrical appliance repairers, electronics mechanics, elevator constructors, and line and cable installers.

Sources of Additional Information

Information about apprenticeships or other work opportunities in the trade is available from local firms that employ maintenance electricians, and from local union-management apprenticeship committees. In addition, the local office of the State employment service may provide information about training opportunities. Some State employment service offices screen applicants and give aptitude tests.

For general information about the work of electricians, contact:

International Brotherhood of Electrical Workers, 1125 15th St. NW., Washington, D.C. 20005.

National Electrical Constructor Association, 7315 Wisconsin Ave. NW., Washington, D. C. 20014.

National Joint Apprenticeship and Training Committee for the Electrical Industry, 9700 E. George Palmer Hwy., Lanham, Md. 20801.

Motorcycle Mechanics

(D.O.T. 620.281-054 and .384-010)

Nature of the Work

In 1950, just over 500,000 motorcycles were registered in United States compared with over 5 million today. Accompanying this rapid rise in the number of motorcycles has been a rapid increase in the number of motorcycle mechanics. Although many cycling enthusiasts repair their own vehicles, most rely on skilled mechanics.

Motorcycles, like automobiles, need periodic servicing to operate at peak efficiency. Spark plugs, ignition points, brakes, and many other parts frequently require adjustment or replacement. This routine servicing represents the major part of the mechanic's work.

The mark of a skilled mechanic is the ability to diagnose mechanical and electrical problems and to make repairs in a minimum of time. In diagnosing problems, the mechanic first obtains a description of the symptoms from the owner, and then runs the engine or test rides the motorcycle. The mechanic may have to use special testing equipment and disassemble some components for further examination. After pinpointing the problem, the mechanic makes needed adjustments or replacements. Some jobs require only the replacement of a single item, such as a carburetor or generator, and may be completed in less than an hour. In contrast, an overhaul may require several hours, because the mechanic must disassemble and reassemble the engine to replace worn valves, pistons, bearings, and other internal parts.

Mechanics use common handtools such as wrenches, pliers, and screwdrivers, as well as special tools for getting at parts that are hard to remove such as flywheels and bearings. They also use compression gages, timing lights, and other kinds of testing devices. Hoists are used to lift heavy motorcycles.

Most mechanics service only a few of the many makes and models of motorcycles and motor scooters. In large shops, some mechanics specialize in overhauling and rebuilding engines and transmissions, but most are expected to perform all kinds of repairs. Mechanics may occasionally repair minibikes, go-carts, snowmobiles, outboard motors, lawnmowers, and other equipment powered by small gasoline engines.

Working Conditions

Motorcycle repair shops generally are well lighted and well ventilated, but are noisy when engines are being tested. The work is not hazardous, although mechanics are subject to cuts, bruises, burns, and other minor injuries. Since most motorcycles are relatively lightweight and have easily accessible parts, mechanics rarely do heavy lifting or work in awkward positions.

Places of Employment

About 13,000 persons worked full time as motorcycle mechanics in 1978, and a few thousand more had part-time jobs. Most mechanics work for motorcycle dealers. Others work for city governments to maintain police motorcycles. A small number of mechanics work for firms that specialize in modifying or "customizing" motorcycles. Most shops employ fewer than five mechanics. Motorcycle mechanics work in every State and major city.

Mechanics who specialize in repairing motorcycles work mainly in metropolitan areas. In smaller cities, motorcycles frequently are repaired by owners, managers of motorcycle dealerships, or mechanics who repair all kinds of equipment powered by small gasoline engines, such as outboard motors and lawnmowers.

Sometimes mechanics must disassemble an engine to diagnose a problem.

Training, Other Qualifications, and Advancement

Motorcycle mechanics usually pick up skills from experienced workers on the job. Beginners usually start by learning to uncrate, assemble, and road test new motorcycles. Next, they do routine maintenance jobs such as adjusting brakes and replacing spark plugs and ignition points. As trainees gain experience, they progress to more difficult tasks such as repairing electrical systems and overhauling engines and transmissions. Generally, 2 to 3 years of training on the job are necessary before trainees become skilled in all aspects of motorcycle repair.

Trainees usually accumulate handtools as they gain experience. Experienced mechanics often have hundreds of dollars invested in tools.

Employers sometimes send mechanics and experienced trainees to special training courses conducted by motorcycle manufacturers and importers. These courses, which can last as long as 2 weeks, are designed to upgrade the worker's skills and provide information on repairing new models.

When hiring trainees, employers look particularly for cycling enthusiasts who have gained practical experience by repairing their own motorcycles. However, many employers will hire trainees with no riding experience if they have mechanical aptitude and show an interest in learning the work. Trainees must obtain a motorcycle driver's license to deliver newly assembled motorcycles and test drive those brought in for repairs.

Most employers prefer high school graduates, but will accept applicants with less education. Courses in small engine repair—offered by some high schools and vocational schools—generally are helpful, as are courses in automobile mechanics, science, and mathematics. Many motorcycle dealers employ students to help assemble new motorcycles and perform minor repairs.

Public schools in some large cities offer postsecondary and adult education in small engine and motorcycle repair. Some technical schools have training programs for motorcycle mechanics. Many junior and community colleges and correspondence schools offer courses in motorcycle repair.

Because all internal combustion engines are similar, skills learned through repairing motorcycles can be transferred to other fields of mechanical work. For example, motorcycle mechanics can become automobile, truck, or diesel mechanics with additional training, but such a transfer would not necessarily mean higher earnings.

Motorcycle mechanics have limited advancement possibilities. Those with supervisory ability may advance to service manager and, eventually, to general manager in large dealerships. Those who have the necessary capital may become dealers.

Employment Outlook

Employment in this relatively small occupation is expected to grow about as fast as the average for all occupations through the 1980's. Openings arising from growth in the demand for mechanics will fluctuate from year to year, however, as motorcycle sales and thus employment of motorcycle mechanics appear to be sensitive to cyclical changes in the economy. Additional openings will arise as experienced mechanics retire, die, or transfer to other fields.

Underlying the anticipated growth in the number of motorcycle mechanics is the continued growth in the number of motorcycles. Increases in the young adult population and in personal income as well as a growing interest in the motorcycle as a means of inexpensive transportation will create a demand for more motorcycles. Also, growth in the numbers of minibikes and snowmobiles could stimulate the demand for mechanics.

Opportunities for employment will be best for persons who have some experience and a full set of tools. Persons with postsecondary school training in motorcycle repair should have a competitive advantage over those without this training.

Most job opening will be in larger dealerships, which are located mainly in suburbs of metropolitan areas. Many motorcycle dealers in small cities do not have enough business to hire full-time trainees, but part-time or summer jobs may be available.

Earnings

Earnings of motorcycle mechanics and trainees vary widely and depend on level of skill, geographic location, season of the year, and employer. Limited information indicates that experienced mechanics employed by motorcycle dealers earned between $5 and $9 an hour in 1978. Trainees earned substantially less.

Some mechanics receive an hourly rate or a weekly salary. Others receive a percentage—usually about 50 percent—of the labor cost charged to the customer. If a mechanic is paid on a percentage basis, income depends on the amount of work assigned and how rapidly the mechanic completes it. Frequently, trainees are paid on a piecework basis when uncrating and assembling new motorcycles. At other times, they are paid an hourly rate or weekly salary.

Motorcycling increases sharply with warmer weather. As a result, most mechanics work more than 40 hours a week during the summer. Many temporary employees work only part time, and are laid off in the fall. However, a large proportion of these are either students or workers with other jobs.

A small percentage of motorcycle mechanics are members of the International Association of Machinists and Aerospace Workers.

Related Occupations

Many other workers need the same skills, abilities, and interests as motorcycle mechanics. Such occupations include appliance repairers, automobile-generator-and-starter repairers, boat-engine mechanics, maintenance electricians, electric-motor repairers, and vacuum cleaner repairers.

Sources of Additional Information

For further information regarding employment opportunities and training, contact local motorcycle dealers or the local office of the State employment service.

Piano and Organ Tuners and Repairers

(D.O.T. 730.281-038, .361-010, -014, and 828.261-010)

Nature of the Work

Whether they are used to perform the classics or contemporary rock, pianos and organs are major sources of entertainment and recreation. Maintaining the instruments so they perform properly is the job of piano and organ tuners and repairers. There are four different kinds of piano and organ tuners and repairers: Piano tuners, piano techicians, pipe-organ repairers, and electronic-organ technicians.

When a piano key is struck, a felt-covered wooden hammer strikes a steel string, causing it to vibrate. The number of times the string vibrates in a second is called its pitch. For the piano to sound right, all its strings must be set at their proper pitch. *Piano tuners* (D.O.T. 730.361-010) adjust piano strings so that they will be in proper pitch.

Tuners begin by adjusting the pitch of the "A" string. Striking the key, the tuner compares the string's pitch to that of a tuning fork. Using a tuning hammer (also called a tuning lever or wrench), tuners turn a steel pin to tighten or loosen the string until its pitch matches that of the tuning fork. The pitch of all the other strings is set in relation to the "A" string. The standard 88-key piano has about 260 strings and can be tuned in about an hour.

Pianos are complex instruments with thousands of wooden, steel, iron, ivory, and felt parts. Understandably, such instruments occasionally require repair. *Piano technicians* (D.O.T. 730.281-038) locate and correct problems that may affect the piano's sound. Most technicians also tune pianos.

To get an idea of what is wrong, technicians talk to the customer. They also may play the piano or partially dismantle it to inspect the parts. When technicians discover the problem, they make repairs or adjustments. They may realign hammers that do not strike the strings just right—this is called regulating the piano. They may replace worn felt or broken strings. They may rebuild or replace the wooden sounding board that amplifies the string's vibrations. Sometimes technicians completely rebuild pianos. To dismantle and repair pianos, technicians use common handtools as well as special ones, such as regulating, repinning, and restringing tools.

Although organs and pianos may look somewhat alike, they work differently, and few people work on both instruments. Moreover, people who service organs specialize in either pipe or electronic organs.

Pipe-organ repairers (D.O.T. 730.361-014) tune, repair, and install organs that make music by forcing air through one of two kinds of pipes—flue pipes or reed pipes. The sound of a flue pipe, like that in a whistle, is made by air forced through an opening. The reed pipe makes its sound by vibrating a brass reed in the air current.

To tune an organ, repairers first match the pitch of the "A" pipes with that of a tuning fork. The pitch of other pipes is set by comparing it with that of the "A" pipes. To tune a flue pipe, the technician moves a metal slide that increases or decreases the pipe's "speaking length." A reed pipe is tuned by adjusting the length of the reed. A day or more may be needed to finish one of these jobs, because most organs have hundreds of pipes.

Like piano technicians, pipe-organ repairers must locate and correct problems in the organ's components that affect its sound. This may involve replacing worn parts of the pipes, the console, or other components. Repairers also do maintenance work, such as cleaning the pipes, on a regular schedule.

Occasionally, pipe-organ repairers assemble organs onsite in churches and auditoriums. They follow the designer's blueprints and use a variety of hand and power tools to install and connect the air chest, blowers, air ducts, pipes, and other components. Technicians may work in teams or be assisted by helpers. A job may take several weeks or even months, depending on the size of the organ.

In contrast with pipe organs, the sound from electronic organs is made by electronic generators and computer circuits. As a result, *electronic-organ technicians* (D.O.T. 828.261-010) have very different duties from pipe-organ repairers. They use special electronic test equipment to tune and to check tone and amplification. Most electronic organs do not require tuning. Those that do are fairly simple to tune. However, these organs may break down due to faulty transistors, dirty contacts, and other problems.

To locate the cause of a breakdown, technicians first check for common sources of trouble such as loose connections. When routine checks do not work, technicians refer to wiring diagrams and service manuals that show connections within organs, provide adjustment information, and describe causes of trouble. Circuits that might cause the problem are checked with electronic meters. For example, technicians check voltages until an unusual or irregular measure shows up the part of the circuitry causing trouble. When the cause of the problem is found, technicians make repairs. Often this is done by replacing faulty parts such as circuit boards. In their work, technicians use soldering irons, wire cutters, and other handtools.

Working Conditions

The work is relatively safe, although tuners and repairers may suffer small cuts and bruises when making repairs. Electrical shock is a minor hazard for electronic-organ technicians. Work is performed in shops and homes and public buildings, such as churches and schools, where working conditions usually are pleasant.

Places of Employment

About 8,000 persons worked as piano and organ tuners and repairers in 1978; most worked on pianos. About two-thirds of the total worked in repair shops; many are self-employed. Another one-fifth were employed by piano and organ dealers. Most of the rest worked for piano and organ manufacturers.

Piano and organ tuners and repairers are employed mostly in cities and States that have large populations. In towns too small to offer enough work for a full-time job in this field, piano and pipe-organ work may be done part time by local music teachers and professional musicians. Similarly, electronic-organ work may be done by television and radio repairers.

Training, Other Qualifications, and Advancement

Piano tuners and technicians and pipe-organ repairers generally learn their trade on the job. Music stores and large repair shops hire inexperienced people as trainees. Trainees do general cleanup work, help move and install instruments, and do other routine tasks. Working under the supervision of experienced workers, they learn to tune the instruments and make repairs. Usually 4 to 5 years of on-the-job training and practice work are needed to become a competent piano technician or pipe-organ repairer.

A small number of technical schools and colleges offer courses in piano technology that last 6 months to 2 years. Home study (correspondence school) courses in piano technology also are available. These courses emphasize practice tuning and repairing of pianos. Graduates of the courses often are encouraged to refine their skills by working for a time with an experienced tuner or technician.

Formal training or work experience in electronics is needed for jobs as electronic-organ technician trainees. Training in electronics is available from private vocational schools, community colleges, some high schools, and the Armed Forces. Trainees learn to repair organs on the job working for music stores or in classes run by organ manufacturers.

Employers prefer high school graduates for beginning jobs in piano or organ servicing. Music courses help develop the student's ear for tonal quality. Courses in woodworking also are useful because many of the moving parts in pianos and pipe organs are made of wood.

People interested in a career in these fields should have good hearing, mechanical aptitude, and manual dexterity. Because work frequently is done in the customer's home, a neat appearance and a pleasant, cooperative manner also are important. Ability to play the instrument helps but is not essential as a qualification.

Piano and organ tuners and repairers keep up with new developments in their fields by studying trade magazines and manufacturers' service manuals. The Piano Technicians Guild helps its members improve their skills through training programs conducted at local chapter meetings and at regional and national seminars. Guild members also can take a series of tests to earn the title, Registered Tuner-Technician. The title is an acknowledgment of the technician's ability. Most electronic-organ manufacturers conduct brief courses periodically to provide information on technical changes in their instruments.

Tuners and repairers who work for large dealers or repair shops can advance to supervisory positions. Most people in this field move up, however, by going into business for themselves. Opening a repair business is fairly easy because only a small investment in tools is required. Basic piano or pipe-organ tools cost only a few hundred dollars. By contrast, tools and test equipment for electronic organs may cost about a thousand dollars. Self-employed tuners and repairers may operate out of their own homes and use either a car or a small truck for service calls. They also may work another job until their clientele is large enough to support a repair business.

Employment Outlook

Employment of piano and organ tuners and repairers is expected to grow more slowly than the average for all occupations through the 1980's. The number of pianos and organs in use will increase as the population grows and as people get more leisure time. However, the growth in the number of pianos and organs will be limited because of competition from other forms of entertainment and recreation. Job openings will become available each year as experienced workers retire, die, or transfer to other occupations. However, this is a very small occupation, and the number of job openings will be few.

Opportunities for beginners will be best in piano and organ dealerships and large repair shops. Many repair shops are too small to afford a full-time helper, although they may hire one helper part time.

Earnings

Experienced workers earned from $5 to $10 an hour in 1978, according to the limited information available. Beginning rates for helpers ranged from $3 to $5 an hour. Wages vary with the skill of the worker and the area of the country.

Many self-employed tuners and repairers earned more than $12,000 a year, and earnings in excess of $15,000 a year were not uncommon. Earnings of the self-employed depend on the size of the community, their

Putting a piano in proper pitch requires a good ear and concentration.

ability to attract and keep customers, their operating expenses, and competition from other tuners and repairers.

During fall and winter, people spend more time indoors playing their pianos or organs. Consequently, many tuners and repairers work more than 40 hours a week at that time. Self-employed tuners and repairers frequently work evenings and weekends to suit their customers.

Related Occupations

There are almost as many different musical-instrument repairers as there are different musical instruments. Other occupations in this trade are accordion repairer, fretted-instrument repairer, harpsichord repairer, violin repairer, wind-instrument repairer, accordion tuner, percussion-instrument repairer, percussion tuner, and bow repairer.

Sources of Additional Information

Details about job opportunities may be available from local piano and organ dealers and repair shops. For general information about piano technicians and a list of schools offering courses in piano technology, write to:

Piano Technicians Guild, Inc., 113 Dexter Ave. N., Seattle, Wash. 98109.

Shoe Repairers

(D.O.T. 365.361-014)

Nature of the Work

People like their shoes to look nice and feel comfortable. Keeping them that way is the job of the shoe repairer. Using their knowledge of shoe construction and leatherworking, shoe repairers give worn shoes a new lease on life.

Replacing soles and heels is the most common type of shoe repair. Repairers place the shoe on a last, a block shaped like a foot. They remove the old sole and heel with a knife and pincers. To prepare the shoe for the new sole, repairers rough the bottom by holding it against a sanding wheel. Repairers then cement to the shoe a precut piece of leather that will be the new sole. They pound the leather with a hammer or on a machine so it adheres to the shoe, and cement or stitch it in place. To form the new sole, repairers smooth the edge of the leather against a sanding wheel and cut off the excess using a trimming machine. To reheel the shoe, repairers select a precut replacement heel or cut one to shape and cement and nail it in place. Finally, the new sole and heel are stained and buffed to match the color of the shoe.

Shoe repairers also replace insoles, restitch loose seams, and restyle old shoes by changing heels or dyeing uppers. Highly skilled repairers may design, make, or repair orthopedic shoes according to doctors' prescriptions. Repairers also may mend handbags, luggage, tents, and other items made of leather, rubber, or canvas. They also replace zippers, dye handbags, and stretch shoes to conform to the foot.

In large shops, repair work sometimes is divided into a number of specialized tasks. For example, some repairers only remove and replace heels and soles; others only restitch torn seams.

Shoe repairers use a variety of power-operated equipment, such as sole-stitchers, heel-nailing machines, and sewing machines. Among the handtools they use are hammers, knives, awls, nippers, and skivers (a special tool for splitting pieces of leather).

Working Conditions

Because many shoe repairers own shops, working conditions often are determined by the repairer. Shops are usually comfortable, but some may be crowded and noisy and have poor lighting or ventilation. Strong odors from leather goods, dyes, and stains may be present.

The work is not strenuous and there are few hazards. However, it does require stamina because repairers must stand much of the time.

Self-employed shoe repairers have managerial responsibilities in addition to their regular duties. They have to maintain good relations with their customers. They have to decide whether to sell items such as shoe polish and leather goods. Shop owners also keep business records and supervise other repairers, helpers, and cashiers.

Places of Employment

About 22,000 shoe repairers were employed in 1978. About one-half of them owned shoe repair shops, many of which were small, one-person operations. Most of the remaining repairers worked in shoe shops. Some repairers worked in shoe stores, department stores, and drycleaning shops. A small number were employed in shoe manufacturing, to repair shoes damaged in production. These workers generally are less skilled than those who work in repair shops.

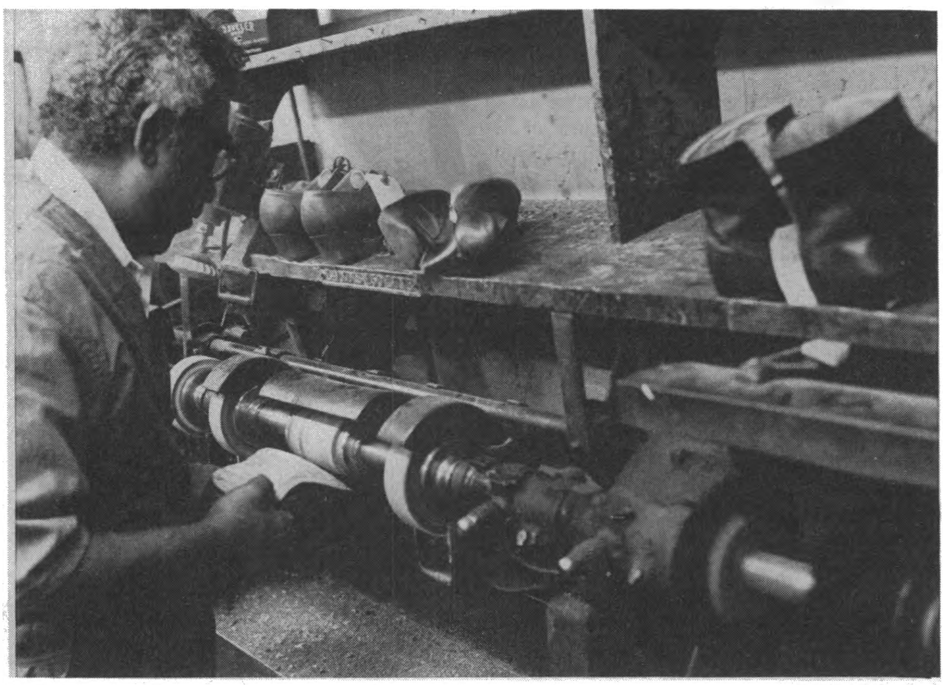
Shoe repairers are employed throughout the country. Employment, however, is concentrated in large cities.

Training, Other Qualifications, and Advancement

Some shoe repairers learn their trade on the job as helpers to experienced repairers. Helpers begin by assisting experienced repairers with simple tasks, such as removing soles and heels and staining, brushing, and shining shoes. As they gain experience, trainees learn to replace heels and soles, to estimate the cost of repairs, and to deal with customers. Helpers usually become fully skilled in 6 months to 2 years.

A limited number of vocational schools offer training in shoe repair. Applicants to these schools usually must have a high school diploma. In vocational classes, students study shoe construction and practice different types of shoe repair. In addition to learning shoe repairing, vocational school students attend classes in business administration. The programs last from 6 months to 2 years. Graduates often are encouraged to gain additional training by working with experienced shoe repairers.

Shoe repairers must have manual dexterity and mechanical aptitude to work with various machines and handtools. They must be reliable because they work alone with little supervision. In addition to being skilled craftworkers, repairers who own



Shoe repairers rely on a variety of power-operated equipment, such as "roughing" machines.

shops must be good business managers. These repairers must have a working knowledge of business administration, marketing, and accounting.

Advancement opportunities for shoe repairers are limited. Many open their own shops and some who are employed in large shops become supervisors.

Employment Outlook

Employment of shoe repairers is not expected to change significantly through the 1980's. Nevertheless, numerous job openings are expected each year in this relatively small occupation, because of the need to replace experienced shoe repairers who retire, die, or leave the field for other reasons. Job opportunities should be good for people with some training in shoe repair. However, training is difficult to obtain since there are few vocational training programs and inexperienced workers often have difficulty finding a job as a helper in a repair shop.

For many years, employment of shoe repairers declined because new shoes were relatively inexpensive and many people bought new shoes instead of having old ones fixed. This reduced the need for shoe repairs and repairers. The popularity of cushion-soled shoes and other casual footwear which usually are not practical to repair also limited the demand for these workers. Shoe price increases, however, should stimulate the demand for repairs. As a result, shoe repairer employment is expected to remain about the same in the future.

Earnings

Shoe repairers earned between $3 and $5 an hour in 1978, according to the limited information available. Some managers and owners of shoe repair shops earned more than $300 a week.

Shoe repairers often work more than 40 hours a week. The workweek is sometimes 10 hours a day, 6 days a week. Although shoe repair shops are busiest during the spring and fall, work is steady with no seasonal layoffs.

Related Occupations

Other occupations in which workers make and repair items using leather and cloth are alterations tailor, furniture upholsterer, furrier, harness maker, luggage repairer, rug repairer, saddlemaker, and custom shoemaker.

Sources of Additional Information

Information about the shoe repair business and training opportunities may be obtained from:

Shoe Service Institute of America, 222 W. Adams St., Chicago, Ill. 60606.

Information about work opportunities is available from State employment service offices, as well as shoe shops and shoe service wholesalers in the community.

Television and Radio Service Technicians

(D.O.T. 720.281-018)

Nature of the Work

Television and radio service technicians repair a large and growing number of home electronic products, of which television sets and radios are the most numerous. Stereo components, tape recorders, and even electronic organs also are repaired by these technicians. Some service technicians specialize in repairing one kind of equipment—for example, television sets or car radios. Others repair several types—televisions, video tape machines, intercoms, and public address systems.

Electronic equipment may operate unsatisfactorily for many reasons, such as defective parts, faulty circuits, or poor connections. Service technicians must check and evaluate each possible cause of trouble. They begin by checking common causes such as loose connections. Talking to customers may help technicians identify the problem.

When routine checks do not locate the trouble, technicians refer to wiring diagrams and service manuals that show connections and provide information on how to locate problems. Using test equipment, such as voltmeters, oscilloscopes, and signal generators, they check circuits. For example, they may measure voltages or wave forms in the circuits of a television set for unusual or irregular measurements that indicate the faulty parts. To make repairs, technicians replace faulty parts or make adjustments, such as focusing and converging the picture or correcting the color balance of a television set. In their work, technicians use pliers, soldering irons, wire cutters, and other handtools. Technicians who make customer service calls carry tubes, modules, and other parts that can be easily replaced in the customer's home.

Self-employed service technicians have managerial responsibilities in addition to their regular duties. They have to order equipment and supplies, keep records, and supervise other technicians.

Working Conditions

Service technicians work in shops or customers' homes and working conditions generally are good. They usually work alone and receive little supervision. Technicians who service television sets in homes may do considerable driving. Hazards in the trade include electrical shock and strains from lifting and carrying.

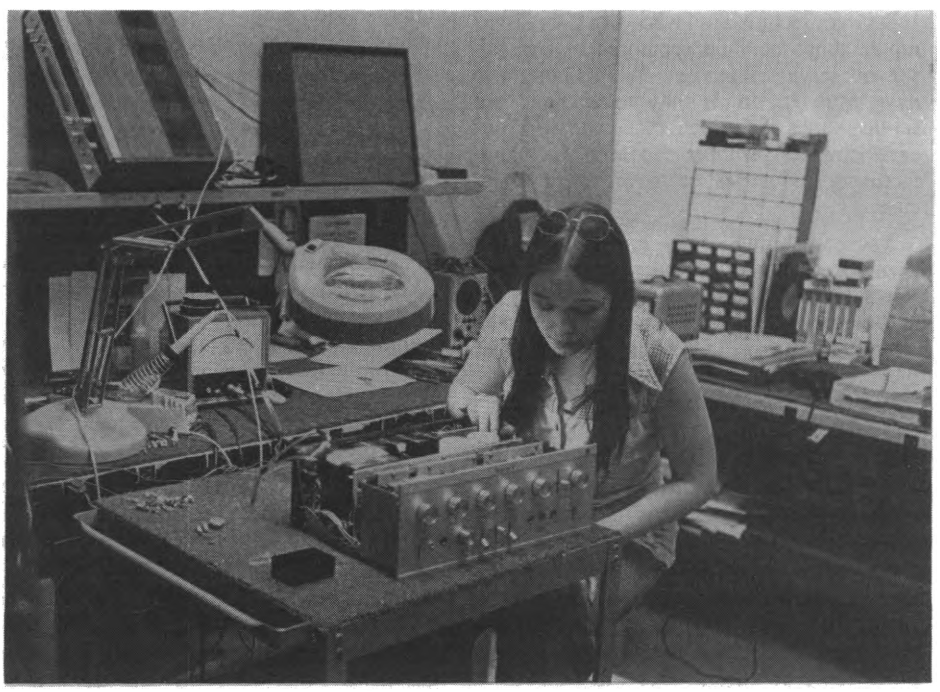
Places of Employment

About 131,000 people worked as radio and television service technicians in 1978. About one-quarter of them were self-employed, a much larger proportion than in most skilled trades. Two-thirds of all service technicians, either self-employed or working for others, worked in television repair shops and stores that sell and service television sets, radios, and other electronic products.

Television and radio service technicians work in almost every city. Geographically, employment is distributed in much the same way as the Nation's population.

Training, Other Qualifications, and Advancement

Training in electronics generally is required to get an entry level job as a television



A technician checking for problems with electronic test equipment.

and radio service technician. High schools, private vocational schools, and junior colleges offer training in television and radio repair. Programs in these schools include subjects such as mathematics, physics, schematic reading, electricity, and hands-on work with television sets, radios, and other equipment. The training lasts from 1 to 2 years.

The military services offer training and work experience that are very useful in civilian electronics work. However, additional training in television electronics may be required by employers.

New technicians usually begin by working in the shop or in the field under the supervision of an experienced worker. Large repair stores may provide inhouse training to familiarize new workers with particular brands and models of equipment.

Technicians must keep abreast of changes in technology. Manufacturers, employers, and trade associations, such as the National Association of Television and Electronic Servicers of America, conduct training seminars to teach technicians servicing methods for new models or products. Technicians also keep up with developments by studying manufacturers' service manuals and technical magazines.

Television and radio service technicians must be able to manipulate small parts and tools, and must have good eye-hand coordination, normal hearing, and good eyesight and color vision. An ability to work with people is essential in dealing with customers.

Some States require radio and television technicians to be licensed. To obtain a license, applicants must pass an examination designed to test their knowledge of electronic circuits and components and their skill in the use of testing equipment.

Service technicians who work in large repair shops may be promoted to supervisor or service manager. Technicians who have sufficient funds may open their own service shops. Some technicians obtain jobs as electronics "trouble shooters" in manufacturing industries or government agencies.

Those planning to go into business for themselves should take some business administration courses, particularly accounting and consumer relations. Those interested in advancing to positions such as electronics technician can improve their opportunities by taking courses in automatic controls, electronic engineering, television engineering, and mathematics.

Employment Outlook

Employment of television and radio service technicians is expected to increase faster than the average for all occupations through the 1980's. In addition to openings from employment growth, openings will result each year from the need to replace experienced technicians who retire, die, or change occupations.

Employment of service technicians is expected to increase in response to the growing number of television sets, radios, phonographs, tape recorders, and other home entertainment products, although improvements in technology will reduce service requirements for these products. Rising population and personal incomes will contribute to this growth. Greater use of electronic products for purposes other than entertainment also is expected. For example, closed circuit television is being used increasingly to monitor production processes in manufacturing plants, to protect buildings, and to bring educational programs into classrooms.

People who enter the occupation should have steady work because the television and radio repair business is not very sensitive to changes in economic conditions.

Earnings

Earnings of television and radio service technicians ranged from \$4.00 to \$8.75 an hour in 1978, based on the limited information available. The wide variations in wage rates reflect differences in skill levels, types of employers, and geographic locations.

Television and radio service technicians usually work 40 to 48 hours a week.

Some service technicians are members of labor unions. Most of these belong to the International Brotherhood of Electrical Workers.

Related Occupations

Other occupations in which workers repair electronic equipment include appliance repairers, business machine repairers, computer service technicians, communications technicians, and electronic organ technicians.

Sources of Additional Information

For more information about jobs in this field, contact local shops and stores that service television sets and radios and other electronic equipment. Technical and vocational schools that offer courses in television and radio repair or electronics may provide information about training. In addition, locals of the International Brotherhood of Electrical Workers and the local office of the State employment service may have information about programs that provide training opportunities.

Information about the work of television and radio service technicians is available from:

National Association of Television and Electronic Servicers of America, 5908 S. Troy St., Chicago, Ill. 60629.

Electronics Industries Association, 2001 Eye St. NW., Washington, D.C. 20006.

Truck Mechanics and Bus Mechanics

(D.O.T. 620.261-010; .281-026, -038, -062, -066; and .381-010, -022; and .684-018.)

Nature of the Work

Commercial vehicles serve an important function in the Nation's economy. Heavy trucks are used by industries such as mining and construction to carry ore and building materials, and by commercial trucking lines for general freight hauling. Small trucks are used for local hauling. Buses are used for both local and transcontinental transportation, as well as for shipping some goods. Truck and bus mechanics keep these vehicles in good operating condition.

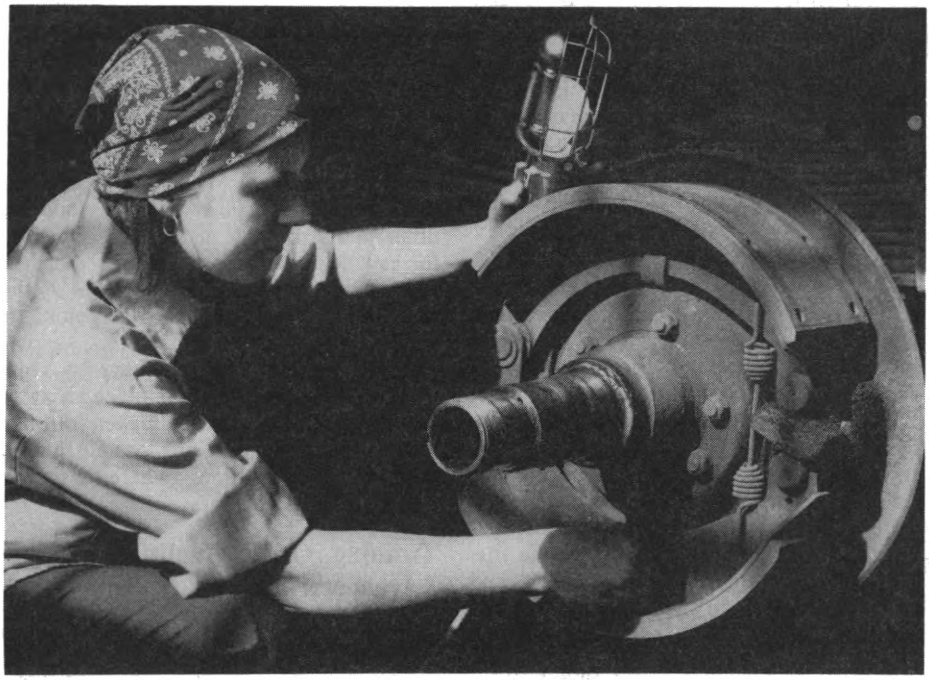
Truck and bus mechanics work on both diesel and gasoline engines. Diesel engines are found mostly in heavy trucks and buses, although growing numbers of lighter trucks, buses, and even cars are being built with diesels because of their durability and better gas mileage.

Mechanics who work for organizations that maintain their own vehicles may spend much time doing preventive maintenance to assure safe operation, prevent wear and damage to parts, and reduce costly breakdowns. During a maintenance check, they usually follow a regular check list that includes the inspection of brake systems, steering mechanisms, wheel bearings, and other important parts. If a part is not working properly, they usually can repair or adjust it. If it cannot be fixed, it is replaced.

In many shops mechanics do all kinds of repair work. For example, they may work on a vehicle's electrical system, one day and do major engine repair the next. In some large shops, however, mechanics specialize in one or two types of repair work. For example, one mechanic may specialize in major engine repair, another in transmission work, another in electrical systems, and yet another in suspension or brake systems.

Truck and bus mechanics use a variety of tools in their work. They use power tools such as pneumatic wrenches to remove bolts quickly; machine tools such as lathes and grinding machines to rebuild brakes and other parts; welding and flame cutting equipment to remove and repair exhaust systems and other parts; common handtools such as screwdrivers, pliers, and wrenches to work on small parts and reach hard-to-get-to places; and jacks and hoists to lift and move large parts. Truck and bus mechanics also use a variety of testing equipment. For example, when working on electrical systems, they may use ohmmeters, ammeters, and voltmeters; to locate engine malfunctions, they often use tachmeters and dynamometers.

For heavy work, such as removing engines and transmissions, two mechanics may work as a team, or a mechanic may be assisted by



Truck and bus mechanics may spend much time doing preventive maintenance.

an apprentice or helper. Mechanics generally get their assignments from shop supervisors or service managers who may check the mechanics' work or assist in diagnosing problems.

Working Conditions

Truck and bus mechanics usually work indoors, although they may occasionally work or make repairs on the road. They are subject to the usual shop hazards such as cuts and bruises. Mechanics handle greasy and dirty parts and may stand or lie in awkward or cramped positions to repair vehicles. Work areas usually are well lighted, heated, and ventilated, and many employers provide locker rooms and shower facilities.

Places of Employment

A large proportion of the estimated 140,000 truck mechanics employed in 1978 worked for firms that owned fleets of trucks. Fleet owners include trucking companies and businesses that haul their own products such as dairies and bakeries. Other employers include truck dealers, truck manufacturers, truck repair shops, firms that rent or lease trucks, and Federal, State, and local governments.

Most of the estimated 22,000 bus mechanics employed in 1978 worked for local transit companies and intercity buslines. Bus manufacturers employed a relatively small number of mechanics.

Truck and bus mechanics are employed in every section of the country, but most work in large towns and cities where trucking companies, buslines, and other fleet owners have large repair shops.

Training, Other Qualifications, and Advancement

Most truck or bus mechanics learn their skills on the job. Beginners usually do tasks such as cleaning parts, fueling, and lubrication. They may also drive vehicles in and out of the shop. As beginners gain experience and as vacancies become available, they usually are promoted to mechanics' helpers. In some shops, beginners—especially those having prior automobile repair experience—start as mechanics' helpers.

Most helpers can make minor repairs after a few months' experience and advance to increasingly difficult jobs as they prove their ability. Generally, at least 3 to 4 years of on-the-job experience are necessary to qualify as an all-round truck or bus mechanic. Additional training may be necessary for mechanics who wish to specialize in diesel engines.

Most training authorities recommend a formal 4-year apprenticeship as the best way to learn these trades. Typical apprenticeship programs for truck and bus mechanics consist of approximately 8,000 hours of shop training to obtain practical experience working on transmissions, engines, and other components and at least 576 hours of classroom instruction to learn blueprint reading, mathematics, engine theory, and safety. Frequently, these programs include training in both diesel and gasoline engine repair.

For entry jobs, employers generally look for applicants who have mechanical aptitude and are at least 18 years of age and in good physical condition. Completion of high school is an advantage in getting an entry mechanic job because employers believe such a person has at least some traits of a good worker, such as reliability and perseverance. Employers do not want to spend a lot of time and money training mechanics only to see them quit. To drive trucks or buses on public roads, applicants may need a State chauffeur's license.

Persons interested in becoming truck or bus mechanics can gain valuable experience by taking high school or vocational school courses in automobile and diesel repair. Science and mathematics help a mechanic understand how trucks and buses operate. Practical experience in automobile repair in a gasoline service station or the Armed Forces or from a hobby also is valuable.

Most mechanics must buy their own handtools. Experienced mechanics often invest hundreds of dollars in tools.

Employers sometimes send experienced mechanics to special training classes conducted by truck, bus, diesel engine, and parts manufacturers. In these classes, mechanics learn to repair the latest equipment or receive special training in subjects such as diagnosing engine malfunctions. Mechanics also must read service and repair manuals to keep abreast of engineering changes.

Experienced mechanics who have leadership ability may advance to shop supervisors or service managers. Truck mechanics who have sales ability sometimes become truck sales representatives. Some mechanics open their own gasoline service stations or repair shops.

Employment Outlook

Employment of truck mechanics is expected to increase faster than the average for all occupations through the 1980's as a result of significant increases in the transportation of freight by trucks. More trucks will be needed for both local and intercity hauling due to the increased production of goods and the necessity of transporting them greater distances and to more places as both population and industrial centers spread out. In addition to the jobs created by transportation growth, many openings will arise to replace truck mechanics who retire, die, or transfer to other occupations.

Bus mechanic employment is expected to increase about as fast as the average for all occupations through the 1980's as the number of buses on the Nation's roads increases. More buses will be needed for local travel due to increased emphasis on mass transit systems. Intercity bus travel, on the other hand, is expected to remain about the same. Most job openings will result from the need to replace bus mechanics who retire, die, or transfer to other occupations.

Earnings

Truck and bus mechanics employed by trucking companies, buslines, and other firms that maintain their own vehicles had estimated average hourly earnings of $8.36 in 1978, about one and one-half times the average earnings of all nonsupervisory workers in private industry, except farming.

Beginning apprentices usually earn one-half the rate of skilled workers and receive increases about every 6 months until they complete their apprenticeship and reach the rate of skilled mechanics.

Most mechanics work between 40 and 48 hours per week. Those employed by truck and bus firms which provide service around the clock may work evenings, nights, and weekends. They usually receive a higher rate of pay for this work.

Many truck and bus mechanics are members of labor unions, including the International Association of Machinists and Aerospace Workers; the Amalgamated Transit Union; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the Transport Workers Union of America; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters, Chauffers, Warehousemen and Helpers of America (Ind.).

Related Occupations

Truck and bus mechanics repair trucks and buses and keep them in good working order. Related motor vehicle service occupations include automobile body repairers, customizers, mechanics, painters, and service advisors.

Sources of Additional Informaiton

More details about work opportunities for truck or bus mechanics may be obtained from local employers such as trucking companies, truck dealers, or bus lines; locals of unions previously mentioned; or the local office of the State employment service. Local State employment service offices also may have information about apprenticeships and other training programs.

For general information about the work of truck mechanics and apprenticeship training, write to:

American Trucking Associations, Inc., 1616 P St. NW., Washington, D.C. 20036.

Automotive Service Industry Association, 444 North Michigan Ave., Chicago, Ill. 60611.

Vending Machine Mechanics

(D.O.T. 639.281-014)

Nature of the Work

Vending machines have become a familiar scene in everyday life. In places of recreation, work, and education, vending machines provide all types of refreshments, from a piece of candy to a complete meal. Vending machine mechanics keep these machines in good working order.

Mechanics check machines before installation. When working on complicated machines, such as beverage or food dispensers, they check to see that the machines give proper quantities of ingredients and that refrigerating and heating units work properly. On gravity-operated machines, mechanics check springs, plungers, and merchandise delivery systems. They also test coin and change-making mechanisms. When installing machines on location, mechanics make the necessary water and electrical connections and recheck the machines for proper operation.

If a machine breaks down, mechanics must determine the cause of the trouble. They first inspect the machine for obvious problems, such as loose electrical wires, malfunctions of the coin mechanism, and leaks. If the problem cannot be readily located, they may refer to troubleshooting manuals and wiring diagrams and use testing devices such as electrical circuit testers to find defective parts. Mechanics may repair faulty parts at the site. However, they often install replacements and take broken parts to the company shop for repair.

Preventive maintenance—avoiding trouble before it starts—is another major part of the job. For example, mechanics periodically clean electrical contact points, lubricate mechanical parts, and adjust machines to perform properly.

In repair and maintenance work, mechanics use pipe cutters, soldering irons, wrenches, screwdrivers, hammers, and other handtools. In the repair shop, they may use power tools, such as grinding wheels, saws, and drills.

Because vending machines dispense food, mechanics must know State public health and sanitation standards as well as those established under local plumbing codes. They also must know and follow safety procedures, especially when lifting heavy objects and working with electricity and gas.

Mechanics must do some clerical work, such as filing reports, preparing repair cost estimates, and ordering parts. Those employed by small operating companies may service as well as repair machines. These combination "mechanic-routeworkers" stock machines, collect money, fill coin and currency changers, and keep daily records of merchandise distributed. (Additional information about vending machine route drivers is included in the statement on route drivers elsewhere in the *Handbook*.)

Working Conditions

Some mechanics work in repair shops, others work in the field, but many do both. Those who work in the field drive a service truck between locations.

Vending machine repair shops generally are quiet, well lighted, and have adequate work space. However, when servicing machines on location, mechanics may work in cramped quarters, such as passageways, where pedestrian traffic is heavy. Repair work is relatively safe, although mechanics are subject to shop hazards such as electrical shocks and cuts from sharp tools and metal objects.

Places of Employment

In 1978, about 23,000 mechanics maintained and repaired more than 5 million vending machines. Most mechanics work for vending companies that sell food and other items through machines. Some work for soft drink bottling companies that have their own coin-operated machines. Other mechanics, employed as instructors by vending machine manufacturers, explain technical innovations and ways to repair new machines to company mechanics. Although mechanics are employed throughout the country, most are located in areas with large populations where there are many vending machines.

Training, Other Qualifications, and Advancement

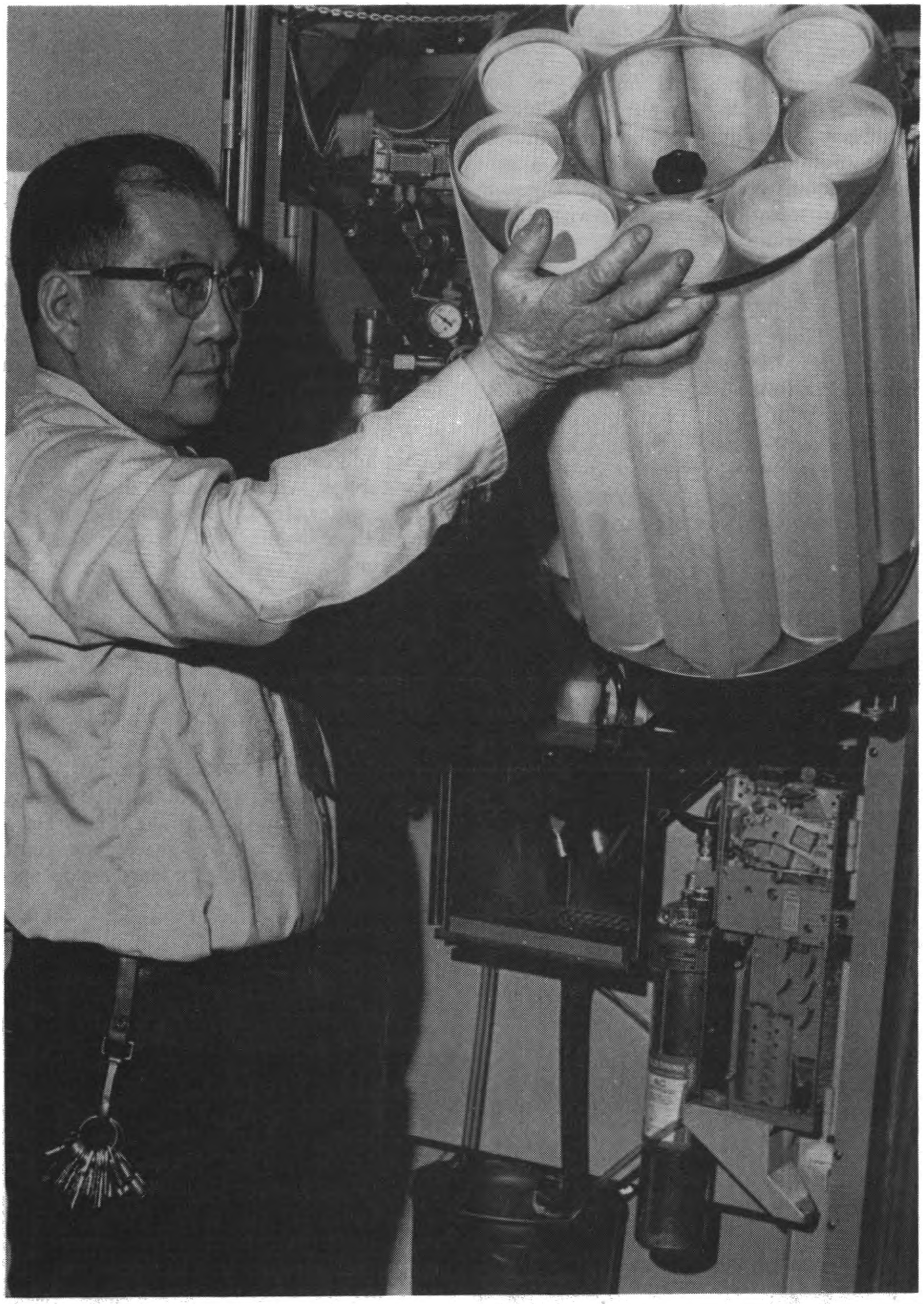
Persons often enter this trade as general shop helpers or vending machine route drivers. Most new workers learn the trade informally on the job by observing, working with, and receiving instruction from experienced mechanics. Trainees usually start out by doing simple jobs such as cleaning, painting, or refurbishing machines. From there, they learn to rebuild machines—removing defective parts, repairing, adjusting, and testing the machines. Next, they accompany an experienced mechanic on service calls, and then go out on their own. They call upon the expertise of other mechanics, when necessary. At this point they have completed their on-the-job training. This process takes from 6 months to 3 years, depending on the individual's capabilities, previous education, and the quality of instruction.

The National Automatic Merchandising Association has established an apprenticeship program to help employers train new workers. Apprentices are guaranteed periods of training in various skills. The program also calls for 144 hours of related instruction each year in subjects such as basic electricity, blueprint reading, customer relations, and safety. Apprenticeships last 3 years.

To learn about new machines, employees sometimes attend manufacturer-sponsored training sessions in repair shops, in manufacturers' service divisions, or in major cities. Employers usually pay wages and expenses during these sessions, which may last from a few days to several weeks.

Some employers encourage both trainees and experienced mechanics to take evening courses in subjects related to machine operation and repair—for example, basic electricity and refrigeration. Employers often pay for at least part of the tuition and book expenses for these courses.

Many beginners are high school graduates, but employers may not require a diploma. High school or vocational school courses in electricity, refrigeration, and machine repair help beginners to qualify



Preventive maintenance is a major part of the job of vending machine mechanics.

for entry jobs. There are 12 high schools and junior colleges in the country offering 1- to 2-year training programs in vending machine mechanics.

Employers require applicants to demonstrate mechanical ability, either through their work experience or by scoring well on mechanical aptitude tests. Since mechanics are exposed to thousands of dollars in merchandise and cash, employers prefer applicants who have a record of honesty and respect for the law. The ability to deal tactfully with people also is important. A commercial driver's license and a good driving record are essential for most vending machine repair jobs.

Skilled mechanics may be promoted to supervisory jobs. Some open their own vending companies.

Employment Outlook

Employment of vending machine mechanics is expected to grow about as fast as the average for all occupations through the 1980's. More vending machines will be installed as demand for fast food service grows and as more industrial plants, hospitals, and stores move to suburban areas where restaurants are not always close by. In addition vending companies will increase the variety of products sold through the machines. Growth in the number of vending machines will create more jobs for mechanics. Job openings also will arise as experienced mechanics retire, die, or transfer to other occupations. Persons with training or previous experience in vending machine repair should have good job prospects.

Earnings

Wage rates for vending machine mechanics ranged from $4.25 to $7.25 an hour in 1978, based on information from a small number of union contracts. Apprentices start at 50 percent of the rate paid experienced mechanics and receive increases every 6 months.

Most vending machine mechanics work 8 hours a day, 5 days a week, and receive premium pay for overtime. Since vending machines can be operated around the clock, mechanics sometimes work at night and on weekends and holidays. Some union contracts stipulate higher pay for nightwork and for emergency repair jobs on weekends and holidays.

Many vending machine mechanics employed by large companies are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America.

Related Occupations

Other workers who repair electromechanical equipment include bowling-pin-machine mechanics, business machine mechanics, electrical-appliance servicers, juke-box servicers, and pinball machine servicers.

Sources of Additional Information

Further information on job opportunities can be obtained from local vending machine firms and local offices of the State employment service. For general information on vending machine mechanics, as well as a list of schools offering courses in vending machine mechanics, write to:

National Automatic Merchandising Association, 7 S. Dearborn St., Chicago, Ill. 60603.

Watch Repairers

(D.O.T. 715.281-010)

Nature of the Work

As the pace of modern living quickens, people become more conscious of time and more dependent on watches and clocks to keep appointments and complete tasks. Cleaning, repairing, and adjusting these devices is the job of watch repairers or, as they are frequently called, watchmakers.

For many years all watches operated mechanically, with the mainspring supplying the power and the wheels and gears regulating the hands that show the time. When a mechanical watch is not working properly, repairers use tweezers, screwdrivers, and other tools to remove the watch movement—the mainspring, wheels, and gears—from the case. Repairers clean the movement in an ultrasonic cleaner. If the watch still does not work, they carefully disassemble the movement to find broken, worn, or improperly adjusted parts. When working wih these small parts watch repairers wear magnifying glasses and sometimes microscopes. They may replace the mainspring and other parts of the winding mechanism, adjust improperly fitted wheels and gears, or replace broken hands. Before reassembling the watch movement, all parts are inspected and checked. When the movement is reassembled, they test its accuracy with a timing machine.

Over the past two decades several types of electronic watches have been marketed. Batteries supply the power in these watches. Tuning forks, or quartz crystals with integrated circuits regulate the time. While some electronic watches still have gears and wheels, others, such as digitals have no moving parts. The work of watch repairers has changed as they have learned to repair electronic watches.

To repair electronic watches, repairers check circuits with electrical test equipment. The meters show which parts of the watch are malfunctioning and have to be replaced. Repairers also replace batteries in electronic watches.

Watch repairers who own jewelry stores may repair jewelry and sell watches, jewelry, silverware, and other items. They also may hire and supervise salesclerks, other watch repairers, and jewelers; arrange window displays; purchase goods to be sold; and perform other managerial duties.

Working Conditions

The work of watch repairers involves little physical exertion, and generally is performed in comfortable surroundings. However, the patience and concentration required to work with small parts can cause stress.

Watch repairers have more freedom than other workers in determining their work setting and hours. Some watch repairers, for example, only work part time and operate out of their homes.

Places of Employment

About 19,000 persons worked as watch repairers in 1978. About two-fifths were self-employed. Most watch repairers worked in jewelry stores or repair shops, which are located throughout the country. A small number had jobs in factories that make watches, clocks, or other precision timing instruments.

Training, Other Qualifications, and Advancement

Most people learn the trade in watch repair schools; others learn through on-the-job training.

There are no educational requirements for entrance into watch repair schools, although most students are high school graduates. Some schools test a student's mechanical aptitude and manual dexterity. Most schools charge tuition and require students to furnish their own handtools. Courses last from 1 to 3 years for full-time students. Students learn to use and care for the watch repairer's tools and machines, make and adjust individual parts, take apart and reassemble various kinds of watch and clock movements, and diagnose and solve repair problems. Some schools offer courses in repairing unusual types of timepieces, such as chronographs and antique watches. Graduates may gain additional training by working with an experienced watch repairer.

Watch repair also can be learned through on-the-job arrangements with experienced workers. However, few shop or store owners are willing to hire inexperienced workers, because of the time required to supervise them. This type of training is less structured than classroom instruction. Trainees learn by observing experienced repairers and by performing simple and then more complex repairs. On-the-job training lasts longer than technical school.

The following States require watch repairers to obtain a license: Florida, Indiana, Iowa, Kentucky, Louisiana, Minnesota, North Carolina, North Dakota, Oregon, and Wisconsin. To obtain a license, repairers must pass an examination designed to test their skill with tools and their knowledge of watch construction and repair.

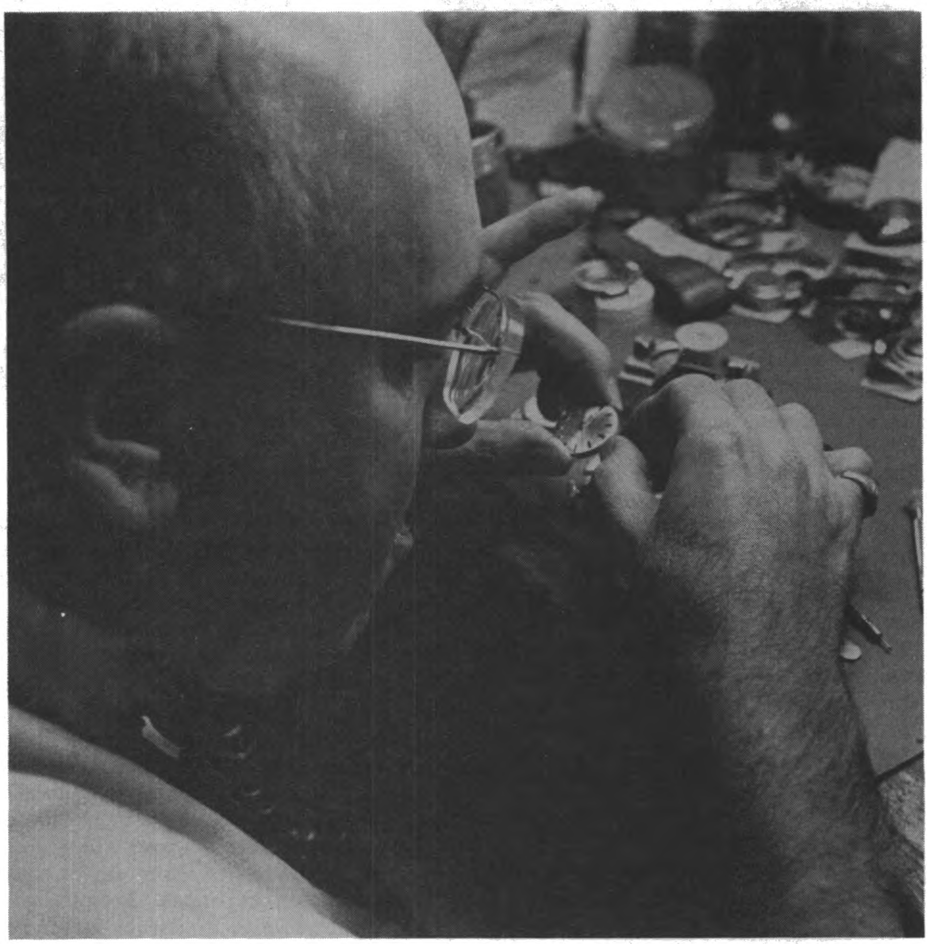
Watch repairers in all States can demonstrate their competence by passing certification examinations given by the American Watchmakers Institute. Tests are given for the title of Certified Watchmaker, Certified Electronic Watchmaker, or Certified Master Watchmaker. Annual voluntary examinations covering new phases of watchmaking also are offered.

A person planning a career as a watch repairer must be willing to sit for long periods and work with a minimum of supervision. The precise and delicate nature of the work requires patience and concentration. Since a watch is simply a small machine, mechanical aptitude is essential. Good depth perception and eye-hand coordination are necessary in working with the tiny parts.

Watch repairers who have sufficient experience and funds may open their own watch repair shops. Watch repairers also may open their own jewelry stores where they can increase their income by selling watches and other merchandise in addition to repairing watches. These stores require a much greater financial investment than do repair shops, because an inventory of expensive merchandise must be obtained.

Employment Outlook

Employment of watch repairers is expected to grow more slowly than the average for all occupations through the 1980's. However, due to the need to replace experienced repairers who retire, die, or leave the occupa-



Watch repair requires a delicate touch.

tion for other reasons, job opportunities should be very good for trained watch repairers.

Although more watches will be sold as population and incomes rise, many will be inexpensive watches that cost little more to replace than repair. Consequently, employment is not expected to keep pace with growth in the number of watches. However, so many watches are in use that the need for watch repairers should remain strong. In recent years, job openings have exceeded the number of trained workers entering the occupation. If this gap continues, trained workers should find jobs readily available. Opportunities are expected to be particularly good for watch repairers who have had training in repairing electronic watches because these watches are growing rapidly in popularity.

Earnings

Watch repairers in entry jobs generally earned from about $150 to $250 a week in 1978, based on the limited information available. Experienced watch repairers working in retail stores and repair shops earned from $10,000 to $14,000 a year. Some watch repairers may be paid a commission based on the number of watches repaired. Others rent space in a jewelry store, set up a repair department, and split the profits with the store owner. Watch repairers who are paid a commission or who own their own businesses can earn considerably more than those working for a salary.

Related Occupations

Watch repairers do detailed work with small parts. Other workers that need similar manual skill include engravers, gunsmiths, hand carvers, hand painters, jewelers, model makers, and taxidermists.

Sources of Additional Information

For information about training courses and watch repairing as a career, contact:

American Watchmakers Institute, 3700 Harrison Ave., Cincinnati, Ohio 45211.

For information about job opportunities in retail stores contact:

Retail Jewelers of America, Inc., Time-Life Building, 1271 Avenue of the Americas, Suite 650, New York, N.Y. 10020.

Further information about work opportunities or training in this trade also is available from local offices of the State employment service.

HEALTH OCCUPATIONS

When people are sick or injured, health services are very important to them. The availability of these services depends, not only on the number of people employed in health occupations, but also on their geographic distribution. During recent years the number of health personnel has grown very rapidly; improving their distribution remains a problem that is being attacked on the national, State, and local level.

About 4.4 million people worked in health-related occupations in 1978. Besides doctors, dentists, and therapists, these include the behind-the-scenes technologists, technicians, administrators, and assistants.

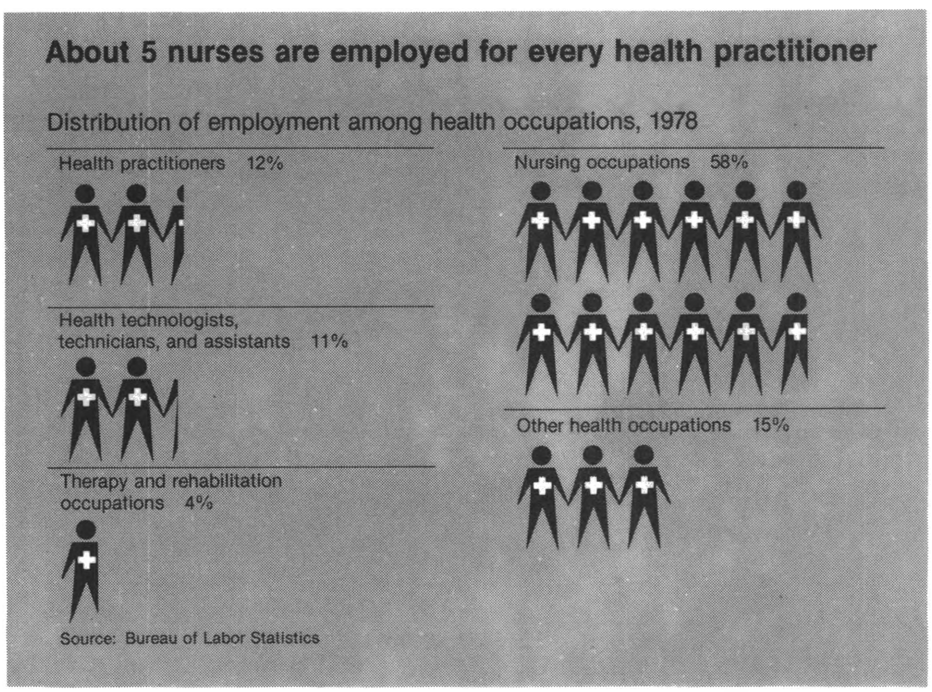
Registered nurses, physicians, pharmacists, and dentists constitute the largest professional health occupations. In 1978 employment in these occupations ranged from 120,000 for dentists to 1,050,000 for registered nurses. Professional health occupations also include other medical practitioners—osteopathic physicians, chiropractors, optometrists, podiatrists, and veterinarians. Therapists (physical therapists, occupational therapists, speech pathologists and audiologists) and administrators (health services administrators and medical record administrators) also are professional health workers, as are dietitians.

Other health service workers include technicians of various types, such as medical technologists, medical X-ray technicians, dental hygienists, and dental laboratory technicians. A large number—1.6 million—worked as practical nurses and auxiliary workers, including nursing aides, orderlies, hospital attendants, and psychiatric assistants.

Hospitals employ about half of all workers in the health field. Others work in clinics, laboratories, pharmacies, nursing homes, public health agencies, mental health centers, private offices, and patients' homes. Health workers are concentrated in the more heavily populated and prosperous areas of the Nation.

Training

The educational and other requirements for work in the health field are as diverse as the health occupations themselves. For example, professional health workers—physicians, dentists, pharmacists, and others—must complete a number of years of preprofessional and professional college education and pass a State licensing examination. On the other hand, some health service occupations—nursing aide, for example—can be entered with no specialized training. Many community and junior colleges offer courses to prepare students for various health jobs. In many occupations, on-the-job training traditionally has been the means of preparation, but employers now prefer persons who have completed a formal educational program.



Earnings

Earnings of health workers range from those of a physician—the highest paid occupation—to those of a nursing aide, who earns only three-fourths of the average for all nonsupervisory workers in private industry, except farming. Earnings for the other health occupations that can be entered with up to 2 years of formal training are about the same as the average. People in health occupations that require graduation from college earn from one-and-a-quarter times to twice these average earnings. Among the occupations for which average yearly earnings are reported in the *Handbook*, the top 15 include 8 of the professional health occupations, including all 6 medical practitioners.

Outlook

Employment in the health field is expected to grow much faster than the average for all occupations through the 1980's, although the rates of growth will differ among individual health occupations. Factors that are expected to contribute to an increase in the demand for health care are population growth and the public's increasing health consciousness. Expansion of coverage under prepayment programs also will contribute to growth in this field, by making it easier for persons to pay for hospitalization and medical care. Increased expenditures by Federal, State, and local governments for health care and services will further raise demand.

In addition to jobs created by growth of the health field, many new workers will be needed each year to replace those who retire, die, or leave the field for other reasons.

Recent expansion of training programs in most of the occupations will add to the supply of trained health service personnel. Depending on the balance between the supply of workers and expected openings, the employment outlook in the various occupations ranges from very good to competitive. See the individual statements for the outlook for each occupation.

Dental Occupations

Proper dental care is an integral part of overall health care. This section focuses on the dental profession and the three dental auxiliary occupations.

Dentists examine and treat patients for oral diseases and abnormalities, such as decayed and impacted teeth. Most dentists are general practitioners, but some specialize in certain areas of dentistry, such as orthodontics or oral surgery. Other dentists are employed in teaching, research, or administration.

Dental hygienists are the only dental auxiliary workers required by each State to be licensed. They scale, clean, and polish teeth, expose X-rays, and instruct patients in proper oral hygiene.

Dental assistants help dentists while they are working with patients. This assistance includes tasks such as handing the dentist the necessary instruments, keeping the patient's mouth clear, and preparing materials for impressions of teeth. They also perform nonchairside duties such as keeping records, receiving patients, and ordering dental supplies.

Dental laboratory technicians make various dental and orthodontal appliances, such as dentures and crowns, according to the models and instructions supplied by dentists. This work requires patience, minute attention to detail, and a high degree of manual dexterity. Some technicians make all kinds of dental appliances, while others concentrate in certain areas of dental laboratory work, such as bridges or artificial teeth

Dentists

(D.O.T. 072)

Nature of the Work

Dentists examine teeth and other tissues of the mouth to diagnose diseases or abnormalities. They take X-rays, fill cavities, straighten teeth, and treat gum diseases. Dentists extract teeth and substitute artificial dentures designed for the individual patient. They also perform corrective surgery of the gums and supporting bones. In addition, they may clean teeth.

Dentists spend most of their time with patients, but may devote some time to laboratory work such as making dentures and inlays. Most dentists, however—particularly those in large cities—send their laboratory work to commercial firms. Some dentists also employ dental hygienists to clean patients' teeth and provide instruction for patient selfcare. (See statement on dental hygienists.) Other assistants perform office work, assist in "chairside" duties, and provide therapeutic services under the supervision of the dentist.

Most dentists are general practitioners who provide many types of dental care; about 10 percent are specialists. The largest group of specialists are orthodontists, who straighten teeth. The next largest group, oral surgeons, operate on the mouth and jaws. The remainder specialize in pedodontics (dentistry for children); periodontics (treating the gums); prosthodontics (making artificial teeth or dentures); endodontics (root canal therapy); public health dentistry; and oral pathology (diseases of the mouth).

About 5 percent of all dentists teach in dental schools, do research, or administer dental health programs on a full-time basis. Many dentists in private practice do this work on a part-time basis.

Working Conditions

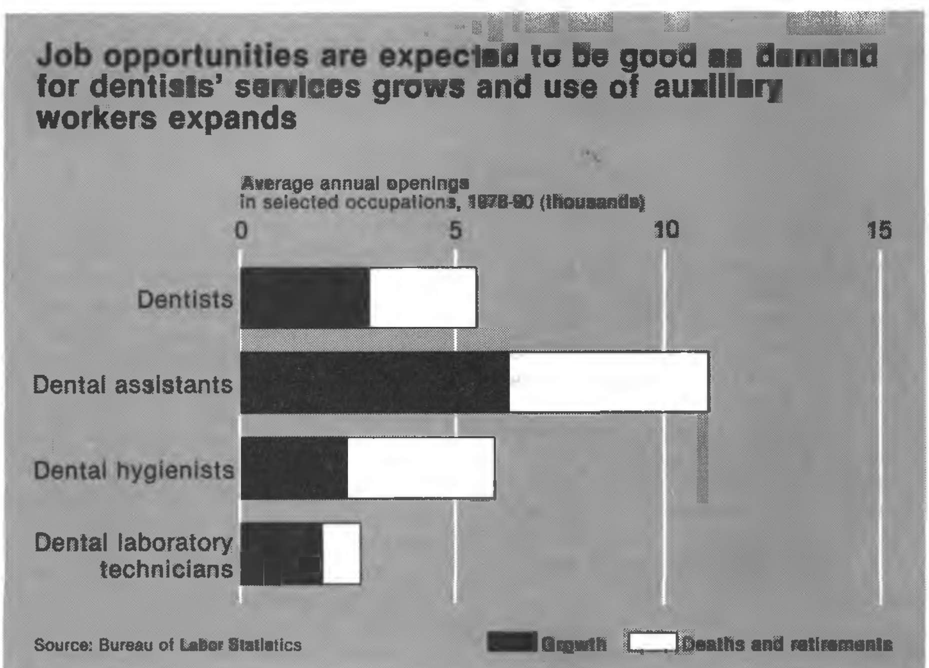
Most dental offices are open 5 days a week, and some dentists have evening hours. Dentists usually work between 40 and 45 hours a week, although many spend more than 50 hours a week in the office. Dentists often work fewer hours as they grow older, and a considerable number continue in part-time practice well beyond the usual retirement age.

Places of Employment

About 120,000 individuals practiced dentistry in the United States in 1978—9 of every 10 were in private practice. About 5,000 served as commissioned officers in the Armed Forces, and about 1,700 worked in other types of Federal Government positions —chiefly in the hospitals and clinics of the Veterans Administration and the Public Health Service.

Training, Other Qualifications, and Advancement

A license to practice dentistry is required in all States and the District of Columbia. To qualify for a license in most States, a candidate must graduate from a dental school approved by the American Dental Association and pass written and practical examinations. In 1978, candidates in 48 States and the District of Columbia could fulfill part of the State licensing requirements by passing a written examination given by the National Board of Dental Examiners. Most State licenses permit dentists to engage in both general and specialized practice. In 14 States, however, a dentist cannot be licensed as a "specialist" without having 2 or 3 years of graduate education and, in some cases, passing a special State examination. In the other 36 States, the extra education also is necessary, but a specialist's practice is regulated by the dental profession, not the State licensing authority. To practice in a different State, a licensed dentist usually must pass the State's examination. However, at least 21 States grant licenses without further examination to dentists already licensed in other States on the basis of their credentials. Dentists who want to teach or do research usually spend an additional 2 to 4 years in advanced dental



training in programs operated by dental schools, hospitals, and other institutions of higher education.

Dental colleges require from 2 to 4 years of predental education. However, about four-fifths of the students entering dental school in 1978 had a baccalaureate or master's degree. Predental education must include courses in the sciences and humanities.

Competition is keen for admission to dental schools. In selecting students, schools give considerable weight to college grades and the amount of college education. In addition, all dental schools participate in a nationwide admission testing program, and scores earned on these tests are considered along with information gathered about the applicant through recommendations and interviews. Many State-supported dental schools also give preference to residents of their particular States.

Dental school training generally lasts 4 academic years although several institutions condense this into 3 calendar years. Studies begin with an emphasis on classroom instruction and laboratory work in basic sciences such as anatomy, microbiology, biochemistry, and physiology. Courses in clinical sciences and preclinical technique also are provided at this time. The last 2 years are spent chiefly in a dental clinic, treating patients.

The degree of Doctor of Dental Surgery (D.D.S.) is awarded by most dental colleges. An equivalent degree, Doctor of Dental Medicine (D.M.D.), is conferred by 19 schools.

Dental education is very costly because of the length of time required to earn the dental degree. However, Federal funds provide a limited number of loans for dental students, and a limited number of scholarships are available for qualifying students who agree to a minimum of 2 years' Federal service.

Dentistry requires both manual skills and a high level of diagnostic ability. Dentists should have good visual memory, excellent judgment of space and shape, and a high degree of manual dexterity, as well as scientific ability. Good business sense, self-discipline, and the ability to instill confidence are helpful for success in private practice. High school students who want to become dentists are advised to take courses in biology, chemistry, health, and mathematics.

Most dental graduates open their own offices or purchase established practices. Some gain experience with established dentists, and save money to equip an office; others may enter residency training programs in approved hospitals. Dentists who enter the Armed Forces are commissioned as captains in the Army and Air Force and as lieutenants in the Navy. Graduates of recognized dental schools are eligible for Federal Civil Service positions and for commissions (equivalent to lieutenants in the Navy) in the U.S. Public Health Service.

Filling a tooth requires a lot of manual dexterity.

Employment Outlook

Employment opportunities for dentists are expected to be very good through the 1980's. Dental school enrollments have grown in recent years because of federally assisted construction of additional training facilities. However, the number of new entrants to the field through 1985 is expected to fall short of the number needed to fill openings created by growth of the occupation and by death or retirement from the profession. By 1990, however, the supply of new dentists is expected to be adequate to meet the demand for dental services.

Employment of dentists is expected to grow about as fast as the average for all occupations due to population growth, increased awareness that regular dental care helps prevent and control dental diseases, and the expansion of prepayment arrangements, which make it easier for people to afford dental services. Fluoridation of community water supplies and improved dental hygiene may prevent some tooth and gum disorders, and preserve teeth that might otherwise be extracted. However, since the preserved teeth will need care in the future, these measures may increase rather than decrease the demand for dental care. Similarly, while new techniques, equipment, and drugs, as well as the expanded use of dental hygienists, assistants, and laboratory technicians should enable individual dentists to care for more patients, these developments are not expected to offset the need for more dentists.

There will continue to be a need for dentists to administer dental public health programs and teach in dental colleges. Also, many dentists will continue to serve in the Armed Forces.

Earnings

During the first year or two of practice, dentists often earn little more than the minimum needed to cover expenses, but their earnings usually rise rapidly as their practice develops. Specialists generally earn considerably more than general practitioners. The average income of dentists in 1978 was about $50,000 a year, according to the limited information available. In the Federal Government, new graduates of dental schools could expect to start at $19,300 a year in 1979. Experienced dentists working for the Federal Government in 1979 earned average annual salaries of $39,500, with some earning as much as $47,500 a year.

Location is one of the major factors affecting the income of dentists who open their own offices. For example, in high-income urban areas, dental services are in great demand; however, a practice can be developed most quickly in small towns, where new dentists easily become known and where they may face less competition from established practitioners. Although the income from practice in small towns may rise rapidly at first, over the long run the level of earnings, like the cost of living, may be lower than it is in larger communities.

Related Occupations

Dentists examine, diagnose, and treat various oral diseases and abnormalities. Other professions which provide health services and which entail similar long and extensive training include clinical psychologist, ophthalmologist, physician, and veterinarian.

Sources of Additional Information

Persons who wish to practice in a given State should obtain the requirements for licensure from the board of dental examiners of that State. Lists of State boards and of accredited dental schools, as well as information on dentistry as a career, are available from:

American Dental Association, Council on Dental Education, 211 East Chicago Ave., Chicago, Ill. 60611.

American Association of Dental Schools, 1625 Massachusetts Ave. NW., Washington, D.C. 20036.

Students should contact the director of student financial aid at the school they attend for information about Federal or other loans and scholarships.

Dental Assistants

(D.O.T. 079.371-010)

Nature of the Work

Dental assistants work with dentists as they examine and treat patients. The assistant makes the patients comfortable in the dental chair, prepares them for treatment, and obtains their dental records. The assistant hands the dentist the proper instruments and materials and keeps the patient's mouth clear by using suction or other devices. Dental assistants prepare materials for making impressions and restorations, and expose radiographs and process dental X-ray film as directed by the dentist. They also provide oral health instruction and prepare instruments for sterilization.

Dental assistants perform a variety of duties that do not require the dentist's professional knowledge and skill. Some assistants make casts of the teeth and mouth from impressions taken by the dentist. In some States, assistants apply medications to the teeth and oral tissue, remove from surfaces of the teeth excess cement used in the filling process, and place rubber dams on the teeth to isolate them for individual treatment. Some dental assistants manage the office and arrange and confirm appointments, receive patients, keep treatment records, send bills, receive payments, and order dental supplies and materials.

The work of the dental assistant should not be confused with that of the dental hygienist, who must be licensed to scale and polish the teeth. (See the following statement on dental hygienists.)

Working Conditions

Dental assistants work in a well-lighted, clean environment. They must be careful in handling radiographic and other equipment. Dental assistants can expect to work chair-side with dentists. They must be a dentist's "third hand," exhibit some manual dexterity, and be able to deal with people who may be under stress.

Places of Employment

About 150,000 persons worked as dental assistants in 1978; about 1 out of 10 work part time.

Most dental assistants work in private dental offices, either for individual dentists or for groups of dentists. Many of the remainder work in dental schools, hospital dental departments, State and local public health departments, or private clinics. The Federal Government employs dental assistants, chiefly in hospitals and dental clinics of the Public Health Service, the Veterans Administration, and the Armed Forces.

Training, Other Qualifications, and Advancement

Most dental assistants learn their skills on the job. An increasing number, however, are trained in formal posthigh school programs. About 300 such programs were accredited by the Commission on Accreditation of Dental and Dental Auxiliary Education Programs in 1978.

Most posthigh school courses in dental assisting are given in junior and community colleges or in vocational or technical schools. More than three-fourths of these programs take 1 year to complete and lead to a certificate or diploma. Graduates of 2-year programs offered in junior and community colleges earn an associate degree upon completion of specialized training and liberal arts courses. The minimum requirement for any of these programs is a high school diploma or its equivalent. Some schools also require typing or a science course for admission. Although some private schools offer 4- to 6-month courses in dental assisting, these are not accredited by the dental profession. Those receiving dental assistant training in the Armed Forces usually qualify for civilian jobs as dental assistants.

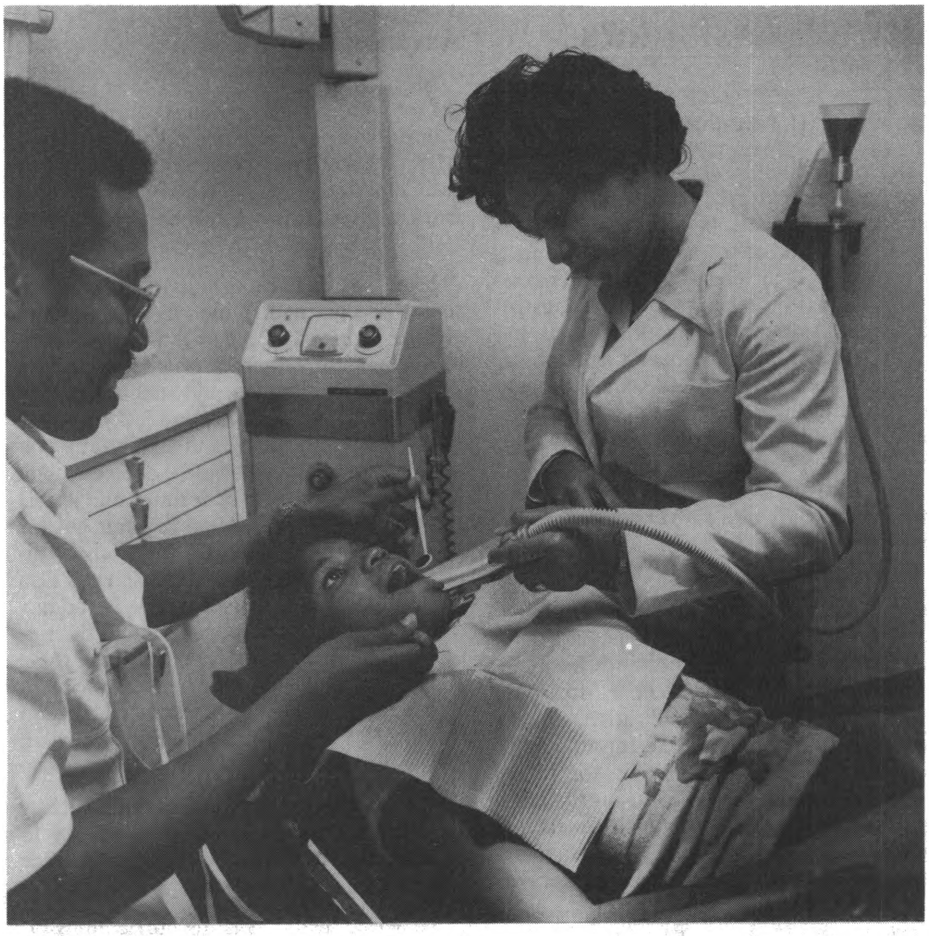
High school students interested in careers as dental assistants should take courses in biology, chemistry, health, typing, and office practices.

Approved dental assisting curriculums include classroom and laboratory instruction in skills and related theory. Trainees get practical experience in affiliated dental schools, local clinics, or selected dental offices.

A correspondence course accredited by the American Dental Association is available for employed dental assistants who are learning on the job or who otherwise are unable to participate in regular dental assisting programs on a full-time basis. The correspondence program is equivalent to 1 academic year of study but generally requires about 2 years to complete.

Graduates of accredited dental assistant programs who successfully complete an examination administered by the Certifying Board of the American Dental Assistants Association become Certified Dental Assistants. Certification is acknowledgement of an assistant's qualifications but is not generally required for employment.

After working as dental assistants, some individuals seek to acquire skills and qualifications for practicing as dental hygienists. Prospective dental assistants who foresee this possibility should plan carefully since credit earned in a dental assistant program often is not applicable toward requirements for a dental hygiene certificate. Some dental assistants become sales representatives for firms that manufacture dental products. The field of dental assisting education offers opportunities in teaching and program administration.



Dental assistants work with dentists as they examine and treat patients.

Employment Outlook

Employment opportunities for dental assistants are expected to be excellent through the 1980's, especially for graduates of academic programs in dental assisting. Part-time opportunities also will be very favorable.

Employment of dental assistants is expected to grow much faster than the average for all occupations, largely because dental students are being taught to use assistants in their practice. The increase in the demand for dental services which stems from population growth, a growing awareness of the importance of regular dental care, and the increasing ability of people to pay for care also will contribute to the demand for dental assistants. For example, increased participation in dental prepayment plans and public programs such as Medicaid bring dental services within the reach of many who could not afford them otherwise.

In addition to job openings created by growth in the demand for dental assistants, thousands of assistants also will be required each year to replace those who leave the field.

Earnings

Salary depends largely on the assistant's education and experience, the duties and responsibilities attached to the particular job, and geographic location.

In 1978, most dental assistants working for dentists in private practice earned between $7,800 and $8,400 annually, based upon the limited information available. A few earned up to $13,000 or more a year depending upon the size of the office and the responsibilities performed by these key personnel.

In the Federal Government, experience and the amount and type of education determine entrance salaries. In 1979, a high school graduate who had 6 months of general experience started at nearly $8,400 a year; graduates of an ADA-approved 1-year training program who had an additional year of general experience could expect to start at nearly $9,400 a year. In general, experienced dental assistants working for the Federal Government in 1979 earned average annual salaries of about $10,500.

Although the 40-hour workweek prevails for dental assistants, the schedule is likely to include work on Saturday. A 2- or 3-week paid vacation is common. Some dentists provide sick leave and other benefits. Dental assistants who work for the Federal Government receive the same employee benefits as other Federal workers.

Related Occupations

Dental assistants perform a variety of duties that do not require the dentist's professional knowledge and skill. Other occupations that provide similar services under the supervision of a medical practitioner include chiropractor assistant, optometric assistant, podiatric assistant, and surgical technician.

Sources of Additional Information

Information about career opportunities, scholarships, accredited dental assistant programs, including the correspondence program, and requirements for certification is available from:

American Dental Assistants Association, 666 N. Lake Shore Dr., Suite 1130, Chicago, Ill. 60611.

Commission on Accreditation of Dental and Auxiliary Educational Programs, 211 E. Chicago Ave., Chicago, Ill. 60611.

Dental Hygienists

(D.O.T. 078.361-010)

Nature of the Work

Dental hygienists are oral health clinicians and educators who help the public develop and maintain good oral health. As members of the dental health team, dental hygienists may perform preventive and therapeutic services under the supervision of the dentist. Specific responsibilities of the hygienist vary, depending on the law of the State where the hygienist is employed, but may include removing deposits and stains from patients' teeth; providing instructions for patient self-care and nutritional counseling; and applying topical fluoride to prevent tooth decay. They take medical and dental histories, expose and develop dental X-ray films, make impressions of teeth for study models, and prepare other diagnostic aids for use by the dentist. Pain control and restorative procedures also may be performed by dental hygienists in some States.

Dental hygienists who work in school systems serve in several capacities. Clinical functions include examining children's teeth, assisting the dentist in determining the dental treatment needed, and reporting the findings to parents. They also scale and polish teeth and give oral hygiene instructions. In addition, they develop and deliver classroom and assembly programs on oral health.

A few dental hygienists assist in research projects. Those having advanced training may teach in schools of dental hygiene.

Working Conditions

Dental hygienists usually work in clean, well-lighted offices. Important health safeguards for persons in this occupation are regular medical checkups and strict adherence to established procedures for using X-ray equipment. Dental hygienists must have manual dexterity because they use various dental instruments with little room for error within a patients' mouth. They also must empathize with patients who often are under stress.

Places of Employment

About 35,000 persons worked as dental hygienists in 1978. Many are employed part time. Most work in private dental offices; some may contract their services to several dentists or dental offices. Public health agencies, school systems, industrial plants, clinics, hospitals, dental hygiene schools, and the Federal Government are other sources of employment for dental hygienists. Some graduates of bachelor's degree programs are commissioned officers in the Armed Forces.

Training, Other Qualifications, and Advancement

Dental hygienists must be licensed. To obtain a license, a candidate must graduate from an accredited dental hygiene school and pass both a written and a clinical examination. For the clinical examination, the applicant is required to perform dental hygiene procedures, such as removing deposits and stains from a patient's teeth. In 1978, candidates in 48 States and the District of Columbia could complete part of the State licensing requirements by passing a written examination given by the National Board of Dental Examiners. Few States permit dental hygienists licensed in other States to practice in their jurisdictions without further examination.

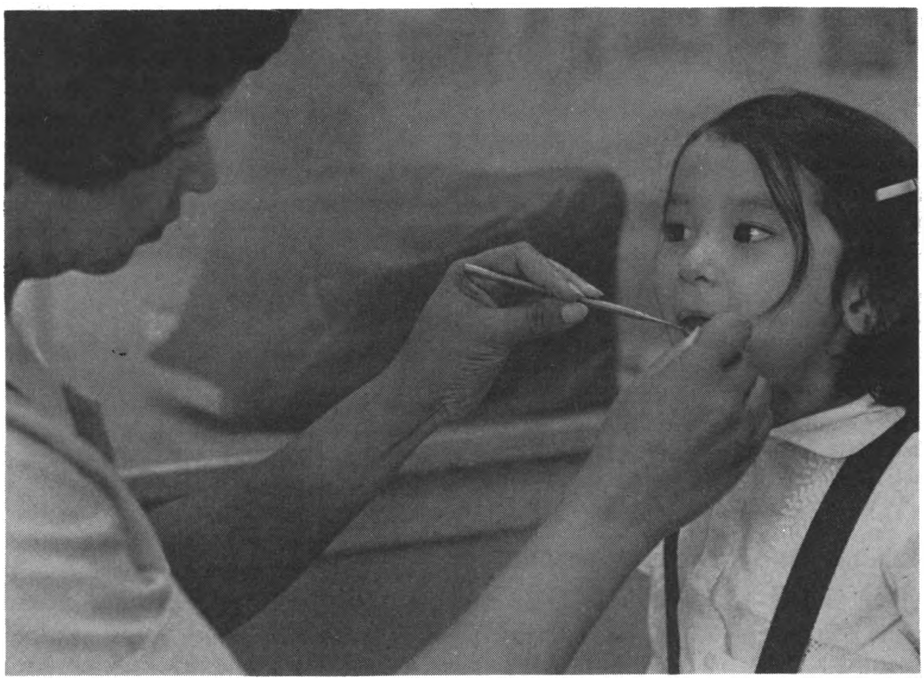
In 1978, 197 schools of dental hygiene in the United States were accredited by the Commission on Accreditation of Dental and Dental Auxiliary Educational Programs. Most programs grant an associate degree; others lead to a bachelor's degree. A few institutions offer both types of programs. Six schools offer master's degree programs in dental hygiene.

Completion of an associate degree program usually is sufficient for the dental hygienist who wants to practice in a private dental office. To do research, teach, and work in public or school health programs, at least a bachelor's degree usually is required. Dental hygienists with a master's degree work as teachers or administrators in dental hygiene and dental assisting training programs, public health agencies, and in associated research.

Competition is keen for admission to dental hygiene schools. The minimum requirement for admission to a school of dental hygiene is graduation from high school. Several schools that offer the bachelor's degree admit students to the dental hygiene program only after they have completed 2 years of college. Many schools also require that applicants take an aptitude test given by the American Dental Hygienists' Association. Dental hygiene training given in the Armed Forces usually does not fully prepare one to pass the licensing exam, but credit for that training may be granted to those who seek admission to accredited dental hygiene programs.

The curriculum in a dental hygiene program consists of courses in the basic sciences, dental sciences, clinical sciences, and liberal arts. These schools offer laboratory, clinical, and classroom instruction in subjects such as anatomy, physiology, chemistry, pharmacology, nutrition, histology (the study of tissue structure), periodontology (the study of gum diseases), dental materials, and clinical dental hygiene.

People who want to become dental hygienists should enjoy working with others. The ability to put patients at ease is helpful. Personal neatness and cleanliness, manual dexterity, and good health also are important qualities. Among the courses recommended for high school students interested in careers in this occupation are biology, health, chemistry, speech, and mathematics.



Dental hygienists who work in school systems examine, scale, and polish children's teeth and instruct them in proper mouth care.

Employment Outlook

Employment opportunities for dental hygienists are expected to be very good through the 1980's. Despite an anticipated rise in the number of graduates from schools of dental hygiene, the demand is expected to be greater than the supply if recent trends in enrollments continue. There also should be very good opportunities for those desiring part-time employment and for those willing to work in rural areas.

Employment of dental hygienists is expected to grow much faster than the average for all occupations because of an expanding population and the growing awareness of the importance of regular dental care. Increased participation in dental prepayment plans and more group practice among dentists should result in new jobs for dental hygienists. Dental care programs for children also may lead to more employment opportunities in this field.

Earnings

Earnings of dental hygienists are affected by the type of employer, education and experience of the individual hygienist, and the geographic location. Dental hygienists who work in private dental offices usually are salaried employees, although some are paid a commission for work performed, or a combination of salary and commission.

Dental hygienists working full time in private offices earned between $12,000 and $13,500 a year in 1978, according to the limited data available. In 1979, the Federal Government paid dental hygienists with no experience starting salaries of about $9,400 a year. Experienced dental hygienists working for the Federal Government earned average annual salaries of about $12,100.

Dental hygienists employed full time in private offices usually work between 35 and 40 hours a week. They may work on Saturdays or during evening hours. Some hygienists work for two dentists or more.

Dental hygienists who work for school systems, health agencies, the Federal Government, or State agencies have the same hours, vacation, sick leave, retirement, and health insurance benefits as other workers in these organizations.

Related Occupations

Dental hygienists relieve dentists from many routine tasks. Other occupations performing similar duties for dentists and physicians include dental assistant, dental laboratory technician, emergency medical technician, general duty nurse, nurse anesthetist, and radiologic technologist.

Sources of Additional Information

For information about accredited programs and the educational requirements to enter this occupation, contact:

Division of Professional Development, American Dental Hygienists' Association, Suite 3400, 444 N. Michigan Ave., Chicago, Ill. 60611.

The State Board of Dental Examiners in each State, or the National Board of Dental Examiners, 211 E. Chicago Ave., Chicago, Ill. 60611, can supply information on licensing requirements.

Dental Laboratory Technicians

(D.O.T. 712.381-018)

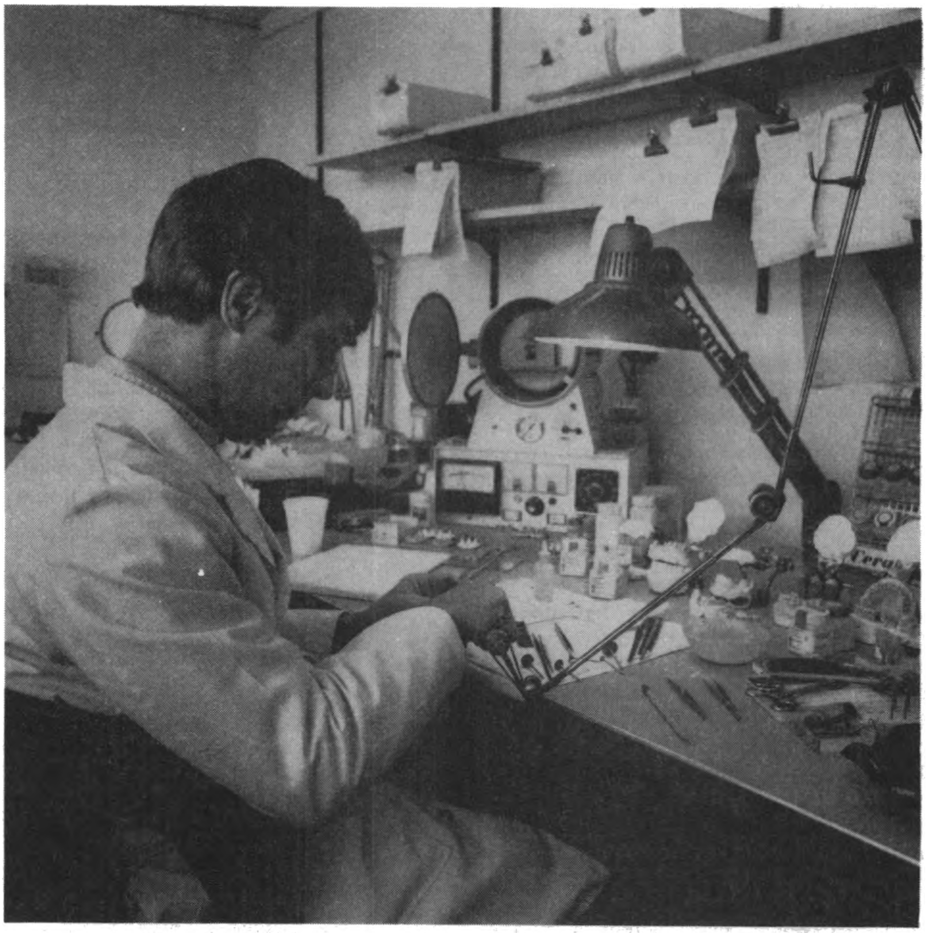
Nature of the Work

Dental laboratory technicians make dentures (artificial teeth), fabricate metal or porcelain crowns and inlays to restore teeth, construct bridges of metal and porcelain to replace missing teeth, and also make dental orthodontic appliances. All work is done following written instructions submitted by the dentist, using impressions made by the dentist of a patient's teeth or mouth, from which models are made from dental stone or plaster pourings. Sometimes these model pourings are made by the dentist, but most often by the technician.

Trainees in beginning jobs usually mix and pour plaster into casts and molds and perform other simple tasks. As they gain experience, they do more difficult laboratory work. Some dental technicians perform the full range of laboratory work. Others are specialists who make crowns and bridges, arrange artificial teeth on dental appliances, make plastic molds for dentures, work with dental ceramics (porcelain), or make castings of gold or metal alloys. Technicians use small hand instruments such as wax spatulas and wax carvers, as well as special electric lathes and drills, high-heat furnaces, metal-melting torches, and other specialized laboratory equipment.

Working Conditions

Whether they are employed in independent commercial laboratories or in dental offices, dental technicians work in typical laboratory surroundings. Work areas are generally clean, well lighted, and well ventilated. Technicians usually have their own workbenches which are equipped with bunsen burners, grinding and polishing machines, and various handtools. Although there is constant pressure to meet dentists' deadlines, schedules are flexible enough to allow for any problems or special requirements that may be involved in completing a difficult job.



Dental laboratory technicians use a wide variety of tools and instruments.

Places of Employment

About 47,000 persons worked as dental laboratory technicians in 1978. Most work in commercial laboratories, either as employees or as owners of the business. Commercial laboratories, which handle orders from dentists, usually employ fewer than 10 technicians. However, a few large laboratories employ over 200 technicians.

About 8,500 dental laboratory technicians work in dentists' offices. Others work for hospitals that provide dental services and for the Federal Government, chiefly in Veterans Administration hospitals and clinics and in the Armed Forces. Establishments that manufacture dental materials and equipment also employ technicians as technical or sales representatives.

Dental laboratories are located mainly in large cities and populous States. Many laboratories receive work through the mail from dentists who work a considerable distance away.

Training, Other Qualifications, and Advancement

Although no minimum formal education is needed to enter this occupation, a high school diploma is an asset. Many dental laboratory technicians learn their craft on the job, although more and more are taking formal training programs before starting work. On-the-job training usually lasts 3 or 4 years, depending on the trainee's previous experience, ability to master the techniques, and the number of specialized areas to be learned. A few public vocational high schools offer courses in dental laboratory work that may be taken together with on-the-job training.

In 1978, 2-year education programs accredited by the Commission on Accreditation of Dental and Dental Auxiliary Educational Programs were offered in 55 schools. High school graduation or equivalent education is required to enter these programs. The training includes formal classroom instruction in dental law and ethics, chemistry, ceramics, metallurgy, and other related subjects. In addition, the student gets supervised practical experience in the school or dental laboratory. After completion of the 2-year training program, the trainee needs about 3 more years of practical experience to develop the skills needed to be recognized as a well-qualified dental laboratory technician. Those receiving dental laboratory training in the Armed Forces usually qualify for civilian jobs as dental laboratory technicians.

Dental laboratory technicians may become Certified Dental Technicians by passing written and practical examinations given by the National Board for Certification, a trust established by the National Association of Dental Laboratories. Certification is becoming increasingly important as evidence of a technician's competence. Well-qualified technicians advance by becoming supervisors or managers in dental laboratories, teachers in dental lab training programs, or salespersons for dental products companies. Some technicians become owners of dental laboratories.

Among the personal qualifications that employers look for in selecting trainees are a high degree of manual dexterity, good color perception, patience, and an inclination for detailed work. High school students interested in careers in this occupation are advised to take courses in art, crafts, metal shop, metallurgy, and sciences.

Employment Outlook

Job opportunities for well-qualified dental laboratory technicians are expected to be excellent through the 1980's. Some experienced technicians should be able to establish laboratories of their own. A technician whose work has become known to several dentists in a community will have the best prospects of building a successful business.

Employment of dental laboratory technicians is expected to grow faster than the average for all occupations due to expansion of dental prepayment plans and the increasing number of older people who require dentures. To keep pace with the demand for their services, dentists will spend more time treating patients and will hire more technicians or send more of their laboratory work to commerical firms.

In addition to job opportunities created by growth, many openings for dental laboratory technicians will occur each year because of the need to replace technicians who die or retire.

Earnings

Dental laboratory technicians who worked full time in commercial laboratories received average annual salaries within the following ranges in early 1979: Trainees with no experience, $6,200 to $7,100; graduates of 2-year dental technology courses with no experience, $7,800 to $8,000; technicians with no formal training and 2 years of on-the-job experience, $8,600 to $9,000; technicians with 2 to 5 years of experience, regardless of training, $11,000 to $12,000; and technicians with more than 5 years of experience, regardless of training, from $15,000 to $20,000. Technicians who specialized in ceramics received the highest salaries (up to $30,000). Large dental laboratories employ supervisors or managers who usually earn more than technicians. In general, earnings of self-employed technicians are higher than those of salaried workers.

In the Federal Government, graduates of ADA-approved programs with no experience were paid starting salaries of about $9,400 a year in 1979. Experienced dental laboratory technicians employed in the Federal Government generally earned between $13,000 and $18,700 annually, with the average earning about $16,100 per year.

Salaried technicians usually work 40 hours a week but self-employed technicians frequently work longer hours. Many technicians in commercial laboratories receive paid holidays and vacations and some also receive paid sick leave, bonuses, and other fringe benefits. Technicians employed by the Federal Government have the same benefits as other Federal employees.

Related Occupations

Dental laboratory technicians make artifical teeth, crowns and inlays, and orthodontic appliances following the specifications and instructions provided by the dentist. Other occupations which provide services or make devices for physicians include arch-support technician, orthotics technician (braces/surgical supports), prosthetics technician (artificial limbs/appliances) and optician (optical mechanic).

Sources of Additional Information

For information about training and a list of approved schools contact:

American Dental Association, Council on Dental Education, 211 E. Chicago Ave., Chicago, Ill. 60611.

Information on scholarships is available from dental technology schools or from the American Fund for Dental Health, 211 East Chicago Ave., Chicago, Ill. 606ll.

For information on career opportunities in commercial laboratories and requirements for certification, contact:

National Association of Dental Laboratories, 3801 Mt. Vernon Ave., Alexandria, Va. 22305.

Medical Practitioners

Medical practitioners work to prevent, cure, and alleviate disease. This group includes about five times as many physicians as all other practitioners combined.

Physicians, osteopathic physicians, and chiropractors all treat injuries and diseases that affect the entire body. These practitioners use different modes of treatment, however. Physicians prescribe medications, exercise, proper diet, and surgery for their patients. Osteopathic physicians use these treatments and also use manipulation of muscles and bones, especially the spine. These manipulations are the primary form of treatment given by chiropractors. Optometrists specialize in eye care and podiatrists treat foot diseases and deformities. Veterinarians treat animals and inspect meat, poultry, and other food as part of public health programs.

All of these occupations are closely regulated. States require that medical practitioners be licensed and pass a State board examination. Only physicians, osteopaths, podiatrists, and veterinarians can use drugs and surgery in their treatment.

Among the six medical practitioner occupations, requirements for a license vary from 6 to 9 years of postsecondary education. After graduation from college, osteopaths must complete a 4-year program and physicians generally a 3- or 4-year program. Most States require a 1-year residency for both physicians and osteopaths. Physicians who specialize must spend more years in residency and pass a specialty board examination. Two years of college are required for entry to one of the 4-year chiropractic schools. Optometrists, podiatrists, and veterinarians all must complete a minimum of 2 years of college before beginning the 4-year program.

Although training to become a medical practitioner is more rigorous than that for most other professional occupations, medical practice also offers unusual rewards—financial and otherwise. Incomes of medical practitioners greatly exceeded the average for all nonsupervisory workers in private industry in 1978, and their earnings were higher than those of any other professional workers with similar years of graduate education. Medical practitioners also enjoy great prestige within the community, and most derive considerable personal satisfaction from knowing their work contributes directly to the well-being of other people or, in the case of veterinarians, to that of the animal population.

All medical practitioners must have the ability and perseverance to complete the years of study required. Medical practitioners should be emotionally stable, able to make decisions in emergencies, and have a strong desire to help the sick and injured. Sincerity and an ability to gain the confidence of patients also are important qualities.

Chiropractors

(D.O.T. 079.101-010)

Nature of the Work

Chiropractic is a system of treatment based on the principle that a person's health is determined largely by the nervous system, and that interference with this system impairs normal functions and lowers resistance to disease. Chiropractors treat patients primarily by manual manipulation (adjustments) of parts of the body, especially the spinal column.

Because of the emphasis on the spine and its position, most chiropractors use X-rays to aid in locating the source of patients' difficulties. In addition to manipulation, most chiropractors use supplementary measures such as water, light, ultrasound, electric, and heat therapy. They also prescribe diet, supports, exercise, and rest. Most State laws specify the types of supplementary treatment permitted in chiropractic. Chiropractors do not use prescription drugs or surgery.

Working Conditions

Chiropractors generally work in private offices. Their workweek typically is 4 1/2 to 5 days.

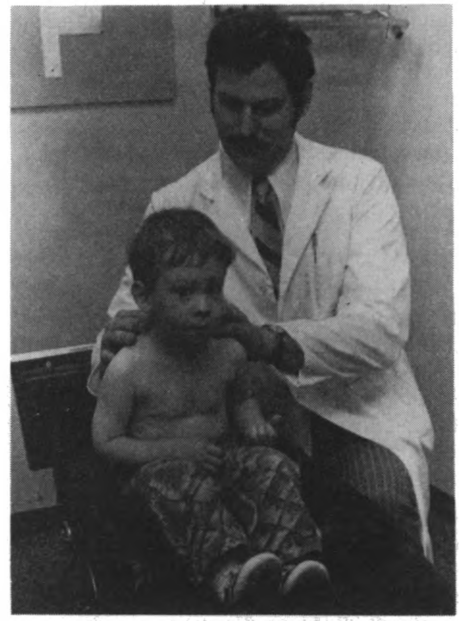
Places of Employment

About 18,000 persons practiced chiropractic in 1978. Most chiropractors were in private practice. Some were salaried assistants of established practitioners or worked for chiropractic clinics. Others taught or conducted research at chiropractic colleges.

Chiropractors often locate in small communities—about half of work in cities of 50,000 inhabitants or less.

Training, Other Qualifications, and Advancement

All 50 States and the District of Columbia regulate the practice of chiropractic and grant licenses to chiropractors who meet certain educational requirements and pass a State board examination. Many States have reciprocity agreements that permit chiropractors licensed in one State to obtain a license in others without taking an examination.



Chiropractic requires keen powers of observation in order to detect physical abnormalities.

Although the type of practice permitted and the educational requirements for a license vary considerably from one State to another, most States require successful completion of a 4-year chiropractic course following 2 years of preprofessional college work. Some States require that specific subjects such as English, chemistry, biology, or physics be a part of this preprofessional work. In addition, several States require that chiropractors pass a basic science examination.

In 1978, 6 of the 15 chiropractic colleges in the United States were fully accredited by the Council on Chiropractic Education; 3 others were recognized candidates working toward accreditation. All required applicants to have a minimum of 2 years of college before entrance, and most required that courses in English, the social sciences, chemistry, biology, and mathematics be taken during those 2 years. Chiropractic colleges emphasize courses in manipulation and spinal adjustments. Most offer a broader curriculum however, including subjects such as physiotherapy and nutrition. In most chiropractic colleges, the first 2 years of the curriculum chiefly include classroom and laboratory work in subjects such as anatomy, physiology, and biochemistry. During the last 2 years, students obtain practical experience in college clinics. The degree of Doctor of Chiropractic (D.C.) is awarded to students completing 4 years of chiropractic training.

Chiropractic requires a keen sense of observation to detect physical abnormalities and considerable hand dexterity but not unusual strength or endurance. Persons desiring to become chiropractors should be able to work independently and handle responsibility. The ability to work with detail is important. Sympathy and understanding are desirable qualities for dealing effectively with patients.

Most newly licensed chiropractors either set up a new practice or purchase an established one. A moderate financial investment is usually necessary to open and equip an office. Some start as salaried chiropractors to acquire experience and funds needed.

Employment Outlook

Requirements for chiropractors are expected to grow about as fast as the average for all occupations through the 1980's. Enrollments in chiropractic colleges, however, have grown dramatically, partly in response to apparent broader public acceptance of the profession. As more students graduate, new chiropractors may find it increasingly difficult to establish a practice in those areas where other practitioners already are located. The best opportunities for new chiropractors may be in small towns and in areas with comparatively few established practitioners.

Earnings

In chiropractic, as in other types of independent practice, earnings are relatively low in the beginning. New graduates who worked as associates to established practitioners earned about $12,000 a year in 1978. Experienced chiropractors averaged about $25,000, according to limited data available, although many earned more.

Related Occupations

Chiropractors diagnose, treat and work to prevent diseases, disorders, and injuries. They emphasize the importance of the nervous system for good health. Other occupations that require similar skills include audiologists, dentists, optometrists, osteopaths, podiatrists, speech pathologists, and veterinarians.

Sources of Additional Information

The State board of licensing in the capital of each State can supply information on State licensing requirements for chiropractors.

General information on chiropractic as a career is available from:

American Chiropractic Association, 2200 Grand Ave., Des Moines, Iowa 50312.

International Chiropractors Association, 1901 L St. NW., Suite 800, Washington, D.C. 20036.

For a list of chiropractic colleges, as well as general information on chiropractic as a career, contact:

Council on Chiropractic Education, 3209 Ingersoll Street, Suite 206, Des Moines, Iowa 50312.

For information on requirements for admission to a specific chiropractic college, contact the admissions office of that school.

Optometrists

(D.O.T. 079.101-018)

Nature of the Work

About 1 out of every 2 persons in the United States wears corrective lenses. Optometrists provide most of this care. They examine people's eyes for vision problems, disease, and other abnormal conditions and test for proper depth and color perception and the ability to focus and coordinate the eyes. When necessary, they prescribe lenses and treatment. Where evidence of disease is present, the optometrist refers the patient to the appropriate medical practitioner. Most optometrists supply the prescribed eyeglasses and fit and adjust contact lenses. Optometrists also prescribe vision therapy or other treatment not requiring surgery.

Although most optometrists are in general practice, some specialize in work with the aged or with children. Others work only with persons having partial sight who can be helped with microscopic or telescopic lenses. Still others are concerned with the visual safety of industrial workers. Some optometrists teach or do research.

Optometrists should not be confused with either ophthalmologists, sometimes referred to as oculists, or dispensing opticians. Ophthalmologists are physicians who specialize in medical eye care, eye diseases, and injuries; perform eye surgery; and prescribe drugs or other eye treatment, as well as lenses. Dispensing opticians fit and adjust eyeglasses according to prescriptions written by ophthalmologists or optometrists; they do not examine eyes or prescribe treatment. (See statements on physicians and dispensing opticians.)

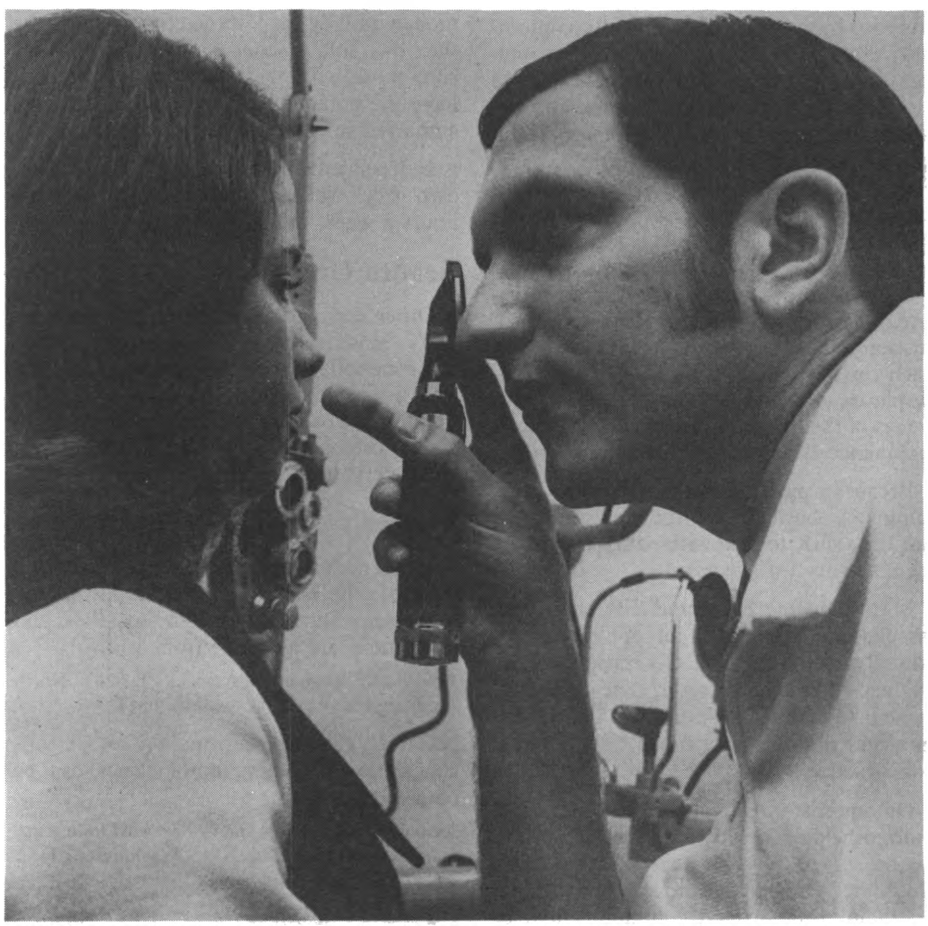
Working Conditions

Optometrists work in places—usually their own offices—that are clean, well lighted, and comfortable. The work requires a lot of attention to detail. Because the work is not physically strenuous, optometrists often can continue to practice after the normal retirement age.

Places of Employment

In 1978, there were about 21,000 practicing optometrists. The majority of optometrists are in solo practice. Others are in partnership or group practice with other optometrists or doctors as part of a professional health care team.

Some optometrists work in specialized hospitals and eye clinics or teach in schools



About 1 out of every 2 persons in the United States wears corrective lenses.

of optometry. Others work for the Veterans Administration, public and private health agencies, and industrial health insurance companies. About 500 optometrists serve as commissioned officers in the Armed Forces. Optometrists also act as consultants to engineers specializing in safety or lighting, consultants to educators in remedial reading, or participants on health advisory committees to Federal, State, and local governments.

About 2 optometrists out of 5 practice in towns of under 25,000 inhabitants.

Training, Other Qualifications, and Advancement

All States and the District of Columbia require that optometrists be licensed. Applicants for a license must have a Doctor of Optometry degree from an accredited optometric school or college and pass a State board examination. In some States, applicants are permitted to substitute the examination of the National Board of Examiners in Optometry, given in the second, third and fourth years of optometric school, for part or all of the written State examination. Some States allow applicants to be licensed without lengthy examination if they have a license in another State. In 44 States, optometrists are required to continue their education in optometry to retain their licenses.

The Doctor of Optometry degree requires a minimum of 6 or 7 years of college consisting of a 4-year professional degree program preceded by at least 2 or 3 years of preoptometric study at an accredited university, college, or junior college. In 1979, there were 13 U.S. schools and colleges of optometry accredited by the Council on Optometric Education of the American Optometric Association. Requirements for admission to these schools usually include courses in English, mathematics, physics, chemistry, and biology or zoology. Some schools also require courses in psychology, social studies, literature, philosophy, and foreign languages. Admission to optometry schools is competitive. Each year, qualified applicants exceed available places, so serious applicants need superior grades in their preoptometric college courses to enhance their chances for acceptance.

Because most optometrists are self-employed, business ability, self-discipline, and the ability to deal with patients tactfully are necessary for success.

Many beginning optometrists enter into associate practice with an optometrist or other health professional. Others purchase an established practice or set up a new practice. Some take salaried positions to obtain experience and the necessary funds to enter their own practice.

Optometrists wishing to advance in a specialized field may study for a master's or Ph. D. degree in physiological optics, neurophysiology, public health administration, health information and communication, or health education. Optometrists who enter the Armed Forces as career officers have the opportunity to work toward advanced degrees and to do vision research.

Employment Outlook

Employment opportunities for optometrists are expected to be favorable through the 1980's. The number of new graduates from schools of optometry is expected to be adequate to fill the positions made available by employment growth and the need to replace optometrists who die or retire.

Employment of optometrists is expected to grow faster than the average for all occupations. An increase in the total population, especially in the group most likely to need glasses—older people—is a major factor contributing to the expected growth in the occupation. Greater recognition of the importance of good vision and the likelihood that more persons will have health insurance to cover optometric services also should increase the demand for optometric services.

Earnings

In 1978, net earnings of new optometry graduates in their first full year of practice averaged about $16,900. Experienced optometrists averaged about $40,000 annually. Optometrists working for the Federal Government earned an average of $22,700 a year in 1978. Incomes vary greatly, depending upon location, specialization, and other factors. Optometrists who start out by working in commercial settings tend to earn more money initially than optometrists who set up their own solo practice. However, in the long run, those with their own private practice have the potential to earn more than those employed in commercial settings.

Independent practitioners can set their own work schedule. Some work over 40 hours a week, including Saturday.

Related Occupations

Other occupations in which the main activity consists of applying logical thinking and scientific knowledge to diagnose and treat disease, disorders, or injuries in humans or animals are chiropractors, dentists, physicians, osteopathic physicians, podiatrists, and veterinarians.

Sources of Additional Information

Information on optometry as a career and a list of scholarships and loan funds offered by various State associations, societies, and institutions are available from:

American Optometric Association, 243 North Lindbergh Blvd., St. Louis, Mo. 63141.

Career guidance information for persons considering becoming optometrists can be obtained by writing to:

Association of Schools and Colleges of Optometry, Suite 210, 1730 M St. NW., Washington, D.C. 20036.

Federal Health Professions Loans are available for optometric students who meet certain criteria of financial need. For information on this financial aid, on the availability of Federal scholarships, and on required preoptometry courses, contact individual optometry schools. The Board of Optometry in the capital of each State can supply a list of optometry schools approved by that State, as well as licensing requirements.

Osteopathic Physicians

(D.O.T. 071.101-010)

Nature of the Work

Osteopathic physicians (D.O.s) diagnose and treat diseases or maladies of the human body. They place special emphasis on the musculo-skeletal system of the body—bones, muscles, ligaments, and nerves. One of the basic treatments or therapies used by osteopathic physicians centers on manipulating this system with the hands. Osteopathic physicians also use surgery, drugs, and all other accepted methods of medical care.

Most osteopathic physicians are "family doctors" who engage in general practice. These physicians usually see patients in their offices, make house calls, and treat patients in osteopathic and other private and public hospitals. Some doctors of osteopathy teach, do research, or write and edit scientific books and journals.

In recent years, specialization has increased. In 1978, about 25 percent of all osteopathic physicians were practicing in specialties, including internal medicine, neurology and psychiatry, ophthalmology, pediatrics, anesthesiology, physical medicine and rehabilitation, dermatology, obstetrics and gynecology, pathology, proctology, radiology, and surgery.

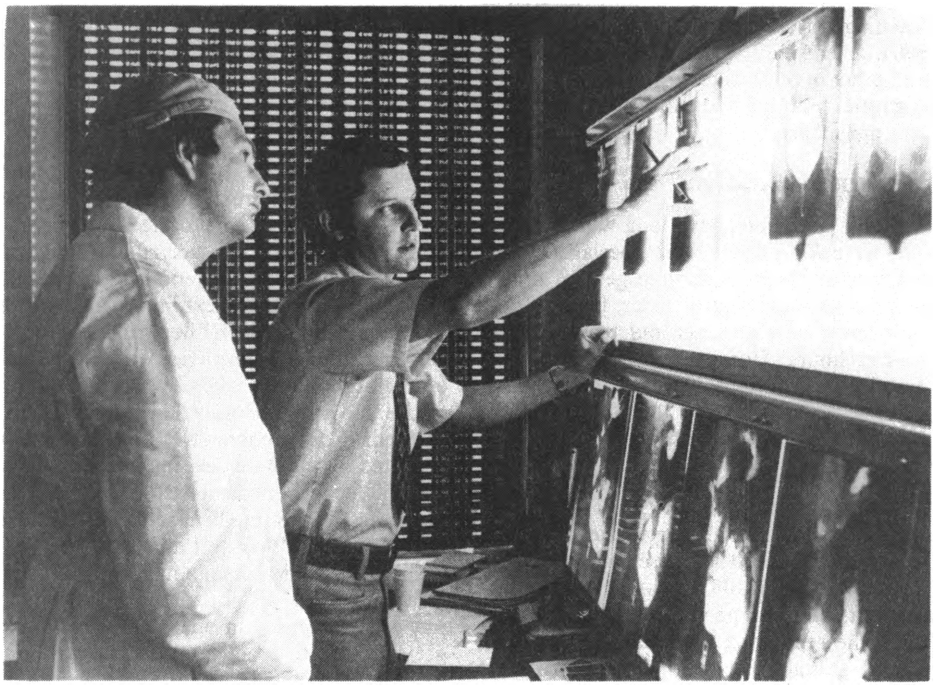
Working Conditions

Many osteopathic physicians work more than 50 or 60 hours a week. Those in general practice usually work longer and more irregular hours than specialists. As osteopathic physicians grow older, they may accept fewer new patients and tend to work shorter hours. However, many continue to practice well beyond 70 years of age.

Places of Employment

About 17,000 osteopathic physicians practiced in the United States in 1978. Almost 85 percent of the active osteopathic physicians were in private practice. A small number were full time staff or faculty members of osteopathic hospitals and colleges, private industry, or government agencies.

Osteopathic physicians are located chiefly in those States that have osteopathic hospital facilities. In 1978, three-fifths of all osteopathic physicians were in Florida, Michigan, Pennsylvania, New Jersey, Ohio, Texas, and Missouri. Twenty-one States and the



Osteopathic physicians are particularly concerned about problems involving the muscles and bones.

District of Columbia each had fewer than 50 osteopathic physicians. More than half of all general practitioners are located in towns and cities having fewer than 50,000 people; specialists, however, practice mainly in large cities.

Training and Other Qualifications

All 50 States and the District of Columbia require a license to practice osteopathic medicine. To obtain a license, a candidate must be a graduate of an approved school of osteopathic medicine and pass a State board examination. In four States, candidates must pass an examination in the basic sciences before they are eligible to take the professional examination; 38 States and the District of Columbia also require a period of internship in an approved hospital after graduation from an osteopathic school. The National Board of Osteopathic Examiners also gives an examination which is accepted by most States as a substitute for State examination. Most States grant licenses without further examination to osteopathic physicians already licensed by another State.

The minimum educational requirement for entry to one of the schools of osteopathic medicine is 3 years of college work, but in practice almost all osteopathic students have a bachelor's degree. Preosteopathic education must include courses in chemistry, physics, biology, and English. Osteopathic colleges require successful completion of 3 to 4 years of professional study for the degree of Doctor of Osteopathy (D.O.). During the first half of professional training, emphasis is placed on basic sciences, such as anatomy, physiology, and pathology, and on the principles of osteopathy; the remainder of the time is devoted largely to experience with patients in hospitals and clinics.

After graduation, nearly all doctors of osteopathic medicine serve a 12-month internship at 1 of the 90 osteopathic hospitals approved by the American Osteopathic Association for intern or residency training. Those who wish to specialize must have 2 to 5 years of additional training.

The osteopathic physician's lengthy training is very costly. Federal and private loans are available to help students meet these costs. In addition, scholarships are available to qualified applicants who agree to a minimum of 2 years' Federal service after graduation.

In 1979, there were 14 schools of osteopathic medicine. Schools admit students on the basis of their college grades, scores on the required New Medical College Admissions Test, and recommendations from premedical college counselors. The applicant's desire to serve as an osteopathic physician rather than as a doctor trained in other fields of medicine is a very important qualification. Colleges also give considerable weight to a favorable recommendation by an osteopathic physician familiar with the applicant's background.

Newly qualified doctors of osteopathic medicine usually establish their own practice, although a growing number enter group practice. Some work as assistants to experienced physicians or join the staff of osteopathic or allopathic (M.D.) hospitals. In view of the variation in State laws, persons who wish to become osteopathic physicians carefully should study the professional and legal requirements of the State in which they plan to practice. The availability of osteopathic hospitals and clinical facilities also should be considered.

Persons who wish to become osteopathic physicians must have a strong desire to pursue this career above all others. They must be willing to study a great deal throughout their career in order to keep up with the latest advances in osteopathic medicine. They should exhibit leadership, emotional stabiliy, and self-confidence. A pleasant personality, friendliness, patience, and the ability to deal with people also are important.

Employment Outlook

Opportunities for osteopathic physicians are expected to be favorable through 1980's. Many localities are without medical practitioners of any kind; many more have few or no osteopathic physicians. In addition, many new osteopaths will be needed to replace those who retire or die. The greatest demand probably will continue to be in States where osteopathic medicine is a widely known and accepted method of treatment, such as Pennsylvania, Florida, and several Midwestern States. Generally, prospects for beginning a successful practice are likely to be best in rural areas, small towns, and city suburbs, where young doctors of osteopathy may establish their professional reputations more easily than in the large cities.

The osteopathic profession is expected to grow faster than the average for all occupations through the 1980's because of general population growth and the rising proportion of elderly persons, the establishment of additional osteopathic hospital facilities, and the extension of prepayment programs for hospitalization and medical care including Medicare and Medicaid.

Earnings

In osteopathic medicine, as in many of the other health professions, incomes usually rise markedly after the first few years of practice. Earnings of individual practitioners are determined mainly by ability, experience, geographic location, and the income level of the community served. Graduates who had completed an approved 3-year residency but had no other experience received a starting salary at a Veterans Administration hospital of about $32,500 a year in 1979. In addition, those who worked full time received up to $7,000 in other cash benefits or "special" payments. In general, the income earned by D.O.s compares favorably with other professions. Specialists usually earn higher incomes than general practitioners.

Related Occupations

Osteopathic physicians work to prevent, diagnose, and treat diseases, disorders, and injuries. Other occupations that require the exercise of similar critical judgments include: Audiologist, chiropractor, dentist, optometrist, physician, podiatrist, speech pathologist, and veterinarian.

Sources of Additional Information

People who wish to practice in a given State should find out about the requirements for licensure directly from the board of examiners of that State. Information on Federal scholarships and loans is available from the director of student financial aid at the individual schools of osteopathy. For a list of State boards, as well as general information on osteopathy as a career, contact:

American Osteopathic Association, Department of Public Relations, 212 East Ohio St., Chicago, Ill. 60611.

American Association of Colleges of Osteopathic Medicine, 4720 Montgomery Lane, Washington, D.C. 20014.

Physicians

(D.O.T. 070.061-010 through .107-014)

Nature of the Work

Physicians perform medical examinations, diagnose diseases, and treat people who are suffering from injury or disease. They also advise patients on how to prevent disease and keep fit through proper diet and exercise. Physicians generally work in their own offices and in hospitals, but they also may visit patients in their homes or in nursing homes.

A decreasing percentage of the physicians who provide patient care are general practitioners (about 15 percent in 1978); most specialize in 1 of about 40 fields for which there is postgraduate training. The largest specialties are internal medicine, general surgery, obstetrics and gynecology, psychiatry, pediatrics, radiology, anesthesiology, ophthalmology, pathology, and orthopedic surgery. The most rapidly growing specialties are in the primary care area—family practice, internal medicine, obstetrics-gynecology, and pediatrics.

Some physicians combine the practice of medicine with research or teaching in medical schools. Others hold full-time research or teaching positions or perform administrative work in hospitals, professional associations, and other organizations. A few are primarily engaged in writing and editing medical books and magazines.

Working Conditions

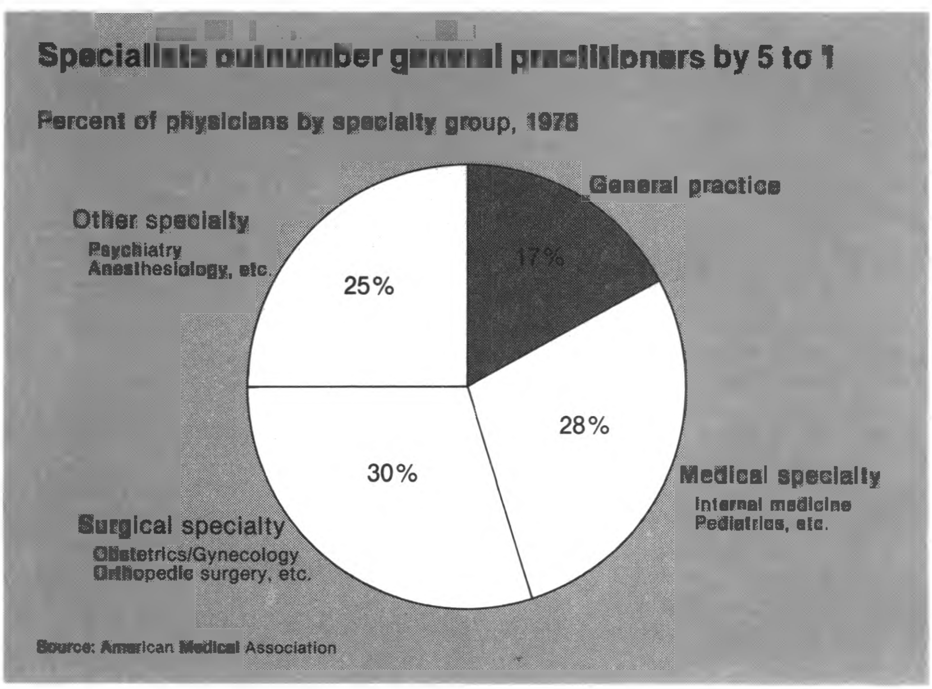
Many physicians have long working days and irregular hours. Most specialists work fewer hours each week than general practitioners. As doctors grow older, they may accept fewer new patients and tend to work shorter hours. However, many continue in practice well beyond 70 years of age.

Place of Employment

About 385,000 physicians were professionally active in the United States in 1978—almost 9 out of 10 providing patient care services. About 220,000 of these had office practices; more than 105,000 others worked as residents or full-time staff member in hospitals. The remaining physicians—more than 32,000—taught or performed administrative or research duties.

In 1978, 10,000 graduates of foreign medical schools served as hospital residents in this country. To be appointed to approved residencies in U.S. hospitals, alien graduates of foreign medical schools must pass the Visa Qualifying Examination offered by the Educational Commission for Foreign Medical Graduates.

The Northeastern States have the highest ratio of physicians to population and the Southern States the lowest. Because physicians have tended to locate in urban areas, close to hospital and educational centers, many rural areas have been underserved by medical personnel. Currently, more medical students are being exposed to practice in rural communities with the direct support of educational centers and hospitals in more populous areas. In addition, some rural areas offer physicians guaranteed minimum incomes to offset the relatively low earnings typical in rural medical practice.



Training and Other Qualifications

All States, the District of Columbia, and Puerto Rico require a license to practice medicine. Requirements for licensure include graduation from an accredited medical school, successful completion of a licensing examination, and, in most States, a period of 1 or 2 years in an accredited graduate medical education program (residency). The licensing examination taken by most graduates of U.S. medical schools is the National Board of Medical Examiners (NBME) test that is accepted by all States except Texas. Graduates of foreign medical schools as well as graduates of U.S. medical schools who have not taken the NBME test must take the Federation Licensure Examination (FLEX) that is accepted by all jurisdictions. Although physicians licensed in one State usually can get a license to practice in another without further examination, some States limit this reciprocity.

In 1978, there were 124 accredited schools in the United States in which students could begin the study of medicine. Of these, 123 awarded the degree of Doctor of Medicine (M.D.); 1 school offered a 2-year program in the basic medical sciences to students who could then transfer to another medical school for the last semesters of study.

The minimum educational requirement for entry to a medical school is 3 years of college; some schools require 4 years. A few medical schools allow selected students who have exceptional qualifications to begin their professional study after 2 years of college. Most students who enter medical schools have a bachelor's degree.

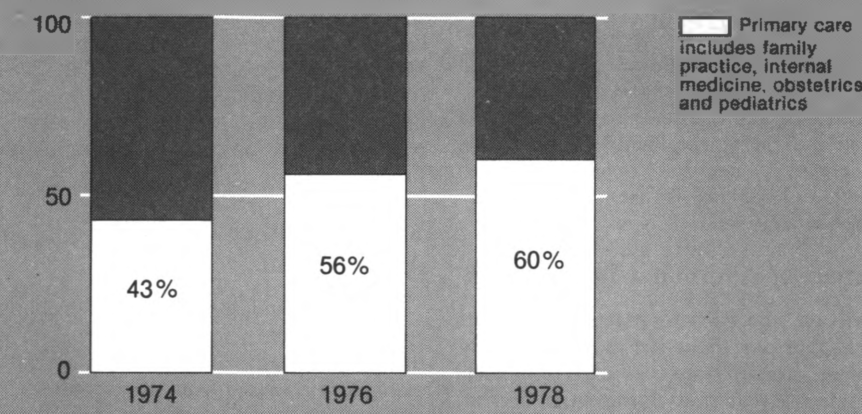
Required premedical study includes undergraduate work in English, physics, biology, and inorganic and organic chemistry. Students also should take courses in the humanities, mathematics, and the social sciences to acquire a broad general education.

Medicine is a popular field of study, and competition for entry to medical school is intense. In 1978, there were about 40,500 applicants for only 16,000 positions. Almost all of those accepted had premedical college grades averaging "B" or better. Other factors considered by medical schools in admitting students include their scores on the New Medical College Admission Test, which is taken by almost all applicants. Consideration also is given to the applicant's character, personality, and leadership qualities, as shown by personal interviews, letters of recommendation, and extracurricular activities in college. Many State-supported medical schools give preference to residents of their particular State and, sometimes, those of nearby States.

Most medical students take 4 years to complete the curriculum for the M.D. de-

In a reversal of earlier patterns, more new medical graduates now enter residencies in primary care than in the highly specialized areas of medicine

Percent of first-year residencies



Source: American Medical Association

gree. Some schools, however, allow students who have demonstrated outstanding ability to follow a shortened curriculum, generally lasting 3 years. A few schools offer the M.D. degree within 6 years of high school graduation.

The first semesters of medical school are spent primarily in laboratories and classrooms, learning basic medical sciences such as anatomy, biochemistry, physiology, pharmacology, microbiology, and pathology. Additionally, students gain some clinical experience with patients during the first 2 years of study, earning to take case histories, perform examinations, and recognize diseases. During the last semesters, students spend the majority of their time in hospitals and clinics under the supervision of clinical faculty, where they become experienced in the diagnosis and treatment of illness.

After graduating from medical school, almost all M.D.'s serve a 1- or 2-year residency. Those planning to work in general practice often spend an additional year in a hospital residency. Those seeking certification in a specialty spend from 2 to 4 years—depending on the specialty—in advanced residency training, followed by 2 years of practice or more in the specialty. Then they must pass the specialty board examinations. Some physicians who want to teach or do research take graduate work leading to a master's or Ph. D. degree in a field such as biochemistry or microbiology.

Medical training is very costly because of the long time required to earn the medical degree. However, financial assistance in the form of loans and scholarships is available primarily from the Federal Government, and to a lesser extent from State and local government and private sources. Some of this aid requires the student to commit a minimum of 2 years' time to Federal service upon graduation and/or to establish financial need.

Persons who wish to become physicians must have a strong desire to serve the sick and injured. They must be willing to study a great deal in order to keep up with the latest advances in medical science. Sincerity and a pleasant personality are assets that help physicians gain the confidence of patients. Physicians also should be emotionally stable and able to make decisions in emergencies.

The majority of newly qualified physicians open their own offices or join associate or group practices. Those who have completed 1 year of graduate medical education (a 1-year residency) and enter active military duty initially serve as captains in the Army or Air Force or as lieutenants in the Navy. Graduates of medical schools are eligible for commissions as senior assistant surgeons in the U.S. Public Health Service, with a salary equivalent to that of an Army captain. Graduates also qualify for Federal Civil Service professional medical positions.

Employment Outlook

The employment outlook for physicians is expected to be favorable through the 1980's. However, medical school enrollments increased dramatically during the 1970's, and these graduates, combined with foreign medical graduates seeking to practice here, will greatly improve the supply of physicians. Moreover, a greater percentage of new medical graduates are entering the primary care specialties, and this may help alleviate a critical shortage in many localities. With more physicians in primary care there may be an increasing movement of physicians into rural and other areas that have experienced shortages in the past.

Growth in population will create much of

One of the fastest growing medical specialties is family practice.

the need for more physicians, and a larger percentage of the population will be in the age group over 65, which uses more physicians' services. Also, the effective demand for physicians' care will increase because of greater ability to pay, resulting from extension of prepayment programs for hospitalization and medical care, including Medicare and Medicaid, and continued Federal Government provision of medical care for members of the Armed Forces, their families, and veterans. In addition, more physicians will be needed for medical research and for the growing fields of public health, rehabilitation, industrial medicine, and mental health.

To some extent, the rise in the demand for physicians' services will be offset by developments that will enable physicians to care for more patients. For example, increasing numbers of medical technicians are assisting physicians; new drugs and new medical techniques are shortening illnesses; and growing numbers of physicians are using their time more effectively by engaging in group practice. The use of physicians' assistants and nurse practitioners also may increase the productivity of physicians.

Although the expected increase in the number of phyisians and in the productivity is likely to result in greater availability of medical care, new physicians should have little difficulty establishing a practice.

Earnings

Stipends of medical school graduates serving as residents in hospitals vary according to the type of residency, geographic area, and size of the hospital, but allowances of $13,000 to $14,000 a year are common. Many hospitals also provide full or partial room, board, and other maintenance allowances to their residents.

Graduates who had completed approved 3-year residencies but had no other medical experience, received a starting salary at Veterans' Administration hospitals of about $32,500 a year in 1979. In addition, those working full time received up to $7,000 in other cash benefits or "special" payments.

Newly qualified physicians who establish their own practice must make a sizable financial investment to equip a modern office. During the first year or two of independent practice, physicians probably earn little more than the minimum needed to pay expenses. As a rule, however, their earnings rise rapidly as their practices develop.

Physicians have the highest average annual earnings of any occupational group. A survey of private, office-based M.D.'s, conducted by *Medical Economics* magazine, reported a median net income of $65,400 in 1977. Historically, most specialists, such as radiologists and surgeons, have earned much more than family or general practitioners. However, earnings of family practitioners in recent years have risen sharply. The average of family practitioners' incomes was 90 percent of that for general surgeons in 1977. Earnings of physicians depend on factors such as the region of the country in which they practice; the patients' income levels; and the physicians' skills, personality, and professional reputation, as well as the length of experience. Self-employed physicians usually earn more than those in salaried positions.

Related Occupations

Physicians work to prevent, diagnose, and treat diseases, disorders, and injuries. Other occupations that require similar kinds of skill and critical judgment include audiologists, chiropractors, dentists, optometrists, osteopathic phsyicians, podiatrists, speech pathologists, and veterinarians.

Sources of Additional Information

Persons who wish to practice in a State should find out about the requirements for licensure directly from the board of medical examiners of that State. Information on Federal scholarships and loans is available from the directors of student financial aid at medical schools. For a list of approved medical schools, as well as general information on premedical education, financial aid, and medicine as a career, contact:

Council on Medical Education, American Medical Association, 535 N. Dearborn St., Chicago Ill. 60610.

Association of American Medical Colleges, Suite 200, One Dupont Circle, NW., Washington, D.C. 20036.

Podiatrists

(D.O.T. 079.101-022)

Nature of the Work

Podiatrists diagnose and treat diseases and deformities of the foot. They perform surgery, fit corrective devices, and prescribe drugs, physical therapy, and proper shoes. To help in diagnoses, they take X-rays and perform or prescribe blood and other pathological tests. Podiatrists treat a variety of foot conditions, including corns, bunions, calluses, ingrown toenails, skin and nail diseases, deformed toes, and arch disabilities. Whenever podiatrists find symptoms of a medical disorder affecting other parts of the body—arthritis, diabetes, or heart disease, for example—they refer the patient to a physician while continuing to treat the foot problem.

Some podiatrists specialize in foot surgery, orthopedics (bone, muscle, and joint disorders), podopediatrics (children's foot ailments), or podogeriatrics (foot problems of the elderly). However, more than four of every five are generalists, who provide all types of foot care.

Working Conditions

Podiatrists usually work independently in their own offices. Their workweek is generally 40 hours, and they may set their hours to suit their practice.

Places of Employment

Of the 8,100 podiatrists active in 1978, the majority were located in large cities. Those who had full-time salaried positions worked mainly in hospitals, podiatric medical colleges, or for other podiatrists. The Veterans' Administration and public health departments employ podiatrists on either a full- or part-time basis. Others serve as commissioned officers in the Armed Forces.

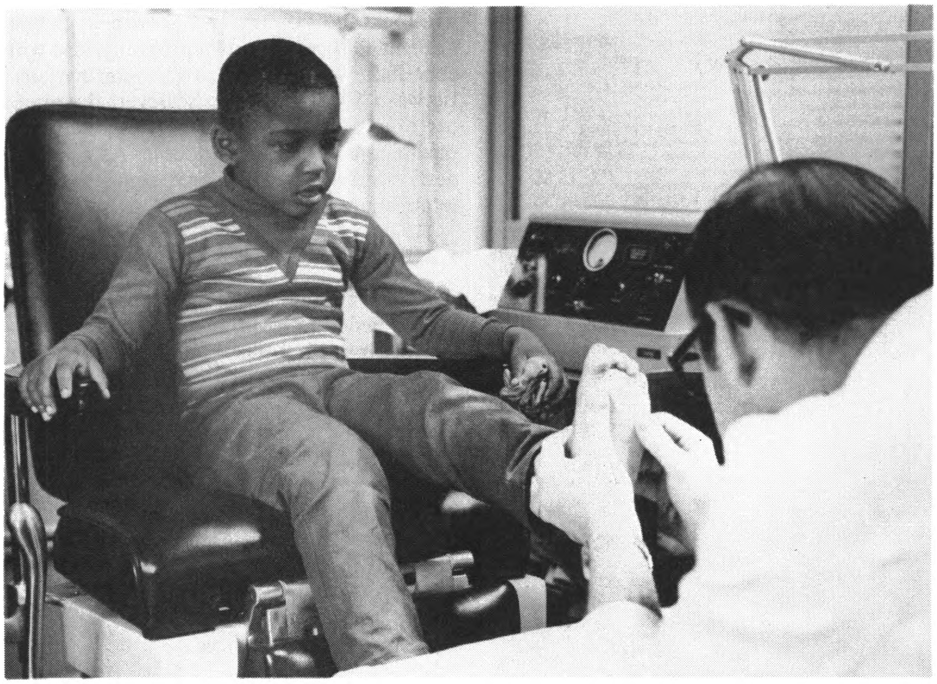
Training, Other Qualifications, and Advancement

All States and the District of Columbia require a license for the practice of podiatry. To qualify for a license, an applicant must graduate from an accredited college of podiatric medicine and pass a written and oral State board proficiency examination. Four States—Georgia, Michigan, New Jersey, and Rhode Island—also require applicants to serve a 1-year residency in a hospital or clinic after graduation. Three-fourths of the States grant licenses without further examination to podiatrists licensed by another State.

The five colleges of podiatric medicine are located in California, Illinois, New York, Pennsylvania, and Ohio. Minimum entrance requirements at these schools include 3 years of college work with courses in English, chemistry, biology or zoology, physics, and mathematics. Competition for entry to these schools is strong, however, and most entrants surpass the minimum requirements. About 90 percent of the class entering in 1978 held at least a bachelor's degree, and the average enrollee had an overall grade point average of 'B' or better. All colleges of podiatric medicine require applicants to take the New Medical College Admissions Test. Of the 4 years in podiatry school, the first 2 are spent in classroom instruction and laboratory work in anatomy, bacteriology, chemistry, pathology, physiology, pharmacology, and other basic sciences. During the final 2 years, students obtain clinical experience while continuing their academic studies. The degree of Doctor of Podiatric Medicine (D.P.M.) is awarded upon graduation. Additional education and experience generally are necessary to practice in a specialty. Federal, State, and private loans are available for needy students to pursue full-time study leading to a degree in podiatric medicine.

Persons planning a career in podiatry should have scientific aptitude and manual dexterity, and like detailed work. A good business sense and congeniality also are assets in the profession.

Most newly licensed podiatrists set up their own practices. Some purchase established practices, or obtain salaried positions to gain the experience and money they need to begin their own.



Podiatrists diagnose and treat foot problems.

Employment Outlook

Opportunities for graduates to establish new practices, as well as to enter salaried positions, should be favorable through the 1980's.

Employment of podiatrists is expected to grow faster than the average for all occupations as podiatry gains recognition as a healing art and as an expanding population demands more health services. The growing number of older people who need foot care and who are entitled to certain podiatrists' services under Medicare also is expected to spur demand.

Earnings

Newly licensed podiatrists build their practices over a number of years. Income during the first several years is low but generally rises significantly as the practice grows. A net income of over $40,000 a year is common for established podiatrists. Newly licensed podiatrists hired by Veterans' Administration hospitals earned starting salaries between $19,263 and $25,041 in 1978.

Related Occupations

Podiatrists work to prevent, diagnose, and treat human foot diseases, disorders, and injuries. Other occupations that require similar skills include audiologists, chiropractors, dentists, optometrists, osteopathic physicians, physicians, speech pathologists, and veterinarians.

Sources of Additional Information

Information on license requirements in a particular State is available from that State's board of examiners in the State capital.

Information on colleges of podiatric medicine, entrance requirements, curriculums, and student financial aid is available from:

American Association of Colleges of Podiatric Medicine, 20 Chevy Chase Circle, NW., Washington, D.C. 20015.

For additional information on podiatry as a career, contact:

American Podiatry Association, 20 Chevy Chase Circle, NW., Washington, D.C. 20015.

Veterinarians

(D.O.T. 073. except .361-010)

Nature of the Work

Veterinarians (doctors of veterinary medicine) diagnose, treat, and control diseases and injuries among animals. They help prevent the outbreak and spread of animal diseases, many of which can be transmitted to human beings.

Veterinarians treat animals in hospitals and clinics or on farms and ranches. They perform surgery on sick and injured animals and prescribe and administer drugs, medicines, and vaccines.

Veterinary medicine offers a variety of practice specialties. Over one-third of all veterinarians treat small animals or pets exclusively. About one-third treat both large and small animals. A large number specialize in the health and breeding of cattle, poultry, sheep, swine, or horses. Many veterinarians inspect meat, poultry, and other foods as part of Federal and State public health programs. Still others teach in veterinary colleges, do research related to animal diseases, foods, and drugs, or work as part of a medical research team to learn about prevention and treatment of human disease.

Working Conditions

Veterinarians sometimes may be exposed to danger of injury, disease, and infection. Those in private practice often have long and irregular working hours. Veterinarians in rural areas may have to work outdoors in all kinds of weather. Because they are self-employed, veterinarians in private practice usually can continue working well beyond normal retirement age.

Places of Employment

There were about 33,500 veterinarians active in 1978—most in private practice. The Federal Government employed about 2,450 veterinarians, chiefly in the U.S. Department of Agriculture and the U.S. Public Health Service. About 675 more were commissioned officers in the veterinary services of the Army and Air Force. Other employers of veterinarians are State and local government agencies, international health agencies, colleges of veterinary medicine, medical schools, research and development laboratories, large livestock farms, animal food companies, and pharmaceutical companies that manufacture drugs.

Veterinarians are located in all parts of the country, and the type of practice generally varies according to geographic setting. Veterinarians in rural areas mainly treat farm animals; those in small towns usually engage in general practice; those in cities and suburban areas often limit their practice to pets.

Training, Other Qualifications, and Advancement

All States and the District of Columbia require veterinarians to have a license. To obtain a license, applicants must have a Doctor of Veterinary Medicine (D.V.M. or V.M.D.) degree from an accredited college of veterinary medicine and pass written and—in 29 States—oral State board proficiency examinations. Some States issue licenses without further examination to veterinarians already licensed by another State.

For positions in research and teaching, an additional master's or Ph. D. degree usually is required in a field such as pathology, physiology, or bacteriology.

The D.V.M. or V.M.D. degree requires a minimum of 6 years of college consisting of a 4-year professional degree program, preceded by at least 2 years of preveterinary study that emphasizes the physical and biological sciences. Several veterinary medical colleges require 3 years of preveterinary work, however, and most applicants have completed 3 to 4 years of college before entering the professional programs. In addition to rigorous academic instruction, professional training includes considerable practical experience in diagnosing and treating animal diseases, performing surgery,

Over one-third of all veterinarians treat small animals or pets.

and performing laboratory work in anatomy, biochemistry, and other scientific and medical subjects.

In 1978, there were 22 colleges of veterinary medicine accredited by the Council on Education of the American Veterinary Medical Association. Admission to these schools is highly competitive. Each year there are many more qualified applicants than the schools can accept. Serious applicants usually need grades of "B" or better, especially in science courses. Experience in part-time or summer jobs working with animals is advantageous. Colleges usually give preference to residents of the State in which the college is located, because these schools are largely State supported. In the South and West, regional educational plans permit cooperating States without veterinary schools to send students to designated regional schools. In other areas, colleges that accept a certain number of students from other States usually give priority to applicants from nearby States that do not have veterinary schools.

Federal funds provide a limited number of loans for students who want to pursue full-time study leading to the degree of Doctor of Veterinary Medicine.

Most veterinarians begin as employees or partners in established practices. A few start their own practices with a modest financial investment in drugs, instruments, and an automobile. With a more substantial investment, one may open an animal hospital or purchase an established practice.

Newly qualified veterinarians may enter the Army or Air Force as commissioned officers, or qualify for Federal positions as meat and poultry inspectors, disease-control workers, epidemiologists, research assistants, or commissioned officers in the U.S. Public Health Service. A license is not required for Federal employment.

Employment Outlook

Veterinary employment is expected to grow faster than the average for all occupations through the 1980's, primarily because of growth in the companion animal (horses, dogs, and other pets) population. Emphasis on scientific methods of raising and breeding livestock and poultry and growth in public health and disease control programs also will contribute to the demand for veterinarians. Between 1970 and 1990, however, the number of graduates from schools of veterinary medicine is expected to double. As a result, new veterinarians may face competition in establishing practices in some areas.

Earnings

Newly graduated veterinarians employed by the Federal Government started at $18,000 a year in 1979. The average annual salary of veterinarians in the Federal Government was $27,300 in 1978. The incomes of veterinarians in private practice vary considerably, depending on factors such as location, type of practice, and years of experience, but usually are higher than those of other veterinarians. According to the limited data available, the average income of private practitioners was almost $33,000 in 1978.

Related Occupations

Veterinarians work to prevent, diagnose, and treat animal diseases, disorders, and injuries. Other occupations that require similar skills include audiologists, chiropractors, dentists, optometrists, osteopathic physicians, physicians, podiatrists, and speech pathologists.

Sources of Additional Information

A pamphlet entitled *Today's Veterinarian* presents additional information on veterinary medicine as a career, as well as a list of colleges of veterinary medicine. A free copy may be obtained by submitting a request, together with a self-addressed stamped business size envelope, to:

American Veterinary Medical Association, 930 N. Meacham Rd., Schaumburg, Ill. 60196.

Information on opportunities for veterinarians in the U.S. Department of Agriculture is available from:

Animal and Plant Health Inspection Service, Personnel Division, 123 E. Grant St., Minneapolis, Minn. 55403

Food Safety and Quality Service, Personnel Director, 123 E. Grant St., Minneapolis, Minn. 55403.

Students seeking loan or scholarship assistance should send inquiries to the schools in which they are interested.

Medical Technologist, Technician, and Assistant Occupations

Many of the occupations discussed in this section were developed to relieve highly trained professionals of their less complicated and routine duties: *Optometric assistants*, for example, give preliminary eye examinations and help patients do prescribed eye exercises in order to free optometrists and ophthalmologists for more demanding professional duties.

Other medical technician jobs have emerged to meet a previously unfilled need for medical care in situations where physicians and registered nurses are unavailable. Emergency medical technicians, for example, provide medical attention at the site of a fire, automobile accident, or other emergency.

The development of sophisticated diagnostic tools and techniques for treatment, brought about by advances in medical science and technology, also has created the need for workers such as *electrocardiograph technicians,* who operate equipment that monitors a patient's heart action, and *electroencephalographic technicians,* who operate equipment that monitors the electrical activity of a patient's brain.

Medical record technicians and clerks process the large volume of medical records generated daily in hospitals and nursing homes.

This section deals in detail with nine health occupations that are technical or clerical in nature.

Electrocardiograph Technicians

(D.O.T. 078.362-018)

Nature of the Work

Electrocardiograms (EKG's) are graphic heartbeat tracings produced by an instrument called an electrocardiograph. These tracings record the electrical changes that occur during a heartbeat. Physicians use electrocardiograms to diagnose irregularities in heart action and to analyze changes in the condition of a patient's heart over a period of time. Some physicians order electrocardiograms as a routine diagnostic procedure for persons who have reached a specified age. Electrocardiograms are required as part of preemployment physical examinations for people in many fields. In some cases, the tests also are used if surgery is to be performed.

At the request of a physician, electrocardiograms can be recorded in a doctor's office, in the EKG department of a hospital, or at the patient's bedside, since the equipment is mobile. The technician straps electrodes to specified parts of the patient's body, manipulates switches of the electrocardiograph, and repositions electrodes across the patient's chest. The technician must know the anatomy of the chest and heart to properly select the exact locations for the chest electrodes, since the wrong selection may yield an inaccurate diagnosis. The test may be given while the patient is at rest, or in association with mild exercise.

The electrocardiograph records a "picture" of the patient's heart action on a continuous roll of paper. The technician then prepares the electrocardiogram for analysis by a physician, usually a heart specialist. Technicians must be able to recognize and correct any technical errors, such as crossed wires or electrical interference, that prevent an accurate reading. They also must call the doctor's attention to any significant deviations from the norm.

EKG technicians sometimes conduct other tests such as vectorcardiograms, which are multi-dimensional traces; stress testing (exercise tests); pulse recordings; and Holter monitoring and scanning, which is a 12- to 24-hour recording of the EKG on magnetic tape. In addition, some technicians schedule appointments, type doctors' diagnoses, maintain patients' EKG files, and care for equipment.

Working Conditions

Unless they are involved in an emergency case, EKG technicians usually work in a relaxed atmosphere. A lot of their time is spent on their feet. They work directly with patients and therefore must be able to relate well to many kinds of people.

Places of Employment

Nearly 20,000 persons worked as electrocardiograph technicians in 1978. Most EKG technicians worked in cardiology departments of large hospitals. Others worked part time in small general hospitals where workloads are usually not great enough to demand full-time technicians. Some worked full or part time in clinics and cardiologists' offices.

Training, Other Qualifications, and Advancement

Generally, EKG technicians are trained on the job. Training—usually conducted by an EKG supervisor or a cardiologist—lasts up to 1 month for the basic EKG tests and up to 1 year for the more complex ones. Formal training programs varying in length from 1 to 2 years are offered in vocational schools and junior and community colleges. The American Cardiology Technologists Association recognizes six of these programs. Training also is available in the Armed Forces. Generally, the minimum educational requirement for the job is high school graduation. Among high school courses that are recommended for students interested in this field are health, biology, and typing. Familiarity with medical terminology also is helpful and can be acquired in classes on human anatomy and physiology and by studying a medical dictionary.

Persons who want to become EKG technicians should have mechanical aptitude, the ability to follow detailed instructions, presence of mind in emergencies, reliability, and patience.

Because EKG technician is the entry level position in the field of cardiovascular technology, there are good opportunities for advancement. With the proper training and experience, EKG technicians can advance to monitor technicians, cardiovascular technicians, cardiopulmonary technicians, and cardiology technologists. Promotion to supervisory positions also is possible.

Employment Outlook

Employment of EKG technicians is expected to grow faster than the average for all occupations through the 1980's as a result of general population growth, greater health consciousness, and expansion of prepayment programs that make it easier for people to pay for health and medical care. Demand for technicians also should increase due to the rising proportion of older persons, the segment of the population requiring the most heart tests.

In addition to job openings resulting from growth, new EKG technicians will be needed to replace workers who die, retire, or leave the field for other reasons. Because the occupation is quite small, however, there will be relatively few openings. Technicians with formal training should find favorable prospects. Persons without this training, however, may face competition.

Earnings

EKG technicians employed in hospitals, medical schools, and medical centers earned starting salaries of about $7,800 a year in 1978, according to a survey conducted by the

To take an electrocardiogram, the EKG technician attaches electrodes to the patient's body.

University of Texas Medical Branch. Experienced EKG technicians, in some cases, earned as much as $15,100 a year.

Inexperienced EKG technicians with the Federal Government earned $8,366 a year in early 1979; a few experienced technicians earned as much as $15,222 a year. Usually, EKG technicians earn about as much as the average for all nonsupervisory workers in private industry, except farming.

In general, those EKG technicians with previous formal training earn higher starting salaries than those who learn on the job. Also, EKG technicians who perform more sophisticated tests are paid more than those who perform only basic ones.

EKG technicians in hospitals receive the same fringe benefits as other hospital personnel, including hospitalization, vacation, and sick leave benefits. Some institutions provide tuition assistance or free education courses, pension programs, and uniforms. Technicians generally work a 40-hour week, which may include Saturdays and Sundays. Those working in hospitals also may be required to work evening hours.

Related Occupations

Some other occupations requiring operation of technical equipment to test a patient's medical condition include electroencephalographic (EEG) technologists and technicians, radiologic (X-ray) technologists, and medical laboratory workers.

Sources of Additional Information

Local hospitals can supply information about employment opportunities. For additional information about the work of EKG technicians, contact:

American Hospital Association, 840 North Lake Shore Dr., Chicago, Ill. 60611.

Electroencephalographic Technologists and Technicians

(D.O.T. 078.362-022)

Nature of the Work

The field of electroencephalography (EEG) is concerned with recording and studying the electrical activity of the brain. A special instrument, the electroencephalograph, records this activity, producing a written tracing of the brain's electrical impulses. This record of brain waves is called an electroencephalogram.

Various kinds of brain diseases can be diagnosed by neurologists and other qualified medical practitioners with the use of EEG. Electroencephalograms are taken for patients suspected of having brain tumors, strokes, or epilepsy. The consequences of infectious diseases on the brain can be measured with EEG. Electroencephalograms may be taken of children with serious adjustment problems or learning difficulties to discover any organic basis for these problems. EEG also may be used prior to vital organ transplant operations, to help determine whether the potential donor is dead or alive.

The people who operate EEG equipment are known as EEG technicians and technologists. The main job of an EEG technician is to produce electroencephalograms, under the supervision of an EEG technologist or an electroencephalographer (a physician specializing in electroencephalography). Before doing this job, the technician takes a simplified medical history of the patient and helps the patient relax for the test. The technician then applies the electrodes of the electroencephalograph to designated spots on the patient's head and makes sure that the machine is working well. The technician chooses the most appropriate combinations of instrument controls and electrodes to produce the kind of record needed. EEG technicians must be able to recognize and correct any artifacts that appear (an artifact is an electrical or mechanical event that comes from somewhere other than the brain). If there are any mechanical problems with the electroencephalograph, the technician must advise his or her supervisor, so that the machine can be repaired promptly. EEG technicians also need a basic understanding of the kinds of medical emergencies that can occur in laboratories to be able to react properly if an emergency arises. For example, if a patient suffers an epileptic seizure, the EEG technician must take the proper action.

EEG technologists usually perform all the duties of EEG technicians but have a more thorough understanding of all aspects of EEG work. Thus they can apply specific EEG techniques to the particular requirements of a patient. Technologists also may use EEG equipment in conjunction with other electrophysiologic monitoring devices, such as a tape recorder. They also can repair the equipment if it is not working properly. After producing an EEG recording, the technologist writes a descriptive report to accompany it for use by electroencephalographers.

Part of an EEG technologist's job is to supervise EEG technicians. Besides direct supervision during EEG recordings, this includes such things as arranging work schedules and teaching EEG techniques. Technologists often have administrative responsibilities, such as managing the laboratory, keeping records, scheduling appointments, and ordering supplies.

Working Conditions

EEG technologists and technicians usually work in clean, well-lighted surroundings. About half of their time on duty is spent on their feet and a lot of bending over is necessary. The main hazards result from possible electrical shocks from faulty equipment and physical harassment from unruly patients.

Places of Employment

About 7,000 persons worked as electroencephalographic technologists and technicians in 1978. Although EEG personnel work primarily in the neurology departments of hospitals, many work in private offices of neurologists and neurosurgeons.

Training, Other Qualifications, and Advancement

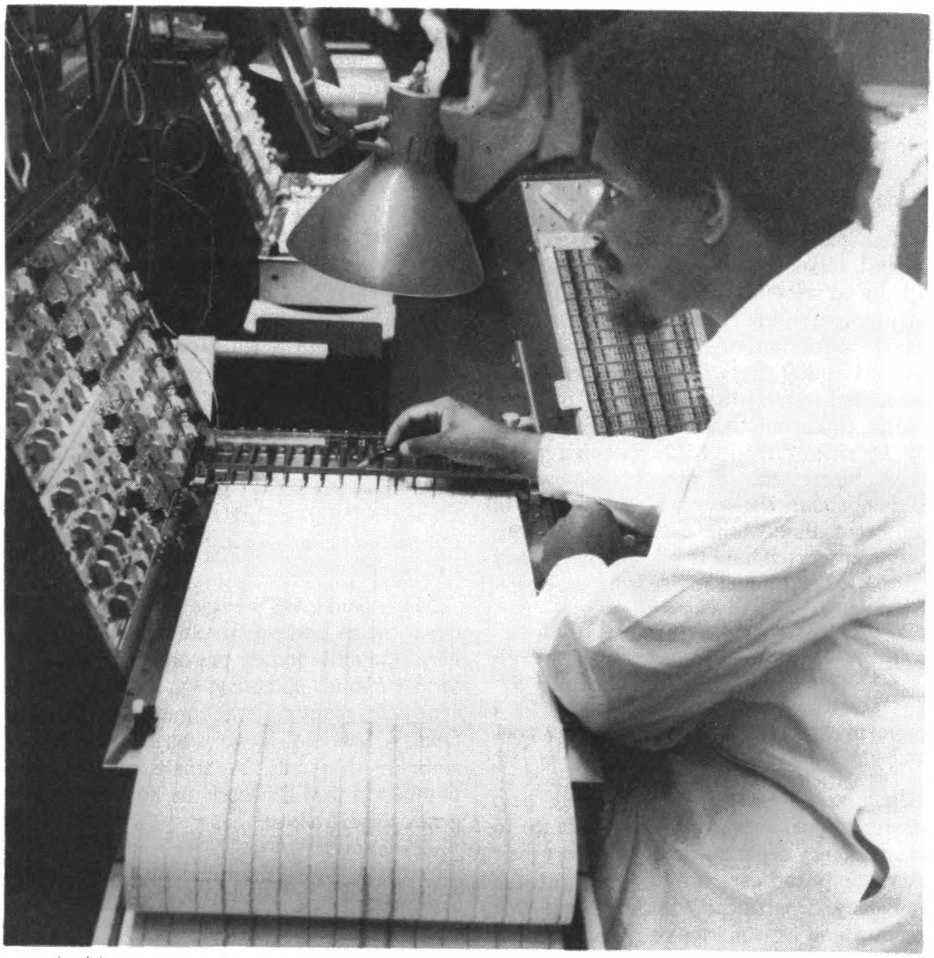
Most EEG technicians working in 1978 were trained on the job by experienced EEG personnel. However, with advances in medical technology, electroencephalograph equipment has become increasingly more sophisticated, requiring technicians with more training.

In 1978, there were 27 formal training programs for EEG technologists and technicians, 12 of which were approved by the American Medical Association's Committee on Allied Health Education and Accreditation. These formal programs usually last from 1 to 2 years and include laboratory experience as well as classroom instruction in neurology, anatomy, neuroanatomy, physiology, neurophysiology, clinical and internal medicine, psychiatry, and electronics and instrumentation. They are carried on in colleges, junior colleges, medical schools, hospitals, and vocational or technical schools.

EEG personnel who have 1 year of training and 1 year of laboratory experience, and who successfully complete a written and oral examination administered by the American Board of Registration of Electroencephalograph Technologists (ABRET), are designated "Registered EEG Technologist" (R.EEG T.). Although not a requirement for employment, registration by ABRET is acknowledgment of a technologist's qualifications and makes better paying jobs easier to obtain.

Persons who want to enter this field should have manual dexterity, good vision, an aptitude for working with electronic equipment, and the ability to work with patients as well as with other members of the hospital team. High school students considering a career in this occupation should take courses in health and biology.

Some EEG technicians in large hospitals can advance to chief EEG technologist and take on increased responsibilities in laboratory management and in teaching basic techniques to new personnel. Chief EEG technologists are supervised by an electroencephalographer, or a neurologist or neurosurgeon.



Because of the serious nature of their work, electroencephalographic technologists and technicians must stay alert on the job.

Employment Outlook

Employment of EEG technologists and technicians is expected to grow much faster than the average for all occupations due to the increased use of EEG's in surgery, in diagnosing and monitoring patients with brain disease, and in research on the human brain. Contributing to the overall increase in health services and the need for EEG technologists and technicians are greater health consciousness and more prepaid health programs.

In addition to openings from growth, many openings will arise when workers retire or leave the field for other reasons.

Earnings

Starting salaries of EEG technicians employed by hospitals, medical schools, and medical centers averaged $8,800 a year in 1978, according to a survey by the University of Texas Medical Branch. Starting salaries for registered EEG technologists were $1,000 to $2,000 higher. Top salaries of experienced EEG technicians ranged as high as $22,600 a year. Highly qualified technologists may earn more as teachers in special training situations or as supervisors of EEG laboratories.

Inexperienced EEG trainees employed by the Federal Government received $8,366 a year in 1979, but they could advance to as much as $16,920 a year. Usually, EEG technicians earn about as much as the average for all nonsupervisory workers in private industry, except farming.

EEG technologists and technicians in hospitals receive the same benefits as other hospital personnel, including hospitalization, vacation, and sick leave benefits. Some institutions may provide tuition assistance or free courses, pension programs, uniforms, and parking.

EEG technologists and technicians generally work a 40-hour week with little overtime, although some hospitals require a standby emergency service after hours and on weekends and holidays.

Related Occupations

Other occupations whose main work consists of performing medical activities under supervision are dental assistants, electrocardiograph technicians, licensed practical nurses, nursing aides, occupational therapy assistants, operating room technicians, orderlies, and physical therapy aides.

Sources of Additional Information

Local hospitals can supply information about employment opportunities. Additional information is available from:

American Hospital Association, 840 North Lake Shore Dr., Chicago, Ill. 60611.

For general information about a career in the field of electroencephalography as well as information on registration with ABRET, contact:

Executive Office, American Society of EEG Technologists, 32500 Grand River Ave., #103, Farmington, Mich.48024.

For a free copy of *Education for Allied Health Careers*, which contains information concerning formal training programs, write to:

American Medical Association, Department of Allied Health Evaluation, 535 North Dearborn St., Chicago, Ill. 60610.

Emergency Medical Technicians

(D.O.T. 079.374-010)

Nature of the Work

An automobile accident, a heart attack, a near drowning, an unscheduled childbirth, a poisoning, a gunshot wound—all of these situations demand urgent medical attention. Seeing medical emergencies like these handled on television has made millions of Americans aware of the crucial role played by emergency medical technicians (EMT's), sometimes called ambulance attendants.

A call from a dispatcher sends EMT's—who usually work in teams of two—to the scene of the emergency. Although speed is essential, the EMT's obey the traffic laws for the operation of emergency vehicles. They also must know the best route to take in the face of traffic, road construction, and weather conditions.

Upon arriving at the scene of the emergency, the driver parks the ambulance in a safe place to avoid accidents. If no police are present, bystanders may be enlisted to lend a hand. For instance, in the case of an automobile accident, bystanders can help control traffic by placing road flares, removing debris, and redirecting traffic.

EMT's first determine the nature and extent of the victims' illnesses or injuries and establish priorities for emergency medical care. Patients receive appropriate medical care, such as opening and maintaining an airway, restoring breathing, controlling bleeding, treating for shock, immobilizing fractures, bandaging, assisting in childbirth, managing mentally disturbed patients, and giving initial care to poison and burn victims.

EMT training stresses efficiency and confidence to reassure both patients and bystanders. EMT's try to handle patients correctly—not wasting any time nor working too hastily. When the situation requires, as in the case of possible epilepsy or diabetes, EMT's look for medical identification emblems that are clues to providing correct treatment.

When persons are trapped, such as in an automobile accident, EMT's face a double problem. First they must assess the victims' injuries and supply all possible emergency medical care and protection to the trapped persons. Then they must use the correct equipment and techniques to remove the victims safely. EMT's may request additional help or special rescue or utility services by radio or telephone from a dispatcher.

In case of death, EMT's notify the proper authorities and arrange for the protection of the deceased's property.

Often patients must be transported to a hospital. In such instances, EMT's place the patients on stretchers, lift them into the ambulance, and secure both the patients and the stretchers for the ride. EMT's choose the nearest hospital they consider best equipped and staffed to treat their patients. To assure prompt treatment upon arrival, EMT's report by radio directly to the hospital emergency department or the emergency dispatcher about the nature and extent of injuries or illness, the number of persons being transported, and the destination. They may ask for additional advice from the hospital's medical staff.

On the way to the emergency department, EMT's constantly watch patients to give additional care as needed or as directed by a physician with whom they have radio contact.

Upon arrival at the hospital, they help transfer the patients from the ambulance to the emergency department. They report their observations and care of the patients to the emergency department staff for diagnostic purposes and as a matter of record. EMT's may help the emergency department staff.

One of the duties of EMT's is to maintain a clean, well-equipped ambulance. After each run, EMT's replace the used linen, blankets, and other supplies, send the used items to be sterilized, and carefully check all equipment so that the ambulance is ready for the next trip. If they have carried patients who have contagious infection or have been exposed to radiation, they decontaminate the interior of the ambulance and report such calls to the proper authorities. EMT's make sure that the ambulance is in good operating condition by checking the gasoline, oil, tire pressure, lights, siren, heater, and communications equipment before their shift begins.

In addition to the basic EMT, whose work has been described, there are two other types of EMT's: EMT-Paramedics and EMT-Dispatchers. Working with radio communication under the direction of a physician, EMT-Paramedics may administer drugs, both orally and intravenously, and use more complex equipment, such as a defibrillator, than basic EMT's.

Although not dealing directly with emergency patients, EMT-Dispatchers nevertheless play an important role. They receive and process calls for emergency medical assistance. Dispatchers send the appropriate persons and resources to the emergency site and coordinate the movement of emergency medical vehicles. By telephone and radio, they serve as a communications link between the appropriate medical facility and those who are sent to attend the emergency patients. EMT-Dispatchers also handle communications for public safety agencies, such as police and fire departments so that services like traffic and fire control can be performed.

Working Conditions

Because EMT's must accompany the patients indoors and outdoors, they are exposed to all kinds of weather. A lot of their time is spent standing, kneeling, bending, and lifting. Although their work can be very strenuous and can produce great pressure, they must be careful to avoid accidents.

Places of Employment

In 1978, an estimated 115,000 persons worked as paid EMT's. In addition, an estimated 175,000 others worked as volunteers on rescue squads—mostly associated with fire departments.

Many paid EMT's work for police and fire departments and private ambulance companies. Funeral homes providing ambulance service employ some EMT's, although in recent years many funeral homes have left this field. A few EMT's work on hospital-based ambulance squads. A small but growing number of EMT's work in hospital emergency departments.

Training, Other Qualifications, and Advancement

Few EMT's received formal training until recent years. Now instruction in emergency medical care techniques is mandatory. A standard training course is the 81-hour pro-

EMT's must handle patients with care.

gram designed by the U.S. Department of Transportation. This program, or its equivalent, is available in all 50 States and the District of Columbia. It is offered by police, fire, and health departments, in hospitals, and as a special course in medical schools, colleges, and universities.

This course provides instruction and practice in dealing with emergencies such as bleeding, fractures, airway obstruction, cardiac arrest, and emergency childbirth. Students learn to use and care for common emergency equipment, such as backboards, suction machines, splints, oxygen delivery systems, and stretchers. Physicians, nurses and senior EMT's usually give the lectures and demonstrations.

After completing the basic 81-hour program, students may take a 2-day course dealing with the removal of trapped victims. Further training courses presently are being prepared by the Department of Transportation for the categories of EMT-Paramedic and EMT-Dispatcher. A special course on driving also is in preparation. Thus, a career ladder for the EMT field is being established.

Although admission requirements vary from State to State and often, from course to course, admittance to an EMT training course generally requires that the applicant be at least 18 years old, have a high school diploma or the equivalent, and have a valid driver's license. Among high school subjects recommended for persons interested in the field are driver education and health and science courses. Training in the Armed Forces as a "medic" also is considered good preparation for prospective EMT's.

Graduates of approved EMT training programs who meet certain experience requirements and successfully pass a written and practical examination administered by the National Registry of Emergency Medical Technicians earn the title of Registered EMT- Ambulance. To maintain their proficiency, EMT's must register again every 2 years. To reregister, an EMT must be working as an EMT, meet a continuing education requirement, and pay a fee.

In 1978 the National Registry began to register EMT-Paramedics. This registration requires current registration as an EMT-Ambulance, successful completion of an EMT-Paramedic training program, 6 months of field experience as an EMT-Paramedic, and passing a written and practical examination. Reregistration is required every 2 years.

Although not a general requirement for employment, registration with the National Registry is acknowledgement of an EMT's qualifications and makes higher paying jobs easier to obtain. By mid-1978, over 96,000 basic EMT's were registered.

In addition, some States require certification that does not necessarily coincide with certification with the National Registry. There certification as a basic EMT or an EMT-Paramedic may require passing a State-prescribed written and practical examination.

EMT's should have good dexterity and physical coordination. They must be able to lift and carry up to 100 pounds. EMT's need good eyesight (eyeglasses may be used) with accurate color vision.

Because EMT's often work under trying conditions, they must exercise good judgment under stress and have leadership ability. Emotional stability and the ability to adapt to many different situations help them handle difficulties. They should have a neat and clean appearance and a pleasant personality.

Employment Outlook

Employment of EMT's is expected to grow faster than the average for all occupations, due to the increasing public awareness of the need for better emergency medical services. For example, since passage of the Highway Safety Act of 1966 and the Emergency Medical Services System Act of 1973, the Federal Government has encouraged the expansion and improvement of ambulance services.

Additional positions for full-time EMT's will become available as more and more communities change from volunteer to paid ambulance services. A trend is underway establishing ambulance service as the third essential community service, after police and fire protection.

Increasing cooperation between ambulance personnel and the physicians and nurses of emergency departments is expected to further contribute to the growth of the emergency medical technician occupation. As the field of emergency medical care develops and personnel become more qualified, more people are expected to use ambulance services, which will increase the demand for EMT's. Despite expected increases in the demand for EMT's, those persons seeking full-time, paid EMT positions are expected to face keen competition, because many persons find the occupation attractive.

In addition to job opportunities created by growth, many openings for EMT's will occur each year because of the need to replace EMT's who retire, die, or leave the labor force for other reasons.

Earnings

Earnings of EMT's depend on the type of employer, the training and experience of the individual, and the geographic location.

In general, graduates of approved 81-hour training programs received starting salaries of between $7,000 and $9,000 annually in 1978, depending on the community. With experience, they can earn up to $12,000 a year. Beginning EMT-Paramedics usually earn annual salaries of at least $10,000, while experienced EMT-Paramedics earn as much as $19,000 a year. EMT's working for police and fire departments usually are paid the same salaries as police officers and firefighters. (See statement on police officers and firefighters elsewhere in the *Handbook*.)

EMT's employed by fire departments often have a 56-hour workweek. Those employed by hospitals, private firms, and police departments usually work 40 hours a week. Volunteer EMT's have varied work schedules, but many put in from 8 to 12 hours a week. Because many ambulance services function 24 hours a day, EMT's often work nights and weekends.

The employee benefits offered by private companies, such as vacation, sick leave, and health insurance, vary widely. EMT's employed by hospitals and police and fire departments receive the same benefits as the other employees.

Related Occupations

Other occupations in which workers often are placed in life-or-death situations that require quick and level-headed reactions are police officers and firefighters.

Sources of Additional Information

Information concerning training courses can be obtained by writing to the Emergency Medical Services Division of the Health Department of your State.

For information about job opportunities for prospective EMT's in your State, contact the Governor's Office for Highway Safety.

Information about the registration of EMT's is available from your State Emergency Medical Services Office, as well as from:

National Registry of Emergency Medical Technicians, 1395 East Dublin-Granville Rd., P.O. Box 29233, Columbus, Ohio 43229.

General information about EMT's is available from:

National Association of Emergency Medical Technicians, P.O. Box 334, Newton Highlands, Mass. 02161.

Medical Laboratory Workers

(D.O.T. 078.121, .161, .261, .281, and .361 except -010 -018, -022, and -026, .381, and .687)

Nature of the Work

Laboratory tests play an important part in the detection, diagnosis, and treatment of many diseases. Medical laboratory workers, often called clinical laboratory workers, include three levels: Medical technologists, technicians, and assistants. They perform tests under the general direction of pathologists (physicians who diagnose the causes and nature of disease) and other physicians, or scientists who specialize in clinical chemistry, microbiology, or the other biological sciences. Medical laboratory workers analyze blood, tissues, and fluids in the human body by using precision instruments such as microscopes and automatic analyzers.

Medical technologists, who usually have 4 years of postsecondary school training, perform complicated chemical, biological, microscopic, and bacteriological tests. These may include chemical tests to determine, for example, the blood cholesterol level, or microscopic examination of the blood to detect the presence of diseases such as leukemia. Technologists microscopically examine other body fluids; make cultures of body fluid or tissue samples to determine the presence of bacteria, parasites, or other microorganisms; and analyze the samples for chemical content or reaction. They also may type and cross match blood samples.

Technologists in small laboratories often perform many types of tests. Those in large laboratories usually specialize in one area such as microbiology (the study of blood cells).

Most medical technologists conduct tests related to the examination and treatment of patients. Others do research, develop laboratory techniques, teach, or perform administrative duties.

Medical laboratory technicians, who generally require 2 years of postsecondary school trining, perform a wide range of tests and laboratory procedures that require a high level of skill but not the in-depth knowledge of highly trained technologists. Like technologists, they may work in several areas or specialize in one field.

Medical laboratory assistants, who generally have a year of formal training, assist medical technologists and technicians in routine tests and related work that can be learned in a relatively short time. In large laboratories, they may specialize in one area of work. For example, they may identify abnormal blood cells on slides. In addition to performing routine tests, assistants may store and label plasma; clean and sterilize laboratory equipment, glassware, and instruments; prepare solutions following standard laboratory formulas and procedures; keep records of tests; and identify specimens.

Working Conditions

Medical laboratory personnel generally work a 40-hour week. Those working in a hospital can expect some evening and weekend duty. Laboratory workers may spend a great deal of time on their feet.

Laboratories generally are well lighted and clean. Although unpleasant odors and specimens of diseased tissue often are present, few hazards exist if proper methods of sterilization and handling of specimens, materials, and equipment are used.

Places of Employment

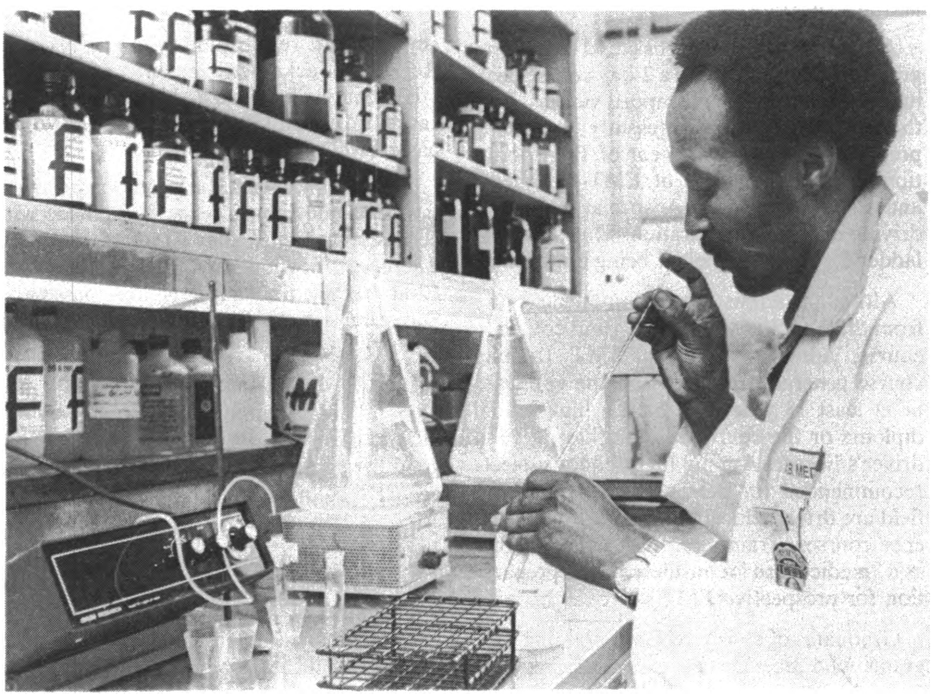
About 210,000 persons worked as medical laboratory workers in 1978. Most medical laboratory personnel work in hospitals. Others work in independent laboratories, physicians' offices, clinics, public health agencies, pharmaceutical firms, and research institutions. Laboratory facilities generally are concentrated in metropolitan areas.

In 1978, Veterans Administration hospitals and laboratories employed about 2,800 medical technologists and about 2,000 medical laboratory technicians. Others worked for the Armed Forces and the U.S. Public Health Service.

Training, Other Qualifications, and Advancement

The minimum educational requirement for a beginning job as a medical technologist is 4 years of college training including completion of a specialized training program in medical technology.

Undergraduate work includes courses in chemistry, biological sciences, and mathematics. These studies give the technologist a broad understanding of the scientific principles underlying laboratory work. Specialized training usually requires 12 months of study and includes extensive laboratory work. In 1978, about 670 hospitals and schools offered programs accredited by the Committee on Allied Health Education and Accreditation (CAHEA) of the American Medical Association. These programs were affiliated with col-



Medical laboratory workers conduct a wide range of tests and analyses.

leges and universities; a bachelor's degree is awarded upon completion. A few programs require a bachelor's degree for entry.

Many universities also offer advanced degrees in medical technology and related subjects for technologists who plan to specialize in a certain area of laboratory work or in teaching, administration, or research.

Medical laboratory technicians acquire their training in a variety of educational settings. Many attend junior or 4-year colleges and universities for 2 years. Some are trained in the Armed Forces. Other technicians receive training in private or nonprofit vocational and technical schools. In 1978, the CAHEA accredited 72 of these programs, and the Accrediting Bureau of Health Education Schools accredited 31.

Most medical laboratory assistants are trained on the job. In recent years, however, an increasing number have studied in 1-year training programs conducted by hospitals, junior colleges in cooperation with hospitals, or vocational schools. In 1978, the CAHEA accredited 109 training programs for medical laboratory assistants. Applicants to these programs should be high school graduates or have an equivalency diploma with courses in science and mathematics. The programs include classroom instruction and practical training in the laboratory. They often begin with a general orientation to the clinical laboratory followed by courses in bacteriology, serology, parasitology, hematology, clinical chemistry, blood banking, and urinalysis.

After they pass the appropriate examinations, medical technologists may be certified as Medical Technologists, MT (ASCP), by the Board of Registry of the American Society of Clinical Pathologists; Medical Technologists, MT, by the American Medical Technologists; or Registered Medical Technologoists, RMT, by the International Society of Clinical Laboratory Technology. These organizations also certify technicians. Certified Laboratory Technicians, CLT, are certified by the National Certification Agency for Medical Laboratory Personnel. Laboratory assistants are certified by the Board of Registry of the American Society of Clinical Pathologists.

Medical technologists must be licensed in California, Florida, Hawaii, Nevada, Tennessee, and New York City. Requirements for licensure include a written examination in some States.

Accuracy, dependability, and the ability to work under pressure are important personal characteristics for a medical laboratory worker. Manual dexterity and normal color vision are highly desirable.

Persons interested in a medical laboratory career should use considerable care in selecting a training program. They should get information about the kinds of jobs obtained by graduates, educational costs, the accreditation of the school, the length of time the training program has been in operation, instructional facilities, and faculty qualifications.

Technologists may advance to supervisory positions in certain areas of laboratory work, or, after several years' experience, to administrative medical technologist in a large hospital. Graduate education in one of the biological sciences, chemistry, management, or education usually speeds advancement. Technicians can advance to technologists by getting additional education and experience. Similarly, assistants can become technicians by acquiring more education and experience.

Employment Outlook

Employment opportunities for medical laboratory workers are expected to be favorable through the 1980's. Employment of these workers is expected to expand faster than the average for all occupations as physicians make wider use of laboratory tests in routine physical checkups and in the diagnosis and treatment of disease. Indirectly influencing growth of the field are population growth, greater health consciousness, and expansion of prepayment programs for medical care that make it easier for people to pay for services.

The use of automated laboratory test equipment is expected to lead to an increase in the number of medical laboratory technicians and assistants relative to technologists. Through technological advances, technicians and assistants can operate equipment to perform tests that previously required the skill of a technologist.

Technologists will be needed to fill supervisory positions in all laboratories. In addition to openings resulting from increased demand for these workers many jobs will become available each year because of the need to replace medical workers who die, retire, or leave the field for other reasons.

Earnings

Salaries of medical laboratory workers vary depending on the employer and geographic location. In general, medical laboratory workers employed in large cities received the highest salaries.

Starting salaries for medical technologists in hospitals averaged about $12,400 a year in 1978, according to a survey conducted by the University of Texas Medical Branch. Beginning salaries for medical laboratory technicians averaged about $10,600 a year in 1978; for certified laboratory assistants, about $9,100. According to the same survey, experienced medical technologists employed in hospitals averaged about $15,700 a year in 1978. Similarly, medical laboratory technicians with experience averaged about $13,500 a year, and certified laboratory assistants about $11,400 annually.

The Federal Government paid newly graduated medical technologists with a bachelor's degree a starting salary of about $10,500 a year in 1979. Those having experience, superior academic achievement, or a year of graduate study entered at about $13,000. The Federal Government paid medical laboratory assistants and technicians starting salaries ranging from about $6,600 to $10,500 a year in 1979, depending on the amount and type of education and experience. Medical technologists in the Federal Government averaged about $15,300 a year, and medical technicians, about $12,700 a year in 1978.

Medical laboratory workers normally receive vacation and sick leave benefits; some have retirement plans.

Related Occupations

Medical laboratory workers perform a wide variety of tests to help physicians diagnose and treat disease. Their principal activity is the analysis and identification of substances. Workers in other occupations who perform laboratory tests include biological aides, chemistry technologists, criminalists, and food testers.

Sources of Additional Information

Information about education and training for medical technologists, technicians, and laboratory assistants meeting standards recognized by the American Medical Association, the U.S. Office of Education, or both, as well as career information on these fields is available from:

American Society of Clinical Pathologists, Board of Registry, P.O. Box 11270, Chicago, Ill. 60612.

American Society for Medical Technology, 5555 W. Loop South, Bellaire, Tex. 77401.

American Medical Technologists, 710 Higgins Rd., Park Ridge, Ill. 60068.

Accrediting Bureau of Health Education Schools, Oak Manor Office, 29089 U.S. 20 West, Elkhart, Ind. 46514.

For information about other technician training programs, contact:

International Society for Clinical Laboratory Technology, 818 Olive St., St. Louis, Mo. 63101.

For a list of training programs for medical technologists, technicians, and assistants that are approved by the American Medical Association, write:

Department of Allied Health Evaluation, American Medical Association, 535 N. Dearborn St., Chicago, Ill. 60610.

For a list of training programs for medical laboratory technicians accredited by the Accrediting Bureau of Health Education Schools, write:

Secretary-ABHES, 29089 U.S. 20 West, Elkhart, Ind. 46514.

Information about employment opportunities in Veterans Administration hospitals is available from the Office of Personnel (054E), Veterans Administration, Washington, D.C. 20420.

Information about clinical and research employment opportunities with the National Institutes of Health is available from the Clinical Center, National Institutes of Health, Bethesda, Maryland 20205.

Medical Record Technicians and Clerks

(D.O.T. 079.367-014 and 245.362)

Nature of the Work

A medical record is a permanent report on a patient's condition and course of treatment in a hospital, clinic, or other health care institution. Physicians, allied health personnel, hospital administrators, public health authorities, and insurance companies rely on these records, which are kept by health care staff known as medical record technicians and clerks.

Medical record technicians and clerks perform the functions essential to maintaining the medical information system, including transcription of medical data, analysis and coding of information, filing, maintenance of registries, compiling of statistics, and abstracting records.

The system used in hospitals to gather, preserve, and maintain the information for medical records requires the teamwork of many medical record technicians and clerks. In large hospitals, recordkeeping activities are supervised and coordinated by a medical record administrator, but in smaller hospitals, experienced medical record technicians often manage the department. In most nursing homes, a medical record clerk, working under the supervision of a medical record consultant who is a Registered Record Administrator (RRA) or an Accredited Record Technician (ART), is responsible for the medical records.

Medical record clerks perform routine clerical tasks. They assemble the information for the records in sequence; check to see that all necessary forms, signatures, and dates are present; and locate any previous medical records that may be on file for the patient. They translate selected information such as sex, age, and referral source into a code and enter it on the records. Medical record clerks answer routine staff requests for information about patients and gather statistics for reports to various groups such as State health departments. Some medical record clerks transcribe reports of operations, X-ray and laboratory examinations, and special treatments given to patients.

Beginning medical record technicians perform duties that may be similar to those of clerks but that require more technical knowledge. The technician codes the diseases, operations, and special therapies according to recognized classification systems and enters the codes on the medical record. This coding makes it easier to refer to the record when there is a need to review the patient's case or to collect data for other purposes. Analyzing records and cross-indexing medical information make up a large part of the technician's work. Technicians review records for completeness, accuracy, and compliance with requirements, referring incomplete records to the person who compiled them. They review records for internal consistency and look for apparent errors.

Technicians obtain information from records in answer to legal, governmental, and insurance company inquiries, and gather statistics and prepare periodic reports for health care facilities on types of diseases treated, types of surgery performed, and utilization of hospital beds. They also supervise medical record clerks, assist the medical staff by preparing special studies and tabulating data from records for research, and take records to court.

Working Conditions

Medical record personnel generally work a standard 40-hour week in a comfortable office environment within a hospital, nursing home, or other health care facility. Because incorrect or misplaced medical records could affect the health and well-being of a patient, close attention to detail is required. Some aspects of the job are highly repetitive.

Places of Employment

In 1978, there were about 15,000 medical record technicians and 35,000 clerks. Although most work in hospitals, a growing number are finding jobs in clinics, nursing homes, community health centers, governmental agencies, consulting firms, and health maintenance organizations. Some medical record technicians are consultants to small health facilities. Some insurance companies employ experienced medical record technicians to collect information from patients' records to determine liability for payment. Public health departments hire medical record technicians to supervise data collection from health care institutions and to assist in research to improve health care. Manufacturers of medical record systems, services, and equipment also employ medical record personnel to help develop and market their products.

Training, Other Qualifications, and Advancement

Most employers prefer to fill technician positions with graduates from one of the colleges that have been accredited by the American Medical Association (AMA) and the American Medical Record Association (AMRA). These colleges have 2-year associate degree programs. In 1978, there were 70 associate degree programs. Required courses include biological sciences, medical terminology, medical record science, business management, and secretarial skills. Persons with this training can take the Accredited Record Technician (ART) examination. Those who pass enter the medical record field as technicians, and can often look forward to promotion to supervisory positions. In 1978, there were about 10,500 ART's.

High school graduates who have basic secretarial skills can enter the medical record field as beginning clerks. About 1 month of on-the-job training will prepare them for routine tasks that do not require much specialized skill. Although not required, high school courses in science, health, typing, mathematics, and office practice are helpful.

The AMRA offers a correspondence course in medical transcription that can be taken either as a home study program or as in-service training. The certificate given upon the successful completion of the course is helpful in applying for a job as a medical record clerk. Knowledge of medical terms

Medical record technicians deal with the records of thousands of patients.

and references provides a good foundation for advancement.

Medical record clerks with several years' experience can advance to the technician level upon completion of 30 credit hours in medical record technology from an accredited college. After completing this course work, the technician is eligible to take the ART examination for accreditation.

Employment Outlook

Employment of medical record technicians and clerks is expected to grow faster than the average for all occupations through the 1980's. This employment growth will stem from a continued increase in the use of health insurance and Medicare and Medicaid, which will result in a need for more complete medical records. New jobs also will be created as nursing homes, clinics, and new types of health care facilities, such as health maintenance organizations, increasingly employ medical record personnel.

The outlook for technicians with a 2-year associate degree or its equivalent will be excellent through the 1980's. It is expected that medical record technicians will be required to have this specialized training in the future as more attention is given to documenting medical care in order to improve medical care delivery. As a result, technicians who have not received formal training may experience strong competition for positions from medical record technicians who have an associate degree. Opportunities for part-time work will continue.

Earnings

Earnings of medical record clerks and technicians vary greatly according to locality. Beginning medical record clerks earned an average of about $8,600 annually in private hospitals in 1978. Earnings ranged from $6,600 in small hospitals in the South to $13,200 in New York City, according to limited data. In general, salaries are highest in big cities and in larger hospitals.

Salaries of medical record technicians follow a similar geographic pattern. Limited data indicate that, in 1978, the median annual salary for ART's was about $13,200. Experienced technicians who were directors of hospital medical record departments averaged about $13,900. Some earned over $15,800 a year.

In Federal hospitals, medical record clerks earned a beginning annual salary of about $8,400 in 1979. Annual salaries of experienced medical record technicians ranged from about $9,400 to $16,900. In 1978, about 1,500 medical record technicians worked for the Federal Government, with average salaries of about $11,200 a year. Some outstanding medical record technicians may work up to higher supervisory positions with corresponding pay increases, although most of these positions are filled by Registered Record Administrators.

Like most hospital employees, medical record personnel receive paid holidays and vacations, health and insurance benefits, and can participate in retirement plans.

Related Occupations

Medical record technicians and clerks work primarily in hospitals maintaining patients' medical records. These workers generally perform a wide variety of technical and clerical duties including verification, transcription, and filing of medical records. Workers in other occupations who may perform similar technical/clerical duties include information clerks, insurance clerks, library technical assistants, medical secretaries, and transcribing-machine operators.

Sources of Additional Information

A list of approved schools for medical record technicians, facts about the correspondence courses for medical transcription and medical record personnel, and additional details on the work performed by medical record technicians are available from:

American Medical Record Association, John Hancock Center, Suite 1850, 875 N. Michigan Ave., Chicago, Ill. 60611.

Operating Room Technicians

(D.O.T. 079.374-022)

Nature of the Work

Operating room technicians, occasionally called surgical technologists, assist surgeons and anesthesiologists before, during, and after surgery. They work under the supervision of registered nurses or surgical technologist supervisors.

They help set up the operating room with the instruments, equipment, sterile linens, and fluids such as glucose that will be needed during an operation. Operating room technicians also may prepare patients for surgery by washing, shaving, and disinfecting body areas where the surgeon will operate. They may transport patients to the operating room and help drape and position them on the operating table.

During surgery, they pass instruments and other sterile supplies to the surgeons and the surgeons' assistants. They hold retractors, cut sutures, and help count the sponges, needles, and instruments used during the operation. Operating room technicians help prepare, care for, and dispose of specimens taken for testing during the operation and help apply dressings. They may operate sterilizers, lights, suction machines, and diagnostic equipment.

After the operation, operating room technicians help transfer patients to the recovery room and assist nurses in cleaning and stocking the operating room for the next operation.

Working Conditions

Operating room technicians work in clean, well-lighted environments. They need stamina to be on their feet the whole time they are on duty and to pay close attention to operations.

Places of Employment

About 35,000 persons worked as operating room technicians in 1978. They worked in hospitals or other institutions that have operating room, delivery room, and emergency room facilities. In addition, many were members of the Armed Forces.

Training, Other Qualifications, and Advancement

Most operating room technicians are trained in vocational and technical schools, hospitals, and community and junior colleges. Most training programs last from 9 months to 1 year; some junior college programs, however, last 2 years and lead to an associate degree. Students receive classroom training as well as supervised clinical experience. Required courses include anatomy, physiology, and microbiology. Courses teaching practical applications include the care and safety of patients during surgery, use of anesthesia and its hazards, and nursing procedures. They also learn how to sterilize instruments, prevent and control infection, and handle special drugs, solutions, supplies, and equipment. In 1978, there were 68 training programs accredited by the Committee on Allied Health Education and Accreditation.

Some operating room technicians are trained on the job. A high school education or the equivalent is required for training and employment. On-the-job training programs in many hospitals include classroom instruction in the same type of courses taught in junior colleges and vocational schools. These programs vary from 6 weeks to 1 year, depending on the trainee's qualifications and the objectives of the training given. Some hospitals prefer applicants who have worked as nursing aides or practical nurses.

Some operating room technicians receive training in the Armed Forces.

The Association of Surgical Technologists awards a certificate to operating room technicians who pass their comprehensive examination. A Certified Surgical Technologist (CST) is recognized as competent in the field and may be paid a higher salary.

Manual dexterity is a necessity for operating room technicians because they must handle various instruments quickly. They must be orderly and emotionally stable. High school students interested in careers in this occupation are advised to take courses in health and biology.

Some operating room technicians advance to assistant operating room administrator and assistant operating room supervisor. Assistant operating room administrators

Operating room technicians must pay close attention to the surgery being performed.

deal with the administrative aspects of running an operating room, such as ordering supplies and arranging work schedules, while assistant operating room supervisors actually direct other technicians in the operating room.

Employment Outlook

Employment in this field is expected to grow faster than the average for all occupations as operating room technicians increasingly assume more routine tasks in the operating room. The same factors that contribute to the demand for health workers in general apply to operating room technicians—namely, population growth and the increased ability of people to pay for medical care due to expansion in coverage under prepayment insurance programs. In addition to job openings resulting from growth of the occupation, new operating room technicians will be needed to replace workers who die, retire, or leave the field for other reasons.

Despite the rapid employment growth that is expected, the small size of this occupation will result in relatively few job openings. Graduates of formal training programs will have the best opportunities for these jobs, while persons without job skills may face competition.

Earnings

The average starting salary for operating room technicians was about $8,600 a year in 1978, according to a national survey conducted by the University of Texas Medical Branch at Galveston. Experienced technicians earned average salaries of approximately $10,700 annually. In 1979, the Federal Government paid operating room technicians starting salaries of $9,391 a year. An experienced operating room technician employed by the Federal Government could earn as much as $15,222 a year.

Graduates of training programs in hospitals and community and junior colleges often earn higher salaries than workers without formal training. Salaries, reflecting variations in the cost of living, also vary widely by geographic location, with those on the East and West Coasts generally higher. Usually, operating room technicians earn about as much as the average for all nonsupervisory workers in private industry, except farming.

Operating room technicians usually work a 5-day, 40-hour week. However, they may be required to work "on call" shifts (staying available to work on short notice).

Related Occupations

Other occupations who perform medical activities under supervision are dental assistants, electrocardiograph technicians, electroencephalographic technologists, licensed practical nurses, nursing aides, occupational therapy assistants, orderlies, and physical therapy aides.

Sources of Additional Information

Additional information on a career as an operating room technician and on training programs for the occupation is available from:

Association of Surgical Technologists, Caller No. E, Littleton, Colo. 80120.

Information on education for the operating room technician occupation also is available from:

American Medical Association, Department of Allied Health Evaluation, 535 North Dearborn St., Chicago, Ill. 60610.

Optometric Assistants

(D.O.T. 079.364-014)

Nature of the Work

Optometric assistants perform a wide variety of tasks, enabling optometrists to devote more time to their professional duties. They keep patients' records, schedule appointments, and handle bookkeeping, correspondence, and filing. They prepare patients for eye examinations, take initial case histories, and record the results of optometrists' examinations. Optometric assistants measure patients for correct and comfortable fit of glasses. They suggest size and shape of eyeglass frames to complement the patient's facial features, and adjust finished eyeglasses by heating, shaping, and bending the plastic or metal frames. They also assist the optometrist in giving instructions on the wear and care of contact lenses.

Optometric assistants help patients with exercises for eye coordination to overcome focusing defects. In the laboratory, they adjust conventional glasses to assure proper fit, insert lenses in frames, repair frames, keep an inventory of optometric materials, and clean and care for the instruments.

In a large establishment such as a clinic, assistants may specialize in visual training, chairside assistance, or office administration. In a smaller practice, they may perform all these duties.

Optometric assistants work in clean, well-lighted, and pleasant surroundings. Although their work is not physically hard, they must be on their feet part of the time. Attention to detail is necessary.

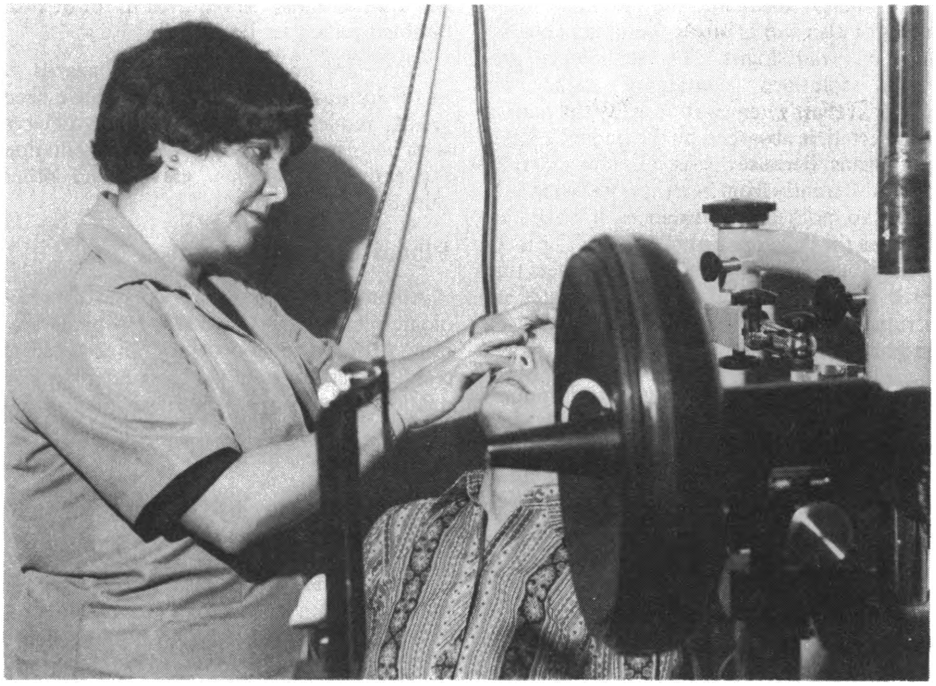
Places of Employment

About 15,000 persons worked as optometric assistants in 1978. Most worked for optometrists in private practice. Others worked for health clinics. Some served as assistants to optometrists in the Armed Forces.

Training, Other Qualifications, and Advancement

Most optometric assistants are trained on the job. Training also can be acquired in 1-year academic courses; 11 schools offered this type of training in 1978. More detailed training in the technical aspects of optometry was available in 21 schools that offered 2-year courses leading to an associate degree. In addition, the U.S. Air Force trained optometric specialists in an accelerated, 16-week training program.

High school graduation or its equivalent, including courses in mathematics and office procedures, is preferred for formal or on-the-job training. All formal programs offer specialized courses such as the anat-



A delicate touch is needed by optometric assistants when teaching patients to wear contact lenses.

omy and physiology of the human eye, vision training (the use of exercises to correct defective vision), and contact lens theory and practice. Programs also include secretarial and office procedures. Lectures and laboratory work are supplemented by actual experience in optometric clinics and practices.

Although most newly hired optometric assistants currently are trained on the job, optometrists prefer to hire assistants who are graduates of 1- or 2-year formal training programs. This training will become more important in gaining initial employment and advancement as more programs become available.

Manual dexterity and accuracy are requirements for persons planning to become optometric assistants. Because of the person-to-person relationship between optometric assistants and patients, a neat appearance, courtesy, and tact are important.

Employment Outlook

Employment of optometric assistants is expected to grow faster than the average for all occupations through the 1980's, due to the rising demand for eye care services and the changing requirements of optometrists. Demand for eye care is expected to increase due to population growth and to the rising proportion of older persons, that segment of the population requiring the most eye care. Employment should rise because of expected increases in the number of support personnel employed by optometrists.

In addition to job openings resulting from growth, new optometric assistants also will be needed to replace workers who die, retire, or leave the field for other reasons. Because the occupation is small, however, openings will be relatively few. Employment opportunities for graduates of formal training programs should be excellent. Persons without this training, however, may face competition. Jobseekers will continue to find many opportunities for part-time work.

Earnings

Earnings of optometric assistants vary by geographical region, academic and technical qualifications, and the size and type of practice of the optometrists employing them. In 1978, beginning salaries ranged from $100 a week for optometric assistants having no training or experience to $250 a week for experienced and highly trained assistants, according to limited information available.

Most optometric assistants work between 30 and 40 hours a week. In many practices, the assistant may work a few hours on Saturday, with a day off during the week.

Related Occupations

Other occupations assisting medical professionals are dental assistants, office nurses, occupational therapy assistants, physical therapist assistants and aides, podiatric assistants, and psychiatric aides.

Sources of Additional Information

Further information on a career as an optometric assistant and a list of training programs are available from:

American Optometric Association, Paraoptometric Guidance Department, 243 North Lindbergh Blvd., St. Louis, Mo. 63141.

Radiologic (X-ray) Technologists

(D.O.T. 078.162, .361-018, and .362-026)

Nature of the Work

Bone fractures, ulcers, blood clots, and brain tumors are just a few of the medical problems that involve the use of X-rays in their treatment, either for diagnosis or therapy. X-rays of the chest also are taken during routine medical checkups to detect the presence of lung diseases in the early stages. The people who operate radiologic equipment and take X-ray pictures (known as radiographs) are called radiologic technologists or radiographers. They usually work under the supervision of radiologists—physicians who specialize in the use of radiographs.

Radiologic technologists may work in any of the three specialties within the field of radiologic technology. The most widely known specialty is X-ray technology or radiography, taking radiographs of parts of the human body for study by a radiologist in diagnosing a patient's problem. The other two are radiation therapy, the use of radiation-producing machines to give therapeutic treatments recommended by radiologists; and nuclear medicine technology, the application of radioactive material to help radiologists diagnose or treat illnesses or injuries.

Before a radiologic technologist can perform any work on a patient, a physician must issue a requisition ordering the work done. Similar to prescriptions for drugs, these requisitions assure that radiologic technologists treat only people certified as needing such treatment by physicians.

Radiologic technologists prepare patients for radiologic examinations, assuring that they remove any articles of clothing, such as belt buckles or jewelry, through which X-rays cannot pass. They then position the patients, either lying on a table or standing, so that the correct parts of the body can be radiographed, always taking care not to aggravate injuries or make the patients uncomfortable. To prevent unnecessary radiograph exposure to unaffected parts, the technologist surrounds the exposed area with radiation protection devices, such as lead shields.

After the necessary preparations, the technologist positions the radiologic machine at the correct angle and height over the appropriate area of a patient's body. Using instruments like a measuring tape, the technologist measures the thickness of the section to be radiographed. He or she sets the proper controls on the machine, such as those regulating exposure time, to produce radiographs of the right density, detail, and contrast. The technologist then places a properly identified X-ray film of the correct size under the part of the patient's body to be examined, and makes the exposure. Afterward, the technologist removes the film and develops it for interpretation by a radiologist. Throughout the procedure, the technologist is careful to use only as much radiation as is necessary to obtain a good diagnostic examination.

When examining a patient using fluoroscopy (watching a patient's internal body movements on a monitor or screen), the radiologic technologist prepares a solution of barium sulphate for the patient to drink. As this solution passes through the patient's digestive tract, a physician looks for diseases, injuries, or defects in the patient's digestive system. When fluoroscopic examinations are performed, whether on the digestive tract or on other parts of the body such as chest, heart, or bones, the technologist assists the physician by preparing and positioning the patient, adjusting the machine, and applying the correct exposure.

In radiation therapy, which is mainly used for treating cancer, the radiologic technologist works under the close supervision of a radiologist. Directed by a radiologist, the technologist applies the correct amount of radiation for the proper period of time to the affected part of the patient's body. The technologist also must keep adequate records of the treatment and is responsible for the comfort and safety of the patient during the treatment.

In nuclear medicine, the radiologic technologist also works under the direct supervision of a radiologist. The technologist prepares solutions containing radioactive material that, when swallowed by the patient or injected, is absorbed by the patient's internal organs. Because diseased tissues generally react differently from healthy ones when subjected to radioactive substances, it is possible to trace the development of disease. The technologist uses special cameras or scanners that pick up the radioactivity, and operates instruments that measure the intensity of the radioactivity.

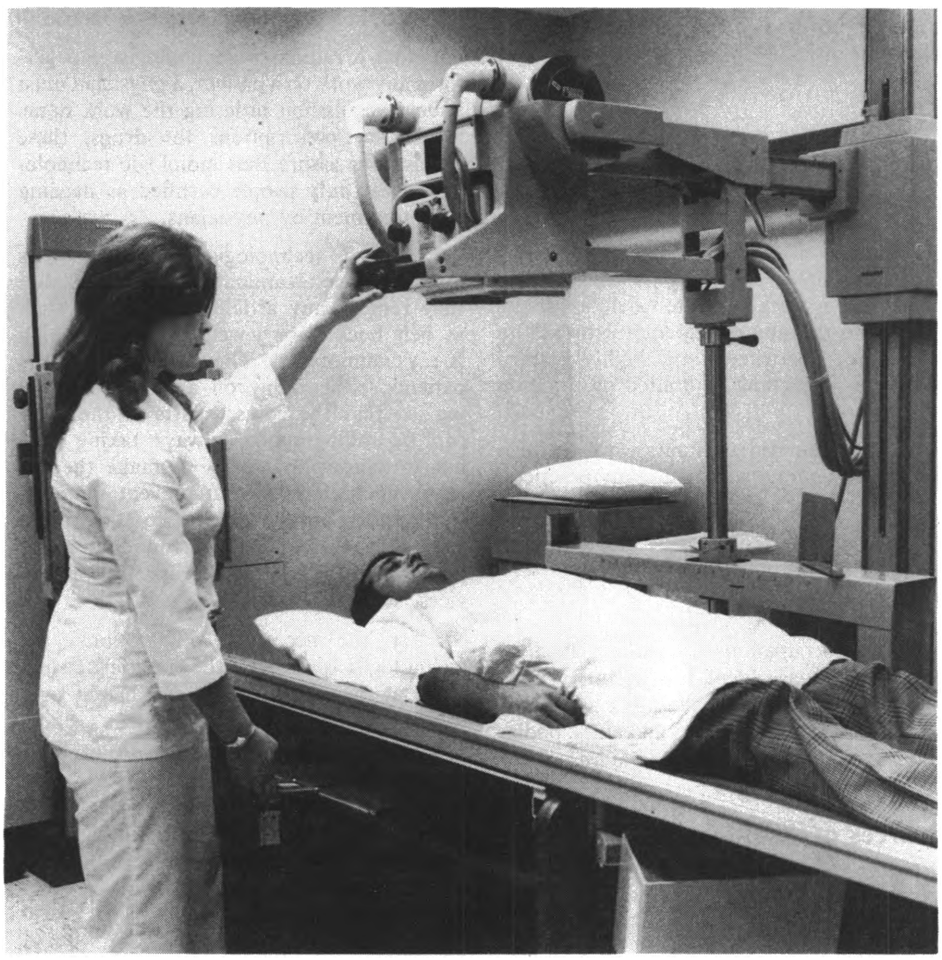
In addition to the duties involved in operating radiologic equipment, radiologic technologists may have certain administrative tasks. Technologists prepare and maintain patients' records—keeping track of the developed film, the date it was taken, and the radiologist's diagnosis. They also may maintain files, schedule appointments, and prepare work schedules for assistants.

Some radiologic technologists are full-time instructors in radiography techniques, teaching in programs of radiologic technology.

Working Conditions

Radiologic technologists generally work a 40-hour week that may include evening or weekend hours. Technologists are on their feet a lot and may be required to lift or turn disabled patients.

There are potential radiation hazards in this field; however, these hazards have been greatly reduced by the use of safety devices such as instruments that measure radiation exposure, lead aprons, gloves, and other shielding.



Radiologic (X-ray) technologists must be careful to use only as much radiation as is necessary to obtain a good picture.

Places of Employment

About 100,000 persons worked as radiologic technologists in 1978. Hospitals employ about three-fourths of all radiologic technologists; most of the remainder work in medical laboratories, physicians' and dentists' offices or clinics, Federal and State health agencies, and public school systems.

Training, Other Qualifications, and Advancement

The requirement for entry into this field is the completion of a formal education program in radiography. In 1978, about 1,100 programs in radiography offered by hospitals, medical schools affiliated with hospitals, colleges, and universities were accredited by the Committee on Allied Health Education and Accreditation of the American Medical Association (AMA).

Education also may be obtained in the military service or through courses in radiography offered by vocational or technical schools. Programs vary in length from 2 to 4 years. Some colleges award a bachelor's degree in radiologic technology. While employers generally pay graduates of bachelor's degree programs the same starting salaries as those of 2- and 3-year programs, there is more potential for promotion for those holding the bachelor's degree. It is advantageous for those planning to be educators or administrators in this field to pursue the bachelor's and master's degrees as preparation.

All programs accept only high school graduates or the equivalent. Courses in mathematics, physics, chemistry, and biology are helpful.

Radiography programs include courses in anatomy, physiology, patient care procedures, physics, radiation protection, film processing, principles of radiographic exposure, medical terminology, radiographic positioning, medical ethics, and radiobiology.

Registration with the American Registry of Radiologic Technologists is an asset in obtaining highly skilled and specialized positions. Registration requirements include graduation from an accredited program of medical X-ray technology and the satisfactory completion of a written examination. After registration, the title "Registered Technologist (ARRT)" may be used. Once registered, technologists may be certified in radiation therapy or nuclear medicine by completing an additional year of combined classroom study and clinical education.

Good health, emotional stability, and a sincere desire to work with the sick and disabled are important qualifications for this profession.

As openings occur, some technologists in large radiography departments may qualify as instructors in radiography techniques or advance to supervisory radiologic technologists.

Employment Outlook

Employment in the field of radiologic technology is expected to expand faster than the average for all occupations through the 1980's as radiologic equipment is increasingly used to diagnose and treat diseases. The demand for radiologic technologists also will increase as prepaid medical programs extend medical care to wider segments of the population. Part-time workers will find the best opportunities in physicians' offices and clinics where full-time radiologic services usually are not required.

Although the demand for radiologic technologists should continue to be strong, the number of graduates of AMA-accredited programs in this field also is expected to grow rapidly during the period. If present enrollment patterns continue, the number seeking to enter the occupation is likely to exceed the number of openings from growth and replacement needs. As a result, graduates may face competition for positions of their choice.

Earnings

Starting salaries of radiologic technologists employed in hospitals averaged about $10,700 a year in 1978, according to a national survey conducted by the University of Texas Medical Branch. Experienced radiologic technologists averaged about $13,300 a year.

Workers with more specialized skills generally earn more. For example, radiation therapy technologists started at about $11,200 in 1978, according to the University of Texas survey, and experienced personnel averaged $14,000 a year. Nuclear medicine technologists have the highest earnings among radiologic technologists, averaging $12,000 to start and $14,700 after several years of experience.

The Federal Government paid new graduates of AMA-accredited programs of radiologic technology a starting salary of about $9,400 a year in 1979. Radiologic technologists in the Federal Government had average earnings of $13,000 a year in 1978.

Sick leave, vacations, insurance, and other benefits are comparable to those covering other workers in the same organization.

Related Occupations

Radiologic technologists operate sophisticated technical equipment to help physicians, dentists, and other medical practitioners diagnose and treat patients. Workers in related occupations include dental hygienists, electrocardiograph technicians, electroencephalographic technologists, and medical technologists.

Sources of Additional Information

For additional information about programs and careers in radiologic technology, write:

The American Society of Radiologic Technologists, 55 E. Jackson Blvd., Chicago, Ill. 60604.

Respiratory Therapy Workers

(D.O.T. 079.361)

Nature of the Work

Respiratory therapy workers, sometimes called inhalation therapy workers, treat patients with cardiorespiratory problems. This treatment may range from giving temporary relief to patients with chronic asthma or emphysema to giving emergency care in cases of heart failure, stroke, drowning, and shock. Respiratory therapy workers also are among the first medical specialists called for emergency treatment of acute respiratory conditions arising from head injury or drug poisoning. The therapy worker's role is a highly responsible one because if a patient stops breathing for longer than 3 to 5 minutes, there is little chance of recovery without serious brain damage, and if oxygen is cut off for more than 9 minutes, death results.

Following doctors' orders, respiratory therapy workers use special equipment, such as respirators and positive-pressure breathing machines, to treat patients who need temporary or emergency respiratory assistance. For example, they use aerosol inhalants to administer medication so that it is confined to the lungs. They also show patients and their families how to use equipment at home. Other duties include keeping records of the cost of materials and charges to patients, and maintaining and making minor repairs to equipment.

There are three levels of workers within the field of respiratory therapy: Therapists, technicians, and assistants. Therapists and technicians perform essentially the same duties. However, the therapist is expected to have a higher level of expertise and may be expected to assume some teaching and supervisory duties. Respiratory assistants have little contact with patients and spend most of their time taking care of the equipment, including cleaning, sterilizing, and storing it. Many are new to the job and are training to advance to the technician or therapist level.

Working Conditions

Respiratory therapy workers generally work a 40-hour week. Because many hospitals operate around the clock, they may be required to work evenings or weekends. Respiratory therapy workers spend long periods standing and, when involved in an emergency, may work under a great deal of stress. The inhalants they work with are highly flammable; however, adherence to safety precautions and regular testing of equipment minimize the danger of fire.

Places of Employment

About 50,000 persons worked as respiratory therapists, technicians, or assistants in 1978. Most work in hospitals, in respiratory therapy, anesthesiology, or pulmonary medicine departments. Others work for oxygen equipment rental companies, ambulance services, nursing homes, and universities.

Training, Other Qualifications, and Advancement

Respiratory apparatus has become increasingly complex in recent years and, although many respiratory therapy workers are trained on the job, formal training now is stressed for entry to the field.

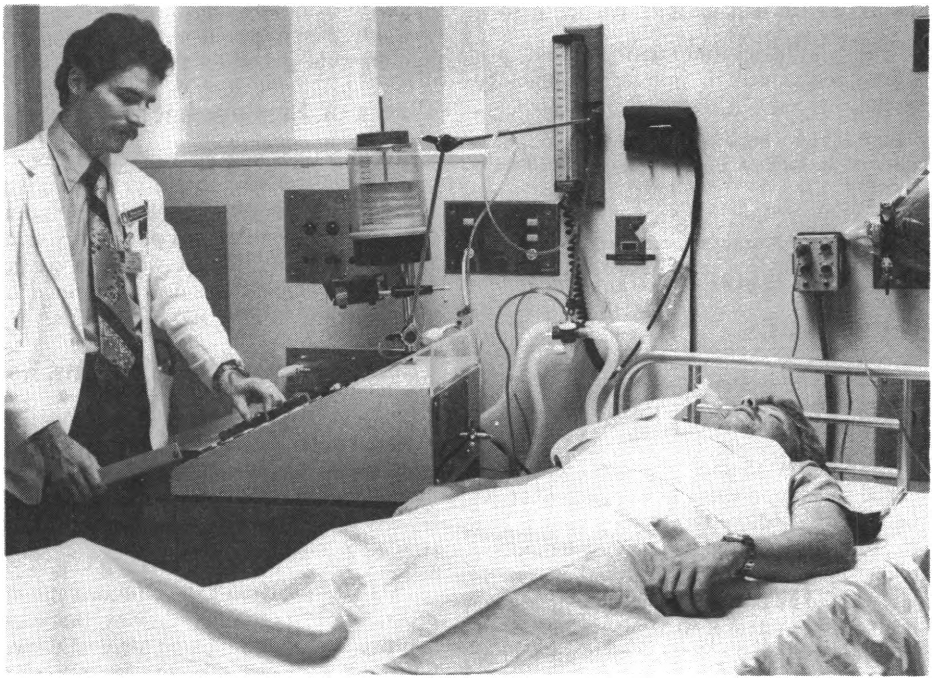
In 1978, nearly 300 institutions offered programs in respiratory therapy that were approved by the Council on Medical Education and Accreditation of the American Medical Association. High school graduation is required for entry to these programs. Courses range in length from 18 months to 4 years and include both theory and clinical work. A bachelor's degree is awarded for completion of a 4-year program and an associate degree for shorter courses. Areas of study include human anatomy and physiology, chemistry, physics, microbiology, and mathematics. Technical courses deal with procedures, equipment, and clinical tests.

Respiratory therapists who have a certificate of completion from an AMA-approved therapist training program, 62 semester hours of college credit, and 1 year of experience following completion of the program are eligible to apply for registration by the National Board for Respiratory Therapy (NBRT). The registry examination consists of written and clinical simulation tests. Applicants must pass both to be awarded the Registered Respiratory Therapist (RRT) credential. In 1978, about 6,500 therapists had been registered.

Individuals who complete an AMA-approved technician training program and have 1 year of experience in respiratory therapy may apply to the NBRT for examination for the Certified Respiratory Therapy Technician (CRTT) credential. The CRTT examination is less comprehensive than the registry examination and consists of a single written test. Approximately 22,000 respiratory technicians had been certified in 1978.

In contrast to therapists and technicians, there are no general requirements for the position of respiratory assistant. The only requirements are those set by the head of the hospital department that is hiring workers. For example, some may require only a high school diploma.

People who want to enter the respiratory therapy field should enjoy working with patients and should understand their physical



Respiratory therapy personnel provide a vital need.

and psychological needs. Respiratory therapy workers must be able to pay attention to detail, follow instructions, and work as part of a team. Operating the complicated respiratory therapy equipment also requires mechanical ability and manual dexterity. High school students interested in a career in this field are encouraged to take courses in health, biology, mathematics, physics, and bookkeeping.

Respiratory therapists can advance to assistant chief, chief therapist, or, with graduate education, to instructor of respiratory therapy at the college level. Respiratory technicians and assistants can advance to the therapist level by taking the appropriate training courses.

Employment Outlook

Employment of respiratory therapy workers is expected to grow much faster than the average for all occupations through the 1980's as a result of general population growth, greater health consciousness, and expansion of prepayment programs that make it easier for people to pay for health care. Demand for these workers also should increase due to the rising proportion of older persons, the segment of the population with the greatest frequency of heart and lung problems. Additional openings will arise from the need to replace those who retire, die, or leave the occupation for other reasons.

Prospects should be excellent for graduates of formal training programs. If the number of these graduates continues to rise, those without this training may face some competition.

Earnings

The starting salary of respiratory therapists employed in hospitals averaged about $11,400 a year in 1978, according to a survey conducted by the University of Texas Medical Branch. Experienced respiratory therapists in hospitals earned average salaries of $13,900 a year in 1978. Salaries of respiratory technicians and assistants are lower than those of respiratory therapists.

The Federal Government paid respiratory therapists starting salaries of about $8,400 a year in 1979, if they had 1 year of AMA-accredited postsecondary school training, and about $9,400 for those with 2 years of AMA-accredited training.

Respiratory therapy workers in hospitals receive the same benefits as other hospital personnel, including hospitalization, paid vacations, and sick leave. Some institutions provide tuition assistance or free courses, pension programs, uniforms, and parking.

Related Occupations

Respiratory therapy workers administer respiratory therapy care and life support to patients with heart and lung difficulties under the supervision of a physician. Workers in other occupations who use therapy methods, equipment, and techniques to help restore a patient's normal functions, generally under the supervision or order of a physician, include dialysis technicians, emergency medical technicians, nurse anesthetists, occupational therapists, and physical therapists.

Sources of Additional Information

Information concerning education programs is available from:

American Association for Respiratory Therapy, 1720 Regal Row, Dallas, Tex. 75235.

Information on the certification of respiratory therapists and respiratory technicians can be obtained from:

The National Board for Respiratory Therapy, Inc., 1900 West 47th Place, Shawnee Mission, Kan. 66205.

On-the-job training information can be obtaining at local hospitals.

Nursing Occupations

The nursing field—consisting of registered nurses; licensed practical nurses; and nursing aides, orderlies, and attendants—accounts for over one-half of total employment among health service workers. Nursing personnel perform a variety of duties to care for and comfort the sick, the injured, and other requiring medical services. This section deals in detail with the three basic nursing occupations.

Registered nurses (RN's) follow the medical regimen prescribed by physicians but often must draw on their professional training to make independent judgments in providing nursing services. Some registered nurses, after advanced training, become *nurse practitioners* and perform services, such as physical examinations, that traditionally physicians have handled. Some become head nurses with responsibility for all nursing services of a specified area, such as a pediatrics ward, in an institution.

Licensed practical nurses (LPN's) povide skilled nursing care to sick, injured, and convalescent patients. They work under the general supervision of physicians and registered nurses, and may sometimes supervise nursing aides, orderlies, and attendants.

Nursing aides, orderlies, and attendants make up the largest group of nursing personnel. They serve meals, feed patients, and do other routine tasks that free registered and practical nurses for work requiring professional and technical training.

Persons who wish to become registered nurses, licensed practical nurses, or nursing aides, orderlies, and attendants should like to work with people because they must work closely with other members of the health team and care for patients who are uncomfortable and cometimes irritable. Nursing workers also must be reliable and levelheaded in emergencies.

Registered Nurses

(D.O.T. 075.117 through .374)

Nature of the Work

Nursing plays a major role in health care. As important members of the health care team, registered nurses perform a wide variety of functions. They observe, assess, and record symptoms, reactions, and progress of patients; administer medications; assist in the rehabilitation of patients; instruct patients and family members in proper health maintenance care; and help maintain a physical and emotional environment that promotes recovery.

Some registered nurses provide nursing services in institutions such as hospitals and nursing homes. Others perform research activities or instruct students. The setting usually determines the scope of the nurse's responsibilities.

Hospital nurses constitute the largest group of nurses. Most are staff nurses who provide skilled bedside nursing care and carry out the medical regimen prescribed by physicians. They may also supervise practical nurses, aides, and orderlies. Hospital nurses usually work with groups of patients that require similar nursing care. For instance, some nurses work with patients who have had surgery; others care for children, the elderly, or the mentally ill. Some are administrators of nursing services.

Registered nurses working in nursing homes provide bedside nursing care to patients convalescing from surgery or an illness, to those suffering from chronic illnesses and disabilities, and to the elderly. They also supervise licensed practical nurses and nursing aides.

Private duty nurses give individual care to patients who need constant attention. The private duty nurse is self-employed and may work in a home, a hospital, or a convalescent institution.

Community health nurses care for patients in clinics, homes, schools, and other community settings. They instruct patients and families in health care and give periodic care as prescribed by a physician. They also may instruct community groups in proper diet and arrange for immunizations. These nurses work with community leaders, teachers, parents, and physicians in community health education. Some community health nurses work in schools.

Office nurses assist physicians, dental surgeons, and occasionally dentists in private practice or clinics. Sometimes they perform routine laboratory and office work in addition to their nursing duties.

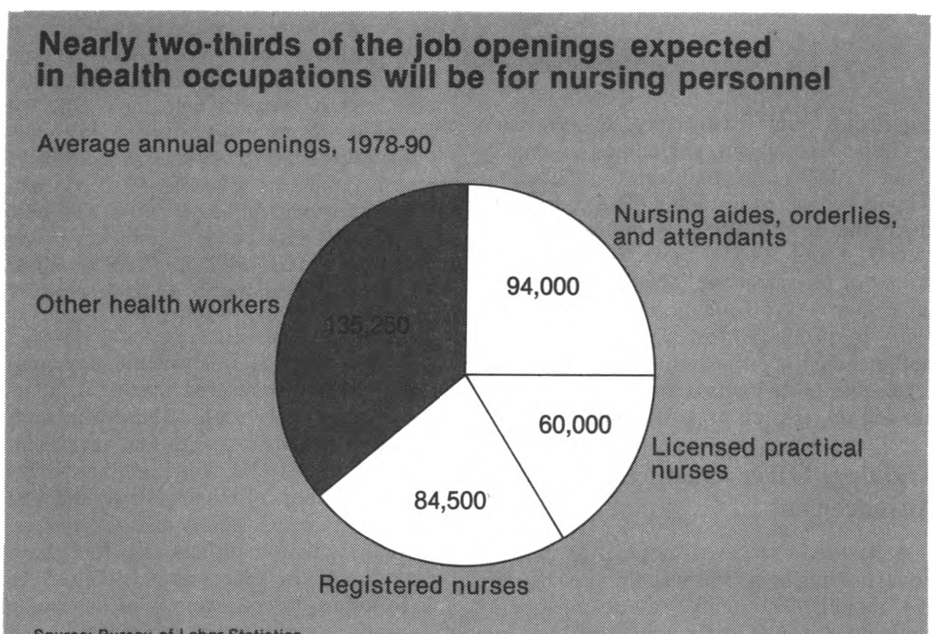
Occupational health or industrial nurses provide nursing care to employees in industry and government and, along with physicians, promote employee health. As prescribed by a doctor, they treat minor injuries and illnesses occurring at the place of employment, provide for the needed nursing care, arrange for further medical care if necessary, and offer health counseling. They also may assist with health examinations and inoculations.

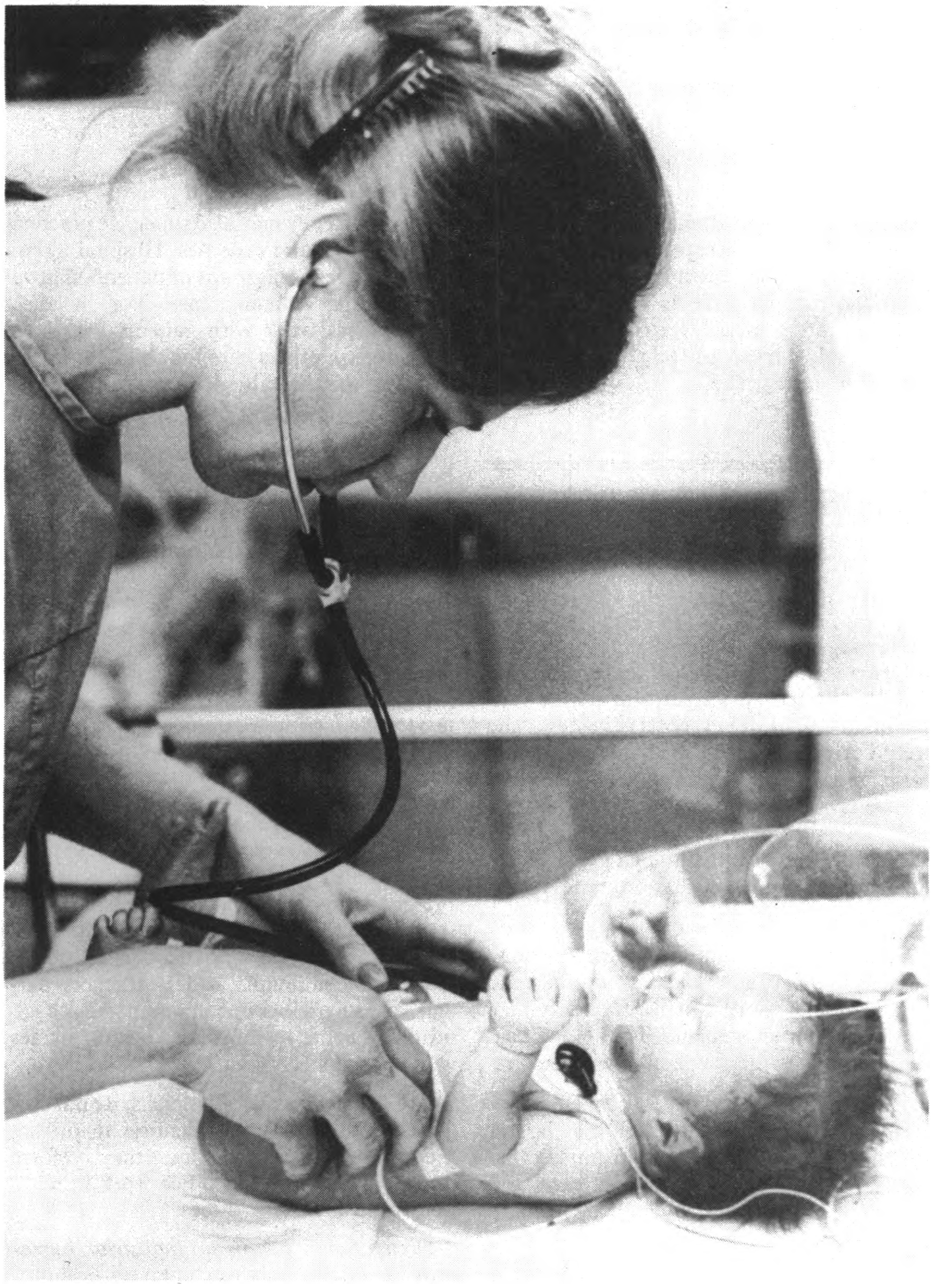
Nurse educators teach students the principles and skills of nursing, both in the classroom and in direct patient care. They also conduct continuing education courses for registered nurses, practical nurses, and nursing assistants.

(Licensed practical nurses who also perform nursing services are discussed elsewhere in the *Handbook*.)

Working Conditions

Nurses generally work indoors in well-lighted, comfortable buildings. Community





Premature babies require round-the-clock care.

health nurses may be required to travel to patients in all types of weather. Although most of the tasks in nursing are not strenuous, nurses need physical stamina because of the amount of time spent walking and standing. In addition, emotional stability is required in order to cope with human suffering and frequent emergency situations. Because patients in hospitals and nursing homes require nursing care at all times, staff nurses in these institutions may be required to work nights and weekends.

Places of Employment

About 1,050,000 persons worked as registered nurses in 1978. About one-third worked part time.

About 70 percent of all registered nurses worked in hospitals, nursing homes, and related institutions. Community health nurses in government agencies, schools, visiting nurse associations, and clinics numbered about 120,000; nurse educators in nursing schools accounted for about 40,000; and occupational health nurses in industry, about 25,000. About 100,000 more worked in the offices of physicians or other health practitioners, or were private duty nurses hired directly by patients. Most of the others were staff members of professional nurse and other organizations or worked for State boards of nursing or research organizations.

Training, Other Qualifications, and Advancement

A license is required to practice professional nursing in all States and in the District of Columbia. To qualify, a nurse must be a graduate of a school of nursing approved by the State board of nursing and pass a written State board competency examination. Nurses may be licensed in more than one State, either by examination or endorsement of a license issued by another State.

Three types of educational programs—diploma, bachelor's degree and associate degree—prepare candidates for licensure. Graduation from high school is required for admission to all schools of nursing.

Diploma programs are conducted by hospitals and independent schools and usually require 3 years of training. Bachelor's degree programs usually require 4 years of study in a college or university, although a few require 5 years. Associate degree programs in junior and community colleges require approximately 2 years of nursing education. In addition, several programs provide licensed practical nurses with the training necessary to upgrade themselves to registered nurses while they continue to work part time. These programs generally offer an associate of arts degree. In 1978, about 1,375 programs, (diploma, bachelor's degree, and associate degree) were offered in the United States. In addition, there were about 115 master's degree and several doctoral degree programs providing advanced education in nursing.

Students should select an educational program only after reflecting on their probable field of practice. Those interested in public health, for example, should enroll in a bachelor's degree program. Public health agencies require at least that level of education, and advancement may be limited for nurses without a bachelor's or master's degree in community health nursing. In addition, those planning to work in research, consultation, teaching, clinical specialization, or administration—fields that require education at the master's level, should start their nursing education in a bachelor's program.

Programs of nursing include classroom instruction and supervised nursing practice in hospitals and health facilities. Students take courses in anatomy, physiology, microbiology, nutrition, psychology, and nursing. They also get supervised clinical experience in the care of patients who have different types of health problems. Students in bachelor's degree programs as well as in some of the other programs are assigned to community agencies to learn how to care for patients in clinics and in the patients' homes. Varying amounts of general education are combined with nursing education in all three types of programs.

Students who need financial aid may qualify for federally sponsored nursing scholarships or low-interest loans. Those who want to pursue a nursing career should have a sincere desire to serve humanity and be sympathetic to the needs of others. Nurses must be able to accept responsibility and direct or supervise the activity of others; they must have initiative, and in appropriate situations be able to follow orders precisely or determine if additional consultation is required; and they must use good judgment in emergencies.

From staff positions in hospitals, experienced nurses may advance to head nurse, assistant director, and director of nursing services. A growing movement in nursing, generally referred to as the "nurse practitioner program," is opening new career possibilities. Several post-bachelor's degree programs prepare nurses for highly independent roles in the clinical care and teaching of patients. These nurses practice in primary roles that include pediatrics, geriatrics, community health, mental health, and medical-surgical nursing.

Employment Outlook

Employment opportunities for registered nurses are expected to be favorable through the 1980's. Some competition for more desirable, higher paying jobs is expected in areas where training programs abound. Nurses with a bachelor's degree should have the best prospects in these areas. In addition, some employers—public health departments, for example—now specify the bachelor's degree as the minimum preparation for employment. Opportunities for full- or part-time work in present shortage areas, such as some southern States and many inner-city locations, are expected to be very good through the 1980's. For nurses who have had graduate education, the outlook is excellent for obtaining positions as administrators, teachers, clinical specialists, and community health nurses.

Growth in employment of registered nurses is expected to be faster than the average for all occupations because of extension of prepayment programs for hospitalization and medical care, expansion of medical services as a result of new medical techniques and drugs, and increased interest in preventive medicine and rehabilitation of the handicapped. In addition to the need to fill new positions, large numbers of nurses will be required to replace those who leave the field each year.

Earnings

Registered nurses who worked in hospitals in 1978 received average starting salaries of about $11,800 a year, according to a national survey conducted by the University of Texas Medical Branch. This was above the average for nonsupervisory workers in private industry, except farming. Registered nurses in nursing homes earned slightly less than those in hospitals. Salaries of industrial nurses averaged $275 a week in mid-1978, according to a survey conducted by the Bureau of Labor Statistics.

In 1979, the Veterans Administration paid inexperienced nurses who had a diploma or an associate degree starting salaries of $11,712 a year; those with a bachelor's degree, $13,700. Nurses employed in all Federal Government agencies earned an average of $16,800 in 1978.

Most hospital and nursing home nurses receive extra pay for work on evening or night shifts. Nearly all receive from 5 to 13 paid holidays a year, at least 2 weeks of paid vacation after 1 year of employment, and also some type of health and retirement benefits.

Related Occupations

Other occupations with responsibilities and duties similar to registered nurses include: Occupational therapists, physical therapists, physicians assistants, and respiratory therapists.

Sources of Additional Information

For information on approved schools of nursing, nursing careers, loans, scholarships, working conditions, and employment opportunities, contact:

Career Information Services, National League for Nursing, 10 Columbus Circle, New York, N.Y. 10009.

Information about employment opportunities in the Veterans Administration is available from:

Department of Medicine and Surgery, Veterans Administration, Washington, D.C. 20420.

Licensed Practical Nurses

(D.O.T. 079.374-014)

Nature of the Work

Licensed practical nurses (LPN's) help care for the physically or mentally ill and infirm. Under the direction of physicians and registered nurses, they provide nursing care that requires technical knowledge but not the professional education and training of a registered nurse. (See statement on registered nurses.) In California and Texas, licensed practical nurses are called *licensed vocational nurses*.

In hospitals, LPN's provide much of the bedside care.They take and record temperatures and blood pressures, change dressings, administer certain prescribed medicines, and help patients with bathing and other personal hygiene. They assist physicians and registered nurses in examining patients and in carrying out nursing procedures. They also assist in the delivery, care, and feeding of infants. Some practical nurses work in specialized units such as intensive care, recovery rooms, or burn units. There they perform special nursing procedures and operate sophisticated equipment to provide care for seriously ill or injured patients. In some instances, experienced LPN's supervise hospital attendants and nursing aides. (See statement on nursing aides, orderlies, and attendants.)

LPN's who work in private homes provide day-to-day patient care that seldom involves highly technical procedures or complicated equipment. In addition to providing nursing care, they may prepare meals, see that patients are comfortable, and help keep up their morale. They may teach family members how to perform simple nursing tasks.

In doctors' offices and in clinics, LPN's prepare patients for examination and treatment, administer medications, apply dressings, and teach patients prescribed health care regimens. They also may make appointments and record information about patients.

Working Conditions

Practical nurses in hospitals generally work 40 hours a week, but often this includes some work at night and on weekends and holidays. Although they work is not strenuous, they often must stand for long periods and help patients move in bed, stand, or walk.

In private homes, LPN's usually work 8 to 12 hours a day and go home at night. Private duty nursing affords a great deal of independence in setting work hours and the length and frequency of vacations.

Places of Employment

In 1978, about 518,000 persons worked as LPN's—about three-fifths of them in hospitals. Most of the others worked in nursing homes, clinics, doctors' offices, sanitariums, and other long-term care facilities. Many worked for public health agencies and welfare and religious organizations. Some self-employed nurses worked in hospitals or in the homes of their patients.

Training, Other Qualifications, and Advancement

All States and the District of Columbia regulate the preparation and licensing of practical nurses. To qualify for a license, applicants must complete a practical nursing course approved by the State board of nursing and pass a written examination. Educational requirements for enrollment in State-approved programs range from completion of eighth or ninth grade to high school graduation. Many schools do not require completion of high school but they give preference to graduates. In addition, physical examinations and aptitude tests usually are required.

In 1978, about 1,340 State-approved programs provided practical nursing training. Trade, technical, or vocational schools offered more than half of these programs. Other programs were available at junior colleges, local hospitals, health agencies, and private educational institutions. Several programs operated by the Army for military personnel also were State-approved for practical nurse training. Graduates from these programs are eligible for licensure.

Practical nurse training programs generally last 1 year and include both classroom study and clinical practice. Classroom instruction covers nursing concepts and princi-

LPN's provide much of the bedside care needed by hospital patients. Some assist in the delivery, care, and feeding of infants.

ples and related subjects including anatomy, physiology, medical-surgical nursing, pediatrics, obstetrics, psychiatric nursing, administration of drugs, nutrition, first aid, and community health. In addition, students receive supervised clinical experience—usually in a hospital.

LPN's should be emotionally stable and have a deep regard for human welfare, because work with the sick and injured can be upsetting.

As part of a health care team, they must be able to follow orders and work under close supervision.

Advancement opportunities are limited without additional training or formal education. In-service educational programs prepare some LPN's for work in specialized areas, such as post-surgery recovery rooms or intensive care units. In some cases, LPN's may prepare to become registered nurses while they continue to work part time.

Employment Outlook

The employment outlook for LPN's is expected to be very good through the 1980's. Employment should continue to rise much faster than the average for all occupations in response to the needs of a growing population, including a large proportion of older people, and expanded public and private health insurance plans. Also, newly licensed practical nurses will be needed each year in large numbers to replace those who die, retire, or leave the occupation for other reasons.

Earnings

The average starting salary of LPN's in hospitals was about $9,000 a year in 1978, according to a national survey conducted by the University of Texas Medical Branch.

Federal hospitals offered beginning LPN's an annual salary of $8,366 in 1979.

Many hospitals give pay increases after specific periods of satisfactory service. Paid holidays and vacation, health insurance, and pension plans are typical benefits provided by hospitals.

Related Occupations

Other workers with duties and skills similar to those of LPN's are dental hygienists, emergency medical technicians, occupational therapists, physical therapists, radiologic technologists, and respiratory therapists.

Sources of Additional Information

A list of State-approved training programs and information about practical nursing is available from:

National League for Nursing, 10 Columbus Circle, New York, N.Y. 10019.

National Association for Practical Nurse Education and Service, Inc., 122 East 42nd St., Suite 800, New York, N.Y. 10017.

For information about a career in practical nursing, contact:

National Federation of Licensed Practical Nurses, Inc., 250 West 57th., New York, N.Y. 10019.

Information about employment opportunities in Veterans Administration hospitals is available from a local Veterans Administration hospital and also from:

Department of Medicine and Surgery, Veterans Administration, Washington, D.C. 20420.

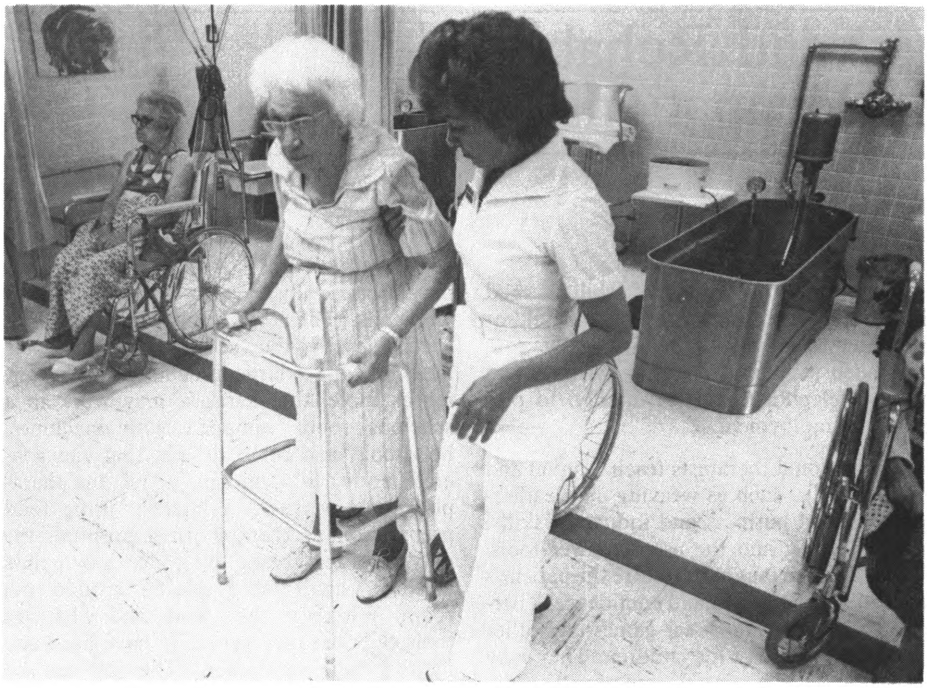
Nursing Aides, Orderlies, and Attendants

(D.O.T. 355.374, .377-014, .667, .674-014 and -018, .677-014, and .687)

Nature of the Work

Nursing aides, orderlies, and attendants perform a variety of duties to care for sick and injured people. They also are called *hospital attendants, nursing assistants, auxiliary nursing workers, geriatric aides*, and (in mental institutions) *psychiatric aides*.

Nursing aides and orderlies answer patients' bell calls and deliver messages, serve meals, feed patients who are unable to feed themselves, make beds, and bathe and dress patients. They also may give massages, take temperatures, and assist patients in getting out of bed and walking. Orderlies escort patients to operating and examining rooms and transport and set up heavy equipment. Some attendants may



Although most nursing aides currently work in hospitals, the majority of new jobs will be in nursing homes, convalescent homes, and other long-term care facilities.

store and move supplies in hospital pharmacies or supply rooms.

The duties of nursing aides depend on the policies of the institutions where they work, the type of patient being cared for, and—equally important—the capacities and resourcefulness of the nursing aide or orderly. In some hospitals, they may clean patients' rooms and do similar housekeeping tasks. In others, they may help registered nurses and licensed practical nurses care for patients. The work depends on whether the patient is confined to bed after major surgery, is recovering after a disabling accident or illness, or needs assistance with daily activities because of advanced age.

Another occupation similar to nursing aide is *homemaker-home health aide*. Working in the homes of patients, they perform duties similar to those of nursing aides, as well as cooking and other light housework. (See statement on homemaker-home health aides elsewhere in the *Handbook*.)

Working Conditions

With few exceptions, the scheduled workweek of attendants in hospitals is 40 hours or less. Because patients need care 24 hours a day, scheduled work hours include nights, weekends, and holidays. Workers spend many hours standing and may have to move patients in bed or help them stand or walk.

Nursing aides often empty bed pans, change soiled bed linens, and care for disoriented and irritable patients. Many gain personal satisfaction, however, from assisting those in need.

Places of Employment

About 1,040,000 persons worked as nursing aides, orderlies, and attendants in 1978. Most work in hospitals, although a rapidly growing number work in nursing homes and other institutions that provide facilities for long-term care and recuperation.

Training, Other Qualifications, and Advancement

Some employers prefer high school graduates, but many, such as Veterans' Administration hospitals, do not require a high school diploma. Employers often accept applicants who are 17 or 18 years of age. Others—particularly nursing homes and mental hospitals—prefer to hire more mature persons who are at least in their mid-twenties.

Nursing aides generally are trained after they are hired. Some institutions combine on-the-job training, under registered nurses or licensed practical nurses, with classroom instruction. Trainees learn to take and record temperatures, bathe patients, change linens on beds occupied by patients, and move and lift patients. Training may last several days or a few months, depending on the policies of the hospital or other institution, the complexity of the duties, and the aide's aptitude for the work.

Courses in home nursing and first aid, offered by many public school systems and other community agencies, provide a useful background of knowledge for the work. Volunteer work and temporary summer jobs in hospitals and similar institutions also are helpful. Applicants should be healthy, tactful, patient, understanding, emotionally stable, and dependable. Nursing aides, as other health workers, should have a genuine desire to help people, be able to work as part of a team, and be willing to perform repetitive, routine tasks.

Opportunities for promotion are limited without further training. Some acquire specialized training to prepare for better paying positions such as hospital operating room technician.

To become licensed practical nurses, nursing aides must complete the year of specialized training required for licensing. Some in-service programs allow nursing aides to get this training while they continue to work part time.

Employment Outlook

Employment of nursing aides is expected to increase faster than the average for all occupations through the 1980's. In addition to those needed because of employment growth, many thousands will be needed each year as workers die, retire, or leave the occupation for other reasons.

Although most jobs for nursing aides and orderlies currently are in hospitals, most new openings will be in nursing homes, convalescent homes, and other long-term care facilities. Major reasons for the expected growth of the occupation are the increasing need for medical care of a growing population, including a larger proportion of elderly people, and the increasing ability of people to pay for health care, largely as a result of the growth in public and private insurance.

Earnings

Nursing aides, orderlies, and attendants earned salaries that were below the average for all nonsupervisory workers in private industry, except farming. Nursing aides employed full time by nursing homes and related facilities earned less than those in hospitals. Depending on the experience of the applicant, starting salaries of nursing aides in Veterans' Administration hospitals ranged from $140 to $180 a week in 1979; most started at $160 weekly. The average salary of nursing aides employed by the Federal Government was $205 a week in 1978.

Attendants in hospitals and similar institutions generally receive at least 1 week's paid vacation after 1 year of service. Paid holidays and sick leave, hospital and medical benefits, extra pay for late-shift work and pension plans also are available to many hospital employees.

Related Occupations

Nursing aides, orderlies, and attendants follow the orders of nurses or other supervisors and assist with the care and treatment of sick or infirm patients. They may move and assemble heavy equipment and perform housekeeping chores. Other workers with similar duties include school child care attendants, companions, occupational therapy aides, physical therapy aides, caretakers, central supply workers, and cook's helpers.

Sources of Additional Information

Information about employment may be obtained from local hospitals and nursing homes.

Therapy and Rehabilitation Occupations

The care given by therapy and rehabilitation workers plays an important part in helping injured, disabled, or emotionally disturbed persons recover to the fullest extent possible. *Physical therapists* and *physical therapist assistants* and *aides* use exercise and other treatments to increase the strength, mobility, and coordination of partially or fully disabled patients. *Occupational therapists* and *occupational therapy assistants and aides* teach skills and crafts to help coordinate and give self-confidence to the disabled and emotionally disturbed. *Speech pathologists* and *audiologists* specialize in helping those with speech and hearing problems.

Anyone considering work in one of these fields should have a genuine concern for the physical and emotional well-being of others. Emotional stability and the ability to maintain a pleasant disposition and a positive outlook also are important, because these workers often deal with patients affected by severe disabilities.

Other occupations also provide the opportunity to work with the disabled and handicapped. Rehabilitation counselors give personal and vocational guidance to the physically, mentally, or socially handicapped. Employment counselors work with the disabled as well as the able-bodied in career planning and job adjustment. Both occupations are described elsewhere in the *Handbook*.

Occupational Therapists

(D.O.T. 076.121-010)

Nature of the Work

Occupational therapists plan and direct educational, vocational, and recreational activities designed to help mentally, physically, or emotionally disabled patients become self-sufficient. They evaluate the capacities and skills of patients, set goals, and plan a therapy program together with the client and members of a medical team that may include physicians, physical therapists, vocational counselors, nurses, social workers, and other specialists.

About 2 therapists out of 5 work with mentally or emotionally handicapped patients, and the rest work with physically disabled persons. These clients represent all age groups and degrees of disability. Patients participate in occupational therapy to determine the extent of abilities and limitations; to regain physical, mental, or emotional stability; to relearn daily routines such as eating, dressing, writing, and using a telephone; and, eventually, to prepare for employment.

Occupational therapists teach manual and creative skills, such as weaving and leatherworking, and business and industrial skills, such as typing and the use of power tools. These skills are taught to restore the patient's mobility, coordination,and confidence. Therapists also plan and direct games and other activities, especially for children. They may design and make special equipment or devices to help disabled patients.

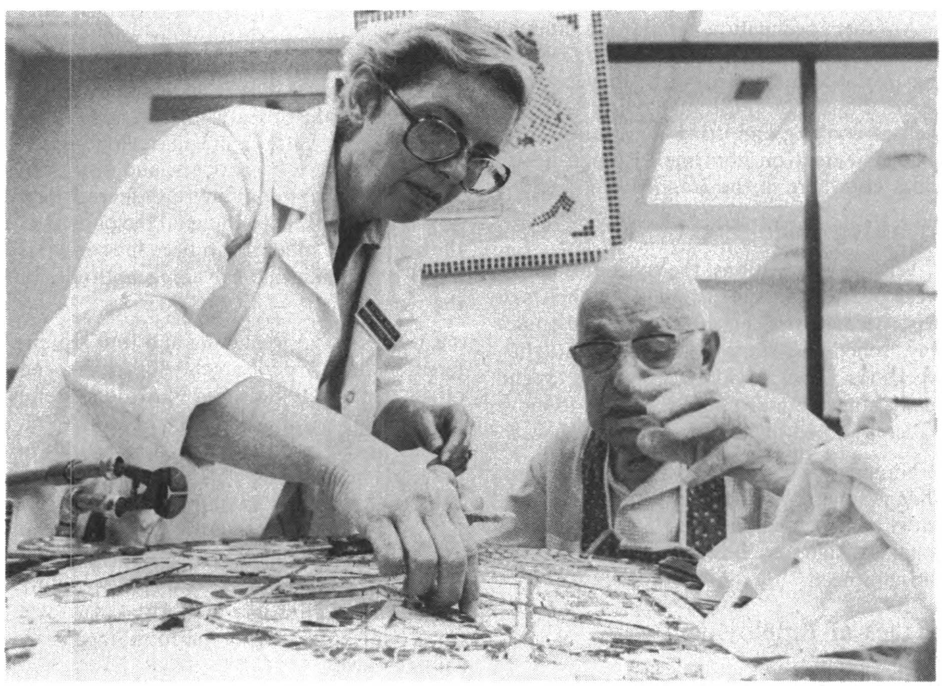
Besides working with patients, occupational therapists supervise student therapists, occupational therapy assistants, volunteers, and auxiliary nursing workers. The chief occupational therapist in a hospital may teach medical and nursing students the principles of occupational therapy. Many therapists supervise occupational therapy departments, coordinate patient activities, or are consultants to local and State health departments and mental health agencies. Some teach in colleges and universities.

Working Conditions

Although occupational therapists generally work a standard 40 hour week, they may occasionally have to work evenings or weekends. Their work environment varies according to the setting and available facilities. In a large rehabilitation center, for example, the therapist may work in a spacious room equipped with machines, handtools, and other devices that can generate noise. In a nursing home, the therapist might work in a kitchen, using food preparation as therapy. In a hospital, the only tools may be building blocks or paints used on small tables placed around the room. Wherever they work and whatever tools they use,they generally have adequate lighting and ventilation. The job can be physically tiring because therapists are on their feet much of the time.

Places of Employment

About 15,000 occupational therapists were employed in 1978. About 3 out of 10 occupational therapists work in hospitals. Rehabilitation centers, nursing homes, schools, outpatient clinics, community mental health centers, and research centers employ most of the others. Some work in special sanitariums or camps for handicapped children, others in State health departments. Still others work in home-care programs for patients unable to attend clinics or workshops. Some are members of the Armed Forces. Many occupational therapists work part time.



Occupational therapist helps patient regain his hand-eye coordination.

Training, Other Qualifications, and Advancement

A degree and certification in occupational therapy is required to enter the profession. In 1978, 53 colleges and universities offered programs in occupational therapy that were accredited by the Council on Allied Health and Education Accreditation of the American Medical Association and the American Occupational Therapy Association. All of these schools offer a bachelor's degree program. Some have a 2-year program and accept students who have completed 2 years of college. Some also offer shorter programs, leading to a certificate or a master's degree in occupational therapy for students who have a bachelor's degree in another field. A graduate degree often is required for teaching, research, or administrative work.

Course work in occupational therapy programs includes physical, biological, and behavioral sciences and the application of occupational therapy theory and skills. These programs also require students to work for 6 to 9 months in hospitals or health agencies to gain experience in clinical practice. Graduates of accredited educational programs are eligible to take the American Occupational Therapy Association certification examination to become a registered occupational therapist (OTR). Occupational therapy assistants who are certified by the association (COTA's) and have 4 years of approved work experience also are eligible to take the examination to become registered occupational therapists. Those COTA's considering this path of entry to the occupation should contact the Director of Certification of the American Occupational Therapy Association to identify the types of experience required to qualify for the examination and to determine the availability of suitable work settings.

Entry to educational programs is keenly competitive and applicants are screened carefully to select those most likely to complete their studies successfully. Persons considering this profession, therefore, should have above average academic performance and consistent grades of "B" or better in science courses, including biology and chemistry. In addition to biology and chemistry, high school students interested in careers as occupational therapists are advised to take courses in health, crafts, and the social sciences. College students who consider transferring from another academic discipline to an occupational therapy program in their sophomore or junior year need superior grades because competition for entrance to programs is more intense after the freshman year.

Personal qualifications needed in the profession include a sympathetic but objective approach to illness and disability, maturity, patience, imagination, manual skills, and the ability to teach.

Newly graduated occupational therapists generally begin as staff therapists. Advancement is chiefly to supervisory or administrative positions; some therapists pursue advanced education and teach or conduct medical research.

Employment Outlook

Employment opportunities for occupational therapists are expected to be favorable through the 1980's. The increasing number of graduates is expected to be roughly in balance with openings expected from future need for these workers and replacement of workers who die, retire, or leave the field for other reasons.

Employment in this occupation is expected to grow much faster than the average for all occupations due to public interest in the rehabilitation of disabled persons and the success of established occupational therapy programs. Many therapists will be needed to staff hospital rehabilitation departments, community health centers, extended care facilities, psychiatric centers, schools for children with developmental and learning disabilities, and community home health programs.

Earnings

Beginning salaries for new graduates of occupational therapy programs working in hospitals averaged about $13,000 a year in 1978, according to a national survey conducted by the University of Texas Medical Branch. Some experienced therapists earned as much as $22,000, and some administrators as much as $25,000 to $30,000.

In 1979, beginning therapists employed by the Veterans Administration (VA) earned starting salaries of about $11,700 a year. The average salary paid occupational therapists working for the VA was about $17,100 in 1978.

Related Occupations

Occcupational therapists use specialized knowledge to help patients prepare to return to work and generally aid them to adjust to their disability. Other workers performing similar duties include orthotists, physical therapists, prosthetists, and speech pathologists and audiologists.

Sources of Additional Information

For more information on occupational therapy as a career, write to:

American Occupational Therapy Association, 6000 Executive Blvd., Rockville, Md. 20852.

Those COTA's interested in qualifying for the examination to become a registered occupational therapist (OTR) through acquired work experience should contact the Director of Certification at the above address.

Occupational Therapy Assistants and Aides

(D.O.T. 076.364 and 355.377-010)

Nature of the Work

Occupational therapy assistants work under the supervision of professional occupational therapists to help rehabilitate patients who are physically and mentally disabled. They help plan and implement programs of educational, vocational, and recreational activities that strengthen patients' muscle power, increase motion and coordination, and develop self-sufficiency in overcoming disabilities.

Occupational therapy assistants teach clients self-care skills such as dressing, eating, and shaving; work-related skills such as the use of power tools; and recreational and social activities such as games, dramatics, and gardening. They also may teach creative skills such as woodworking, ceramics, and graphic arts.

Assistants must be able to teach a broad range of skills because of the wide variety of patients. They may work either with groups or with individual patients. When treating patients with diseases, assistants usually work under the supervision of professional occupational therapists. In other situations, such as organizing crafts projects for handicapped persons living in institutions, they may function independently, with only periodic consultation with professionals.

Occupational therapy aides order supplies, prepare work materials, and help maintain tools and equipment. They also may keep records on patients, prepare clinical notes, and perform other clerical duties.

Some small occupational therapy departments may consist only of a therapist and one other worker. In these cases, the assistant or aide may assume most of the duties of an occupational therapist, within the limits of his or her training.

Working Conditions

Although occupational therapy assistants and aides generally work a standard 40 hour week, they may occasionally have to work evenings and weekends. The areas where they work generally are well lighted and ventilated, although noise levels often are high in areas where power tools are being used. Assistants are on their feet much of the time and may get dirty while cleaning equipment.

Places of Employment

About 10,000 people worked as occupational therapy assistants and aides in 1978. Many occupational therapy assistants work in hospitals. Others work in nursing homes, schools for handicapped children and the mentally retarded, rehabilitation and day

Occupational therapy assistant helps patient regain strength in injured limb.

care centers, special workshops, and outpatient clinics. A small number are members of the Armed Forces.

Occupational therapy aides work in the same locations as assistants, but they generally are employed in hospitals.

Training, Other Qualifications, and Advancement

Two types of educational programs prepare occupational therapy assistants: Junior or community college programs that award an associate degree upon completion and vocational or technical programs. In 1978, 43 schools offered educational programs approved by the American Occupational Therapy Association. Most of these are 2-year college programs. About one-third are 1-year vocational and technical school programs. In addition, the Armed Forces operate a school to train occupational therapy assistants.

Graduates of these programs who successfully complete the written national proficiency examination are certified by the American Occupational Therapy Association and receive the title Certified Occupational Therapy Assistant (COTA). In 1978, about 3,500 employed occupational therapy assistants were COTA's.

Approved programs combine classroom instruction with at least 2 months of supervised practical experience. Courses include the history and philosophy of occupational therapy, occupational therapy theory and skills, anatomy and physiology of the human body, the effect of illness and injury on patients, and human development. Students also practice skills and crafts they later will teach to patients.

Applicants for training programs must be high school graduates or the equivalent. Among the subjects recommended for high school students interested in the occupational therapy field are health, biology, typing, and the social sciences. Preference sometimes is given to applicants who have taken courses in science and crafts and have previous work experience in a health care setting.

Occupational therapy aides train on the job in hospitals and other health care facilities. The length and content of their training depend on the level of difficulty of the duties they are expected to perform.

Occupational therapy assistants and aides should like people, have good physical and mental health, and be able to establish and maintain effective interpersonal relationships. They also should have manual skills because they must teach clients how to use tools and materials.

Occupational therapy assistants and aides who work in large health facilities begin with routine tasks and may advance to more responsible ones as they gain experience. A COTA with 4 years of approved work experience may take the examination to become a registered occupational therapist (OTR) without completing the remaining 2 years of study for a bachelor's degree in occupational therapy. Those COTA's considering this path of entry to the occupational therapy profession should contact the Director of Certification of the American Occupational Therapy Association to identify the types of experience required to qualify for the examination.

Employment Outlook

The employment of occupational therapy assistants and aides is expected to grow much faster than the average for all occupations through the 1980's, primarily because of increased public interest in the rehabilitation of disabled people. All types of health care institutions, especially nursing homes and community health centers, will need more occupational therapy assistants.

Employment opportunities for occupational therapy assistants who are graduates of approved programs are expected to be good through the 1980's. Many openings will be created each year by expansion in this field, and by the need to replace workers who die, retire, or leave the field for other reasons.

The number of enrollees in educational programs for occupational therapy assistants is expected to increase, with the result that assistants in some geographical areas may face competition for jobs. On a national basis, however, the supply of graduates is likely to fall short of requirements.

Earnings

In 1978, starting salaries for occupational therapy assistants generally ranged from about $9,000 to $11,000 a year. Experienced assistants earned between $10,000 and $14,500 a year, according to the limited information available. Occupational therapy assistants working for the Veterans Administration earned starting salaries of about $8,400 annually in 1978, and the average salary paid occupational therapy assistants with the Federal Government was about $12,400 a year.

Occupational therapy aides earned beginning salaries of about $7,500 a year in 1978, according to the limited information available.

Related Occupations

Occupational therapy assistants and aides help administer occupational therapy programs under the supervision of a professional occupational therapist. Other workers with similar auxiliary duties include orthotic assistants, physical therapist assistants, and prosthetics assistants.

Sources of Additional Information

For information about work opportunities and programs offering training for occupational therapy assistants, contact:

American Occupational Therapy Association, 6000 Executive Blvd., Rockville, Md. 20852.

Those COTA's interested in qualifying for the examination to become a registered occupational therapist (OTR) through acquired work experience should contact the Director of Certification, American Occupational Therapy Association, at the above address.

Physical Therapists

(D.O.T. 076.121-014)

Nature of the Work

Physical therapists help persons with muscle, nerve, joint, and bone diseases or injuries to overcome their disabilities. Their patients include accident victims, handicapped children, and disabled older persons. Physical therapists perform and interpret tests and measurements for muscle strength, motor development, functional capacity, and respiratory and circulatory efficiency to develop programs for treatment in cooperation with the patient's physician. They evaluate the effectiveness of the treatment and discuss patient's progress with physicians, psychologists, occupational therapists, and other specialists. When advisable, physical therapists revise the therapeutic procedures and treatments. They help disabled persons accept their physical handicaps and adjust to them. They also teach patients and their families how to continue treatments at home.

Therapeutic procedures include exercises for increasing strength, endurance, coordination, and range of motion; electrical stimulation to activate paralyzed muscles; instruction in carrying out everyday activities and in the use of helping devices; and the application of massage, heat, cold, light, water, or electricity to relieve pain or improve the condition of muscles and skin.

Most physical therapists provide direct care to patients as staff members, supervisors, or self-employed practitioners. Physical therapists usually perform their own evaluations of patients; in large hospitals and nursing homes, however, the director or assistant director of the physical therapy department may handle this work, which requires extensive training and experience. Therapists may treat patients with a wide variety of problems, or they may specialize in pediatrics, geriatrics, orthopaedics, sports medicine, neurology, or cardiopulmonary diseases. Others teach or are consultants.

A physical therapist's work can often be very rewarding.

Working Conditions

Physical therapists generally work in pleasant surroundings. Evening and weekend hours may be required, especially for those in private practice who must be available at times convenient for their patients. The job can be physically exhausting. In addition to standing for long periods, therapists must move equipment and help patients turn, stand, or walk.

Places of Employment

About 30,000 persons worked as licensed physical therapists in 1978. The largest number work in hospitals. Nursing homes employ a growing number of physical therapists and also contract for the services of self-employed therapists. Other therapists work in rehabilitation centers or schools for handicapped children. Some who work for public health agencies treat chronically sick patients in their own homes. Still others work in physicians' offices or clinics, teach in physical therapy educational programs, or work for research organizations. A few serve as consultants in government and voluntary agencies or are members of the Armed Forces.

Training, Other Qualifications, and Advancement

All States, the District of Columbia, and the Commonwealth of Puerto Rico require a license to practice physical therapy. Applicants for a license must have a degree or certificate from an accredited physical therapy educational program and, to qualify, must pass a State licensure examination. Applicants may prepare for State licensure examinations in physical therapy through one of three types of programs, depending upon previous academic study. High school graduates can earn a 4-year bachelor's degree in physical therapy at a college or university. Students who already hold a bachelor's degree in another field, such as biology or physical education, can earn a second bachelor's degree, or a certificate, or an entry level master's degree in physical therapy.

In 1979, 13 certificate programs, 74 bachelor's degree programs and 9 master's degree programs were accredited by the American Physical Therapy Association and the American Medical Association to provide entry level training. There were also 19 other master's degree programs and 4 doctoral degree programs that provided advanced training to those already in the field. One of the master's degree programs is sponsored jointly by the U.S. Army and Baylor University; graduates are commissioned as officers in the Army.

The physical therapy curriculum includes science courses such as anatomy, physiology, neuroanatomy, and neurophysiology; it also includes specialized courses such as biomechanics of motion, human growth and development, and manifestations of disease and trauma. Besides receiving classroom instruction, students get supervised clinical experience administering physical therapy to patients in hospitals and other treatment centers.

Competition for entry to all physical therapy programs is keen. Institutions offering a physical therapy program each year receive many more applications than the number of existing places. Consequently, students seriously interested in attending a physical therapy program must attain superior grades in their earlier studies, especially in science courses. High school courses that are useful include health, biology, chemistry, social science, mathematics, and physics.

Personal traits that physical therapists need include patience, tact, resourcefulness, and emotional stability to help patients and their families understand the treatments and adjust to their handicaps. Physical therapists also should have manual dexterity and physical stamina. Many persons who want to determine whether they have the personal qualities needed for this occupation volunteer for summer or part-time work in the physical therapy department of a hospital or clinic.

A graduate degree combined with clinical experience increases opportunities for advancement, especially to teaching, research, and administrative positions.

Employment Outlook

Employment of physical therapists is expected to grow much faster than the average for all occupations through the 1980's because of increased public recognition of the importance of rehabilitation. As programs to aid handicapped children and other rehabilitation activities expand, and as growth takes place in nursing homes and other facilities for the elderly, many new positions for physical therapists are likely to be created.

Persons seeking physical therapy postions may face some competition, however. If recent trends continue, the number of new graduates is expected to exceed the number of openings that will result each year from expansion in this field and from replacement of those who die or retire. Opportunities should be best in suburban and rural areas. Many part-time positions should continue to be available.

Earnings and Working Conditions

Starting salaries for new physical therapy graduates averaged about $13,000 a year in 1978, according to a national survey conducted by the University of Texas Medical Branch. Earnings of experienced physical therapists averaged about $16,000, with some earning as much as $27,000 a year.

Beginning therapists employed by the Veterans Administration (VA) earned starting salaries of $11,700 a year in 1979. The average salary paid therapists employed by the VA in 1978 was about $17,200 annually; supervisory therapists may earn over $23,000.

Related Occupations

Physical therapists are concerned with the treatment and rehabilitation of persons with physical or mental disabilities or disorders. They may use exercise, massage, heat, water, electricity, and various therapeutic devices to help their patients gain independence. Other workers who perform similar duties include occupational therapists, speech pathologists and audiologists, orthotists, prosthetists, and respiratory therapists.

Sources of Additional Information

Additional information on a career as a physical therapist and a list of accredited educational programs in physical therapy are available from:

American Physical Therapy Association, 1156 15th St. NW., Washington, D.C. 20005.

Physical Therapist Assistants and Aides

(D.O.T. 076.224 and 355.354)

Nature of the Work

Physical therapist assistants and aides work under the supervision of professional physical therapists to help rehabilitate disabled persons so that they may again lead useful and productive lives. They help to restore physical functions and prevent disability from injury or illness.

Assistants help physical therapists test patients to determine the extent of their capabilities and the best treatment for them. Using special therapy equipment, they apply heat, cold, light, ultra sound, and massage, and report to their supervisors on how well the patient is responding to treatment. Assistants help patients perform therapeutic exercises to build strength and increase motion as well as everyday activities such as walking and climbing stairs. They also help physical therapists instruct patients on the use of artificial limbs, braces, and splints.

Physical therapist aides help patients prepare for treatment, and may remove and replace devices such as braces, splints, and slings, and transport patients to and from treatment areas. They may help assistants or therapists by supporting patients during treatment. Aides care for and assemble treatment equipment, make appointments, act as receptionists, and perform other clerical duties.

Some small health care institutions, such as small hospitals or nursing homes, employ only one person besides the therapist in the physical therapy department. In this case, the assistant or aide may assume more duties within the limits of his or her training.

Working Conditions

Physical therapist assistants and aides may be required to work some evenings and weekends. Although they work in clean and pleasant surroundings, the work can be physically exhausting. They are on their feet for hours at a time and may have to move heavy equipment. In addition, they lift patients into and out of wheelchairs, position them on treatment tables, and help them stand or walk.

Places of Employment

About 12,500 persons worked as physical therapist assistants and aides in 1978. Most work in physical therapy departments of general and specialized hospitals. Others work in physicians' or physical therapists' offices and clinics, rehabilitation centers, or nursing homes for the chronically ill and elderly. Some community and government health agencies, schools for handicapped children, and facilities for the mentally retarded also employ physical therapist assistants and aides. A small number are members of the Armed Forces.

Training, Other Qualifications, and Advancement

Training requirements for physical therapist assistants are not uniform throughout the country. Physical therapist assistants are licensed in 24 States where they must be graduates of an accredited 2-year associate degree program and may have to pass a written licensure examination. In States not requiring a license, some physical therapy aides can advance to assistants by acquiring the necessary knowledge and skills on the job, although most employers prefer graduates of accredited programs.

There were 51 accredited programs to train physical therapist assistants in 1978. Most were in junior or community colleges, and all led to an associate degree. Courses include history and philosophy of rehabilitation, human growth and development, anatomy, physiology, and psychology. Studies also cover physical therapist assistant procedures including massage, therapeutic exercise, and heat and cold therapy. Supervised clinical experience also is a requirement of physical therapist assistant programs. The Armed Forces operate schools to train physical therapist assistants, but this training does not satisfy academic requirements for State licensure and no degree is awarded to graduates.

Physical therapist aides train on the job in hospitals and other health care facilities. The length and content of these training programs vary widely, depending on the level of difficulty of duties that aides are expected to

Physical therapy assistant adjusts whirlpool treatment device.

perform, the particular services required by patients in the program, and the amount of time professional therapists spend in teaching trainees. Applicants admitted to physical therapist aide training programs generally must be high school graduates or the equivalent. Employers usually prefer that aides have previous hospital experience as nursing aides.

High school courses that are helpful to physical therapist assistants and aides are health, biology, social science, physical education, mathematics, and typing.

Physical therapist assistants and aides should be in good physical condition. They also need manual dexterity to adjust equipment, body coordination to assist patients, and an interest in assisting the physically handicapped. Emotional stability is important because assistants and aides must maintain a positive, bright outlook while helping patients with very difficult handicaps. Patience and the ability to recognize and appreciate slight improvements also are helpful.

As physical therapist assistants and aides gain experience, they may advance to more responsible duties with corresponding pay increases. Physical therapist assistants with an associate degree from an accredited program sometimes advance to physical therapists by earning the bachelor's degree in physical therapy. A student thinking about this option should arrange his or her associate degree curriculum carefully to correspond to the undergraduate requirements of the bachelor's degree program under consideration.

Some aides advance to physical therapist assistant or physical therapists by resuming their education and completing the academic and clinical education requirements.

Employment Outlook

The number of physical therapist assistants and aides is expected to increase about as fast as the average for all occupations as the demand for professional physical therapists grows. The rise in demand in this field will stem from increased public awareness of the importance of rehabilitation and the growing number of nursing homes which provide therapeutic services. Expanded physical therapy services planned by hospitals, nursing homes, schools for handicapped children, facilities for mentally retarded, and other health and rehabilitation centers are expected to increase the need for physical therapist assistants and aides. Additional workers will be needed to replace those who die or retire.

Due to recent increases in graduates from accredited programs, jobseekers may face competition for the job of their choice. For the Nation as a whole, graduates of physical therapist assistant programs are expected to exceed the number of openings. Competition will be most keen in communities where there are large training programs. Assistants should have brighter employment prospects than aides.

Earnings

In 1978, annual salaries averaged about $6,500 for beginning physical therapist aides and about $9,000 for those with experience, according to the limited information available. Physical therapist assistants received higher salaries than aides, with the average ranging between $9,500 and $11,000 a year in 1978. Physical therapist assistants working for the Veterans Administration (VA) earned starting salaries of about $8,400 a year in 1978, and the average salary paid physical therapist assistants with the VA was about $12,500 annually.

Related Occupations

Physical therapist assistants and aides administer routine therapeutic exercises and treatment under the direction of a physical therapist. Other workers who assist health professionals include occupational therapy assistants and aides, orthotic assistants, prosthetics assistants, nurses aides, and orderlies.

Sources of Additional Information

Information on a career as a physical therapist assistant or aide and on programs offering training for physical therapist assistant is available from:

The American Physical Therapy Association, 1156 15th St. NW., Washington, D.C. 20005.

Speech Pathologists and Audiologists

(D.O.T. 076.101 and .107)

Nature of the Work

About 1 out of 10 Americans is unable to speak or hear clearly. Children who have trouble speaking or hearing cannot participate fully with other children in play or in normal classroom activities. Adults with speech or hearing impairments often have adjustment problems in jobs. Speech pathologists and audiologists provide direct services to these people by evaluating their speech or hearing disorders and providing treatment.

The speech pathologist works with children and adults who have speech, language, and voice disorders resulting from causes such as total or partial hearing loss, brain injury, cleft palate, mental retardation, emotional problems, or foreign dialect. The audiologist primarily assesses and treats hearing problems. Speech and hearing, however, are so interrelated that, to be competent in one of these fields, one must be familiar with both.

The duties of speech pathologists and audiologists vary with education, experience, and place of employment. In clinics, such as in schools, they use diagnostic procedures to identify and evaluate speech and hearing disorders. Then, in cooperation with physicians, psychologists, physical therapists, and counselors, they develop and implement an organized program of therapy. Some speech pathologists and audiologists conduct research such as investigating the causes of communicative disorders and improving methods for clinical services. Others supervise clinical activities.

Speech pathologists and audiologists in colleges and universities teach courses in the principles of communication, communication disorders, and clinical techniques; participate in educational programs for physicians, nurses, and teachers; and work in university clinics and research centers. Although most speech pathologists and audiologists do some administrative work, direc-

Considerable patience is required to help people overcome speech and hearing disabilities.

tors of speech and hearing clinics and coordinators of speech and hearing in schools, health departments, or government agencies may be totally involved in administration.

Working Conditions

Many speech pathologists and audiologists work more than 40 hours a week. They generally work in clean, comfortable surroundings and spend most of their time at a desk or table. Although the job is not physically demanding, the close attention to detail and intense concentration can be mentally exhausting. These workers receive immense satisfaction from seeing their clients' speech and hearing improve, but a lack of progress can be very frustrating.

Places of Employment

About 32,000 persons worked as speech pathologists and audiologists in 1978. Nearly one-half worked in public schools. Colleges and universities employed many in classrooms, clinics, and research centers. The rest worked in hospitals, speech and hearing centers, government agencies, industry, and private practice.

Training, Other Qualifications, and Advancement

An increasing number of States and many Federal programs (such as Medicare and Medicaid) require a master's degree or its equivalent for speech pathologists and audiologists. Some States require a teaching certificate in order to work in the public schools. In 30 States, those offering speech pathology and audiology services outside of schools must be licensed. Licensure requirements vary among the States.

Undergraduate courses in speech pathology and audiology programs include anatomy, biology, physiology, physics, sociology, linguistics, semantics, and phonetics. Courses in speech and hearing as well as in child psychology and psychology of the exceptional child also are helpful. This training usually is available at colleges that offer a broad liberal arts program.

In 1978, about 230 colleges and universities offered graduate education in speech pathology and audiology. Courses at the graduate level include advanced anatomy and physiology of the areas involved in hearing and speech; acoustics; psychological aspects of communication; and analysis of speech production, language abilities, and auditory processes. Graduate students also take courses in the evaluation and remediation of speech, language, and hearing disorders. All students at the graduate level receive supervised clinical training in communicative disorders.

A limited number of scholarships, fellowships, assistantships, and traineeships are available in this field. Teaching and training grants to colleges and universities that have programs in speech and hearing are given by a number of agencies of the U.S. Department of Health, Education, and Welfare—the Rehabilitation Services Administration, the Maternal and Child Health Service, the Office of Education, and the National Institutes of Health. In addition, some Federal agencies distribute money to colleges to aid graduate students in speech and hearing programs. A large number of private organizations and foundations also provide financial assistance for education in this field.

Meeting the American Speech-Language-Hearing Association's (AS-L-HA) requirements for a Certificate of Clinical Competence (CCC) usually is necessary in order to advance professionally. To earn the CCC, a person must have a master's degree or its equivalent, complete a 1-year internship approved by the Association, and pass a national written examination.

Speech pathologists and audiologists should be able to approach problems objectively and have a concern for the needs of others. They also should have considerable patience, because a client's progress often is slow. A person who desires a career in speech pathology and audiology should be able to accept responsibility, work independently, and direct others. The ability to work with detail also is important.

Employment Outlook

Employment of speech pathologists and audiologists is expected to increase much faster than the average for all other occupations through the 1980's. Although some jobs will be available for those having only a bachelor's degree, the increasing emphasis placed on the master's degree by State governments, school systems, and Federal agencies will limit opportunities at the bachelor's degree level.

While employment opportunities for those with a master's degree generally should be favorable, the large number of graduates entering this field may cause some competition. Many openings will occur outside of the large metropolitan areas, and graduates should take this into consideration when seeking employment. Competition for teaching positions in colleges and universities will be very strong throughout the period.

Population growth, which will increase the number of persons having speech and hearing problems, will contribute to the expected expansion in employment of speech pathologists and audiologists through the 1980's. In addition, there is a trend toward earlier recognition and treatment of hearing and language problems in children. Many school-age children, thought to have learning disabilities, actually have language or hearing disorders that speech pathologists and audiologists can treat.

Other factors expected to increase demand for speech pathologists and audiologists are expansion in expenditures for medical research and the growing public interest in speech and hearing disorders. State and Federal laws now require school systems to provide equal educational services for handicapped children, and Medicare and Medicaid programs have expanded their coverage of speech and hearing services.

Earnings

Audiologists working in hospitals generally earn slightly more than speech pathologists. According to a national survey conducted by the University of Texas Medical Branch, audiologists averaged starting salaries of about $14,300 a year in 1978, compared to about $14,000 for speech pathologists. Experienced audiologists averaged

$18,500 a year, compared to $17,500 for speech pathologists.

In 1979, the annual starting salary in the Federal Government for speech pathologists and audiologists with a master's degree was about $15,900. Those having a doctoral degree were eligible to start at about $19,300. The average salary of all speech pathologists and audiologists working for the Federal Government in 1978 was $24,300.

Many speech pathologists and audiologists, particularly those in colleges and universities, supplement their income by acting as consultants, engaging in research projects, and writing books and articles. Almost all receive benefits such as paid vacations, sick leave, and retirement programs.

Related Occupations

Speech pathologists and audiologists specialize in the diagnosis and treatment of speech, language, and hearing problems. Workers in other professions who also perform rehabilitative functions include occupational therapists, optometrists, and physical therapists.

Sources of Additional Information

State departments of education can supply information on certification requirements for those who wish to work in public schools.

A list of college and university programs and a booklet on student financial aid as well as general career information are available from:

American Speech-Language-Hearing Association, 10801 Rockville Pike, Md. 20852.

Other Health Occupations

Dietitians

(D.O.T. 077.061 through .167)

Nature of the Work

Dietitians plan nutritious and appetizing meals to help people maintain or recover good health. They also supervise the food service personnel who prepare and serve the meals, manage dietetic purchasing and accounting, and give advice on good eating habits. Clinical dietitians form the largest group in this occupation; the others are administrative, teaching, and research dietitians. Nutritionists also are included in this field.

Administrative dietitians apply the principles of nutrition and sound management to large-scale meal planning and preparation, such as that done in hospitals, universities, schools, and other institutions. They supervise the planning, preparation, and service of meals; select, train, and direct food service supervisors and workers; budget for and purchase food, equipment, and supplies; enforce sanitary and safety regulations; and prepare records and reports. Dietitians who are directors of dietetic departments also decide on departmental policy; coordinate dietetic services with the activities of other departments; and are responsible for the dietetic department budget, which in large organizations may amount to millions of dollars annually.

Clinical dietitians, sometimes called therapeutic dietitians, plan diets and supervise the service of meals to meet the nutritional needs of patients in hospitals, nursing homes, or clinics. Clinical dietitians confer with doctors and other members of the health care team about patients' nutritional care, instruct patients and their families on the requirements and importance of their diets, and suggest ways to maintain these diets after leaving the hospital or clinic. In a small institution, a dietitian may perform both administrative and clinical duties.

Research dietitians seek ways to improve the nutrition of both healthy and sick people. They may study nutrition science and education, food management, food service systems and equipment, or how the body uses food. Other research projects may investigate the nutritional needs of the aging, persons who have chronic diseases, or space travelers. Research dietitians usually are employed in medical centers or educational facilities, but they also may work in community health programs. (See the statement on food technologists elsewhere in the *Handbook*.)

Dietetic educators teach dietetics to members of the health care team in medical and educational institutions.

Nutritionists may counsel individuals and groups on sound nutrition practices to maintain and improve health, or they may engage in teaching and research. This work covers such areas as special diets, meal planning and preparation, and food budgeting and purchasing. Nutritionists in community health programs may be responsible for the nutrition components of preventive health and medical care services. This includes planning, developing, coordinating, and administering a nutrition program or a nutrition component within the community health program. Nutritionists work in such diverse areas as food industries, educational and health facilities, and agricultural and welfare agencies, both public and private.

An increasing number of dietitians work as consultants to hospitals and to health-related facilities. Others act as consultants to commercial enterprises, including food processors and equipment manufacturers.

Working Conditions

Although most dietitians work 40 hours a week, dietitians in hospitals may sometimes work on weekends, and those in commercial food services have somewhat irregular hours. Dietitians spend much of their time in clean, well-lighted, and well-ventilated areas, such as research laboratories, classrooms, or offices near food preparation areas. However, they do spend time in kitchens and serving areas that often are hot and steamy.

Places of Employment

About 35,000 persons worked as dietitians in 1978. More than one-half work in hospitals, nursing homes, and clinics, including about 1,100 in the Veterans Administration and the U.S. Public Health Service. Colleges, universities, and school systems employ a large number of dietitians to teach or to work in their food service systems. Most of the rest work for health-related agencies, restaurants or cafeterias, and large companies that provide food service for their employees. Some dietitians are employed in the Armed Forces.

Training, Other Qualifications, and Advancement

A bachelor's degree, with a major in foods and nutrition or institution management, is the basic educational requirement for dietitians. This degree can be earned in about 240 colleges and universities, usually in departments of home economics. The college courses that usually are required include food and nutrition, institution management, chemistry, bacteriology, and physiology. Other courses that also are important are mathematics, data processing, psychology, sociology, and economics.

To qualify for professional recognition, the American Dietetic Association (ADA) recommends that graduates complete an ap-

Dietitian verifies dietary needs of each patient before food tray leaves the kitchen.

proved dietetic internship or individual traineeship program. The internship lasts 6 to 12 months and the traineeship program 1 to 2 years. Both programs combine clinical experience under a qualified dietitian with some classroom work. In 1978, 68 internship programs were approved by the ADA. A growing number of coordinated undergraduate programs have been developed that enable students to complete their clinical experience requirement while obtaining their bachelor's degree. In 1978, there were about 70 of these programs offered by medical schools and allied health and home economics departments of colleges and universities. These programs also are approved by the ADA. Persons meeting the qualifications established by the ADA's Commission on Dietetic Registration can become Registered Dietitians (R.D.'s).

Experienced dietitians may advance to assistant or associate director or director of a dietetic department. Advancement to higher level positions in teaching and research usually requires graduate education; public health nutritionists must earn a graduate degree. Graduate study in institutional or business administration is valuable to those interested in administrative dietetics.

Persons who plan to become a dietitian should have organizational and administrative ability, as well as high scientific aptitude, and should be able to work well with a variety of people. Among the courses recommended for high school students interested in careers as dietitians are home economics, business administration, biology, health, mathematics, and chemistry.

Employment Outlook

Employment of dietitians is expected to grow faster than the average for all occupations through the 1980's to meet the nutrition and food management needs of hospitals and extended care facilities, industrial plants, and restaurants. Dietitians also will be needed to staff community health programs and to conduct research in food and nutrition. In addition to new jobs, many others will open each year to replace those who die, retire, or leave the profession for other reasons. Opportunities should remain favorable for dietitians who wish to work part time.

In recent years, employers have used dietetic assistants trained in vocational and technical schools and dietetic technicians educated in junior colleges to help meet the demand for dietetic services. Because this situation is likely to persist, employment opportunities also should continue to be favorable for graduates of these programs.

Earnings

Entry-level salaries of hospital dietitians averaged $12,600 a year in 1978, according to a national survey conducted by the University of Texas Medical Branch. Experienced dietitians received annual salaries ranging from $15,000 to $30,000 according to the American Dietetic Association. The median salary paid by colleges and universities to dietitians with a bachelor's degree was $16,600 a year in 1978. The median salary for those with a bachelor's degree working in commercial or industrial establishments was $15,500 a year; for those in public and voluntary health agencies, $15,800. For self-employed dietitians with a bachelor's degree, the median salary was over $20,000 a year in 1978.

The entrance salary in the Federal Government for those completing an approved internship was about $13,000 in 1979. Beginning dietitians with a master's degree who had completed an internship earned about $15,900. In 1978, the Federal Government paid experienced dietitians average salaries of about $19,600 a year.

Dietitians usually receive benefits such as paid vacations, holidays, health insurance, and retirement benefits. In addition, some hospitals provide free laundry service.

Related Occupations

Dietitians apply the principles of nutrition in a variety of situations. Other workers with similar duties include food technologists, home economists, executive chefs, and food service managers.

Sources of Additional Information

For information on approved dietetic internship programs, scholarships, employment opportunities, registration, and a list of colleges providing training for a professional career in dietetics, contact:

The American Dietetic Association, 430 North Michigan Ave., Chicago, Ill. 60611.

The U.S. Office of Personnel Management, Washington, D.C. 20415, will send information on the requirements for dietetic interns and dietitians in Federal Government hospitals and for public health nutritionists and dietitians in the Public Health Service, U.S. Department of Health, Education, and Welfare; and the District of Columbia government programs.

Dispensing Opticians

(D.O.T. 299.474-010 and 713.361-014)

Nature of Work

Over 110 million people in the United States use some form of corrective lenses to improve their vision. Dispensing opticians (also called *ophthalmic dispensers*) receive lens prescriptions from eye doctors (ophthalmologists) or optometrists, determine the size and style of eyeglasses desired by the customer, write work orders for ophthalmic laboratory technicians, and adjust finished glasses to fit the customer. In many States they fit contact lenses.

Dispensing opticians determine where lenses should be placed in relation to the customer's eyes by measuring the distance between the centers of the pupils. They also help the customer select the proper eyeglass frame by recommending various styles and colors of frames that complement the customer's facial features.

Dispensing opticians analyze and interpret prescriptions and prepare work orders that give ophthalmic laboratory technicians the information they need to properly grind the lenses, and insert them in a frame. The work orders include lens prescriptions and information on lens size, color, and style. After glasses are made, dispensing opticians use a special instrument to check the power and surface qualify of the lenses. Opticians then adjust the frame to the contours of the customer's face and head so that it fits properly and comfortably. Adjustments are made with handtools, such as optical pliers, files, and screwdrivers. A special instrument is used to check the power and surface quality of the lenses.

In fitting contact lenses, dispensing opticians follow ophthalmologists' or optometrists' prescriptions, measure the corneas of customers' eyes and then prepare specifications to be followed by the contact lens manufacturer. Contact lens fitting requires considerably more skill, care, and patience than conventional eyeglass fitting. Dispensing opticians tell customers how to insert, remove, and care for contact lenses during the initial adjustment period, which may last several weeks. The dispensing optician examines the patient's eyes, corneas, lids, and contact lenses with special instruments and microscopes at each visit. Ophthalmologists or optometrists recheck the fit, as needed. Opticians may make minor adjustments; lenses are returned to the manufacturer for major changes.

The majority of dispensing opticians are in the general practice of designing and fitting eyeglasses. Some specialize in the fitting of cosmetic shells to cover blemished eyes. Still others specialize in the fitting of prostheses (artificial eyes). In some shops, they may do lens grinding and finishing and sell other optical goods such as binoculars, magnifying glasses, and nonprescription eyeglasses.

Working Conditions

Dispensing opticians work indoors in pleasant, quiet surroundings that are well lighted and well ventilated. Because they sell and service eye lenses, they deal with customers most of the time.

Places of Employment

About 17,500 persons worked as dispensing opticians in 1978. Most dispensing opticians work for retail optical shops or department stores and other retail stores that sell prescription lenses. Many also work for ophthalmologists or optometrists who sell glasses directly to patients. A few work in hospitals and eye clinics and teach in schools

Analyzing the customer's facial features is a basic part of proper eyeglass fitting.

of ophthalmic dispensing. Many dispensing opticians own retail optical shops.

Dispensing opticians can be found in every State. However, employment is concentrated in large cities and in populous States.

Training, Other Qualifications, and Advancement

Most dispensing opticians learn their skills on the job. On-the-job training in dispensing work may last several years and usually includes instruction in optical mathematics, optical physics, and the use of precision measuring instruments.

Employers prefer persons who have completed formal training programs. In 1978, 21 schools offered 2-year full-time courses in optical fabricating and dispensing work leading to an associate degree. In addition, medical schools, large manufacturers of contact lenses, and professional societies offer short, nondegree courses in contact-lens fitting. A small number of opticians learn their trade in the Armed Forces.

High school graduates also can prepare for optical dispensing work through 2- to 4-year formal apprenticeship programs. Apprentices with exceptional ability may complete their training in a shorter period.

Apprentices receive training in optical mathematics and optical physics and in the use of laboratory equipment. In addition to technical training, apprentices may work directly with patients in fitting eyeglasses and contact lenses. Trainees also are taught the basics of office management and sales.

Employers prefer applicants for entry jobs as dispensing opticians to be high school graduates who have had courses in the basic sciences. A knowledge of physics, algebra, geometry, and mechanical drawing is particularly valuable. Interest in and ability to do precision work are essential. Because dispensing opticians deal directly with the public, they should be tactful and have pleasant personalities.

In 1978, 20 States had licensing requirements governing dispensing opticians: Alaska, Arizona, California, Connecticut, Florida, Georgia, Hawaii, Kentucky, Massachusetts, Nevada, New Jersey, New York, North Carolina, Ohio, Rhode Island, South Carolina, Tennessee, Vermont, and Washington. To obtain a license, the applicant generally must meet certain minimum standards of education and training, and also must pass either a written or practical examination, or both. For specific requirements, the licensing boards of individual States should be consulted.

Many dispensing opticians go into business for themselves. Others may advance by becoming managers of retail optical stores or becoming sales representatives for wholesalers or manufacturers of eyeglasses or lenses.

Employment Outlook

Employment of dispensing opticians is expected to increase faster than the average for all occupations through the 1980's. In addition to job openings from employment growth, some openings will arise from the need to replace experienced workers who retire, die, or leave the occupation for other reasons. Demand for corrective lenses is expected to rise as the general population grows and as the elderly, the group that requires the most eye care, continues to grow as a proportion of the general population. State programs to provide eye care for low-income families, union health insurance plans, and Medicare also will stimulate demand. Moreover, the growing variety of frame styles and colors may encourage individuals to buy more than one pair of glasses.

Employment opportunities should be excellent for dispensing opticians who have an associate degree in opticianry; however, jobseekers without formal training may face competition for jobs of their choice. Opportunities will be best in metropolitan areas because owners operate many of the retail shops in small communities and do not need dispensing opticians.

Earnings

Hourly wage rates for dispensing opticians ranged from $5.75 to $9.25 in 1978, based on information from a small number of union contracts. Dispensing opticians who own and operate their own shops can expect to earn considerably more, generally from $20,000 to $30,000 a year.

Apprentices start at about 60 percent of the skilled worker's rate and are increased periodically so that upon completion of the apprenticeship program, they receive the beginning rate for experienced workers.

Dispensing opticians generally work a 40-hour week. Some, especially those employed in retail shops in large shopping centers, work in the evenings and on Saturdays. Some dispensing opticians are members of unions. The principal union in this field is the International Union of Electrical, Radio and Machine Workers (AFL-CIO).

Related Occupations

Other occupations in which workers with technical knowledge use machines and tools to do precise, delicate work include calibrators, dental laboratory technicians, glass blowers, instrument repairers, locksmiths, ophthalmic laboratory technicians, orthodontic technicians, prosthetics technicians, and watch repairers.

Sources of Additional Information

A list of schools offering courses for people who wish to become dispensing opticians is available from:

National Academy of Opticianry, 514 Chestnut St., Big Rapids, Mich. 49307.

National Federation of Opticianry Schools, Ferris State College, Big Rapids, Mich. 49307

For general information about the occupation, contact:

International Union of Electrical, Radio and Machine Workers, 1126 16th St. NW., Washington, D.C. 20036.

National Federation of Opticianry Schools, Ferris State College, Big Rapids, Mich. 49307.

Opticians Association of America, 1250 Connecticut Ave. NW., Washington, D.C. 20036.

Chairman of Optical Council, IUE-AFL-CIO-CLC, 200 Park Ave. South, New York, N.Y. 10003.

Health Services Administrators

(D.O.T. 169.167-010; 187.117-010, -018, -050; 187.167-034, -090; 188.117-082)

Nature of the Work

Medical and health care is provided by organizations that vary from large teaching hospitals to small walk-in clinics. To function properly, each of these requires effective management which health administrators provide under the general supervision of a board of directors or other governing body.

Administrators direct the various functions and activities that make a health organization work. They may do this personally, where the organization is small, or direct a staff of assistant administrators in larger organizations. Health administrators make many kinds of management decisions. For example, they may review budget proposals, make personnel decisions, and negotiate for the expansion of facilities.

Some health services administrators, including those who manage hospitals or nursing homes, oversee nursing, food services, and in-service training programs. Assistant administrators usually direct the daily operations of these departments; however, the chief executive keeps informed through formal and informal meetings with the assistants, the medical staff, and others. In addition to these management activities, many health administrators help carry out fundraising drives and promote public participation in health programs. This phase of the administrator's job often includes speaking before civic groups, arranging publicity, and coordinating the activities of the organization with those of government or community agencies.

Working Conditions

Health administrators often work long hours. Health facilities such as nursing homes and hospitals operate around the clock, and administrators may be called at all hours to settle emergency problems. Also, some may travel to meetings or, for these who oversee several facilities, to make inspections.

Places of Employment

About 180,000 persons worked in some phase of health administrationin 1978. Most administrators work in health facilities, including hospitals (which employed about half of all administrators), nursing and personal care homes, and health management firms that provide administrative services for a fee.

Some health administrators work for government agencies, including State and local health departments and the U.S. Public Health Service. In addition, the Federal Government hires administrators in Veterans Administration and Armed Forces hospitals and clinics. Others work for voluntary health agencies that support research, provide care and treatment for victims of particular diseases or impairments and conduct professional and public education and communitee service programs.

Training, Other Qualifications, and Advancement

Educational requirements for health services administrators vary according to the position's level of responsibility and the size of the organization. Generally, larger organizations with a more complicated administrative structure require higher credentials than smaller ones.

Applicants with master's degrees in health or hospital administration may be hired as associate or assistant administrators in hospitals, while those with master's degrees in public health often find work as program analysts or program representatives in public health departments. Very few master's degree recipients take entry positions in nursing or personal care homes, although many nursing home administrators pursue graduate education while employed. New master's degree graduates from programs in related disciplines such as public administration or management are sometimes hired for administrative jobs. Master of business administration (MBA) graduates, for example, are sometimes hired by public health departments as program analysts.

Bachelor's degree recipients usually begin their careers as administrative assistants or department heads in hospitals, or as assistant administrators in nursing homes. Graduates of 2-year, associate degree programs generally are hired as unit directors or assistant department heads in hospitals, or as assistants to program representatives in public health departments. Some associate degree holders find assistant administrator jobs in small nursing homes.

The Ph. D. degree usually is required for positions in teaching or research, and is an asset for those seeking administrative jobs in larger, more prestigious health organizations. Although some public health departments still require chief administrators to be physicians, the trend is away from this.

Administrators in Armed Forces hospitals usually are career military personnel.

In 1978, about 60 bachelor degree programs in health services administration were offered. In addition, there were over 75 master's degree, programs in hospital or health services administration that led to the master's degree, and 22 master's degree programs in schools of public health.

To enter graduate programs, applicants must have a bachelor's degree, with courses in natural sciences, psychology, sociology, statistics, accounting, and economics. Competition for entry to these programs is keen, and applicants need above- average grades to gain admission. The programs generally last about 2 years and may include some supervised administrative experience in hospitals, clinics, or health agencies. Programs may include courses such as hospital organization and management, accounting and budget control, personnel administration, public health administration, and the economics of health care.

All States and the District of Columbia require that the administrator of a nursing or personal care home be licensed. Requirements are not uniform, but they generally specify a level of education, such as a bachelor's degree, plus some amount of experience in the field.

Some health services administrators work in nursing homes.

Personal qualifications needed for success as a health administrator include initiative and an interest in helping the sick, injured and handicapped. Administrators should be able to work with and motivate people, and to organize and direct large-scale activities. They also should enjoy public speaking.

Health administrators advance in the profession by taking increasingly more responsible positions. Most frequently, the first job is in a large institution in a position that is somewhat narrow in scope—for example, as department head in charge of purchasing. Advancement is then to successively more responsible jobs such as assistant or associate administrator and finally the chief administrator. Less commonly, hospital administrators begin their careers in small hospitals in positions with broad responsiblities, such as assistant administrator. Regardless of the path of advancement chosen, the ultimate occupational goal in hospitals and nursing homes is chief executive or chief administrative officer.

Employment Outlook

The number of graduate programs in health administration has increased rapidly in recent years; in addition, administative specialists with graduate degrees in other fields have entered the profession. Consequently, it may become more difficult for those with less than a graduate education to enter health administration in top management positions. In addition, some administrative jobs will continue to be filled by registered nurses, physicians, and members of religious communities.

Employment of health services administrators is expected to grow much faster than the average for all occupations through the 1980's as the quantity of patient services increases and health services management becomes more complex. The demand for administrators will be stimulated by the formation of more group medical practices and health maintenance organizations (facilities that offer subscribers a broad range of medical services for a set fee). Administrators also will be needed in nursing and convalescent homes to handle the increasing amount of administrative work expected as these facilities expand in size.

Earnings

Salaries of hospital administrators depend on factors such as the level of job responsibility; the size, type, and location of the hospital; and the size of its administrative staff and budget.

Chief administrators in hospitals with 100 to 150 beds earned an average of $36,000 a year in 1978. Some, in larger hospitals, earned over $55,000. Recent recipients of master's degrees in health administration starting work in Veterans' Administration (VA) hospitals earned $15,920 a year in 1979. The average salary paid administrators of Federal hospitals was $32,100.

Commissioned officers in the Armed Forces who work as hospital administrators hold ranks ranging from second lieutenant to colonel or from ensign to captain. Commanding officers of large Armed Forces hospitals are generally physicians, who may hold higher ranks. Hospital administrators in the U.S. Public Health Service are commissioned officers holding ranks equivalent to those of lieutenant (junior grade) through captain in the Navy.

Administrators of nursing and personal care homes usually earn lower salaries than those paid hospital administrators in facilities having similar numbers of beds. Average annual earnings of nursing home administrators in 1978 were about $21,500. Most administrators employed by voluntary health agencies earned between $20,000 and $30,000 a year in 1978.

Related Occupations

Health services administrators plan programs, set policies, and make decisions for a health service agency or institution. Other administrators with similar responsibilities include social welfare administrators, business enterprise officers, community organization directors, curators, college or university department heads, medical-record administrators, recreation superintendents.

Sources of Additional Information

Information about health administration and the academic programs in this field offered by universities, colleges, and community colleges is available from:

American College of Hospital Administration, 840 North Lake Shore Drive, Chicago, Ill. 60611.

Association of University Programs in Health Administration, One Dupont Circle, NW., Washington, D.C. 20036.

National Health Council, Health Careers Program, 1740 Broadway, New York, N.Y. 10019.

American College of Nursing Home Administrators, 4650 East-West Hwy., Washington, D.C. 20014.

Medical Record Administrators

(D.O.T. 079.167-014)

Nature of the Work

All health care institutions keep records that contain medical information on each patient, including case histories of illnesses or injuries, reports on physical examinations, X-rays and laboratory tests, doctors' orders and notes, and nurses' notes. These records are necessary for correct and prompt diagnosis and treatment of illnesses and injuries. They also are used for research, insurance claims, legal actions, evaluation of treatment and medications prescribed, and in the training of medical personnel. Medical information in hospitals also is used to evaluate patient care provided in the hospital and as a basis for health care planning for the community.

Medical record administrators direct the activities of the medical record department and develop systems for documenting, storing, and retrieving medical information. They supervise the medical record staff, which processes and analyzes records and reports on patients' illnesses and treatment. They train members of the medical record staff for specialized jobs, compile medical statistics required by State or national health agencies, and assist the medical staff in evaluations of patient care or research studies. Medical record administrators serving as department heads are a part of the hospital management staff and participate fully in management activities. As the administrators responsible for the medical information system, they may be required to testify in court about records and record procedures.

The size and type of institution affect the duties and amount of responsibility assigned to medical record administrators. In large hospitals, chief medical record administrators supervise other medical record administrators, technicians, and clerks. Smaller hospitals may employ only two or three persons in the medical record department; in nursing homes usually one person keeps the medical records. In these cases, a consulting medical record administrator usually advises technical and clerical personnel performing medical record functions.

Working Conditions

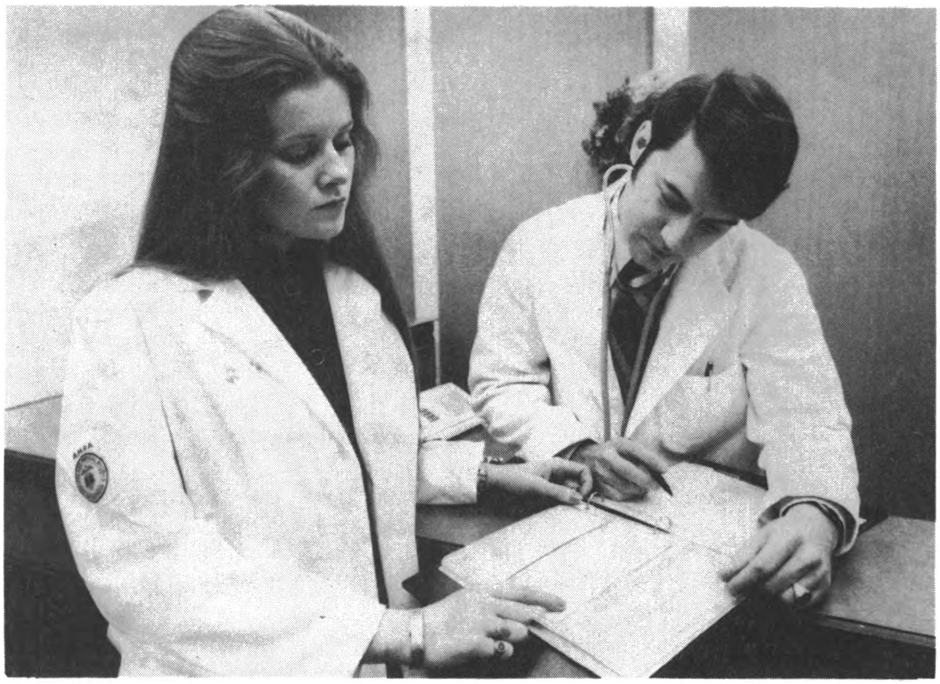
Medical record adminstrators generally work a standard 40-hour week in clean, well-lighted surroundings. Because the record department seldom is involved in emergency situations, the work environment may be a relaxed one. However, accuracy and attention to detail are essential, and this can be very tiring.

Places of Employment

Most of the 12,500 medical record administrators employed in 1978 worked in hospitals. The remainder worked in clinics, nursing homes, State and local public health departments, and medical research centers. Some health insurance companies also employ medical record administrators to help determine liability for payment of their clients' medical fees. Other medical record administrators work for firms that manufacture equipment for recording and processing medical data and develop and print health insurance and medical forms. In addition, many small health care facilities hire medical record administrators as consultants.

Training, Other Qualifications, and Advancement

Preparation for a career as a medical record administrator is offered in specialized programs in colleges and universities. Most programs last 4 years and lead to a bachelor's



Medical record administrators often work closely with physicians.

degree in medical record administration. However, concentration in medical record administration begins in the third or fourth year of study, making transfer from a junior college possible. One-year certificate programs also are available for those who already have a bachelor's degree and required courses in the liberal arts and biological sciences. In 1978, there were 44 programs in medical record administration approved by the Council on Medical Education and Accreditation of the American Medical Association and the American Medical Record Association (AMRA). High school courses that provide a good background include health, business administration, mathematics, and biology.

Training for medical record administrators includes both classroom instruction and practical experience. Anatomy, physiology, fundamentals of medical science, medical terminology, and medical record science are among the required scientific courses. In addition, management courses such as hospital organization and administration, health law, statistics, data processing, and computer science are part of the curriculum. Experience in the medical record departments of hospitals provides students with a practical background in applying standardized medical record practices, compiling statistical reports, analyzing data, and organizing medical record systems.

Graduates of approved schools in medical record administration are eligible for the national registration examination given by AMRA. Passing this examination gives professional recognition as a Registered Record Administrator (RRA). According to the AMRA, there were about 6,500 employed RRA's in 1978.

Medical record administrators must be accurate and interested in detail, and must be able to speak and write clearly. Because medical records are confidential, medical record administrators must be discreet in processing and releasing information. Supervisors must be able to organize, analyze, and direct work procedures and be able to work effectively with other hospital personnel.

Medical record administrators with some experience in smaller health facilities may advance to positions as department heads in large hospitals or to higher level positions in hospital administration. Some coordinate the medical record departments of several small hospitals. Others move on to medical record positions in health agencies. Many teach in the expanding programs for medical record personnel in 2- and 4-year colleges and universities.

Employment Outlook

Employment opportunities for graduates of approved medical record administrator programs are expected to be good through the 1980's. Employment is expected to grow about as fast as the average for all occupations, with the increasing use of health facilities as more and more people are covered by health insurance. The detailed information required by third-party payers, such as insurance companies and government agencies, also will cause growth in the occupation. More consultants will be needed to standardize health records in outpatient clinics, community health centers, nursing homes, and home care programs. The importance of medical records in research and the growing use of computers to store and retrieve medical information also should increase the demand for qualified medical record administrators to develop new medical information systems. Part-time employment opportunities also should be available in teaching, research, and consulting work for health care facilities.

Earnings

The salaries of medical record administrators are influenced by the location, size, and type of the employing institution, as well as by the duties and responsibilities of the position. The average starting salary for medical record administrators in hospitals was about $14,500 a year in 1978, according to a national survey conducted by the University of Texas Medical Branch. Salaries for experienced record administrators in hosptials averaged about $18,000 a year, with some earning well over $30,000.

Newly graduated medical record administrators employed by the Federal Government generally started at about $10,500 a year in 1979; those having good academic records were eligible to begin at about $13,000. In 1978, the Federal Government paid experienced medical record administrators average salaries of about $16,000 a year.

Related Occupations

Medical record administrators work almost exclusively in hospitals and, as a member of the health care team, assume responsibility for a large volume of medical records. They train and supervise workers who verify, transcribe, code, and maintain files on patients' medical history. Workers in other occupations who provide similar administrative services in related fields include: Emergency medical service coordinators, hospital-insurance representatives, library directors, and public health educators.

Sources of Additional Information

Information about approved schools and employment opportunites is available from:

American Medical Record Association, John Hancock Center, Suite 1850, 875 N. Michigan Ave., Chicago, Ill. 60611.

Pharmacists

(D.O.T. 074.161)

Nature of the Work

Pharmacists dispense drugs and medicines prescribed by medical and dental practitioners and supply and advise people on the use of many medicines that can be obtained with and without prescriptions. Pharmacists must understand the use, composition, and effect of drugs and often test them for purity and strength. They may maintain patient medication profiles and advise physicians on the proper selection and use of medicines. Compounding—the actual mixing of ingredients to form powders, tablets, capsules, ointments, and solutions—is now only a small part of pharmacists' practice, since most medicines are produced by manufacturers in the form used by the patient.

Many pharmacists employed in community pharmacies also have other duties. Besides dispensing medicines, some pharmacists buy and sell nonpharmaceutical merchandise, hire and supervise personnel, and oversee the general operation of the pharmacy. Other pharmacists, however, operate prescription pharmacies that dispense only medicines, medical supplies, and health accessories.

Pharmacists in hospitals and clinics dispense prescriptions and advise the medical staff on the selection and effects of drugs; they also make sterile solutions, buy medical supplies, teach in schools of nursing and allied health professions, and perform administrative duties. In addition, pharmacists work as consultants to the medical team in matters related to daily patient care in hospitals, nursing homes, and other health care facilities. Their role is crucial to safe, efficient, and proper therapeutic care.

Some pharmacists, employed as sales or medical service representatives by drug manufacturers and wholesalers, sell medicines to retail pharmacies and to hospitals, and inform health personnel about new drugs. Others teach in colleges of pharmacy, supervise the manufacture of pharmaceuticals, or are involved in research and the development of new medicines. Some pharmacists edit or write technical articles for pharmaceutical journals, or do administrative work. Some combine pharmaceutical and legal training in jobs as patent lawyers or consultants on pharmaceutical and drug laws.

Pharmacist fills prescription.

Working Conditions

Pharmacists usually work in a clean, well-lighted, and well-ventilated area that resembles a small laboratory. Shelves are lined with hundreds of different medicines and drugs. In addition, some items are refrigerated and all controlled substances are kept under lock and key.

According to a recent survey, pharmacists average 44 hours a week in their primary work setting. Many pharmacists work in a secondary setting where they average 15 hours a week, often as a consultant to a nursing home or other facility. Pharmacies often are open in the evenings and on weekends, and all States require a registered pharmacist to be in attendance during pharmacy hours. Self-employed pharmacists often work more hours than those in salaried positions.

Places of Employment

About 135,000 persons worked as licensed pharmacists in 1978. About 100,000 pharmacists worked in community pharmacies. Of these, about one-third owned their own pharmacies; the others were salaried employees. Most of the remaining pharmacists worked for hospitals, pharmaceutical manufacturers, wholesalers, and government and educational institutions. Quite a few community and hospital pharmacists do consulting work for nursing homes and other health facilities in addition to their primary jobs. As a rule, pharmacy services in nursing homes are provided by consultants rather than by salaried employees.

Some pharmacists are civilian employees of the Federal Government who work chiefly in hospitals and clinics of the Veterans Administration and the U.S. Public Health Service. Additional Federal agencies employing pharmacists include the Department of Defense, the Food and Drug Administration and other branches of the Department of Health, Education, and Welfare, and the Drug Enforcement Administration. Other pharmacists serve in the Armed Forces or teach in colleges of pharmacy. State and local health agencies and pharmaceutical and other professional associations also employ pharmacists.

Most towns have at least one pharmacy with one pharmacist or more in attendance. Most pharmacists, however, practice in or near cities and in those States that have the largest populations.

Training, Other Qualifications, and Advancement

A license to practice pharmacy is required in all States and the District of Columbia. To obtain a license, one must graduate from an accredited pharmacy degree program, pass a State board examination and—in all States—have a specified amount of practical experience or internship under the supervision of a licensed pharmacist. Internships generally are served in a community or hospital pharmacy. In 1978, all States except California, Florida, and Hawaii granted a license without reexamination to qualified pharmacists already licensed by another State. Many pharmacists are licensed to practice in more than one State.

At least 5 years of study beyond high school are required to graduate from one of the degree programs accredited by the American Council on Pharmaceutical Education in the 72 colleges of pharmacy. Most graduates receive a Bachelor of Science (B.S.) or a Bachelor of Pharmacy (B. Pharm.) degree. About one-third of the colleges of pharmacy also offer advanced professional degree programs leading to a Doctor of Pharmacy (Pharm: D.) degree; three of the schools offer only the Pharm. D. degree. The Pharm. D. degree as well as the B.S. and B. Pharm. degrees may serve as the entry degree for licensure as a pharmacist.

Admission requirements vary. A few colleges admit students directly from high school. Most colleges of pharmacy, however, require entrants to have completed 1 or 2 years of prepharmacy education in an accredited junior college, college, or university. A prepharmacy curriculum usually emphasizes mathematics and basic sciences, such as chemistry, biology, and physics, but also includes courses in the humanities and social sciences. Because entry requirements vary among colleges of pharmacy, prepharmacy students should inquire about and follow the curriculum required by colleges they plan to attend.

The bachelor's degree in pharmacy is the minimum educational qualification for most positions in the profession. An increasing number of students are enrolled in advanced professional programs leading to the Pharm. D. degree. A master's or Ph. D. degree in pharmacy or a related field usually is required for research work and a Pharm. D., master's, or Ph. D. usually is necessary for administrative work or college teaching. Although a number of pharmacy graduates interested in further training pursue an advanced degree in pharmacy, there are other options. Some enter medical, dental, or law school, and others pursue graduate degrees in science or engineering.

Areas of special study include pharmaceutics and pharmaceutical chemistry (physical and chemical properties of drugs and dosage forms), pharmacology (effects of drugs on the body), pharmacognosy (drugs derived from plant or animal sources), hospital pharmacy, clinical pharmacy, and pharmacy administration. Clinical pharmacy is the synthesis of the basic science education and the application of this knowledge to drug management problems in the care of patients. Courses in pharmacy administration are particularly helpful to pharmacists who become executives or managers.

All colleges of pharmacy offer courses in pharmacy practice, designed to educate students in the skilled processes required for compounding and dispensing prescriptions, and to give students an appreciation for the profession and an understanding of the responsibilities pharmacists have in their relationships with physicians and patients. Many college programs of pharmacy increasingly are emphasizing direct patient care as well as consultative services to other health professionals.

A limited number of Federal scholarships and loans are available for students studying full time toward a degree in pharmacy. In addition, scholarships are awarded annually by drug manufacturers, chain drugstores, corporations, State and national pharmacy associations, colleges of pharmacy, and other organizations.

Since many pharmacists are self-employed, prospective pharmacists interested in this type of practice should have some business capability, interest in medical science, and the ability to gain the confidence of clients. Honesty, integrity, and orderliness are important attributes for the profession. In addition, accuracy is needed to compound and dispense medicines as well as keep records required by law.

Pharmacists often begin as employees in community pharmacies. After they gain experience and obtain the necessary funds, they may become owners or part owners of pharmacies. A pharmacist who gains experience in a chain drugstore may advance to a managerial position, and later to a higher executive position within the company. Hospital pharmacists who have the necessary training and experience may advance to director of pharmacy service or to other administrative positions. Pharmacists in industry often have opportunities for advancement in management, sales, research, quality control, advertising, production, packaging, and other areas.

Employment Outlook

The employment outlook for pharmacists is expected to be favorable through the 1980's. However, if the number of pharmacy graduates continues to rise as rapidly as it has in recent years, graduates may experience competition for jobs. Employment growth is expected to be faster than the average for all occupations. Additional openings will result from deaths, retirements, and other separations from the labor force.

Employment will grow as new pharmacies are established in large residential areas, small towns, and rural locations. Many community pharmacies are expected to hire additional pharmacists because of a trend towards shorter working hours. Demand for pharmacists also will be generated by such factors as population growth; increased life expectancy; greater demand for drugs, particularly among the elderly; availability of a wider range of drug products for preventive and therapeutic uses; the rising standard of health care; and the growth of public and private health insurance programs that provide payment for prescription drugs.

Employment of pharmacists in hospitals and other health facilities is expected to rise faster than in other work settings. Pharmacists increasingly provide direct patient care and consultative services to physicians and other professionals in health facilities. Pharmacists with advanced training will be needed for college teaching and top administrative posts.

Earnings

Salaries of pharmacists are generally influenced by the location, size, and type of employer, as well as the duties and responsibilities of the position. The average starting salary for pharmacists working in hospitals was about $17,000 a year in 1978, according to a national survey conducted by the University of Texas Medical Branch; experienced hospital pharmacists averaged about $21,000 a year. Pharmacists who do consulting work in addition to their primary job may have total earnings considerably higher than this. Experienced pharmacists, particularly owners or managers of pharmacies, often earn considerably more.

The minimum entrance salary in the Federal Government for a new graduate with a bachelor's degree from an approved pharmacy degree program was about $13,000 a year in 1979. However, most graduates qualified for a beginning salary of about $15,900 a year; those with 2 years of graduate work, about $19,300 a year. Pharmacists with additional years of experience may start at a higher salary. The average salary for all federally employed pharmacists was about $20,800 in 1978.

According to a survey conducted by the American Association of Colleges of Pharmacy, average annual salaries of full-time personnel in colleges of pharmacy during 1978 were as follows: deans, about $42,000; assistant and associate deans, about $32,000; full professors, around $33,000; associate professors, around $26,000; and assistant professors, about $22,000.

Related Occupations

Pharmacists fill the prescriptions of physicians, dentists, and other health practitioners and are responsible for selecting, compounding, dispensing, and preserving drugs and medicines. Workers in other professions requiring similar educational training and who work with pharmaceutical compounds or perform related duties include pharmaceutical bacteriologists, pharmaceutical chemists, pharmaceutical-compounding supervisors, and pharmacologists.

Sources of Additional Information

Additional information on pharmacy as a career, preprofessional and professional requirements, programs offered by colleges of pharmacy, and student financial aid is available from:

American Association of Colleges of Pharmacy, Office of Student Affairs, 4630 Montgomery Ave., Suite 201, Bethesda, Md. 20014.

General information on pharmacy is available from:

American Pharmaceutical Association, 2215 Constitution Ave. NW., Washington, D.C. 20037.

Information about chain drugstores is available from:

National Association of Chain Drug Stores, 1911 Jefferson Davis Highway, Arlington, Va. 22202.

General information on retail pharmacies is available from:

National Association of Retail Druggists, 1750 K St. NW., Washington, D.C. 20006.

For a list of accredited colleges of pharmacy, contact:

American Council on Pharmaceutical Education, One East Wacker Dr., Chicago, Ill. 60601.

Information on requirements for licensure in a particular State is available from the Board of Pharmacy of that State or from:

National Association of Boards of Pharmacy, One East Wacker Dr., Suite 2210, Chicago, Ill. 60601.

Information on college entrance requirements, curriculums, and financial aid is available from the dean of any college of pharmacy.

SOCIAL SCIENTISTS

Social scientists study people and social institutions. They investigate all aspects of human society—from the fossilized remains of prehistoric life to the latest television shows. Social science research provides insights that help us understand the many different ways in which individuals and groups make decisions, exercise power, or respond to change, for example. Through their studies and analyses, social scientists assist educators, government officials, business leaders, and others who need an understanding of the dynamics of individual and group behavior.

Research is a basic activity for many social scientists. They use established methods to assemble a body of fact and theory that contributes to human knowledge. Applied research usually is designed to produce information that will enable people to make better decisions or manage their affairs more effectively. Surveys are widely used in the social sciences to collect facts, opinions, or other information. Data collection takes many other forms, however, including excavations at an archeological "dig;" the analysis of historical records and documents; aerial photography of the earth's surface; experiments with human subjects or lower animals in a psychological laboratory; and the administration of standardized tests and questionnaires.

The importance of surveys as a method of collecting social science data has resulted in statistics becoming an essential part of the training for most social science careers. Mathematics is also very important in most disciplines. Indeed, the widespread introduction of mathematical and other quantitative research methods in economics, political science, experimental psychology, and other fields is among the most important changes in the social sciences in recent times. The ability to use computers for research purposes is a "must" in many disciplines.

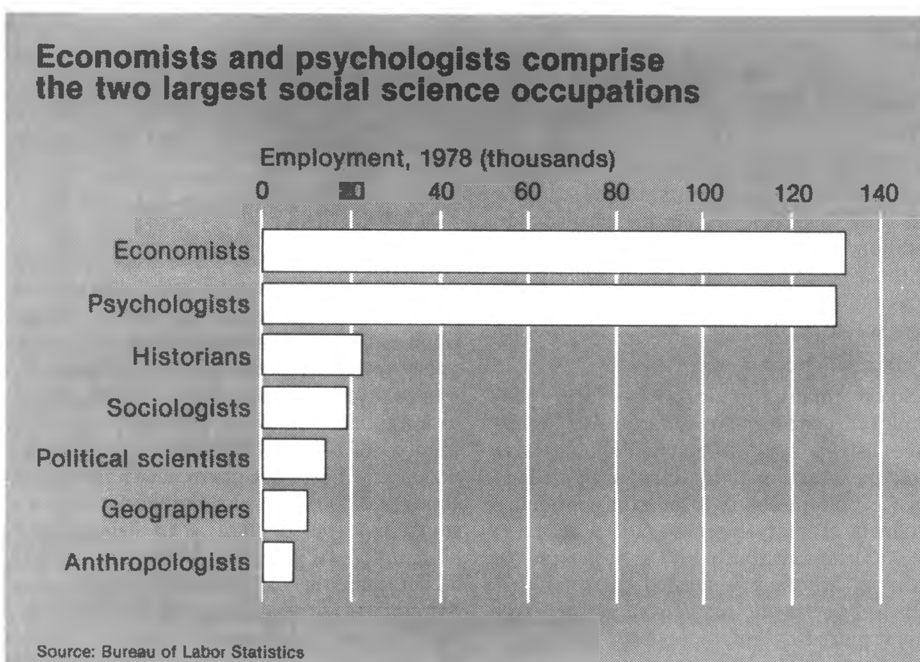
Regardless of their field of specialization, social scientists are concerned with some aspect of society, culture, or personality. *Anthropologists* study the relics and ruins of ancient civilizations, analyze human physical characteristics, and compare the customs, values, and social patterns of different cultures. *Economists* study the way we use our resources to produce goods and services. They compile and analyze data that explain the costs and benefits of allocating resources in different ways. *Geographers* study such features of the earth's surface as vegetation and climate and interpret the relationship between geographic factors and human activity. Because geographers are concerned with patterns of human settlement—why and how people live where they do—their research touches upon economics, politics, health, and culture. *Historians* describe and interpret the people, ideas, institutions, and events of the past and present. *Political scientists* investigate the ways in which political power is amassed and used. Studying such topics as public opinion, political decisionmaking, and ideology, they analyze the structure and operation of governments and examine informal political entities as well. *Psychologists* study human behavior and use their expertise to counsel or advise individuals or groups. Their research also assists advertisers, politicians, and others interested in influencing or motivating people. *Sociologists* analyze the behavior of groups or social systems such as families, neighborhoods, or clubs.

Besides the occupations described in this section, a number of related fields are covered elsewhere in the *Handbook*. See the statements on lawyers, urban planners, city managers, statisticians, mathematicians, programmers, systems analysts, marketing research workers, newspaper reporters, social workers, college and university teachers, college student personnel workers, and counseling occupations.

The Ph. D. is a minimum requirement for most positions in colleges and universities and is important for advancement to many top-level nonacademic posts. Graduates with master's degrees have more limited professional opportunities, although the situation varies a great deal by field. Bachelor's degree holders have even more limited opportunities and in most social science occupations do not qualify for "professional" positions. The bachelor's degree does, however, provide a suitable background for many different kinds of "junior professional" jobs, such as research assistant, administrative aide, or trainee.

The seven social science occupations provided employment for about 335,000 persons in 1978. The interdisciplinary nature of the various fields makes it difficult to determine the exact size of each profession. Economics and psychology are the largest fields; anthropology is the smallest.

Many social scientists work in colleges and universities, where they characteristically combine teaching with research and consulting. The importance of the academic world as a source of employment varies by discipline, however. Economists and psychologists are much more heavily involved in nonacademic, "applied" pursuits than are other social scientists. The predominance of academic employment in such disciplines as anthropology and sociology may cause problems in the future since little if any employment growth is anticipated in the academic sector through the 1980's, a reflection of declining college enrollments. Compared to the past, few academic positions will be available, and efforts are underway to acquaint new graduates with "alternative" or "nontraditional" career opportunities in such applied areas as program administration and evaluation research. Such positions are available in Federal, State, and local government agencies; research organizations and consulting firms; hospitals and



Economists and psychologists comprise the two largest social science occupations

Source: Bureau of Labor Statistics

other health facilities; labor unions, trade associations, nonprofit organizations, and business firms.

The number of advanced degrees awarded in the social sciences through the 1980's is expected to exceed job openings, producing a highly competitive outlook for professional positions traditionally requiring a doctorate. Job prospects are better in some disciplines than in others. As in the past, top graduates of leading universities will have a decided advantage in competing for jobs, especially for the limited number of academic jobs. Other considerations that affect employment opportunities in the social sciences include degree level; field of specialization; specific skills and/or experience; desired work setting; salary requirements; and geographic mobility. More detailed information about the employment outlook in individual social science occupations appears in the following statements.

Anthropologists

(D.O.T. 055.067 and 090.227-010)

Nature of the Work

Anthropologists study people—their evolution and physical characteristics, and the cultures they create. The domain is broad; anthropologists study people's traditions, beliefs, customs, languages, material possessions, social relationships, and value systems. They generally concentrate in one of four subfields: Cultural anthropology, archeology, linguistics, or physical anthropology.

Most anthropologists specialize in cultural anthropology, sometimes called ethnology. *Ethnologists* study the customs, culture, and social life of groups, and may spend months or years living with a group to learn about its way of life. These anthropologists may learn another language or adopt new customs while observing and studying a group. Ethnographic research may focus on a particular institution or aspect of group life such as kinship, personality, art, law, religion, economics, or ecological adaptation. The field lends itself to comparative studies, such as those on different societies' attitudes towards old age. In recent years, ethnologists have ventured beyond their traditional concern with nonindustrialized societies. More and more, their research deals with groups found in modern urban societies: Ghetto inhabitants, drug addicts, politicians, and business leaders, for example.

Archeologists study cultures from artifacts and other remains in the ground. Using scientific techniques for dating and analyzing everything they find, archeologists gather and examine the remains of homes, tools, clothing, ornaments, and other evidences of human life and activity to reconstruct the inhabitants' history and customs. Archeological fieldwork takes place wherever people once lived. Sites are found in all parts of the world, and they span many centuries—from ancient times up to the present. In a desert in New Mexico, for example, archeologists have uncovered an ancient kiva—an Indian religious chamber. In a cave by the Dead Sea, they have found pieces of ancient scrolls several thousand years old. Extensive excavations at the huge Cahokia site just across the Mississippi River from St. Louis have permitted reconstruction of the Indian town as it appeared in the 12th century and provided clues as to the social and economic life of the inhabitants. In recent years, support has grown for archeological study of relatively modern communities—American colonial settlements and 19th century industrial towns, for example.

These archeologists are discussing discoveries made during a recent trip to Africa.

Linguistic anthropologists study the role of language in various cultures. They examine the sounds and structure of a society's language and relate these to people's behavior and thought patterns. Their research tells us, for example, that the way people use language may influence the way they think about things.

Physical anthropologists are concerned with humans as biological organisms. They study the evolution of the human body and look for the earliest evidence of human life. They also do research on racial groups and may explore, for example, the effect of heredity and environment on different races. Their work requires extensive training in anatomy, biology, chemistry, genetics, and the study of primates (the order of mammals that includes humans, apes, and monkeys). A physical anthropologist might study children's growth and development or teach a chimpanzee to communicate with sign language. A knowledge of body structure enables these anthropologists to work as consultants on projects as diverse as the design of military equipment and the sizing of clothing. *Anthropometrists* specialize in the measurement of the body or skeleton.

Anthropologists, like other social scientists, are research-oriented. Most, however, combine fieldwork or other forms of anthropological research with other activities: Teaching, writing, consulting, or administering programs. Moreover, a growing number of anthropologists specialize in *applied anthropology*; they concern themselves first and foremost with practical applications for research findings. *Medical anthropologists*, for example, may study cultural attitudes towards medicine and health care to help formulate a health program for a particular group. Some medical schools hire medical anthropologists as instructors. *Urban anthropologists* study complex, industrialized societies and examine the influence of city life upon people and their institutions. Some anthropologists work with architects, designers, and land use experts in planning community development projects. Others advise social service agencies; their cross-cultural insights enable them to help improve the delivery of health, counseling, nutritional, and other services to particular population groups. Still other anthropologists use their knowledge of ethnic customs and values to help educators improve the effectiveness of classroom teaching and increase parental involvement. The advice of anthropologists has been sought in the planning of bilingual education programs, for example.

Preparing cultural environmental impact statements is an increasingly important activity for anthropologists, as it is for other social scientists. In many communities, environmental protection and historic preservation laws require local authorities to identify historic areas which may be affected by development or renovation plans. Typically, those proposing to build something new or demolish something old are required to suggest ways of avoiding or lessening any adverse impacts. Generally, the research and writing involved in preparing an impact statement are done on a consultant basis by anthropologists associated with museums, colleges and universities, research institutes, or private consulting firms. In some cases, anthropologists are hired by highway commissions or planning departments to prepare impact statements.

Working Conditions

Dividing their time among teaching, research, and administrative responsibilities, anthropologists employed by colleges and universities have flexible work schedules. On the other hand, anthropologists working in government agencies and private firms have much more structured work schedules. Anthropologists often work alone behind a desk, reading, analyzing data, and writing up the results of their research. Many experience the pressures of deadlines, tight schedules, and heavy workloads, and sometimes must work overtime. Their routine may be interrupted by numerous telephone calls, letters, special requests for information, meetings, or conferences.

Only when anthropologists participate in field research do their working conditions differ. Under these circumstances, they are an integral part of a research team. Fieldwork may require traveling to remote areas, working under adverse weather conditions, living in primitive housing, and adjusting to different cultural environments. Physical stamina is important because anthropologists doing fieldwork may have to lift equipment, walk considerable distances, and spend long hours digging. In other words, fieldwork can be arduous physical labor—relieved, however, by the hope that some new insight into human society may result.

Places of Employment

About 7,000 persons worked as anthropologists in 1978. About 4 out of 5 anthropologists work in colleges and universities, where they teach and do research and consulting work. (More detailed information may be found in the *Handbook* statement on college and university faculty.)

The Federal Government employs several hundred anthropologists, chiefly in the Departments of Interior, State, Agriculture, and the Army, and in the Smithsonian Institution. Anthropologists who work for State and local governments are primarily involved in community development planning, health planning, archeological research, and historic preservation. A number of them have administrative jobs in museums.

Some anthropologists work for consulting firms or operate their own consulting services. They conduct research and prepare proposals for government agencies, community organizations, citizens' groups, and business firms. Some consultants specialize in overseas development projects.

Training, Other Qualifications, and Advancement

Students who want to become anthropologists should obtain the Ph. D. degree. College graduates with bachelor's degrees often get temporary positions and assistantships in graduate departments where they are working for advanced degrees. A master's degree, plus field experience, is sufficient for many beginning professional positions, but promotion to top positions generally is reserved for individuals who have a Ph. D. degree. Colleges and universities require a Ph. D. for permanent teaching appointments. Persons with a master's or bachelor's degree in anthropology may qualify for research and administrative positions in government and private firms.

A student interested in anthropology should acquire a broad background in the social and physical sciences and in languages. Mathematics, statistics, and computer science are increasingly important research tools. Undergraduates may begin their field training in archeology by arranging, through their university departments, to accompany expeditions as laborers or to attend field schools established for training. They may later become supervisors in charge of the digging or collection of material and finally may direct a portion of the work of the expedition. Ethnologists and linguists usually do their fieldwork independently. Most anthropologists base their doctoral dissertations on data collected through field research; they are therefore experienced fieldworkers by the time they earn the Ph. D. degree.

The Federal Government generally requires a college degree with 24 semester hours in anthropology for entry level positions as anthropologists and 20 semester hours in anthropology, including one course in American archeology, for archeologists. However, because competition for Federal jobs is keen, additional education or experience may be required.

Over 300 colleges and universities have bachelor's degree programs in anthropology; some 160 offer master's degree programs and about 90, doctoral programs. The choice of a graduate school is very important. Students interested in museum work should select a school associated with a museum that has anthropological collections. Similarly, those interested in archeology either should choose a university that offers opportunities for summer experience in archeological fieldwork or attend an archeological field school elsewhere during summer vacations.

Interdisciplinary studies are an important part of an anthropologist's professional training, for anthropology embraces all aspects of life and overlaps many other disciplines, each with its own tradition and body of knowledge. To bring anthropological insights to bear on projects centered in another discipline—bilingual education is a good example—the anthropologist may have to learn theory and techniques from another field. For this reason, some departments of anthropology are combined with other departments such as sociology or geography.

Some anthropology students seek to broaden their employment possibilities by pursuing courses or degrees in other areas including law, medicine, public administration, and education.

Anthropologists should have a special interest in natural history and social studies and enjoy reading, research, and writing. Creativity and intellectual curiosity are essential to success in this field. In addition, anthropologists must be objective and systematic in their work. Perseverance is essential, particularly for archeologists who may spend years accumulating and piecing together artifacts from ancient civilizations. The ability to analyze data and think logically also is important. Anthropologists must be able to speak and write well to communicate the results of their work effectively.

Employment Outlook

Employment of anthropologists is expected to increase about as fast as the average for all occupations through the 1980's. However, nearly all of the anticipated employment growth will occur in nonacademic jobs—notably in consulting firms, research institutes, corporations, and Federal, State and local government agencies. Among the factors contributing to growth in the occupation is environmental, historic, and cultural resource preservation legislation. This is expected to create opportunities for various kinds of anthropologists to work full time or on a temporary contract basis for consulting firms, government agencies, academic institutions, and museums. Growing interest in ethnic studies may spur demand for anthropological research in that area.

College and university teaching, which will remain the largest area of employment for anthropologists, is likely to experience little growth due to the projected slowdown in college enrollments.

The number of qualified anthropologists seeking to enter the field is expected to exceed available positions. As a result, doctorate holders may face keen competition through the 1980's, particularly for jobs in colleges and universities. Some are expected to accept temporary appointments with little or no hope of gaining tenure. Graduates with master's degrees are expected to face very keen competition, although some may find jobs in junior colleges and government and private agencies. The few bachelor's degree holders who do find jobs as anthropologists may have very limited advancement opportunities within the profession. Some teaching positions may be available in high schools for those who meet State certification requirements.

Overall, specialties offering the best employment prospects include archeology and physical, medical, and urban anthropology.

Earnings

According to the 1977-78 College Placement Council Salary Survey, bachelor's degree candidates in the social sciences received offers averaging around $10,700 a year; master's degree candidates in the social sciences, around $13,200.

Based on limited information, starting salaries in private industry and government for anthropologists with a Ph. D. degree were generally about $18,000 a year in 1978. Master's degree holders generally started at $15,000 to $18,000 a year.

The results of a 1978 American Anthropological Association survey of departments of anthropology included data on faculty salaries. The average beginning salary for new faculty members without full-time teaching experience was in the range of $14,000 to $15,000 for persons with a Ph. D. and $11,500 to $13,500 for persons without a Ph. D. Faculty salaries varied widely but generally were lower in departments granting only bachelor's degrees than in departments granting graduate degrees. Most professors earned from $18,000 to over $30,000 a year; associate professors, $15,000 to $27,000; assistant professors, $12,000 to $24,000; and instructors, $12,000 to $18,000.

The Federal Government recognizes education and experience in certifying applicants for entry level positions. Anthropologists having a bachelor's degree could begin at $10,507 or $13,014 a year in 1979, depending upon the applicant's academic record and experience. The starting salary for those having a master's degree generally was $15,920 a year; for those having a Ph. D., $19,263. Anthropologists in the Federal Government averaged around $31,200 in 1978; archeologists, around $17,900.

Many anthropologists in colleges and universities supplement their regular salaries with earnings from other sources such as summer teaching, research grants, and consulting fees.

Related Occupations

Like anthropologists, people in several other occupations are concerned with understanding how social institutions operate. Among them are economists, geographers, historians, political scientists, psychologists, sociologists, urban planners, marketing research workers, and newspaper reporters.

Sources of Additional Information

For information about careers (including opportunities for contract work in archeology and historic preservation and State employment opportunities for archeologists); job openings; grants and fellowships; and schools that offer training in anthropology, contact:

The American Anthropological Association and the Society for American Archeology, 1703 New Hampshire Ave. NW., Washington, D.C. 20009.

For information on careers and fieldwork opportunities in archeology, contact:

The Archeological Institute of America, 53 Park Place, New York, N.Y. 10007.

Economists

(D.O.T. 050 and 090.227-010)

Nature of the Work

Economists study the way a society uses scarce resources such as land, labor, raw materials, and machinery to provide goods and services. They plan and conduct research, then compile and analyze the results, in order to determine the costs and benefits of making, distributing, and using resources in a particular way. Their research might focus on such topics as energy costs, inflation, business cycles, unemployment, tax policy, or farm prices.

Some economists are primarily theoreticians. They may develop theories to explain the causes of inflation, for example, through the use of mathematical models. Most economists, however, are concerned with practical applications of economic policy in a particular area, such as finance, labor, agriculture, transportation, energy, or health. They use their understanding of economic relationships to advise business firms, insurance companies, banks, securities firms, industry associations, labor unions, and others.

Depending on the topic they're studying, economists may have to devise methods and procedures for obtaining the data they need. Sampling techniques may be used in conducting a survey, for example, and econometric modeling techniques may be used to develop projections. Preparing reports usually is an important part of the economist's job. He or she may be called upon to review and analyze all the relevant data, prepare tables and charts, and write up the results in clear, concise language.

Being able to present economic and statistical concepts in a meaningful way is particularly important for economists whose research is policy directed. Economists who work for business firms may be asked to provide management with information to make decisions on marketing and pricing of company products; to look at the advisability of adding new lines of merchandise, opening new branches, or diversifying the company's operations; to analyze the effect of changes in the tax laws; or to prepare economic and business forecasts. Business economists working for firms that carry on operations abroad may be asked to prepare forecasts of foreign economic conditions.

Economists who work for government agencies assess economic conditions in the United States and abroad and predict the economic impact of specific changes in legislation or public policy. They study such questions as the effect on youth unemployment of changes in minimum wage legislation, for example. Most government economists are in the fields of agriculture, business, finance, labor, transportation, or international trade. For example, economists in the U.S. Department of Commerce study domestic production, distribution, and consumption of commodities or services; those in the Federal Trade Commission prepare industry analyses to assist in enforcing Federal statutes designed to eliminate unfair, deceptive, or monopolistic practices in interstate commerce; and those in the Bureau of Labor Statistics plan surveys and analyze data on prices, wages, employment, and productivity.

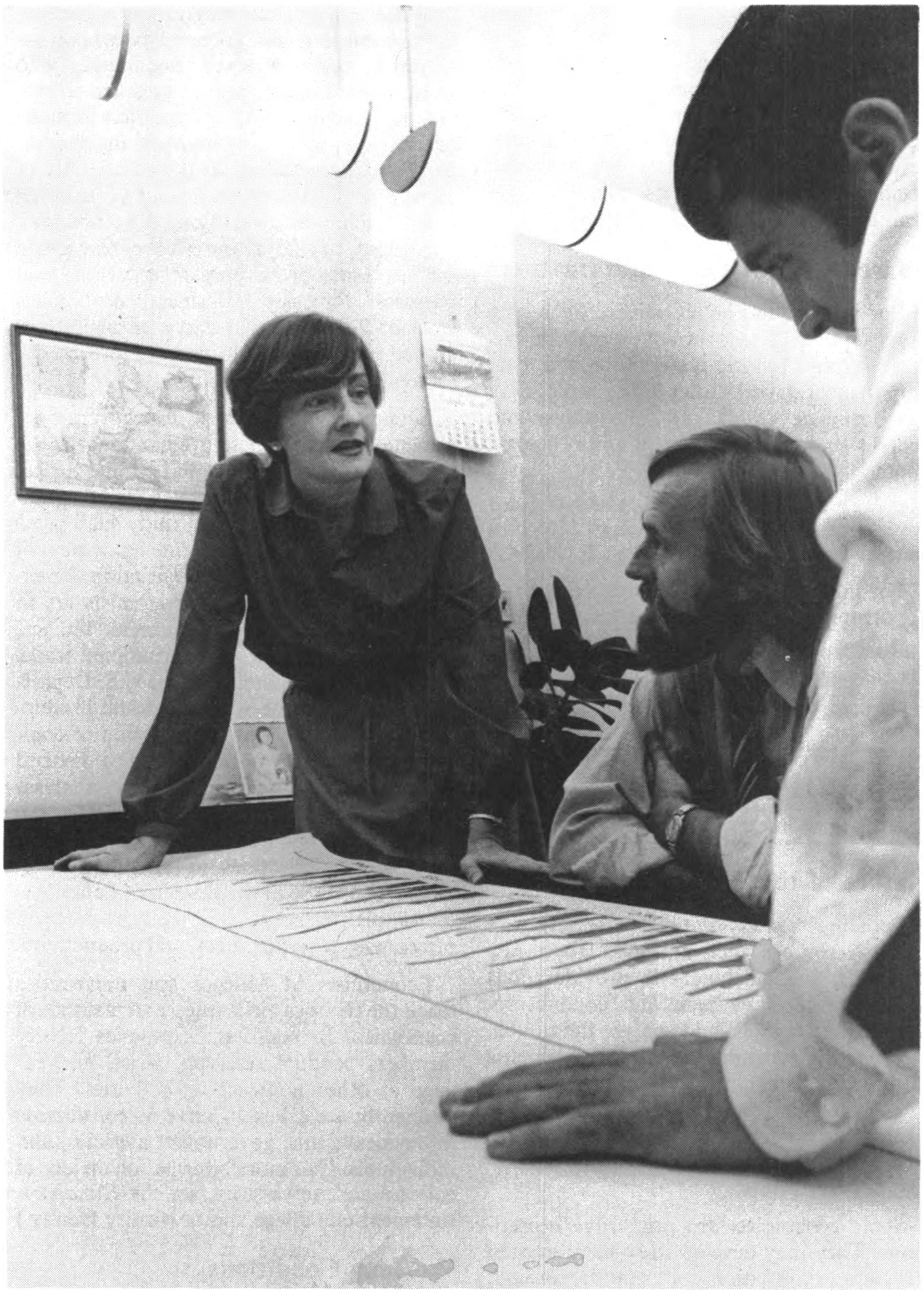
Economists in colleges and universities teach the theories, principles, and methods of economics. In addition, economics faculty members conduct research, write, and engage in other nonteaching activities. They frequently are asked to serve as consultants to business firms, government agencies, and individuals. (For more information on jobs in colleges and universities, see the *Handbook* statement on college and university faculty.)

Working Conditions

Economists employed by colleges and universities have flexible work schedules, dividing their time among teaching, research, and administrative responsibilities. Economists working for government agencies and private firms, on the other hand, have much more structured work schedules. They often work alone with only books, statistical charts, computers, and calculators for company. Or they may be an integral part of a research team on some assigned projects. Most economists work under pressure of deadlines, tight schedules, and heavy workloads, and sometimes must work overtime. Their routine may be interrupted by telephone calls, letters, special requests for data, meetings, or conferences. Travel may be necessary to collect data or attend conferences.

Places of Employment

Economics is the largest social science field. About 130,000 persons worked as



Economists examining a chart on business activity in the United States during 1972.

economists in 1978. About 3 out of 4 of these jobs are in private industry, including manufacturing firms, banks, insurance companies, securities and investment companies, economic research firms, and management consulting firms. Colleges and universities and government agencies at all levels employ most other economists. Some, however, run their own consulting businesses. A number of economists combine a full-time job in government, business, or an academic institution with part-time or consulting work in another setting.

Economists work in all large cities and university towns. The largest number are in the New York City and the Washington, D.C., metropolitan areas. Some work abroad for companies with major international operations; for the Departments of State, Commerce, Agriculture, and other U.S. Government agencies; and for international organizations.

Training, Other Qualifications, and Advancement

Economists must have a thorough understanding of economic theory and of mathematical methods of economic analysis. Since many beginning jobs for economists in government and business involve the collection and compilation of data, a thorough knowledge of basic statistical procedures is required. In addition to courses in macroeconomics, microeconomics, econometrics, and business and economic statistics, training in computer science is highly recommended.

At the undergraduate level, courses in the following subjects also are valuable: Business cycles; economic and business history; economic development of selected areas; money and banking; international economics; public finance; industrial organization; labor economics; comparative economic systems; economics of national planning; urban economic problems and policies; marketing principles and organization; consumer analysis; organizational behavior; and business law.

A bachelor's degree with a major in economics is sufficient for many beginning research, administrative, management trainee, and business sales jobs. However, graduate training increasingly is required for advancement to more responsible positions as economists. Areas of specialization at the graduate level include advanced economic theory, comparative economic systems and planning, econometrics, economic development, economic history, environmental and natural resource economics, history of economic thought, industrial oganization, institutional economics, international economics, labor economics, monetary economics, public finance, regional and urban economics, and social policy. Students should select graduate schools strong in specialties in which they are interested. Some schools help graduate students find internships or part-time employment in government agencies or economic research firms. The work experience and contacts can be useful in testing career preferences and learning how the job market for economists really works.

In the Federal Government, candidates for entrance positions generally need a college degree with a minimum of 21 semester hours of economics and 3 hours of statistics, accounting, or calculus. However, because competition for Federal jobs is keen, additional education or experience may be required.

A master's degree generally is the minimum requirement for a job as a college instructor in many junior colleges and small 4-year schools. In some colleges and universities, however, a Ph. D. degree is necessary for appointment as a teaching assistant or instructor. The Ph. D. degree is required for a professorship and is necessary to gain tenure, which is becoming increasingly difficult to obtain.

In government, industry, research organizations, and consulting firms, economists who have a graduate degree usually can qualify for more responsible research and administrative positions. A Ph. D. may be necessary for top positions in some organizations. Experienced business economists may advance to managerial or executive positions in banks, industrial concerns, trade associations, and other organizations where they formulate practical business and administrative policy.

About 1,500 colleges and universities offer bachelor's degree programs in economics; about 260, master's; and about 120, doctoral programs.

Persons who consider careers as economists should be able to work accurately with detail since much time is spent on data analysis. Patience and persistence are necessary because economists may spend long hours on independent study and problem solving. Sociability enables economists to work easily with others. Economists must be objective and systematic in their work and must be able to express themselves effectively both orally and in writing. Creativity and intellectual curiosity are essential to success in this field, just as they are in other areas of scientific endeavor.

Employment Outlook

Employment of economists is expected to grow faster than the average for all occupations through the 1980's. However, about as many openings will result from deaths, retirements, and other separations from the labor force as from employment growth.

Business and industry, research organizations, and consulting firms will continue to provide the largest number of employment opportunities for economists, reflecting the complexity of the domestic and international economies and increased reliance on quantitative methods of analyzing business trends, forecasting sales, and planning purchases and production operations. Employers will accordingly seek economists well trained in econometrics and statistics.

The continued need for economic analyses on the part of lawyers, accountants, engineers, health administrators, urban planners, and others will also contribute to an increase in the number of jobs for economists. Employment of economists in State and local government agencies is expected to increase in response to the heavy responsibilities of local authorities in such areas as housing, transportation, environment and natural resources, health, and employment development and training. Employment of economists in the Federal Government is expected to rise slowly—in line with the rate of growth projected for the Federal work force as a whole. Little or no employment growth is expected in colleges and universities, the traditional employer of many highly qualified economists. As a result, many such economists are expected to enter nonacademic positions.

Persons who graduate with a bachelor's degree in economics through the 1980's are likely to face keen competition for jobs as economists. However, many of these degree holders will find employment in government, industry, and business as management or sales trainees, or as research or administrative assistants. Those with strong backgrounds in mathematics, statistics, and computer science may be hired by private firms for marketing research work. Candidates who hold master's degrees in economics face very strong competition for teaching positions in colleges and universities, although some may gain positions in junior and community colleges. However, they should find good opportunities for administrative, research, and planning positions in private industry and government. Those with a strong background in marketing and finance may have the best prospects in business. Ph. D.'s are likely to face competition for academic positions, although those graduating from high-ranking universities may have an advantage. Generalists with a strong background in mathematics and statistics who can teach an applied area are in greatest demand. Ph. D.'s should have favorable opportunities in government, industry, research organizations, and consulting firms.

Generally, a strong background in economic theory and econometrics provides the tools for acquiring any specialty within the field. Those skilled in quantitative techniques and their application to economic modeling and forecasting are likely to have the best job opportunities.

Earnings

According to the 1977-78 College Placement Council Salary Survey, bachelor's degree candidates in economics received offers averaging around $12,200 a year; master's degree candidates in the social sciences, around $13,200; bachelor's degree candidates offered positions in the field of finance and economics, around $12,100.

According to an American Economic Association survey, average salaries of economists employed in college and university departments that offered the Ph. D. degree for the academic year 1977-78 were as follows: For professors, about $29,500; for associate professors, about $21,500; for assistant professors, about $17,100; and for instructors, about $13,300. Average salaries were lower in departments that offered only the master's or bachelor's degree.

The median base salary of business economists in 1978 was $33,000, according to a National Association of Business Economists survey. About one-half of the respondents reported additional compensation from their primary employment while about one-third reported income from secondary employment. Economists in general administration and economic advisors commanded the highest salaries while statisticians, econometricians, and teachers had the lowest base salaries. By industry, the highest paid business economists were in the securities and investment, mining, or consulting fields.

Those with a Ph. D. reported the highest salaries while there was relatively little salary difference between master's and bachelor's degree holders. A substantial number of economists supplement their salaries by consulting, teaching, and research activities.

The Federal Government recognizes education and experience in certifying applicants for entry level positions. In general, the entrance salary for economists having a bachelor's degree was was $10,507 a year in 1979; however, those with superior academic records could begin at $13,014. Those having a master's degree could qualify for positions at an annual salary of $15,920, while those with a Ph. D. could begin at $19,263. Economists in the Federal Government averaged around $27,700 in 1978. Economists work in many government agencies, primarily in the Departments of State; Treasury; Army; Interior; Agriculture; Commerce; Labor; Health, Education, and Welfare; Housing and Urban Development; and Transportation.

Based on a 1978 State government salary survey, average salaries for economists (positions requiring a bachelor's degree) ranged from about $12,200 to $16,200; for principal economists (positions requiring a master's degree and experience), from $17,000 to $22,700; and for chiefs of economic research (positions requiring a master's degree and extensive administrative or supervisory experience), from $21,600 to $28,200.

Related Occupations

Economists are concerned with understanding and interpreting financial matters. Others with jobs in this area include financial analysts, bank officers, accountants, underwriters, actuaries, securities sales workers, appraisers, credit analysts, loan officers, and budget officers.

Sources of Additional Information

For information on job openings for economists with graduate degrees and on schools offering graduate training in economics, contact:

American Economic Association, 1313 21st Avenue South, Nashville, Tenn. 37212.

For additional information on careers in business economics, contact:

National Association of Business Economists, 28349 Chagrin Blvd., Suite 201, Cleveland, Ohio 44122.

Geographers

(D.O.T. 018.131-010, .261, .262-010, and .281-010; 029.067 and .167-010; and 090.227-010)

Nature of the Work

Geographers do research on a wide range of social, economic, and environmental issues. They study the spatial distribution and location of various characteristics of the earth's surface. Such studies help to explain changing patterns of human settlement—where people live, why they are located there, and how they earn a living.

Geographers are involved in a variety of activities. Most are college or university teachers and, like other faculty members, do research and consulting in addition to teaching. (For more information, see the *Handbook* statement on college and university faculty.) Other geographers are primarily researchers or analysts. They prepare reports and recommendations and may work for consulting firms, research organizations, business and industrial firms, or government agencies. Some geographers use their specialized knowledge and research skills in planning or administrative jobs in such fields as economic development or environmental resource management.

Depending on their training and field of interest—or on a client's needs—a geographer might examine the distribution of landforms; study variations in climate, soils, or vegetation; or analyze such resources as water and minerals. Like other social scientists, geographers are concerned with human resources, and frequently their research overlaps that of other disciplines. Thus, a geographer might study political organizations, transportation systems, marketing systems, patterns of industrial development, housing, or public health.

Research techniques depend on the topic under study. However, field study, including interviews and the use of surveying and meteorological instruments, is a standard technique. In addition, geographers analyze maps, aerial photographs, and data transmitted by remote sensing equipment on satellites. Some geographers construct maps, graphs, and diagrams in the course of their research. Geographers typically make use of advanced statistical techniques and mathematical models—and, frequently, a computer —when they analyze or map the data they have obtained.

Geographers specialize, as a rule. *Economic geographers* deal with the geographic distribution of an area's economic activities —manufacturing, mining, forestry, agriculture, trade, and communications. Their research might be used for feasibility studies, to determine the costs and benefits of putting resources to use in a particular way. *Political geographers* are concerned with the relationship of geography to politics. They might be asked to help define and describe political boundaries, including those of cities, counties, and administrative subdivisions, as well as offshore areas. *Urban geographers* study cities. They provide background information and make recommendations in such areas as community development, population policy, housing, transportation, and industrial development.

These geographers are making use of mapping and statistical techniques in their study of forms.

The physical characteristics of the earth are the focus of *physical geographers*. They are concerned with the impact of the configuration of the earth's surface on human activities and study the earth's relief, drainage, vegetation patterns, wildlife distribution, and climates. They also study the effect of physical characteristics on navigation and other activities. Typically, they specialize in a particular branch of physical geography such as geomorphology—the study of landforms—or hydrology—the study of water. Geographers specializing in climatology use atmospheric data to describe overall climatic conditions and to do research into the causes of climatic change. They may determine the significance of climatic conditons for defense, conservation, agriculture, health, transportation, marketing, and other activities.

Regional geographers study the physical, climatic, economic, political, and cultural characteristics of a particular region or area, which may range in size from a river basin to a State, a country, or even a continent. In addition to an understanding of the geography of a region, some knowledge of its history, customs, and languages may be necessary.

Cartographers compile and interpret data and design and construct maps and charts. They also conduct research in surveying and mapping techniques and procedures.

Medical geographers study the effect of the environment on health and take into account such factors as climate, vegetation, mineral traces in water, and atmospheric pollution. They work with public health officials, biostatisticians, and others to determine how our health is influenced by our physical surroundings—including access to health-care facilities.

Geographers may specialize even further in other subfields, including agricultural geography, biogeography, conservation, cultural geography, geographical methods and techniques, historical geography, location theory, population geography, remote sensing, rural geography, social geography, and transportation.

Formal training in geography provides the background for a wide range of jobs requiring expertise in environmental resources, regional planning, and social science research. Examples of such jobs are aerial photo interpreter, climatologist, community development specialist, ecologist, intelligence analyst, map analyst, land economist, marketing analyst, regional planner, research analyst, site researcher, and transportation planner. Jobs such as these generally require knowledge not only of geography, but of other disciplines as well. Particularly useful are combinations of geography with economics, political science, sociology, anthropology, geology, or urban planning.

Working Conditions

Geographers employed by colleges and universities have flexible work schedules, dividing their time among teaching, research, and administrative responsibilities. Geographers working for government agencies and private firms, on the other hand, have much more structured work schedules. They often work alone behind a desk or a drafting table, reading and writing reports on their research or constructing maps and charts. Many experience the pressures of deadlines and tight schedules and sometimes must work overtime. Their routine may be interrupted by telephone calls, letters, special requests for information, meetings, or conferences.

Increasingly, geographers conduct research and surveying operations in the field. Under these circumstances, they are an integral part of a research team. Fieldwork may require traveling to remote areas, working under severe weather conditions, living in primitive housing, and adjusting to different cultural environments. Physical stamina also is important because fieldwork requires long working hours, occasionally under adverse conditions.

Places of Employment

About 10,000 persons worked as geographers in 1978. Colleges and universities employ over half of all geographers. The Federal Government also is an important employer of geographers, and many work in the Washington, D.C. area. For these geographers, employed mostly by mapping and intelligence agencies, skills in cartography, photogrammetry, and remote sensing data interpretation are important.

The principal Federal employers are the Departments of Defense, Interior, Commerce, and Agriculture. Other agencies include the Departments of State; Transportation; Education, and Health and Human Services; and Energy; the Environmental Protection Agency (EPA); National Aeronautics and Space Administration (NASA); and the Central Intelligence Agency (CIA).

Geographers employed by State and local governments work mostly in the fields of urban and regional planning, economic development, and community development.

Private industry employs some geographers as researchers and planners; often, they specialize in location analysis. Geographers work for textbook and map publishers, travel agencies, manufacturing firms, real estate development corporations, insurance companies, communications and transportation firms, and chainstores. Some work for scientific foundations and research organizations or run their own research or consulting business.

Training, Other Qualifications, and Advancement

The minimum educational requirement for beginning positions in geography in government, industry, or secondary schools usually is a bachelor's degree with a major in the field. However, a master's degree increasingly is required for many entry level positions. Applicants to entry level jobs would find it helpful to have training in a specialty such as cartography, photogrammetry, remote sensing data interpretation, statistical analysis including computer science, or environmental analysis.

A master's degree is the minimum requirement for the position of college instructor in junior colleges and some 4-year schools, and is important for advancement in business and government. However, a Ph. D. or advancement into doctoral candidacy is required for a first appointment at some institutions of higher education. A Ph. D. degree and a record of significant published research is required for a professorship and is necessary to gain tenure. The Ph. D. degree also is necessary for many senior level planning, research, and administrative positions in government, industry, research organizations, and consulting firms.

In the Federal Government, geographers generally must have a college degree with a minimum of 24 semester hours in geography or related fields. Cartographers need a college degree including at least 18 hours in one or a combination of the following: Cartography, photogrammetry, geodesy, or plane surveying. However, because competition for Federal jobs is keen, additional education or experience may be required.

About 340 colleges and universities offered programs in geography in 1978. Some departments of geography are combined with other disciplines such as urban planning or geology. To further illustrate the interdisciplinary nature of the field, courses in remote sensing and photogrammetry often are offered in departments of geography as well as geology, forestry, or engineering. Undergraduate study provides a general introduction to the field of geography and often includes field study. Research methods and writing skills also are taught. Typical courses offered are physical geography, cultural geography, climatology and meteorology, economic geography, political geography, urban geography, and quantitative methods in geography. Courses in cartography, photogrammetry, remote sensing, historical geography, ecology, natural resource planning, social geography, geography of transportation, geographic aspects of pollution, and geography of various regions also are offered. Geography majors should take appropriate electives in other departments. For example, courses in economics, architecture, urban planning, and urban and rural sociology are important for planners; courses in drawing, design, computer science, and mathematics are important for cartographers; and courses in physics, botany, and geology are important for physical geographers.

In 1978, about 140 institutions offered master's degree programs; 56 offered Ph. D. programs. Applicants for advanced degrees are required to have a bachelor's degree in one of the social or physical sciences with a substantial background in geography. The program of graduate study includes field and laboratory work as well as course work in geography and a thesis. Graduate schools also require course work in advanced mathematics, statistics, and computer science because of the increasing importance of quantitative research methods. A language may be required for those students who plan to specialize in foreign regional geography. In recognition of the increasing importance of applied research, academic programs are putting more emphasis on preparing individuals to apply their knowledge to the solution of practical problems.

Students should select graduate schools that offer appropriate areas of specialization and good research opportunities in nearby libraries, archives, laboratories, and field stations. Internships or part-time employment for graduate students often may be available in government agencies or research, scientific, or industrial firms.

Persons who want to become geographers should enjoy reading, studying, and researching because they must keep abreast of developments in the field. Creativity and intellectual curiosity are important because geographers work with abstract ideas and theories as well as doing practical studies. Patience and persistence help, because geographers spend long hours on independent study and problem solving. They also must be objective and systematic in their work. The ability to communicate ideas effectively, both orally and in writing, is important in this field, as it is in any research-oriented job. The ability to work well with others is often important. Geographers who handle precision drafting tools need manual dexterity.

Employment Outlook

Employment of geographers is expected to grow about as fast as the average for all occupations through the 1980's. Most openings are likely to result from deaths, retirements, and other separations from the labor force.

Little or no employment growth is anticipated in colleges and universities, the traditional employer of many highly qualified geographers; as a result, many such geographers are expected to seek nonacademic positions. Many opportunities are becoming available in urban and environmental management and planning, including such areas as location analysis, land and water resources planning, and health planning. Those with strong backgrounds in urban, economic, and physical geography and in quantitative techniques should be in particular demand. Significant demand also is expected for graduates with knowledge of remote sensing, photogrammetry, and cartography. The Federal Government will need additional personnel to work in programs such as health planning, regional development, environmental quality, and intelligence. Employment of geographers in State and local government is expected to expand, particularly in health planning; conservation; environmental quality; highway planning; and city, community, and regional planning and development. Private industry is expected to hire increasing numbers of geographers for market research and location analysis.

The employment outlook for geographers with the Ph. D. is expected to be favorable through the 1980's for research and administrative positions in government, industry, research organizations, and environmental and other consulting firms. Ph. D.'s may face competition for academic positions, although those graduating from high-ranking universities may have an advantage. Some are likely to accept temporary assignments with little or no hope of acquiring tenure. Those with the master's degree are likely to face competition for academic positions, although some may continue to find jobs in junior and community colleges. Graduates with a master's degree who have training in applied areas should have good opportunities for planning and marketing positions in government and industry; others may face competition.

Graduates with a bachelor's degree are expected to face strong competition for jobs as geographers. Those with quantitative skills and training in cartography, remote sensing, or planning should have the best prospects. Many of these degree holders may find employment in government and industry as management or sales trainees, research assistants, or administrative assistants. Others may obtain employment as research or teaching assistants in educational institutions while studying for advanced degrees. Some bachelor's degree holders teach at the high school level, although in some States the master's degree is becoming essential for high school teaching positions. Others earn library science degrees and become map librarians.

Earnings

According to the 1977-78 College Placement Council Salary Survey, bachelor's degree candidates in the social sciences received offers averaging around $10,700 a year; master's degree candidates in the social sciences, around $13,200.

According to an Association of American Geographers survey, starting salaries for Ph. D.'s with no teaching experience averaged around $14,000 for the academic year 1977-78, while the average salary of geographers employed in colleges and universities was about $21,000. Salaries of geographers in planning positions in business and industry are comparable to those in the Federal Government.

Geographers in educational institutions usually have an opportunity to earn income from other sources, such as consulting work, special research, and publication of books and articles.

The Federal Government recognizes education and experience in certifying applicants for entry level positions. In general, geographers in the Federal Government with the bachelor's degree and no experience started at $10,507 or $13,014 a year in 1979, depending on their college achievement. Those with a master's degree started at $15,920 a year, and those with the Ph. D. at $19,263. Geographers in the Federal Government averaged around $23,200 a year in 1978; cartographers, around $22,800.

Related Occupations

Knowledge of physical and environmental science is important to geographers. Others whose work requires training in these fields include engineers, geologists, geophysicists, meteorologists, oceanographers, astronomers, chemists, physicists, surveyors, and drafters.

Sources of Additional Information

For additional information on careers and job openings for geographers, and on schools offering various programs in geography, contact:

Association of American Geographers, 1710 16th St. NW., Washington, D.C. 20009.

For additional information on careers in cartography, surveying, and geodesy, contact:

American Congress on Surveying and Mapping, 210 Little Falls St., Falls Church, Va. 22046.

For more information on careers and a list of schools that offer courses in photogrammetry and remote sensing, contact:

American Society of Photogrammetry, 105 North Virginia Ave., Falls Church, Va. 22046.

Historians

(D.O.T. 052; 090.227-010; 101; 102.017-010; and 102.117-010)

Nature of the Work

History is the record of past events, institutions, ideas, and people. Historians describe and analyze the past through writing, teaching, and research. They use standard techniques to locate and evaluate historical evidence. Historians do not accept documents, records, or spoken accounts at face value; they study each piece of evidence carefully to determine whether it is reliable or genuine. Once they have established the validity of historical evidence, historians try to determine the significance of their findings. Sometimes they develop theories to explain the importance of facts and their interrelationships. They may, for example, relate their knowledge of the past to current events in an effort to explain the present.

Historians almost always specialize. Some concentrate on the history of a country or a region; others study a particular period of time—the 20th century, for example. In this country, while many historians specialize in the social or political history of the United States or modern Europe, a growing number concern themselves with African, Latin American, Asian, or Middle Eastern history. Some specialize in the history of a field, such as economics, medicine, philosophy, religion, science, technology, music, art, military affairs, women, or the labor movement. Other fields of specialization are genealogy, biography, rare books and documents, and historic preservation.

Most historians are teachers in colleges or universities. Like other faculty members, they may also lecture, write, and do consulting work. Some historians employed by colleges and universities engage only in research; often, they are leading authorities in their fields. (For more information on these jobs, see the *Handbook* statement on college and university faculty.)

A growing number of historians do many things besides teach, however. *Archivists* and *curators* work for museums, special libraries, or historical societies, where they typically identify, classify, and preserve historical documents, treasures, and other material. They may also administer historical activities —helping scholars use manuscripts and artifacts and educating the public through exhibits and publications. Many do an extensive amount of scholarly research and writing.

Biographers write about the lives of individuals, using diaries, news accounts, personal correspondence, interviews with relatives and business associates of their subjects, and other sources of information. *Genealogists* trace family history, using birth, death, and marriage certificates, court records, wills, records of real estate transactions, and other evidence.

A growing number of historians are concerned with the protection and preservation of historic buildings and sites. Their goal is to identify and interpret our historical heritage, which includes houses, public buildings, factories, churches, forts, public markets, farms, and battlefields. Some historians are employed to manage, interpret, and write about restored communities and other places of historic interest. Historic preservationists also work to save city neighborhoods and old business districts and maintain their unique historic and architectural qualities. This usually means a joint effort with architects, lawyers, urban planners, business and community leaders, and city officials.

Some historians serve as consultants to editors, publishers, and producers of materials for radio, television, and motion pictures. Others are employed as researchers by government agencies, social science research firms, and other organizations. They might be asked, for example, to assist in the preparation of an environmental impact statement or to provide information for a community development plan.

Working Conditions

Historians employed in colleges and universities have flexible work schedules, dividing their time among teaching, research, and administrative responsibilities. Historians working in government agencies and private firms, on the other hand, have much more structured schedules. They often work alone behind a desk, reading and writing reports on their research. Many experience the pressures of deadlines and tight schedules, and sometimes must work overtime. Their routine may be interrupted by telephone calls, letters, special requests for information, meetings, or conferences. Travel may be necessary to collect information or attend meetings.

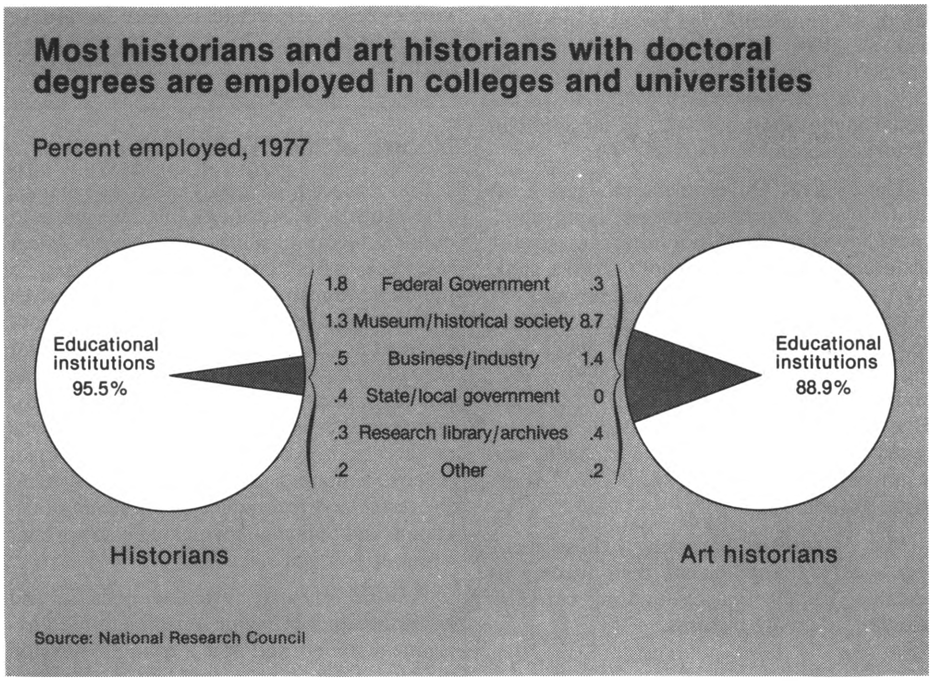
Places of Employment

An estimated 23,000 persons worked as professional historians in 1978. Colleges and universities employed most of them. Historians also work in archives, libraries, museums, research and educational organizations, historical societies, publishing firms, large corporations, and government agencies. Historians, archivists, and museum curators employed in the Federal Government work principally in the National Archives, Smithsonian Institution, General Services Administration, or in the Departments of Defense, Interior, and State. Other Federal employers include the National Aeronautics and Space Administration, Central Intelligence Agency, National Security Agency, and the Departments of Agriculture, Commerce, Education, Energy, and Transportation. A number work for State and local governments.

Training, Other Qualifications, and Advancement

Graduate education usually is necessary for a job in this field. A master's degree in history is the minimum requirement for the position of college instructor. However, a Ph. D. degree is required for a first appointment at some institutions of higher education and for many other entry level positions. A Ph. D. is required for a professorship or a top administrative position, and is necessary to gain tenure. However, tenure is becoming increasingly difficult to acquire.

While historians in the Federal Government generally must have a college degree with 24 semester hours in history, requirements may vary for certain specialists. For example, archivists need a college degree with 18 semester hours in American history or government and 12 additional hours of history, American civilization, economics, political science, or related fields; museum curators need a college degree in museum studies or in an appropriate subject field such as art history or the history of technology. However, because competition for Federal



jobs is keen, additional education or experience may be required. Most historians in the Federal Government and in nonprofit organizations have Ph. D. degrees or their equivalent in training and experience.

Although a bachelor's degree with a major in history is sufficient training for some beginning jobs in government—either Federal, State, or local—advancement opportunities may be limited for persons without at least a master's and preferably a Ph. D. degree in history. Since beginning jobs are likely to be concerned with the collection and preservation of historical data, a knowledge of archival work is helpful.

Training for historians is available in many colleges and universities. Over 800 schools offer programs for the bachelor's degree; about 320, the master's; and about 150, the doctorate.

History curriculums in the Nation's colleges and universities are varied; however, each basically provides training in research methods, writing, and speaking. These are the basic skills essential for historians in all positions. Quantitative methods of analysis, including statistical and computer techniques, are increasingly important for historians; most graduate history departments include them. Most doctoral candidates must exhibit competence in at least one foreign language.

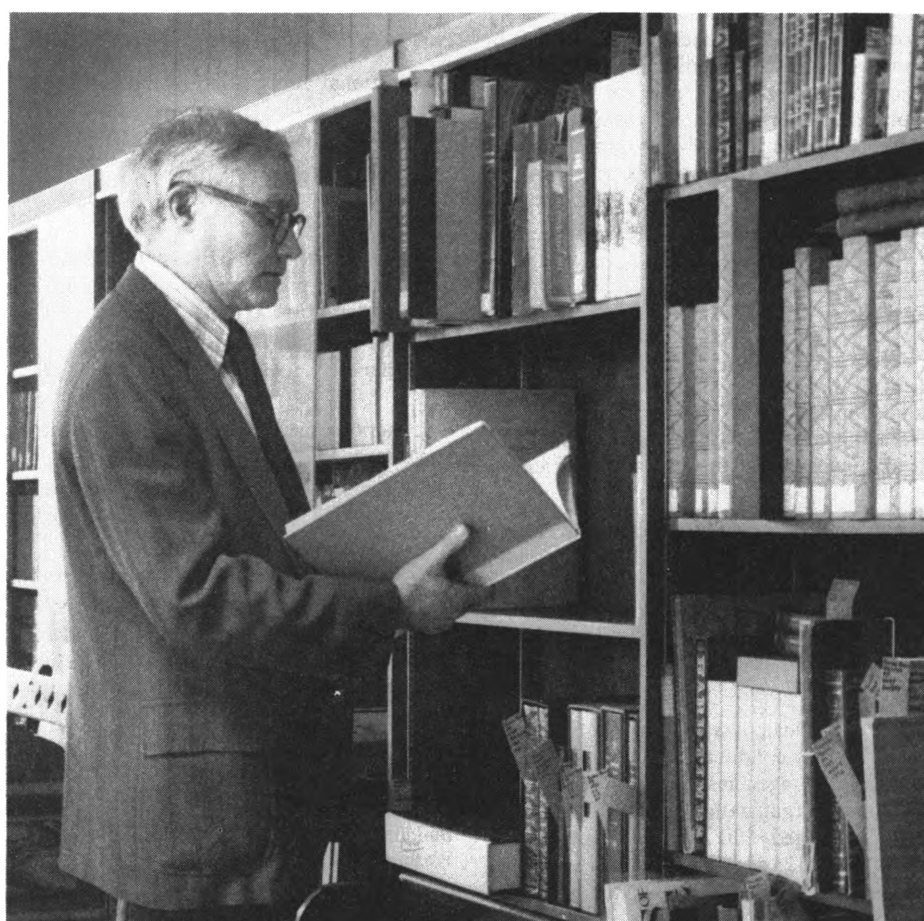
A greater emphasis on preparing history students for nonacademic careers is apparent. History departments are offering more courses and programs designed to prepare graduates for museum jobs, archival management, historic editing, historic preservation, and applied research. Courses in other applied fields such as public administration or business administration also greatly enhance one's opportunities for nonacademic employment.

Historians spend a great deal of time doing research, writing papers and reports, and giving lectures and presentations. They must possess strong analytical skills in order to evaluate historical evidence and work effectively with abstractions and theories. They must be systematic and objective in their work, since they must consider all relevant facts before reaching a conclusion. Patience and persistence are necessary, because historians spend long hours in independent study. As in other fields of scientific endeavor, the qualities of intellectual curiosity and creativity are essential.

Presenting the results of their research is an important part of a historian's job, so the ability to communicate effectively—both orally and in writing—is a "must." The ability to work with others on joint research projects can be important.

Employment Outlook

Overall, little if any growth is expected in the employment of historians through the 1980's. Replacement needs accordingly will constitute the principal source of jobs. Openings in colleges and universities, museums, research firms, government agencies, and other organizations will occur as workers die, retire, or leave the occupation for other reasons. Persons with computer backgrounds and training in quantitative methods in historical research are expected to have the most favorable job opportunities in business, industry, government, and research firms. Historians with strong backgrounds in historic preservation or other applied disciplines such as public administration or business administration also may be in a relatively favorable position. Of those seeking college faculty jobs, applicants who are qualified to teach several areas of history, such as American



Historians must be thorough in their research before reaching any conclusions.

history combined with African or Latin American history, should have the best opportunities.

The oversupply of history graduates is expected to continue; throughout the 1980's, the number of persons seeking to enter the occupation will greatly exceed available positions. As a result, historians with a Ph. D. are expected to face very keen competition for positions. Those graduating from prestigious universities may have some advantage in this highly competitive situation. Since academic institutions are the traditional employers of many highly qualified historians and competition for these jobs is expected to be particularly keen, some Ph. D.'s are expected to accept part-time, temporary assignments as instructors with little or no hope of gaining tenure. An increasing number of Ph. D.'s will take research or administrative positions in government, industry, research firms, and other nonacademic institutions.

Persons with the master's degree in history will encounter even more severe competition for jobs as historians. Some may find teaching positions in junior and community colleges, while others may find jobs in government and industry. Those who meet State certification requirements may become secondary school teachers.

People with a bachelor's degree in history are likely to find very limited opportunities for employment as professional historians. However, an undergraduate major in history provides an excellent background for jobs in a number of fields including international relations and journalism, and for continuing education in law, business administration, and related disciplines. Many graduates will find jobs in secondary schools or in government, business, and industry as management or sales trainees, or as research or administrative assistants.

Earnings

According to the 1977-78 College Placement Council Survey, bachelor's degree candidates in the social sciences received offers averaging around $10,700 a year; master's degree candidates in the social sciences, around $13,200.

According to information from the American Historical Association, colleges and universities offered new Ph. D.'s starting salaries ranging from about $12,000 to $14,000 for the academic year 1977-78. Full professors and top administrators earn substantially more.

The American Association for State and Local History conducted a survey of salaries in historical agencies, including museums and other organizations. In 1978, agency heads averaged $20,256; assistant agency heads, $15,912; division heads, $15,864; advanced professionals, $14,496; and beginning professionals, $11,412.

According to a survey by the National Research Council, the 1977 median annual salary of full-time employed Ph. D.'s in history was $21,400; in educational institutions, $21,500. The median annual salary of Ph. D.'s in art history was $19,900; in educational institutions, $19,900; in museums or historical societies, $18,800.

The Federal Government recognizes education and experience in certifying applicants for entry level positions. In general, historians having a bachelor's degree could start at $10,507 or $13,014 a year in 1979, depending upon the applicant's academic record. The starting salary for those having a master's degree was $15,920 a year, and for those having a Ph. D., $19,263. Historians in the Federal Government averaged around $25,800 a year in 1978; museum curators, around $24,800; and archivists, around $22,900.

Many historians, particularly those in college teaching, supplement their income by teaching summer classes, writing books or articles, or giving lectures.

Related Occupations

Historians study past events, institutions, and ideas. Their concern with understanding how societies operate is shared by other workers, including writers, journalists, political scientists, economists, sociologists, anthropologists, geographers, planners, and marketing research workers.

Sources of Additional Information

Additional information on careers and job openings for historians, and on schools offering various programs in history, is available from:

American Historical Association, 400 A St. SE., Washington, D.C. 20003.

For information on careers and schools offering degree programs and courses in historic preservation, contact:

National Trust for Historic Preservation, 1789 Massachusetts Ave.NW., Washington, D.C. 20036.

General information on careers for historians is available from:

Organization of American Historians, Indiana University, 112 North Bryan St., Bloomington, Ind. 47401.

For additional information on careers for historians, send a self-addressed, stamped envelope to:

American Association for State and Local History, 1400 Eighth Avenue South, Nashville, Tenn. 37203.

For information on museum careers and museum studies programs, contact:

Office of Museum Programs, Arts and Industries Building, Room 2235, Smithsonian Institution, Washington, D.C. 20560.

For information on training for museum careers, contact:

American Association of Museums, 1055 Thomas Jefferson St. NW., Washington, D.C. 20007.

Political Scientists

(D.O.T. 051, 059.267-010, and 090.227-010)

Nature of the Work

Political scientists study political behavior and institutions. Although some specialize in political theory or philosophy, most political scientists, particularly those specializing in public administration, concern themselves with the organization and operation of government at all levels in the United States and abroad. They explore such phenomena as public opinion, political parties, elections, and special interest groups. They also focus on the workings of the bureaucracy, the Presidency, Congress, and the judicial system. Processes and techniques of public administration and public policymaking also are concerns of political scientists.

Political scientists examine political and administrative behavior in order to aid government leaders and others trying to develop policies and plan programs that meet a society's needs. Like other social scientists, political scientists are research-oriented and base their theories on a systematic analysis of the data they collect. Depending on the topic under study, a political scientist might conduct a public opinion survey, analyze election results, or compare the principal features of various tax proposals. Some areas of political science research are highly quantitative, and involve the use of sophisticated simulation and modeling techniques.

Most political scientists work in colleges and universities. They may combine research or administrative duties with teaching, and often they do consulting work as well. (For more information, see the *Handbook* statement on college and university faculty.)

Some political scientists are primarily researchers or consultants in nonacademic organizations. They might survey public opinion on a current issue, explore the political and administrative ramifications of a government reorganization, or suggest ways of mobilizing support for a particular candidate, policy, or administrative change. The results of political science research are used by public officials, political parties, government administrators, legislative staffs and committees, citizens' groups, legislative reference bureaus, taxpayers' associations, and business firms.

Because of their understanding of political institutions and political and administrative processes, political scientists are well qualified for jobs in and out of government. Many are employed in government management and staff positions; others are employed by legislatures and courts; still others are involved in government relations. Here they may work as lobbyists or consultants for government liaison by business firms, trade associations, public interest groups, and other organizations. Some political scientists work as journalists. A few work primarily as advisors to candidates for political office.

Working Conditions

Political scientists employed in colleges and universities have flexible work schedules, dividing their time among teaching, research, and administrative responsibilities. Those employed by government agencies and private firms, on the other hand, have much more structured schedules. They study and interpret data, prepare reports, confer with coworkers, and meet with government officials, business executives, and others. Many experience the pressures of deadlines, tight schedules, and heavy workloads, and sometimes must work overtime. They may travel to interview people, conduct surveys, attend meetings and conferences, and present reports.

Political scientists on foreign assignment must adjust to unfamiliar cultures and climates. Those in the diplomatic service work long and irregular hours, both in the office and in many social activities considered part of the job.

A strong background in political science has been invaluable to these senatorial staff members.

Places of Employment

About 14,000 persons worked as political scientists in 1978. About four-fifths worked in colleges and universities. Most of the remainder worked for government agencies, consulting firms, political organizations, research institutes, public interest groups, or business firms. This employment estimate does not include all those trained as political scientists who work in government and the private sector in administrative positions or as journalists and other related positions.

Political scientists can be found in nearly every college or university town since courses in government and political science are taught in almost all institutions of higher education. Since the national headquarters of many associations, unions, and other organizations are located in Washington, D.C., this area attracts a sizable number of political scientists in research or policy jobs.

Government employs political scientists both domestically and abroad. They deal with legislative or administrative matters in areas such as foreign affairs, international relations, intelligence, housing, economic development, transportation, environmental protection, social welfare, or health. Political scientists also apply their analytical expertise in such fields as marketing, advertising, public relations, personnel, finance, and consumer affairs.

Training, Other Qualifications, and Advancement

Graduate training generally is required for employment as a political scientist. Completion of all the requirements for the Ph. D. degree is the prerequisite for appointment to academic positions in some colleges and universities and is required for a professorship and tenure. However, tenure is becoming increasingly difficult to attain.

Graduates with a master's degree can qualify for teaching positions in junior and community colleges and for administrative and research positions in government, industry, and research or civic organizations. A master's degree in international relations, foreign service, or foreign area study provides a suitable background for Federal Government positions concerned with foreign affairs. Competence in one or more foreign languages may be important for those who wish to enter the Foreign Service. Minimum requirements for intelligence, foreign affairs, and international relations specialists in the Federal Government generally include a college degree with 24 semester hours in political science, history, economics, or related fields. However, because competition for Federal jobs is keen, additional education or experience may be required. A growing number of applicants for the Foreign Service, for example, have a Ph. D., law degree, or other advanced degree.

People with a bachelor's degree in political science may qualify as trainees in such areas as management, research, administration, sales, and law enforcement. Many students with bachelor's degrees in political science go on to study law, journalism, or some specialized or related branch of political science, such as public administration or international relations.

In 1978, about 1,400 colleges and universities offered a bachelor's degree in political science; around 165, master's programs; about 120, doctoral programs. Approximately 250 schools offered specialties in public administration. Some schools combine political science with another discipline such as history in one department, while others have separate departments of political science, public administration, international studies, or other fields. Some universities have separate schools of public affairs and administration. Colleges and universities strongly recommend field training and internships in government, politics, public service, and similar fields. Internships give students an opportunity to gain experience and make contacts that may be helpful in getting a job later on. However, the number of internships is limited and prospective interns face keen competition.

Undergraduate programs in political science include courses in the principles of government and politics, State and local government, comparative studies, political theory, foreign area studies, foreign policy, public administration and policy, political behavior, constitutional, administrative, and international law, and many other offerings. Other courses might deal with the problems of detente, politics of growth and technology, politics of health, legal status of women, international economics, and political warfare in the age of nuclear destruction. A growing number of programs at both the undergraduate and graduate levels offer courses in quantitative and statistical methods, including the use of computers.

Graduate students may specialize in U.S. politics, comparative politics, international politics, foreign area studies, political behavior, political theory, public administration, urban affairs, public policy, and other areas. Doctoral candidates often must exhibit competence in one or more foreign languages and quantitative research techniques.

Persons planning to be political scientists should have qualities that are important in any research or management career. Most important of all are intellectual curiosity—a questioning, probing mind and a keen interest in solving intellectual puzzles—and a commitment to public service. Political scientists also need to be able to think objectively and independently; to handle data carefully and systematically; and to analyze information and ideas. Patience and persistence are important in conducting independent research, and creativity helps in formulating ideas. Because the results of political science research are almost always presented orally or in writing, communication skills are important, too. The ability to write clearly and well is essential.

For some political scientists, an intense interest in political systems and the way they operate is an asset. Active participation in student government, local political campaigns, community newspapers, service clubs, and community activities is recommended for the practical experience and perspective it can provide. Such experience is particularly useful for political scientists who specialize in politics or community organization.

Employment Outlook

Employment of political scientists is expected to increase more slowly than the average for all occupations through the 1980's. Most job openings will result from deaths, retirements, and other separations from the labor force. Colleges and universities, the traditional employers of highly qualified political scientists, are not expected to hire additional faculty members; indeed, as college enrollments decline, some vacancies may remain unfilled.

The number of persons who graduate with advanced degrees in political science will greatly exceed available job openings through the 1980's. Ph. D.'s face stiff competition, particularly for academic jobs. The prestige of the university from which a Ph. D. graduates may be increasingly important in this highly competitive situation. Many Ph. D.'s seeking college teaching jobs are expected to accept part-time, temporary assignments as instructors with little or no hope of gaining tenure. Graduates seeking to enter the Foreign Service also face very stiff competition.

Graduates trained in applied fields such as public administration and public policy should have the best prospects for both academic and nonacademic positions. Persons trained in quantitative research methods and U.S. Government also are in a relatively advantageous position. Those in comparative politics, international relations, and political theory face the most difficult job market. A strong background in economics, marketing, computer science, statistics, and other applied fields increases one's chances for a job in business, industry, or consulting firms.

Master's degree holders face very keen competition for academic positions, but some may find jobs in community and junior colleges. As is the case with Ph. D.'s, graduates trained in public policy or public administration have the best opportunities for jobs in Federal, State, and local government, research bureaus, political organizations, and business firms.

New graduates with a bachelor's degree are expected to find few opportunities for jobs as professional political scientists. Many of these graduates are expected to accept positions as trainees in government, business, and industry. For those planning to continue their studies in law, foreign affairs, journalism, and related fields, political science provides an excellent background. Some new graduates who meet State certification requirements will be able to enter high school teaching.

Earnings

According to the 1977-78 College Placement Council Salary Survey, bachelor's degree candidates in the social sciences received offers averaging around $10,700 a year; master's degree candidates in the social sciences, around $13,200; bachelor's degree candidates offered positions in the field of public administration, around $10,300.

According to an American Political Science Association Survey, the median beginning salaries for new faculty members during academic year 1977-78 were $13,500 for Ph. D.'s and $12,500 for those without a Ph. D. The median salaries of political scientists employed in educational institutions in 1977-78 were around $26,000 for full professors, $18,-000 for associate professors, $15,000 for assistant professors, and $13,000 for lecturers and instructors.

According to a survey by the National Research Council, the 1977 median annual salaries of full-time employed Ph. D.'s in social science (includes area studies, political science, public administration, and international relations) were $23,300; in educational institutions, $22,700; in the Federal Government, $32,300; in State and local government, $24,500.

The Federal Government recognizes education and experience in certifying applicants for entry level positions. In general, the entrance salary for those with a bachelor's degree was $10,507 or $13,014 a year in 1979, depending upon the applicant's academic record. The starting salary for those with a master's degree was $15,920 a year, and for those with a Ph. D., $19,263. Intelligence specialists in the Federal Government averaged around $25,800 in 1978; international relations specialists, $32,900; and foreign affairs specialists, $30,300.

Some political scientists, particularly those in college teaching, supplement their income by teaching summer courses or consulting.

Related Occupations

A political scientist's training enables him or her to understand the ways in which political power is amassed and used. Others whose jobs require substantial knowledge of the political process include journalists, lawyers, city managers, Foreign Service Officers, campaign managers, political consultants, pollsters, lobbyists, legislative liaison officers, political aides, and politicians.

Sources of Additional Information

The American Political Science Association, 1527 New Hampshire Ave. NW., Washington, D.C. 20036 offers two career pamphlets, one for undergraduates and one for faculty and graduate students, at $1 each. *A Guide to Graduate Study in Political Science* is available for $5. In addition, a monthly newsletter listing job openings, primarily academic, is available to members of the association.

Programs in Public Affairs and Administration, a directory that contains data on the academic content of programs, the student body, the format of instruction, and other information, may be purchased for $10 from:

National Association of Schools of Public Affairs and Administration, 1225 Connecticut Ave. NW., Suite 306, Washington, D.C. 20036.

For additional information on careers in the Foreign Service, contact:

Board of Examiners, Foreign Service, Box 9317, Rosslyn Station, Arlington, Va. 22209.

For additional information on internships, contact:

National Society for Internships and Experiential Education, 1735 I St. NW., Suite 601, Washington, D.C. 20006.

Psychologists

(D.O.T. 045.061, .067, .107-022, -026, -030, and -034; and 090.227-010)

Nature of the Work

Psychologists study human behavior and mental processes to understand and explain people's actions. Some research psychologists investigate the physical, emotional, or social aspects of human behavior. Others in colleges and universities combine teaching, research, and administration. (For more information, see the *Handbook* statement on college and university faculty.) Still other psychologists in applied fields counsel and conduct training programs; do market research; or administer rehabilitation programs in hospitals or clinics.

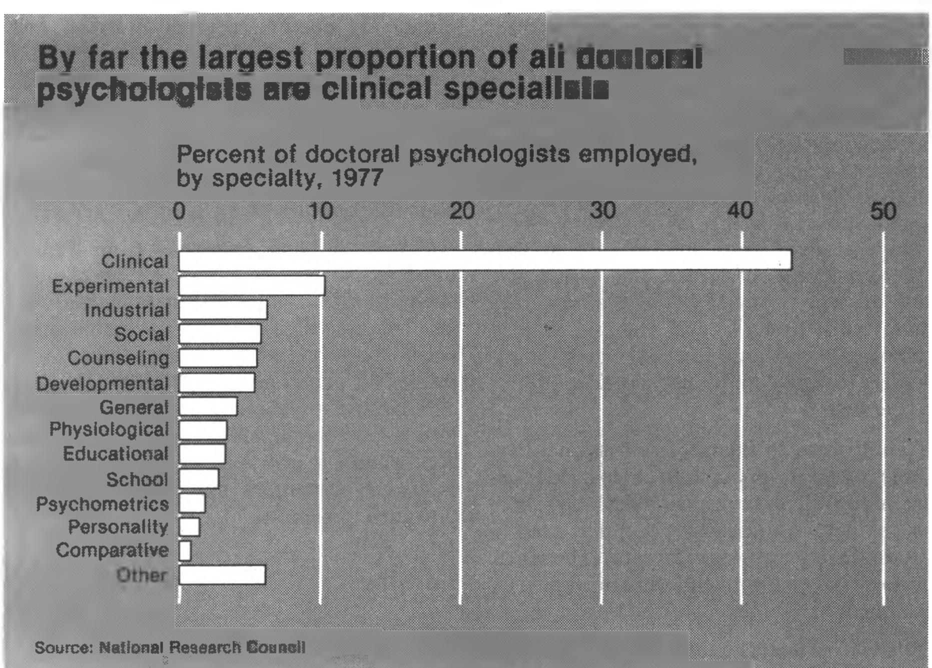
Like other social scientists, psychologists collect and test the validity of data and formulate hypotheses. Research methods depend on the topic under study. Psychologists gather information from controlled laboratory experiments; performance, aptitude, and intelligence tests; observation, interviews, and questionnaires; and surveys.

Psychologists usually specialize. *Experimental psychologists* study behavior processes and work with human beings and lower animals such as rats, monkeys, and pigeons; prominent areas of experimental research include motivation, learning and retention, sensory and perceptual processes, and genetic and neurological factors in behavior. *Developmental psychologists* study the patterns and causes of behavioral change as people progress through life; some concern themselves with behavior during childhood, while others study changes that take place during maturity and old age. *Personality psychologists* study human nature, individual differences, and the ways in which those differences develop. *Social psychologists* examine people's interactions with others and with the social environment; prominent areas of study include group behavior, leadership, attitudes, and interpersonal perception. Psychologists in *evaluation research* study health and social programs and try to determine how successful they are. *Environmental psychologists* study the influence of their surroundings on people. *Population psychologists* study demography's relation to personal and social behavior. *Comparative psychologists* compare the behavior of different animals, including man. *Physiological psychologists* study the relationship of behavior to the biological functions of the body. Psychologists in the field of *psychometrics* develop and apply procedures for measuring psychological variables such as intelligence and personality.

Clinical psychology is the largest specialty among doctoral psychologists (see chart). *Clinical psychologists* generally work in hospitals or clinics, or maintain their own practices. They may help the mentally or emotionally disturbed adjust to life. They interview patients; give diagnostic tests; provide individual, family, and group psychotherapy; and design and carry through behavior modification programs. Clinical psychologists may collaborate with psychiatrists and other specialists in developing treatment programs. *Counseling psychologists* use several techniques, including interviewing and testing, to help people with problems of everyday living—personal, social, educational, or vocational. *Educational psychologists* study psychological processes as related to applied problems in education to foster intellectual, social, and emotional development of individuals. *School psychologists* evaluate students' needs and problems, facilitate school adjustment, and help solve learning and social problems in schools. *Industrial and organizational psychologists* apply psychological techniques to personnel administration, management, and marketing problems. They are involved in policy, planning, training and development, psychological test research, counseling, and organizational development and analysis, among other activities. *Engineering psychologists* develop and improve human-machine systems, military equipment, and industrial products. *Community psychologists* apply psychological knowledge to problems of urban and rural life. *Consumer psychologists* study the psychological factors that determine an individual's behavior as a consumer of goods and services. Other areas of specialization include psychology and the arts, history of psychology, psychopharmacology, psychology of women, and military, rehabilitation, and philosophical and health psychology.

Working Conditions

A psychologist's specialty and place of employment determine his or her working conditions. For example, clinical and counseling psychologists in private practice have pleasant, comfortable offices and set their own hours. However, they often must work in the evenings. Some employed in hospitals, nursing homes, and other health facilities also work irregular hours, while others in schools and clinics work regular hours. Engineering psychologists may study work flow and work arrangements in factories or large plants. Experimental psychologists spend much time conducting research on animals in laboratories. Psychologists employed by academic institutions divide their time among teaching, research, and administrative responsibilities. Some maintain part-time clinical practices as well. In contrast to the many psychologists who have flexible work schedules, some in government and private industry have more structured schedules. Reading and writing research reports, they often work alone behind a desk. Many experience the pressures of deadlines, tight schedules, and heavy workloads, and sometimes must work overtime. Their routine may be interrupted frequently. Travel may be required to attend conferences or conduct research.



Places of Employment

About 130,000 people worked as psychologists in 1978. The largest group worked in educational institutions—primarily colleges and universities. Some were counselors; others were researchers, administrators, or teachers.

The second largest group of psychologists work in hospitals, clinics, rehabilitation centers, nursing homes, and other health facilities. Many others work for government agencies at the Federal, State, and local levels. The Veterans Administration, the Department of Defense, and the Public Health Service employ more psychologists than other Federal agencies. Psychologists also are employed by research organizations, management counsulting firms, market research firms, and businesses. Some are in practice for themselves or have their own research or consulting firms.

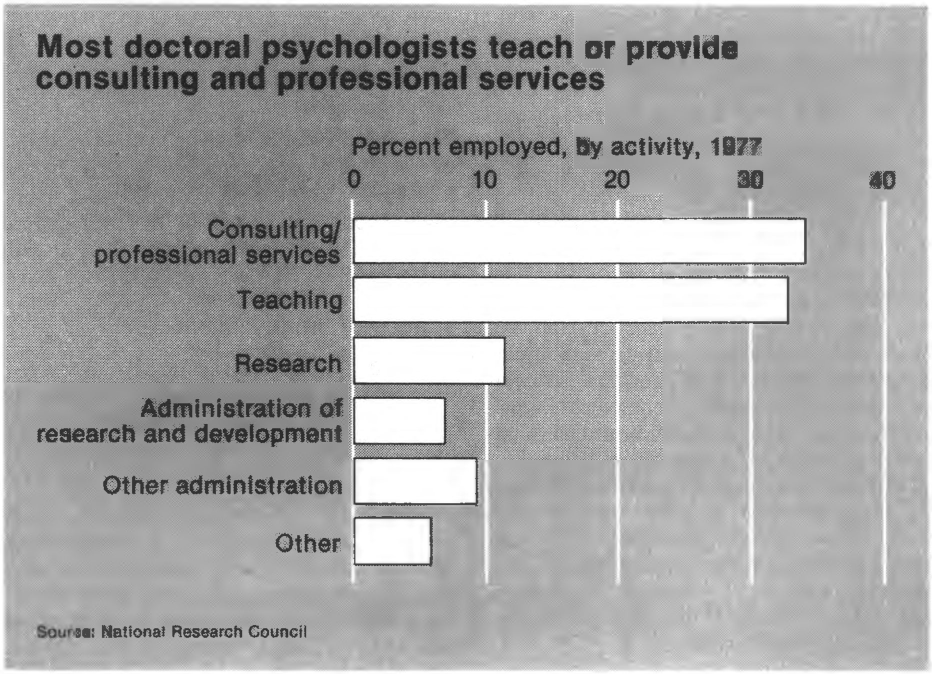
Training, Other Qualifications, and Advancement

A doctoral degree, the minimum required for employment as a psychologist, is increasingly important for advancement and tenure, particularly in the academic world. People with doctorates in psychology (Ph. D. or Psy. D.—Doctor of Psychology) qualify for a wide range of responsible research, clinical, and counseling positions in universities and the government.

People with a master's degree in psychology can administer and interpret tests as psychological assistants. Under the supervision of psychologists, they can conduct research in laboratories or perform administrative duties. They may teach in 2-year colleges, or work as school psychologists or counselors. (See the *Handbook* statements on school counselors and rehabilitation counselors.)

People with a bachelor's degree in psychology are qualified to assist psychologists and other professionals in community mental health centers, vocational rehabilitation offices, and correctional programs; to work as research or administrative assistants; to take jobs as trainees in government or business; or —provided they meet State certification requirements—to teach high school. However, without additional academic training, their advancement opportunities are limited.

In the Federal Government, candidates having at least 24 semester hours in psychology and one course in statistics qualify for entry level positions though competition is



keen. Clinical psychologists generally must have completed the Ph. D. or Psy. D. requirements and have served an internship; counseling psychologists usually need 2 years of graduate study in counseling and 1 year of counseling experience.

At least 1 year of full-time graduate study is needed to earn a master's degree in psychology. Requirements usually include practical experience in an applied setting or a master's thesis based on a research project. Three to five years of graduate work usually are required for a doctoral degree. The Ph. D. degree culminates in a dissertation based on original research. The Psy. D., based on practical work and examinations rather than a dissertation, prepares students for clinical and other applied positions. In clinical or counseling psychology, the requirements for the Ph. D. degree generally include an additional year or more of internship or supervised experience.

Competition for admission into graduate programs is keen. Some universities require an undergraduate major in psychology. Others prefer only basic psychology with courses in the biological, physical, and social sciences, statistics, and mathematics.

Over 1,500 colleges and universities offer a bachelor's degree program in psychology; about 325, a master's; about 165, a Ph. D.; and about 10, a Psy. D. In addition, a growing number of professional schools of psychology not affiliated with colleges or universities offer the Psy. D. The American Psychological Association (APA) presently accredits Ph. D. training programs in clinical, counseling, and school psychology as well as Psy. D. programs. In 1978, over 100 colleges and universities offered fully approved programs in clinical psychology; over 20, in counseling psychology; fewer than 10, in school psychology; and 2 Psy.D. programs. APA also has approved about 140 internship facilities for doctoral training in clinical and counseling psychology.

Because graduates face increasing competition, particularly for academic jobs, many take courses in law, medicine, business, marketing, public affairs, and other fields to enhance their qualifications for nonacademic careers.

Although financial aid is becoming increasingly difficult to obtain, some graduate students are awarded fellowships or scholarships, or arrange part-time employment. The Veterans Administration offers predoctoral traineeships to interns in VA hospitals, clinics, and related training agencies. The National Science Foundation, the Department of Health, and Human Services, the Armed Forces, and many other organizations also provide fellowships and loans. However, the present trend at the Federal level is to provide low-interest loans rather than fellowships and grants.

Psychologists who want to enter independent practice must meet certification or licensing requirements. In 1978, all States and the District of Columbia had such requirements. Licensing laws vary by State, but generally require a doctorate in psychology, 2 years of professional experience, and an examination. Some States certify those with master's level training as psychological assistants or associates. Some States require continuing education for relicensure.

The American Board of Professional Psychology awards diplomas in clinical, counseling, industrial and organizational, and school psychology. Candidates generally need a doctorate in psychology, 5 years' experience, professional endorsements, and must pass an examination.

People pursuing a career in psychology must be emotionally stable, mature, and able to deal effectively with people. Sensitivity, compassion, patience, and the ability to lead and inspire others are particularly important for clinical work and counseling. Research psychologists should be able to do detailed work independently and as part of a team. Verbal and writing skills are necessary to communicate research findings. Patience and perseverance are vital qualities because results from psychological treatment of patients or research often are long in coming.

Employment Outlook

Employment of psychologists is expected to grow faster than the average for all occupations through the 1980's. In addition to employment growth, some openings will result from deaths, retirements, and other separations from the labor force.

Several factors should help maintain a strong demand for psychologists: (1) Public concern for the development of human resources which may result in more services for minorities, the elderly, and the poor; (2) heightened awareness of the need for testing and counseling children; (3) Federal legislation emphasizing good health rather than treatment of illness; and (4) psychological services in a national health insurance program.

Some openings are likely to occur as psychologists move into the field of technology assessment—the study of the effects of technological advances in areas such as agriculture, energy, the environment, and the conservation and use of natural resources. Psychologists increasingly are involved in program evaluation in such fields as health, education, military service, law enforcement, and consumer protection.

A doctorate is necessary for those wishing to enter the field, but the degree does not guarantee a job. Through the 1980's, the number of doctoral degrees awarded each year will increase and heighten competition for jobs, particularly teaching and research. Nonacademic settings may offer the best prospects, but budgetary restraints in both the public and private sectors could limit expansion of psychological services and thus alter the job outlook.

Persons holding doctorates from leading universities in applied areas such as clinical, counseling, and industrial or organizational psychology will have more favorable prospects for nonacademic jobs than those trained in experimental, physiological, and comparative psychology. Some may accept jobs below their levels of aspiration. Graduates willing to work in smaller and newer academic institutions may have better employment prospects.

Earnings

According to the 1977-78 College Placement Council Salary Survey, bachelor's degree candidates in the social sciences received

Sensitivity, compassion, patience, and the ability to inspire others are vital for counseling psychologists.

offers averaging around $10,700 a year; master's degree candidates in the social sciences, $13,200.

According to a 1977 survey by the National Research Council, the median annual salary of doctoral psychologists was about $23,800. In educational institutions, the median was about $22,300; in the Federal Government, about $30,300; in State and local government, about $23,000; in hospitals and clinics, about $23,000; in other nonprofit organizations, about $24,500; and in business and industry, about $33,800. Ph. D. or Psy. D. psychologists in private practice and in applied specialties generally have higher earnings than other psychologists.

The Federal Government recognizes education and experience in certifying applicants for entry level positions. In general, the entrance salary for psychologists having a bachelor's degree was $10,507 or $13,014 a year in 1979; counseling psychologists with a master's degree and 1 year of counseling experience could start at $15,920; clinical psychologists having a Ph. D. or Psy.D. degree and 1 year of internship could start at $19,263. The average salary for psychologists in the Federal Government was about $28,200 a year in 1978.

According to a 1978 State Salary Survey, average annual salaries of clinical psychologists (positions usually requiring a doctor's degree in clinical psychology plus completion of an approved internship or period of supervised experience) in State government range from about $17,300 to $22,900.

Related Occupations

Psychologists are trained to evaluate, counsel, and advise individuals and groups. Others who do this kind of work are psychiatrists, social workers, clergy, special education teachers, and counselors.

Sources of Additional Information

For information on careers, educational requirements, financial assistance, and job openings, contact:

American Psychological Association, Educational Affairs Office, 1200 17th St. NW., Washington, D.C. 20036.

Information on traineeships and fellowships also is available from colleges and universities that have graduate departments of psychology.

Sociologists

(D.O.T. 054 and 090.227-010)

Nature of the Work

Sociologists study human society and social behavior by examining the groups that people form. These groups include families, tribes, communities, and governments, as well as a great variety of social, religious, political, business, and other organizations. Sociologists study the behavior and interaction of groups; trace their origin and growth; and analyze the influence of group activities on individual members. Some sociologists concern themselves primarily with the characteristics of social groups and institutions. Others are more interested in the ways individuals are affected by the groups to which they belong.

Fields of specialization for sociologists include social organization, social psychology, rural and urban sociology, racial and ethnic relations, criminology and penology, and industrial sociology. Other important specialties include medical sociology—the study of social factors that affect mental and public health; demography—the study of the size, characteristics, and movement of populations; and social ecology—the study of the effect of the physical environment and technology on the distribution of people and their activities.

Sociological research, like other kinds of social science research, involves collecting information, testing its validity, and analyzing the results. Sociologists usually conduct surveys or do case studies in order to gather the data they need. For example, after providing for controlled conditions, a sociologist might test the effects of different styles of leadership on individuals in a small group. Sociological researchers also conduct large-scale experiments to test the efficacy of different kinds of social programs. They might test and evaluate particular programs of income assistance, job training, or remedial education, for example. Increasingly, sociologists apply statistical and computer techniques in their research. The results of sociological research aid educators, lawmakers, administrators, and others interested in social problems and social policy. Sociologists work closely with members of other professions including psychologists, physicians, economists, political scientists, anthropologists, and social workers.

Most sociologists are college and university teachers. Like other college faculty, they may conduct research, do consulting work, or handle administrative duties in addition to teaching. (For more information, see the *Handbook* statement on college and university faculty.)

Some sociologists are primarily administrators. They apply their professional knowledge in areas of practice as diverse as intergroup relations, family counseling, public opinion analysis, law enforcement, education, personnel administration, public relations, regional and community planning, and health services planning. They may, for example, administer social service programs in family and child welfare agencies or develop social policies and programs for government, community, youth, or religious organizations.

A number of sociologists are employed as consultants. Using their expertise and their social science research skills, they advise on such diverse problems as halfway houses and foster care for the mentally ill, ways of counseling ex-offenders, and market research for advertisers and manufacturers. Increasingly, sociologists are involved in the evaluation of social and welfare programs. Some do technical writing and editing.

Working Conditions

Most sociologists do a lot of desk work, reading and writing reports on their research. Those employed by colleges and universities have flexible work schedules, dividing their time among teaching, research, consulting, and administrative responsibilities. Those working in government agencies and private firms, on the other hand, have more structured work schedules. Like other professionals in such settings, many experience the pressures of deadlines, tight schedules, and heavy workloads, and sometimes must work overtime. Their routine may be interrupted by numerous telephone calls, letters, requests for information, and meetings. Travel may be required to collect data for research projects or attend professional conferences.

Places of Employment

About 19,000 persons were employed as sociologists in 1978. Colleges and universities employ about four-fifths of all sociologists. A number work for government agencies at all levels and deal with such subjects as poverty, public assistance, population policy, social rehabilitation, community development, and environmental impact studies. Sociologists in the Federal Government work primarily for the Departments of Defense, Health and Human Services, Education, Interior, and Agriculture. Others are employed by the Departments of Transportation and Energy, the Environmental Protection Agency, and the Veterans Administration. Some persons with training in sociology work as social science analysts, statisticians, and in other positions for Federal agencies.

Some sociologists hold managerial, research, and planning positions in corporations, research firms, professional and trade associations, consulting firms, and welfare or other nonprofit organizations. Others run their own research or consulting businesses.

Since sociology is taught in most institutions of higher learning, sociologists may be found in nearly all college communities. They are most heavily concentrated, however, in large colleges and universities that offer graduate training in sociology and opportunities for research.

Training, Other Qualifications, and Advancement

A master's degree in sociology usually is the minimum requirement for employment as a sociologist. Sociologists with master's degrees can qualify for administrative and research positions in public agencies and private businesses, provided they have sufficient training in research, statistical, and computer methods. However, advancement opportunities generally are more limited for master's degree holders than for Ph.D's. Sociologists with master's degrees may qualify for teaching positions in junior colleges and for some college instructorships. Many colleges, however, appoint as instructors only people who have training beyond the master's degree level—frequently the completion of all requirements for the Ph. D. degree except the doctoral dissertation. Although financial aid is increasingly difficult to obtain, some outstanding graduate students may get teaching or research assistantships that provide both financial aid and valuable experience.

The Ph.D. degree is required for appointment to permanent teaching and research positions in colleges and universities. The doctorate also is essential for senior level positions in nonacademic research institutes, consulting firms, corporations, and government agencies.

Bachelor's degree holders in sociology may get jobs as interviewers or as administrative or research assistants. Many work as social workers, counselors, or recreation workers in public and private welfare agencies. Sociology majors who have sufficient training in statistical and survey methods may qualify for positions as junior analysts or statisticians in business or research firms or government agencies.

Over 140 colleges and universities offer doctoral degree programs in sociology; most of these also offer a master's degree. In 150 schools, the master's is the highest degree offered, and about 900 schools have bachelor's degree programs. Sociology departments offer a wide variety of courses including sociological theory, statistics and quantitative methods, dynamics of social interaction, sex roles, population, social stratification, social control, small group analysis, rural-urban relations, formal and complex organizations, sociology of religion, law, the arts, war, politics, education, occupations and professions, and mental health, in addition to many others.

Some departments of sociology have highly structured programs while others are relatively unstructured and leave course selection largely up to the individual student. Departments have different requirements regarding foreign language skills; courses in statistics; and completion of a thesis for the master's degree.

In the Federal Government, candidates generally need a college degree including 24 semester hours in sociology, with course work in theory and methods of social research. However, since competition for the limited number of positions is so keen, advanced study in the field is highly recommended.

The choice of a graduate school is important for people who want to become sociologists. Students should select schools that have adequate research facilities and offer appropriate areas of specialization such as theory, demography, or quantitative methods. Opportunities to gain practical experience also may be available, and sociology departments frequently help place students in business firms and government agencies.

The ability to handle independent research is important for sociologists. Intellectual curiosity is an essential trait; researchers must have inquiring minds and a desire to find explanations for the phenomena they observe. Like other social scientists, sociologists must be objective in gathering information about social institutions and behavior; they need analytical skills in order to organize data effectively and reach valid conclusions; and they must be careful and systematic in their work. Because communicating their findings to other people is such an important part of the job, sociologists must be able to formulate the results of their work in a way that others will understand. The ability to speak well, and to write clearly and concisely, is a "must" in this field.

Employment Outlook

Employment of sociologists is expected to increase more slowly than the average for all occupations through the 1980's. Most openings will result from deaths, retirements, and other separations from the labor force. Some academic openings may result from the growing trend to add sociology courses to the curriculums of other academic disciplines, such as medicine, law, business administration, and education. Demand in the nonteaching area will center around the increasing involvement of sociologists in the evaluation and administration of programs designed to cope with social and welfare problems.

The number of persons who graduate with advanced degrees in sociology through the 1980's is likely to exceed greatly the available job openings. Graduates with a Ph. D. face increasing competition, particularly for academic positions, although those with degrees from the most outstanding institutions may have an advantage in securing teaching jobs. Academic institutions increasingly seek persons qualified to perform a dual role: Teach and also conduct applied research in a university-affiliated organization such as a center for environmental studies. Job search time for new graduates seeking academic jobs will be longer than in the past, and some Ph. D.'s may accept temporary, part-time positions as instructors.

Other Ph. D.'s may find research and administrative positions in government, corporations, research organizations, and consulting firms. Those well trained in quantitative research methods, including survey techniques, advanced statistics, and computer science will have the widest choice of jobs. For example, private firms that contract with the government to evaluate social programs and conduct other research increasingly seek sociologists with strong quantitative skills. Demand is expected to be strong for those with training in applied sociological areas including criminology, deviant behavior, medical sociology, and family and sex roles, among others. Sociologists with training in other applied disciplines, such as public policy, public administration, and business administration, will be attractive to employers seeking managerial and administrative personnel.

Persons with a master's degree will continue to face very keen competition for academic positions, although some may find jobs in junior and community colleges. They also will face strong competition for the limited number of positions as sociologists open to them in nonacademic settings. Some may find research and administrative jobs in government, research firms, and corporations.

Bachelor's degree holders will find few opportunities for jobs as professional sociologists. As in the past, many graduates will take positions as trainees and assistants in government, business, and industry. Training in quantitative research methods provides these graduates with the most marketable skills. For those planning to continue their studies in law, journalism, social work, recreation, counseling, and other related disciplines, sociology provides an excellent background. Some who meet State certification requirements may enter high school teaching.

Earnings

According to the 1977-78 College Placement Council Salary Survey, bachelor's degree candidates in the social sciences received offers averaging around $10,700 a year; master's degree candidates in the social sciences, around $13,200.

The Federal Government recognizes education and experience in certifying applicants for entry level positions. In general, the entrance salary for sociologists with a bachelor's degree was $10,507 or $13,014 a year in 1979, depending upon the applicant's academic record. The starting salary for those with a master's degree was $15,920 a year, and for those with a Ph. D., $19,263. Sociologists in the Federal Government averaged around $25,000 a year in 1978.

According to a 1977 survey by the National Research Council, the median annual salary of all doctoral social scientists (including sociologists) was $23,800. For those in educational institutions, it was $22,800; in the Federal Government, $32,900; in State and local government, $21,300; in other nonprofit organizations, $27,700; and in business and industry, $30,100.

In general, sociologists with the Ph. D. degree earn substantially higher salaries than those without the doctoral degree. Many sociologists, particularly those employed by colleges and universities for the academic year, supplement their regular salaries with earnings from other sources, such as summer teaching and consulting work.

Related Occupations

Sociologists are not the only people whose jobs require an understanding of social processes and institutions. Others whose work demands such expertise include anthropologists, economists, geographers, historians, political scientists, psychologists, urban planners, marketing research workers, newspaper reporters, and social workers.

Sources of Additional Information

Additional information on careers, job openings, and graduate departments of sociology is available from:

The American Sociological Association, Career and Research Division, 1722 N St. NW., Washington, D.C. 20036.

SOCIAL SERVICE OCCUPATIONS

For workers in the social service occupations, helping others is a fundamental part of the job. To do their jobs well, social workers, counselors, and others in the "helping professions" must be people-oriented. In this field, people with different backgrounds and skills often work together as members of a team. Some have years of professional training; others are aides and volunteers. Their joint efforts can help people who are troubled or unhappy.

Each of the helping professions has its own approach and techniques. Social work is dedicated to helping people cope with crises that threaten to disrupt their lives. Social workers help their clients understand what is happening to them and why, so that they can find their own solutions. They may assist families that are being torn apart by poverty, alcoholism, drug abuse, behavior problems, or illness. Sometimes, the problems that families and individuals face are so complicated that it takes people with several kinds of training to suggest a solution. For this reason, social workers have teamed up with members of other professions, including medicine, nursing, therapy, psychology, education, law, and religion. Growing attention is being given within the social work profession to directing and influencing social change. Social workers may join forces with health, housing, transportation, or urban planners to suggest ways of making a community a more wholesome place to live. They also use direct action to help people deal with some of the forces that shape their lives. Social workers may, for example, do research to identify community needs; publicize their findings; draft legislation; or comment on public proposals in such areas as housing, health, and welfare services.

Counselors help people understand themselves. They help them come to terms with their lives and give them the support and encouragement they need to make the most of their opportunities. Counselors usually specialize. School counselors help students develop educational plans that fit the students' abilities, interests, and career potential. Employment counselors guide people of all ages in planning careers and finding jobs. Their advice helps clients select appropriate fields of endeavor, and then prepare for them. Rehabilitation counselors advise people with physical, mental, or social disabilities. These counselors help handicapped persons understand what adjustments are needed in their personal lives and vocational plans in order to achieve a satisfactory lifestyle. College career planning and placement counselors help college students choose careers and advise them on the kinds of training or experience that will best help them find a job.

Members of the clergy counsel people of their faith and provide spiritual leadership within their communities. They enable people to worship according to the dictates of their consciences. As spiritual leaders, members of the clergy are widely regarded as models for moral and ethical conduct. They frequently counsel people who have problems in their jobs, homes, schools, or social relationships; often, these are emotional problems. In fact, they deal in such delicate personal and emotional areas that the law provides that they need not disclose the nature of their communications with their congregants. Members of the clergy help people in their communities in many other ways. They may set up programs that feed the poor, care for the sick, provide companionship for the lonely, and involve children and adults in educational and recreational activities.

Other occupations involve helping people, too. Cooperative extension service workers work with people who live in rural areas; they do educational work in such areas as agriculture and home economics, and encourage youth activities and community development. Home economists provide training and technical assistance in areas that make everyday life more comfortable and livable—consumer economics, housing, home management, home furnishings and equipment, food and nutrition, clothing and textiles, and family development and relations.

People in social service occupations become closely involved with their clients' lives, and the services they provide can have far-reaching effects. Advice on schools, jobs, careers, rehabilitation, or emotional and family problems may lead an individual to make fundamental decisions about the future. Suggestions made by a counselor or social worker may shape a client's entire future. Members of the clergy in particular may become involved in the most intimate details of their congregants' lives. A genuine concern for other people is therefore essential for anyone considering a career in this field.

Caring about people and wanting to assist is not enough, though. People in social service occupations must be good at dealing with other people and relating to them; they must have a manner that inspires trust and confidence. Nearly all of them undergo training in how to work with others. Tact and sensitivity are necessary traits. Anyone who comes in contact with people's deepest feelings and beliefs—as members of the clergy and counselors often do—needs empathy, the ability to sense others' feelings. Patience is important as well, for clients often are confused, hesitant, fearful, or angry. They often are not clear themselves as to what the problem is or may have difficulty describing it.

Speaking and writing skills are important. In some of these jobs, workers have to keep notes and records. They must be able to present all the important points about a client's situation clearly and quickly. Verbal skills are also necessary. Counselors and social workers must be able to communicate on a one-to-one basis, and to work easily with groups. There also are occasions when they must speak before large audiences. Members of the clergy, of course, do this regularly.

Finally, workers in the social service occupations should know themselves—their own strengths, weaknesses, and goals. Emotional stability is important because people in this field are so often in touch with situations that are worrisome or depressing. There are occupational hazards in this work. There is danger of being overwhelmed by others' misery, the danger of expecting too much of yourself, the danger of "burning out" and losing the sensitivity that brought you to the field in the first place.

Training for a social service career ranges from just a few weeks for an aide to many years for a professional. Homemaker-home health aides generally take a 1- or 2-week course right after they begin work. Many other social service aides—those doing valuable work in reaching out to their neighbors and others in need—have little formal training. They do not even have to be high school graduates, for that matter. What counts in getting their jobs is their knowledge of the community and their ability to deal with people. For professional occupations, such as social worker and counselor, however, a college degree and graduate education are necessary. Often, professional education includes an internship, or period of work experience, that enables the student to learn how to apply classroom knowledge to real-life situations.

The following section describes in greater detail the work of people in 12 social service occupations.

Counseling Occupations

At some point in their lives, most people seek advice or assistance for personal, educational, or vocational problems. These problems may be relatively minor, such as a conflict in a student's class schedule, or may involve serious emotional or physical disabilities. Regardless of the problem, counselors often are the ones to whom people turn for help.

Counselors may specialize in a specific area and work setting. Some deal primarily with school children, while others work only with adults. Some counselors are trained to assist in educational or vocational planning; others help people deal with their day to day problems. Whatever the area of specialization, counselors help people understand themselves—their capabilities and potential—so that they can make and carry out decisions and plans for a satisfying and productive life.

This chapter covers four counseling specialties: School counseling, rehabilitation counseling, employment counseling, and college career planning and placement.

School counselors are the largest counseling group. They are primarily concerned with the personal, social, and educational development of students.

Rehabilitation counselors help persons with physical, mental, or social handicaps to become more productive individuals.

Employment counselors advise people—the unemployed or unskilled, for example—who cannot find a job or have problems in career choice and planning.

College career planning and placement counselors help college students examine their own interests, abilities, and goals; explore career alternatives; and make and follow through with a career choice.

Persons who want to enter the counseling field must be interested in helping people and have an ability to understand their behavior. A pleasant but strong personality that instills confidence in clients is desirable. Counselors also must be patient, sensitive to the needs of others, and able to communicate orally as well as in writing.

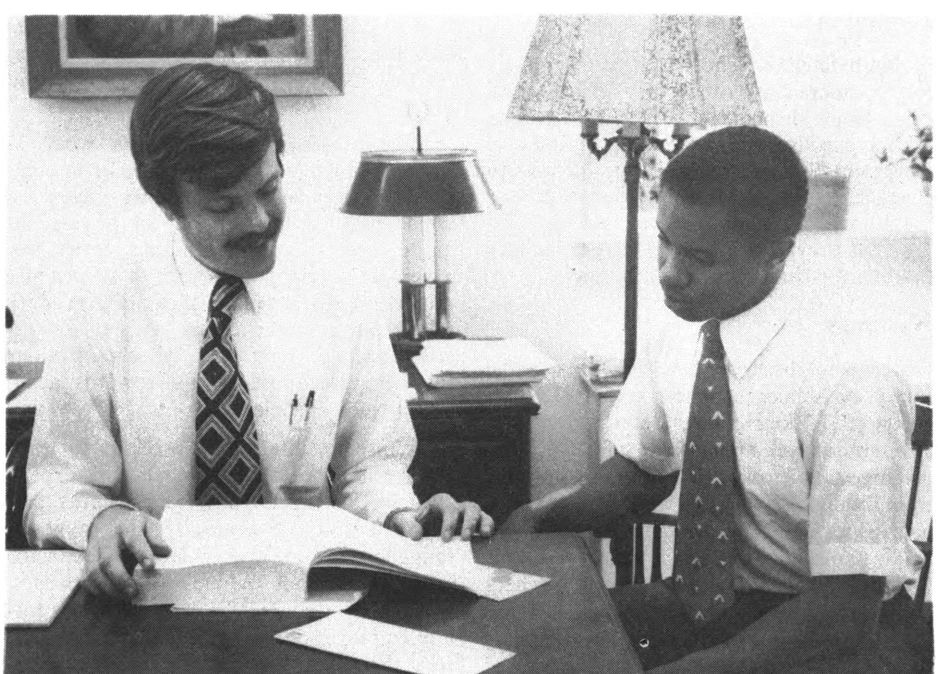
In addition, many psychologists, social workers, and college student personnel workers also do counseling. These and other fields which entail some counseling, such as teaching, health, law, religion, and personnel, are described elsewhere in the *Handbook*.

School Counselors

(D.O.T. 045.107-010)

Nature of the Work

Uncertainty about a career choice, difficulty with a particular class, or an unhappy home life are examples of problems that many students face. Usually these problems cannot be solved by the student alone; professional assistance often is needed. Most schools hire counselors to give individual attention to students' educational, career, and social development.



School counselors help students gain a better understanding of their interests, abilities, and personality characteristics.

The counselor's role is to help students understand themselves better—their abilities, talents, personality characteristics, and career options, for example. To accomplish this, counselors may use tests and individual or group counseling; sometimes they develop specialized methods or seek the assistance of community resource persons.

When helping students in career choices, counselors often administer and evaluate tests. Some counselors also have responsibility for a career information center and the school's career education program. The counselor may, for example, suggest ways in which a math teacher can incorporate into a lesson information on occupations that require mathematics. Or the counselor may arrange field trips to factories and business firms or show films which provide a view of real work settings. The desired result is a student who is more aware of careers that match his or her talents, likes, and abilities and who can, with the assistance of the counselor, develop an educational and career plan.

School counselors must keep up-to-date on opportunities for educational and vocational training beyond high school to counsel students who want this information. They must keep informed about training programs in 2- and 4-year colleges; in trade, technical, and business schools; apprenticeship programs; and available federally supported programs. Counselors also advise students about educational requirements for entry level jobs, job changes caused by technological advances, college entrance requirements, and places of employment.

Counselors in junior high and high schools often help students find part-time jobs, either to enable them to stay in school or to help them prepare for their vocation. They may help both graduates and dropouts to find jobs or may direct them to community employment services. They also may conduct surveys to learn more about hiring experiences of recent graduates and dropouts, local job opportunities, or the effectiveness of the educational and guidance programs.

Counselors work with problems affecting the school as a whole as well as those affecting only one or two individuals. If drug abuse is a problem, counselors may, for example, initiate group counseling sessions to discuss the dangers of taking drugs. Or they may speak individually with students and their parents.

Counselors work closely with other staff members of the school, members of the community, and parents. Often, teachers and counselors confer about problems affecting a student or group of students. A teacher may refer a student who appears to have problems dealing with classmates to a counselor who will attempt to find the cause. Counselors may arrange meetings with parents or community agencies, such as mental health organizations, if a student's problems are serious.

Elementary school counselors help children to make the best use of their abilities by identifying these and other basic aspects of the child's makeup at an early age, and by evaluating any learning problems. Methods used in counseling grade school children differ in many ways from those used with older students. Observations of classroom and play activity furnish clues about children in the lower grades. To better understand children, elementary school counselors spend much time consulting with teachers and parents. They also work closely with other staff members of the school, including psychologists and social workers.

Some school counselors, particularly in secondary schools, teach classes in occupational information, social studies, or other subjects. They also may supervise school clubs or other extracurricular activities, often after regular school hours.

Working Conditions

Most school counselors work the traditional 10-month school year with a 2-month vacation. They work closely with school administrators, teachers, and parents as well as students. Helping students solve specific problems can be emotionally exhausting.

Places of Employment

About 45,000 people worked full time as public school counselors during 1978. Most counselors work in large schools. An increasing number of school districts, however, provide guidance services to their small schools by assigning more than one school to a counselor.

Training, Other Qualifications, and Advancement

Most States require school counselors to have counseling and teaching certificates. However, a growing number of States no longer require teacher certification. Depending on the State, a master's degree in counseling and from 1 to 5 years of teaching experience usually are required for a counseling certificate. People who plan to become counselors should learn the requirements of the State in which they plan to work since requirements vary among States and change rapidly.

College students interested in becoming school counselors usually take the regular program of teacher education, with additional courses in psychology and sociology. In States where teaching experience is not a requirement, it is possible to major in a liberal arts program. A few States substitute a counseling internship for teaching experience. In some States, teachers who have completed part of the courses required for the master's degree in counseling are eligible for provisional certification and may work as counselors under supervision while they take additional courses.

Counselor education programs at the graduate level are available in more than 450 colleges and universities, usually in the departments of education or psychology. One to two years of graduate study are necessary for a master's degree. Most programs provide supervised field experience.

Subject areas of required graduate level courses usually include appraisal of the individual student, individual counseling procedures, group guidance, information service for career development, professional relations and ethics, and statistics and research.

The ability to help young people accept responsibility for their own lives is important for school counselors. They must be able to coordinate the activity of others and work as part of the team which forms the educational system.

School counselors may advance by moving to a larger school; becoming director or supervisor of counseling or guidance; or, with further graduate education, becoming a college counselor, educational psychologist, school psychologist, or school administrator. Usually college counselors and educational psychologists must have the Ph. D. degree.

Employment Outlook

Employment of school counselors is likely to grow more slowly than the average for all occupations through the 1980's as declining school enrollments coupled with financial constraints limit demand. Future growth in counselor employment will depend largely on the amount of funds that the Federal Government provides to the States, particularly funding for career education.

Earnings

According to a recent survey, the average salary of school counselors in 1978 was around $17,700. However, salaries varied by size, grade level, and locality of the school. Average salaries of school counselors ranged from around $9,200 to about $30,500. School counselors generally earn more than teachers at the same school. (See statements on kindergarten and elementary school teachers and secondary school teachers.)

In most school systems, counselors receive regular salary increments as they obtain additional education and experience. Some counselors supplement their income by part-time consulting or other work with private or public counseling centers, government agencies, or private industry.

Related Occupations

School counselors help students gain a better understanding of their interests, abilities, and personality characteristics, and also help them deal with personal, social, academic, and vocational problems. Other occupations involved in helping people in similar ways include caseworkers, clinical psychologists, elementary school teachers, parole officers, probation officers, social workers, secondary school teachers, and vocational rehabilitation counselors.

Sources of Additional Information

State departments of education can supply information on colleges and universities that offer training in guidance and counseling as well as on the State certification requirements.

Additional information on this field of work is available from:

American School Counselor Association, 22 Skyline Place, Suite 400, 5203 Leesburg Pike, Falls Church, Va. 22041.

Employment Counselors

(D.O.T. 045.107-010 and -018)

Nature of the Work

All too often, people look for jobs before they develop realistic career goals, acquire the proper training, or learn enough about the job market. They run the risk of becoming dissatisfied with their work or failing to find a job at all. Employment counselors (sometimes called vocational counselors) provide people with career information and other kinds of help in getting a job.

Most employment counselors work in State employment service offices or in community agencies. Community agencies, which may be either public or private, include career planning and placement programs for special groups such as women and minorities; social service agencies that counsel school dropouts, drug abusers, or ex-offenders; and neighborhood organizations that help direct young people towards meaningful roles in society.

Counselors interview jobseekers to learn about their interests, training, work experience, work attitudes, physical capacities, and personal traits. If necessary, they may arrange for aptitude and achievement tests. To learn more about the jobseeker's aptitudes, skills, and interests, they may contact a former employer or school principal. The counselor then describes a number of suitable occupations and discusses the client's employment prospects in each field.

Often, employment counselors refer clients

Counselors often administer aptitude and achievement tests.

to other agencies for additional help. For example, if a person stutters, the employment counselor might suggest speech therapy at a local health facility. A counselor might refer a client with outdated job skills to a training program, arrange an equivalency exam for someone who has not finished high school, or suggest child care that would fit a working parent's schedule. Proper referral requires that employment counselors be thoroughly familiar with community resources and that they keep in touch with other social service and health professionals.

Counselors may suggest specific employers and appropriate ways of applying for work. In some cases, counselors may contact employers about jobs for applicants, although placement specialists often handle this work in State employment service agencies. After job placement or entrance into training, counselors may follow up to determine if the applicant needs additional assistance.

The unemployed and graduates looking for their first job are typical clients that an employment counselor might see during an ordinary workday. Some clients have skills to start work immediately; others who have not completed school or lack marketable skills need assistance such as remedial education, job training, or advice about interviewing and filling out application forms. People with job market disadvantages often need extensive counseling. They may need help to resolve emotional, family, or other fundamental problems that prevent their securing and holding a job.

In recent years, the employment problems of many special groups have come into sharper focus. Veterans, school dropouts, handicapped people, older workers, women, and minorities sometimes need special help to turn talents and abilities into marketable skills. Employment counselors who work with these clients increasingly use group counseling, and follow-up counseling for clients who have begun working.

Working Conditions

Counselors usually work about 40 hours a week, but some in community agencies may have evening appointments to counsel clients already employed.

Working space is often limited, but offices are designed to be free from noise and distractions to allow for confidential discussions with clients.

Places of Employment

In 1978 about 3,100 persons worked in employment counseling or related technical and supervisory positions in State employment service offices in every large city and many smaller towns. In addition, about 3,000 employment counselors worked for various private or community agencies, primarily in larger cities. Some worked in institutions such as prisons, training schools for delinquent youths, and mental hospitals. Some counselors teach in graduate training programs or conduct research.

Training, Other Qualifications, and Advancement

All States require counselors in public employment offices to meet State civil service or merit system requirements. However, these minimum educational and experience standards vary by State. Some require a master's degree in counseling or a related field; others require only a high school diploma. Experience in counseling, interviewing, and job placement also may be required, particularly for those without advanced degrees.

Applicants with graduate degrees and additional experience may enter at higher levels on the counselor career ladder. In many States, individuals with extensive experience in the employment service may enter the counselor career ladder, take the prescribed university course, and gain the necessary experience to move upward.

Although minimum entrance requirements are not standardized among private and community agencies, most prefer, and some require, a master's degree in vocational counseling or in a related field such as psychology, personnel administration, counseling, guidance education, or public administration. Many private agencies prefer to have at least one staff member who has a doctorate in counseling psychology or a related field. For those lacking an advanced degree, employers usually emphasize experience in closely related work such as rehabilitation counseling, employment interviewing, school or college counseling, teaching, social work, or psychology.

In each State, the public employment service offices provide in-service training programs for their new counselors or trainees. In addition, both their new and experienced counselors often enroll for training at colleges and universities during the regular academic year or at institutes or summer sessions. Private and community agencies also often provide in-service training opportunities.

College students who wish to become employment counselors should study psychology and basic sociology. Graduate level courses include techniques of counseling, psychological principles and psychology of careers, assessment and appraisal, cultures and environment, and occupational information. Counselor education programs at the graduate level are available in more than 450 colleges and universities, mainly in departments of education or psychology. To obtain a master's degree, students must complete 1 to 2 years of graduate study including actual supervised experience in counseling.

Persons aspiring to be employment counselors should have a strong interest in helping others make and carry out vocational decisions. They should be able to work independently and to keep detailed records.

Well-qualified counselors with experience may advance to supervisory or administrative positions as directors of agencies, area supervisors of guidance programs, consultants, or counseling professors.

Employment Outlook

Qualified applicants are expected to face competition for jobs as employment counselors through the 1980's. Employment in this small occupation depends largely on Federal funding for the State, local, and community agencies that provide job counseling. In recent years, the number of counselors in State offices has changed very little, but some new jobs have opened up in community agencies funded under the Comprehensive Employment and Training Act (CETA).

In addition to new jobs, some openings for employment counselors will result from the need to replace those who die, retire, or transfer to other fields.

Earnings

Salaries of employment counselors in State employment services vary considerably from State to State. In 1978, salaries ranged from about $7,000 for entry level positions to $21,000 for experienced counselors. The average starting salary for beginning workers was $10,506, while experienced counselors averaged $13,814.

According to the limited data available, the average starting salary for counselors in private, nonprofit organizations in 1978 was $12,500. The average for experienced workers was $18,000. In general, salaries of employment counselors are about one and one-half times as high as average earnings for all nonsupervisory workers in private industry, except farming.

Counselors generally receive benefits such as vacations, sick leave, pension plans, and insurance coverage.

Related Occupations

Other professionals interview people, discuss their problems, and suggest useful solutions. Among them are school psychologists, guidance counselors, parole officers, probation officers, and social workers.

Sources of Additional Information

For general information on employment or vocational counseling, contact:

American Personnel and Guidance Association, 2 Skyline Place, Suite 400, 5203 Leesburg Pike, Falls Church, Va. 22041.

The administrative office for each State's employment security agency can supply specific information about local job opportunities, salaries, and entrance requirements for positions in public employment service offices. For information, contact the nearest local office of your public employment service under State Government listings in your local telephone directory. A list of all public employment service offices may be obtained by writing to:

U.S. Department of Labor, Employment and Training Administration, U.S. Employment Service, 601 D St. NW., Washington, D.C. 20213.

Rehabilitation Counselors

(D.O.T. 045.107-042)

Nature of the Work

Each year more mentally, physically, and emotionally disabled persons become self-sufficient and productive citizens. They find employment in a wide variety of occupations previously thought too complex or physically demanding for them to handle. A growing number are studying in colleges and technical schools throughout the United States. One member of the team of professionals who help disabled individuals leave a sheltered environment to lead as normal a life as possible is the rehabilitation counselor.

Rehabilitation counselors begin their work by learning about their client. They may read school reports, confer with medical personnel, and talk with family members to determine the exact nature of the disability. They also discuss with physicians, psychologists, and occupational therapists the types of skills the client can learn. At that point, the counselor begins a series of discussions with the client to explore training and career options. The counselor then uses this information to develop a rehabilitation plan.

A rehabilitation program generally includes specific job training, as well as other specialized training the disabled person may need. When working with a blind individual, for example, the counselor may arrange for training with seeing-eye dogs. The disabled person then may spend a few months learning to cross streets and ride public transportation systems. Throughout this period, the counselor and disabled client meet regularly to discuss progress in the rehabilitation program and any problems that may arise.

Counselors also must find jobs for disabled persons and often make followup checks to insure that placement has been successful. If the new employee has a specific problem on the job, the counselor may suggest adaptations to the employer.

Because job placement is such an important aspect of a counselor's work, he or she must keep in touch with members of the business community to learn the type of jobs available and training required. They also try to alleviate any fears on the part of employers about the suitability of hiring handicapped individuals. As a result, counselors may spend time publicizing the rehabilitation program to business and community associations.

An increasing number of counselors specialize in a particular area of rehabilitation; some may work almost exclusively with blind people, deaf people, alcoholics, drug addicts, the mentally ill, or retarded persons. Others may work almost entirely with persons living in poverty areas.

The amount of time spent counseling each client varies with the severity of the disabled person's problems as well as with the size of the counselor's caseload. Some rehabilitation counselors are responsible for many persons in various stages of rehabilitation; on the other hand, less experienced counselors, or those working with the severely disabled, may work with relatively few cases at a time.

Working Conditions

Rehabilitation counselors generally work a 40-hour week or less, with some overtime work required to attend community and civic meetings in the evening. They may spend only part of their time in their offices counseling and performing necessary paperwork. The remainder of their time is spent away from the office, working with prospective employers, training agencies, and the disabled person's family. The ability to drive a car often is necessary for this work.

Rehabilitation counselors must maintain close contact with handicapped clients and their families over many months or even years. The counselor often has the satisfaction of watching day-by-day progress in the disabled person's fight for independence. At other times, however, the counselor may experience the disappointment of a client's failures.

Places of Employment

About 19,000 persons worked as rehabilitation counselors in 1978. About 70 percent worked in State and local rehabilitation agencies financed cooperatively with Federal and State funds. Some vocational rehabilitation specialists and counseling psychologists worked in the Veterans Administration's vocational rehabilitation program. Rehabilitation centers, sheltered workshops, hospitals, mental health centers, labor unions, insurance companies, special schools, centers for independent living, and other public and private agencies with rehabilitation programs and job placement services for the disabled employ the rest.

Training, Other Qualifications, and Advancement

A bachelor's degree with courses in counseling, psychology, and related fields is the minimum educational requirement for rehabilitation counselors. However, employers are placing increasing emphasis on the master's degree in rehabilitation counseling or vocational counseling, or in related subjects such as psychology, education, and social work. Work experience in fields such as vocational counseling and placement, psychology, education, and so-

Rehabilitation counselors begin their work by learning about their client.

cial work is an asset for securing employment as a rehabilitation counselor. Most agencies have work-study programs whereby employed counselors can earn graduate degrees in the field.

In 1978, 84 colleges and universities accredited by the Council on Rehabilitation Education offered graduate programs in rehabilitation counseling. Usually, 1 1/2 to 2 years of study are required for the master's degree. Included is a period of actual work experience as a rehabilitation counselor under the close supervision of an instructor. Besides a basic foundation in psychology, courses generally included in master's degree programs are counseling theory and techniques, occupational and educational information, and community resources. Other requirements may include courses in placement and followup, tests and measurements, psychosocial effects of disability, and medical and legislative aspects of rehabilitation.

To earn the doctorate in rehabilitation counseling or in counseling psychology may take a total of 4 to 6 years of graduate study. Intensive training in psychology and other social sciences, as well as in research methods, is required.

Many States require that rehabilitation counselors be hired in accordance with State civil service and merit system rules. In most cases, these regulations require applicants to pass a competitive written test, sometimes supplemented by an interview and evaluation by a board of examiners. In addition, some private organizations require rehabilitation counselors to be certified. To become certified, counselors must pass exams administered by the Commission on Rehabilitation Counselor Certification.

Because rehabilitation counselors deal with the welfare of individuals, the ability to accept responsibility is important. It also is essential that they be able to work independently and be able to motivate and guide the activity of others. Counselors who work with the severely disabled need unusual emotional stability. They must be very patient in dealing with clients who often are discouraged, angry, or otherwise difficult to handle.

Counselors who have limited experience usually are assigned the less difficult cases. As they gain experience, their caseloads are increased and they are assigned clients with more complex rehabilitation problems. After obtaining considerable experience and more graduate education, rehabilitation counselors may advance to supervisory positions or top administrative jobs.

Employment Outlook

Because most State and private rehabilitation agencies are funded primarily by the Federal Government, the extent of employment will depend largely on the level of government spending. Additional positions, however, are expected to become available in private companies, such as manufacturing and service firms, for rehabilitation counselors to help in equal employment opportunity efforts. Colleges and universities that employ coordinators of services to handicapped students are another source of increasing employment opportunities for rehabilitation counselors. In addition to growth needs, many counselors will be required annually to replace those who die, retire, or leave the field for other reasons.

Earnings

The average minimum salary of rehabilitation counselors in State agencies was about $11,500 in 1978; the average maximum salary was $15,200.

The Veteran's Administration paid counseling psychologists with a 2-year master's degree and 1 year of subsequent experience—and those with a Ph. D.—starting salaries of $19,263 in early 1979. Those with a Ph. D. and a year of experience, and those with a 2-year master's degree and much experience, started at $23,087. In addition, the Veteran's Administration employed a number of vocational rehabilitation specialists—generally with master's degrees—at starting salaries of $13,014 to $19,263. The average salary of vocational rehabilitation counselors in the Federal Government was $20,100 in 1978.

Related Occupations

Rehabilitation counselors help mentally, physically, and emotionally disabled individuals become self-sufficient and productive citizens. Related occupations include: Industrial-organizational psychologists, school counselors, employment counselors, parole officers, probation officers, social workers, and occupational therapists.

Sources of Additional Information

For information about rehabilitation counseling as a career, contact:

American Psychological Association, Inc., 1200 17th St. NW., Washington, D.C. 20036.

American Rehabilitation Counseling Association, 2 Skyline Place, 5203 Leesburg Pike, Suite 400, Falls Church, Va. 22041.

National Rehabilitation Counselіng Association, 1522 K St. NW., Washington, D.C. 20005.

A list of educational institutions offering training in rehabilitation counseling can be obtained from:

Division of Manpower Development, Rehabilitaton Services Administration, Department of Education, Room 3321, Mary E. Switzer Building, 330 C St. SW., Washington, D.C. 20201.

Information on certification requirements and procedures is available from:

Commission on Rehabilitation Counselor Certification, 8 South Michigan Ave., Suite 3301, Chicago, Ill. 60603.

College Career Planning and Placement Counselors

(D.O.T. 166.167-014 and .267-010)

Nature of the Work

Choosing a career is a decision all college students face. Identifying a field of work that matches one's likes, dislikes, personal qualities, and talents can be difficult and time consuming. Once a career choice has been made, the job search begins in earnest—writing resumes, searching out prospective employers, and requesting interviews. Looking for a job can be an anxiety-producing and discouraging experience.

Career planning and placement counselors help bridge the gap between education and work by assisting students in all phases of career decisionmaking and planning. These counselors, sometimes called *college placement officers*, provide a variety of services to college students and alumni. They encourage students to examine their interests, abilities, and goals, and then help them explore career alternatives. They may help students test career interests by arranging internships, field placements, or part-time or summer employment. Counselors discuss the kinds of jobs open to college graduates with a particular major and help students evaluate the pros and cons of further training.

Because a liberal arts curriculum is not specifically career oriented, these students in particular can benefit from the knowledge and experience of college career planning and placement counselors. Even in areas like accounting or engineering, where the correlation between college major and career is quite direct, students benefit from counseling assistance in deciding where and how to look for a job.

Career planning and placement counselors also arrange for job recruiters to visit the campus to discuss their firms' personnel needs and to interview applicants. They provide employers with information about students and inform students about business operations and personnel needs in industry. A counselor may, for example, explain to students that workers in certain industries are subject to layoffs. In order to counsel students adequately, counselors must keep abreast of labor market information, including wages, hours, training, and employment prospects. This means reading career and counseling literature and maintaining contact with industry and government recruiters.

Some career planning and placement counselors, especially those in community and junior colleges, advise school administrators on curriculum and course content. They may consult employers and then suggest courses that would prepare students more adequately for local jobs. In addition, some placement directors and counselors, especially those working in small schools, also teach. All counselors maintain a library of career guidance and recruitment information.

Placement counselors may specialize in areas such as law, education, or part-time and summer work. However, the extent of specialization usually depends upon the size and type of college as well as the size of the placement staff.

Working Conditions

Working as they do with students, alumni, faculty, and employers, college career planning and placement counselors have people-oriented jobs. Their work entails a great deal of contact with others—in counseling sessions, meetings, public appearances, and telephone calls. This work can be deeply gratifying because counselors share in the growth and development of students. In addition, they are constantly exposed to new ideas and developments in the working world. Many persons pursue careers as college counselors because of the intellectual stimulation and other intangible benefits of an academic environment.

Places of Employment

Nearly all 4-year colleges and universities and many community and junior colleges provide career planning and placement services to their students and alumni. Large colleges and junior colleges may employ several counselors working under a director of career planning and placement activities. In many institutions, however, a combination of placement functions is performed by one director aided by a clerical staff. In small colleges and junior colleges, the functions of career counselors may be performed on a part-time basis by members of the faculty or administrative staff. Universities frequently have placement officers for each major branch or campus.

About 5,000 persons worked as career planning and placement counselors in 2- and 4-year colleges and universities in 1978.

Training, Other Qualifications, and Advancement

Although no specific educational program exists to prepare persons for career planning and placement work, colleges and universities increasingly seek applicants with a mas-

Helping students select courses is an interesting and challenging part of the job.

ter's degree in counseling, college student personnel work, or a behavioral science. One or two years of work experience in business or industry are invaluable preparation for this occupation.

In 1978, over 100 colleges and universities offered graduate programs in college student personnel work. Graduate courses that are helpful for career planning and placement counseling include counseling theory and techniques, vocational testing, theory of group dynamics, personnel management, organizational behavior, and industrial relations.

Some people enter the career planning and placement field after gaining a broad background of experience in business, industry, government, or educational organizations. An internship in a career planning and placement office also is helpful.

Like other counselors, college career planning and placement counselors need certain personal traits. A respect and concern for the individual, based on a belief in the student's self-worth and capacity for growth, is important in this field. Counselors must be able to communicate with and gain the confidence of students, faculty, and employers in order to work effectively with them. Intellectual curiosity and openmindedness are important, for counselors need to develop and maintain an understanding of the personal, economic, and environmental forces that affect career decisions. People in this field should be energetic and able to work under pressure because they must organize and administer a wide variety of activities.

Advancement for career planning and placement professionals usually is through promotion to an assistant or associate position, director of career planning and placement, director of student personnel services, or some other higher level administrative position. A doctoral degree may be helpful for such advancement. However, the extent of such opportunity usually depends upon the type of college or university and the size of the staff.

Employment Outlook

Employment of college career planning and placement counselors is not expected to increase significantly through the 1980's. Budgetary constraints in many institutions of higher education will limit expansion of counseling and placement services. Slight increases may occur in community and junior colleges where there are no career planning and placement programs at present. While colleges and universities increasingly emphasize career planning and placement services for students at all levels including special groups—adults seeking a midcareer change as well as minority, low-income, and handicapped students—schools will tend to utilize existing staff rather than hire additional personnel.

As with other academic jobs, applicants for college career planning and placement positions will face keen competition. Those with a master's degree in counseling or a related field and experience in business or industry may have the best job prospects.

Earnings

According to a survey of colleges and universities, the median salary of student placement directors was around $18,100 a year in 1978. Salaries generally were higher in public than in private institutions, and higher in major universities and 4-year institutions than in 2-year schools.

Career planning and placement counselors frequently work more than a 40-hour week; irregular hours and overtime often are necessary, particularly during the "recruiting season." Most counselors are employed on a 12-month basis. They are paid for holidays and vacations and usually receive the same benefits as other professional personnel employed by colleges and universities.

Related Occupations

College career planning and placement counselors help students attain career goals. Others who help people attain goals and solve personal problems include school counselors, employment counselors, rehabilitation counselors, personnel and labor relations workers, social workers, psychologists, members of the clergy, teachers, and college student personnel workers.

Sources of Additional Information

A pamphlet on college career planning and placement is available from:

The College Placement Council, Inc., P.O. Box 2263, Bethlehem, Pa. 18001.

Clergy

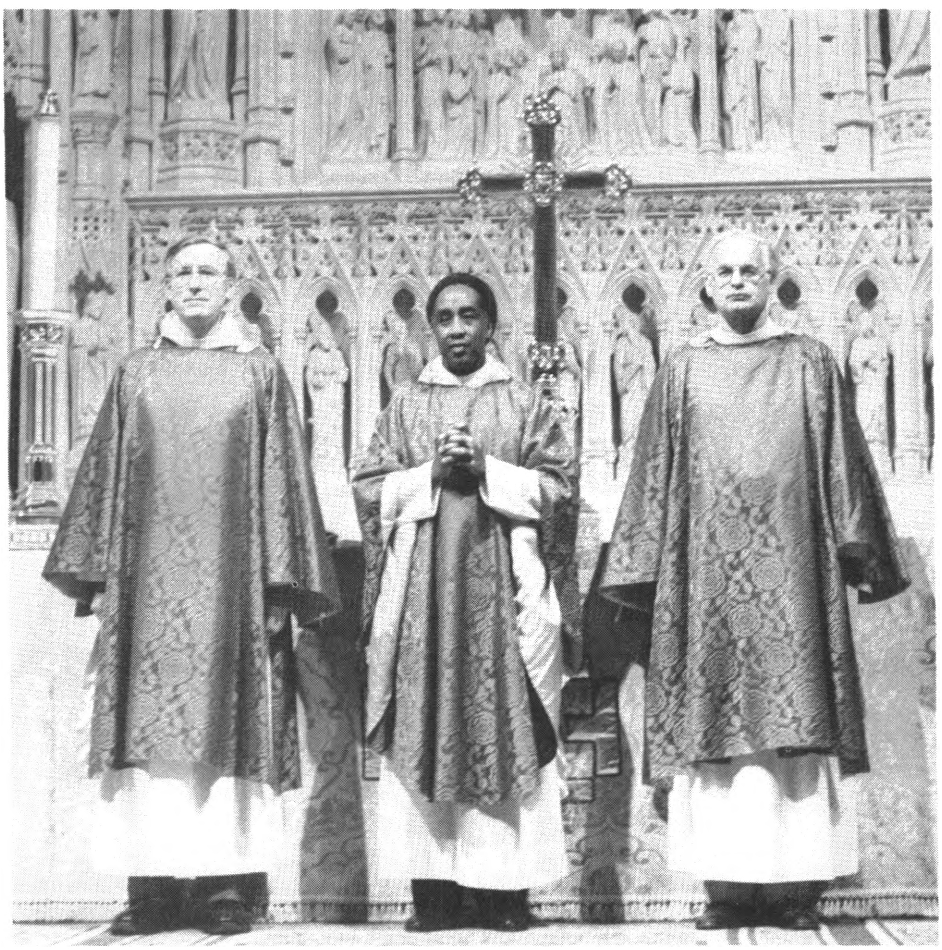
Deciding on a career in the clergy involves considerations different from those involved in other career choices. When persons choose to enter the ministry, priesthood, or rabbinate, they do so primarily because they possess a strong religious faith and a desire to help others. Nevertheless, it is important to know as much as possible about the profession and how to prepare for it, the kind of life it offers, and its needs for personnel.

The number of clergy needed depends largely on the number of people who participate in organized religious groups. This affects the number of churches and synagogues established and pulpits to be filled. In addition to the clergy who serve congregations, many others teach or act as administrators in seminaries and in other educational institutions; still others serve as chaplains in the Armed Forces, industry, correctional institutions, hospitals, or on college campuses; or render service as missionaries or in social welfare agencies.

Persons considering a career in the clergy should seek the counsel of a religious leader of their faith to aid in evaluating their qualifications. The most important of these are a deep religious belief and a desire to serve the spiritual needs of others. The priest, minister, or rabbi also is expected to be a model of moral and ethical conduct. A person considering one of these fields must realize that the civic, social, and recreational activities of a member of the clergy often are influenced and restricted by the customs and attitudes of the community.

The clergy should be sensitive to the needs of others and able to help them deal with these needs. The job demands an ability to speak and write effectively, to organize, and to supervise others. The person entering this field also must enjoy studying because the ministry is an occupation which requires continuous learning. In addition, the ministry demands considerable initiative and self-discipline.

More detailed information on the clergy in the three largest faiths in the United States—Protestant, Roman Catholic, and Jewish—is given in the following statements, prepared in cooperation with leaders of these faiths. Information on the clergy in other faiths may be obtained directly from leaders of the respective groups.



Minister conducting worship services.

Protestant Ministers

(D.O.T. 120.007-010)

Nature of the Work

Protestant ministers lead their congregations in worship services and administer the various rites in their churches, such as baptism, confirmation, and Holy Communion. They prepare and deliver sermons and give religious instruction. They also perform marriages; conduct funerals; counsel individuals who seek guidance; visit the sick, aged, and handicapped at home and in the hospital; comfort the bereaved; and serve church members in other ways. Many Protestant ministers write articles for publication, give speeches, and engage in interfaith, community, civic, educational, and recreational activities sponsored by or related to the interests of the church. Some ministers teach in seminaries, colleges, and universities.

The services that ministers conduct differ among Protestant denominations and also among congregations within a denomination. In many denominations, ministers follow a traditional order of worship; in others, they adapt the services to the needs of youth and other groups within the congregation. Most services include Bible reading, hymn singing, prayers, and a sermon. In some denominations, Bible reading by a member of the congregation and individual testimonials may constitute a large part of the service.

Ministers serving small congregations generally work on a personal basis with their parishioners. Those serving large congregations have greater administrative responsibilities and spend considerable time working with committees, church officers, and staff, besides performing their other duties. They may have one or more associates or assistants who share specific aspects of the ministry, such as a minister of education who assists in educational programs for different age groups, or a minister of music.

Working Conditions

Ministers are "on call" for any serious troubles or emergencies that involve or affect members of their churches. They also may work long and irregular hours in administrative, educational, and community service activities.

Many of the ministers' duties are sedentary in nature, such as reading or researching in a study or a library while preparing sermons or writing articles.

In denominations such as the Methodist Church, ministers are subject to reassignment by a central body to a new pastorate every few years.

Places of Employment

In 1978, most of the 190,000 Protestant ministers served individual congregations. Some also worked in closely related fields such as chaplains in hospitals and the Armed Forces. The greatest number of clergy are affiliated with the five largest groups of churches—Baptist, United Methodist, Lutheran, Presbyterian, and Episcopal.

All cities and most towns in the United States have at least one Protestant church with a full-time minister. Some churches employ part-time ministers; many part-time clergy are seminary students, ministers retired from full-time pastoral responsibilities, or those who also have secular jobs. Although most ministers are located in urban areas, many live in less densely populated areas where they may serve two or more congregations.

Training and Other Qualifications

Educational requirements for entry into the Protestant ministry vary greatly. Some denominations have no formal educational requirements, and others ordain persons having varying amounts and types of training in Bible colleges, Bible institutes, or liberal arts colleges.

In 1978, there were 146 American theological institutes accredited by the Association of Theological Schools in the United States and Canada. These admit only students who have received a bachelor's degree or its equivalent with a liberal arts major from an accredited college. Many denominations require a 3-year course of professional study in one of these accredited schools or seminaries after college graduation. The degree of master of divinity is awarded upon completion.

Recommended preseminary or undergraduate college courses include English, history, philosophy, the natural sciences, social sciences, the fine arts, music, religion, and foreign languages. These courses provide a knowledge of modern social, cultural, and scientific institutions and problems. However, students considering theological study should contact, at the earliest possible date, the schools to which they intend to apply, to learn how to prepare for the program they expect to enter.

The standard curriculum for accredited theological schools consists of four major categories: Biblical, historical, theological, and practical. Courses of a practical nature such as psychology, religious education, and administration are emphasized. Many accredited schools require that students gain experience in church work under the supervision of a faculty member or experienced minister. Some institutions offer doctor of ministry degrees to students who have completed 1 year or more of additional study after serving at least a year as minister. Scholarships and loans are available for students of theological institutions.

In general, each large denomination has its own school or schools of theology that reflect its particular doctrine, interests, and needs. However, many of these schools are open to students from other denominations. Several interdenominational schools associated with universities give both undergraduate and graduate training covering a wide range of theological points of view.

Persons who have denominational qualifications for the ministry usually are ordained after graduation from a seminary. In denominations that do not require seminary training, clergy are ordained at various appointed times. For example, the Evangelical minister may be ordained with only a high school education.

Men and women entering the clergy often begin their careers as pastors of small congregations or as assistant pastors in large churches.

Employment Outlook

The anticipated slow growth in church membership combined with pressures of rising costs and inadequate financial support are expected to result in only limited growth in requirements for ministers. However, the number of persons being ordained has been increasing and is likely to continue to do so. As a result, new graduates of theological schools are expected to face increasing competition in finding positions and more experienced ministers will face competition in their efforts to move to large congregations with greater responsibility and more remuneration. The supply-demand situation will vary among denominations, with more favorable prospects for ministers in Evangelical churches. Most of the openings for clergy that are expected through the 1980's will therefore result from the need to replace those in existing positions who retire, die, or leave the ministry.

Newly ordained Protestant ministers who do not have a parish have these alternatives: Working in youth counseling, family relations, and welfare organizations; teaching in religious educational institutions; and serving as chaplains in the Armed Forces, hospitals, universities, and correctional institutions.

Earnings and Working Conditions

Salaries of Protestant clergy vary substantially, depending on age, experience, denomination, size and wealth of congregation, and geographic location. The estimated median annual income of Protestant ministers, including housing allowance, was about $13,000 in 1978.

Sources of Additional Information

Persons who are interested in entering the Protestant ministry should seek the counsel of a minister or church guidance worker. Each theological school can supply information on admission requirements. Prospective ministers also should contact the ordination supervision body of their particular denomination for information on special requirements for ordination.

Rabbis

(D.O.T. 120.007-010)

Nature of the Work

Rabbis are the spiritual leaders of their congregations and teachers and interpreters of Jewish law and tradition. They conduct religious services and deliver sermons on the Sabbath and on Jewish holidays. Like other clergy, rabbis conduct weddings and funeral services, visit the sick, help the poor, comfort the bereaved, supervise religious education programs, engage in interfaith activities, and involve themselves in community affairs.

Rabbis serving large congregations may spend considerable time in administrative duties, working with their staffs and committees. Large congregations frequently have an associate or assistant rabbi. Many assistant rabbis serve as educational directors.

Nearly all rabbis serve Orthodox, Conservative, or Reform congregations. Regardless of their particular point of view, all Jewish congregations preserve the substance of Jewish religious worship. Congregations differ in the extent to which they follow the traditional form of worship—for example, in the wearing of head coverings, the use of Hebrew as the language of prayer, or the use of music or a choir. The format of the worship service and, therefore, the ritual that the rabbis use may vary even among congregations belonging to the same branch of Judaism.

Rabbis also may write for religious and lay publications, and teach in theological seminaries, colleges, and universities.

Working Conditions

Rabbis work long hours and are "on call" to visit the sick, comfort the bereaved, and provide counseling to those who need it. Community and educational activities may also require long or irregular hours.

Some of their duties are intellectual and sedentary, such as study of religious texts and researching and writing sermons and articles for publication.

Rabbis have a good deal of independent authority, since there is no formal hierarchy among them. They are responsible only to the Board of Trustees of the congregations they serve.

Rabbi telling Bible stories to nursery school children in his congregation.

Places of Employment

About 4,000 persons were employed as rabbis in 1978; approximately 1,550 were Orthodox rabbis, 1,350 were Conservative, and 1,200 Reform. Some work as chaplains in the military services, in hospitals and other institutions, or in one of the many Jewish community service agencies. Others are employed in colleges and universities as teachers in Jewish Studies programs.

Although rabbis serve Jewish communities throughout the Nation, they are concentrated in those States that have large Jewish populations, particularly New York, California, Pennsylvania, New Jersey, Florida, Illinois, Massachusetts, Maryland including the Washington, D.C. metropolitan area, and Ohio.

Training and Other Qualifications

To become eligible for ordination as a rabbi, a student must complete a course of study in a seminary. Entrance requirements and the curriculum depend upon the branch of Judaism with which the seminary is associated.

About 30 seminaries train Orthodox rabbis. The Rabbi Isaac Elchanan Theological Seminary and the Hebrew Teachers College of Skokie are the two seminaries in the United States that have formal 3-year ordination programs and require a bachelor's degree for entry. Most Orthodox rabbis, however, are ordained informally in seminaries with programs of varying length, depending on the individual student. There are no formal requirements for admission to these seminaries, nor are any degrees granted. When students have become sufficiently learned in the Talmud, the Bible, and other religious studies, they may be ordained with approval of three authorized rabbis.

The Hebrew Union College—Jewish Institute of Religion is the official seminary that trains rabbis for the Reform branch of Judaism. It is the only major branch that has approved the training and ordination of women as rabbis. In 1978, about 20 percent of the 200 Reform seminarians were women.

The Jewish Theological Seminary of America is the official seminary that trains rabbis for the Conservative branch of Judaism. Both seminaries require the completion of a 4-year college course, as well as earlier preparation in Jewish studies, for admission to the rabbinic program leading to ordination. Normally 5 years of study are required to complete the rabbinic course at the Reform seminary, including 1 year of preparatory study in Jerusalem. Exceptionally well-prepared students can shorten this 5-year period to a minimum of 3 years. A student having a strong background in Jewish studies can complete the course at the Conservative seminary in 4 years; for other enrollees, the course may take as long as 6 years.

In general, the curriculums of Jewish theological seminaries provide students with a comprehensive knowledge of the Bible, Talmud, Rabbinic literature, Jewish history, theology, and courses in education, pastoral psychology, and public speaking. Students of the Reform seminary get extensive practical training in dealing with the social and political problems in the community. Training for alternatives to the pulpit, such as leadership in community services and religious education, increasingly is stressed.

Some seminaries grant advanced academic degrees in fields such as Biblical and Talmudic research. All Jewish theological seminaries make scholarships and loans available.

Newly ordained rabbis usually begin as leaders of small congregations, assistants to experienced rabbis, directors of Hillel Foundations on college campuses, teachers in seminaries and other educational institutions, or chaplains in the Armed Forces. As a rule, the pulpits of large and well-established Jewish congregations are filled by experienced rabbis.

Employment Outlook

The employment outlook for rabbis varies among the three major branches of Judaism.

Reform rabbis may face competition for available positions. As a result, the Hebrew Union College—Jewish Institute of Religion, the only seminary that trains rabbis for the Reform branch of Judaism, has begun to limit enrollments by raising admission standards.

Orthodox clergy already encounter keen competition, attributable in large part to the informal ordination process. More Orthodox rabbis have been involved in teaching in religious schools at various levels than in pulpit work, and this is expected to continue. Many will also have to seek employment in secular fields.

Rabbis in the Conservative branch of Judaism, on the other hand, will have very good employment opportunities, if present trends continue.

Earnings

Incomes vary depending on the size and financial status of the congregation, as well as its denominational branch and geographic location. Rabbis usually earn additional income from gifts or fees for officiating at ceremonies such as weddings.

In 1978, the annual earnings of rabbis generally ranged from $15,000 to $35,000, including housing allowance. Earnings of Orthodox rabbis tend to be at the lower end of the scale; earnings of Conservative and Reform rabbis tend to be at the upper end of the scale. Some senior rabbis in large congregations earn upward of $50,000 a year.

Sources of Additional Information

Persons who are interested in becoming rabbis should discuss their plans for a vocation with a practicing rabbi. Information on the work of rabbis and allied occupations can be obtained from:

The Jewish Theological Seminary of America, (Conservative), 3080 Broadway, New York, N.Y. 10027.

The Rabbi Issac Elchanan Theological Seminary, an affiliate of Yeshiva University, (Orthodox), 2540 Amsterdam Ave., New York, N.Y. 10033.

Hebrew Union College—Jewish Institute of Religion, (Reform), whose three campuses are located at 1 W. 4th St., New York, N.Y. 10012; at 3101 Clifton Ave., Cincinnati, Ohio 45220; and at 3077 University Mall, Los Angeles, Calif. 90007; Reconstructionist Rabbinical College, 2308 N. Broad St., Philadelphia, Pa. 19132.

Roman Catholic Priests

(D.O.T. 120.007-010)

Nature of the Work

Roman Catholic priests attend to the spiritual, pastoral, moral, and educational needs of the members of their church. Their duties involve delivering sermons; administering the sacraments of marriage and of penance, and presiding at liturgical functions, such as funeral services. They also comfort the sick, console and counsel those in need of guidance, and assist the poor.

Their day usually begins with morning meditation and Mass, and may end with the hearing of confessions or an evening visit to a hospital or a home. Many priests direct and serve on church committees, work in civic and charitable organizations, and assist in community projects.

There are two main classifications of priests—diocesan (secular) and religious. Both types have the same powers acquired through ordination by a bishop. The differences lie in their way of life, the type of work to which they are assigned, and the church authority to whom they are immediately subject. Diocesan priests generally work as individuals in parishes assigned to them by the bishop of their diocese. Religious priests generally work as part of a religious order, such as the Jesuits, Dominicans, or Franciscans. They may engage in specialized activities, such as teaching or missionary work, assigned to them by superiors of their order.

Both religious and diocesan priests hold teaching and administrative posts in Catholic seminaries, colleges and universities, and high schools. Priests attached to religious orders staff a large proportion of the church's institutions of higher education and many high schools, whereas diocesan priests are usually concerned with the parochial schools attached to parish churches and with diocesan high schools. The members of religious orders do most of the missionary work conducted by the Catholic Church in this country and abroad.

Roman Catholic Priests attend to spiritual needs of members of their church.

Working Conditions

Priests spend long and irregular hours working for the church and the community.

Religious priests are assigned duties by their superiors in their particular orders. Some religious priests serve as missionaries in foreign countries where they may live under difficult and primitive conditions. Some religious priests live a communal life in monasteries where they devote themselves to prayer, study, and assigned work.

Diocesan priests ordinarily serve church members in parishes and they are "on call" at all hours to serve their parishioners in emergency situations. They also have many intellectual duties including study of the scriptures and keeping up with current religious and secular events in order to prepare sermons. Diocesan priests are responsible to the bishop in the diocese.

Places of Employment

There were approximately 58,000 priests in 1978. There are priests in nearly every city and town and in many rural communities. The majority are in metropolitan areas, where most Catholics reside. Catholics are concentrated in the Northeast and Great Lakes regions, with smaller concentrations in California, Texas, and Louisiana. Large numbers of priests are located in communities near Catholic educational and other institutions.

Training and Other Qualifications

Preparation for the priesthood generally requires 8 years of study beyond high school. There are over 450 seminaries where students receive training for the priesthood. Preparatory study may begin in the first year of high school, at the college level, or in theological seminaries after college graduation.

High school seminaries provide a college preparatory program that emphasizes English grammar, speech, literature, and social studies. Some study of Latin is required and the study of modern language is encouraged. The seminary college offers a liberal arts program, stressing philosophy and religion; the study of man through the behavioral sciences and history; and the natural sciences and mathematics. In many college seminaries, a student may concentrate in any of these fields.

The remaining 4 years of preparation include sacred scripture; dogmatic, moral, and pastoral theology; homiletics (art of preaching); church history; liturgy (Mass); and canon law. Fieldwork experience usually is also required; in recent years, this aspect of a priest's training has been emphasized. Diocesan and religious priests attend different major seminaries, where slight variations in the training reflect the differences in the type of work expected of them as priests. Priests commit themselves not to marry.

Postgraduate work in theology is offered at a number of American Catholic universities or at ecclesiastical universities around the world, particularly in Rome. Also, many priests do graduate work in fields unrelated to theology. Priests are encouraged by the Catholic Church to continue their studies, at least informally, after ordination. In recent years, continuing education for ordained priests has stressed social sciences, such as sociology and psychology.

Young men never are denied entry into seminaries because of lack of funds. In seminaries for secular priests, scholarships or loans are available. Those in religious seminaries are financed by contributions of benefactors.

The first assignment of a newly ordained secular priest is usually that of assistant pastor or curate. Newly ordained priests of religious orders are assigned to the specialized duties for which they are trained. Depending on the talents, interests, and experience of the individual, many opportunities for greater responsibility exist within the church.

Employment Outlook

More priests will be needed in the years ahead to provide for the spiritual, educational, and social needs of the increasing number of Catholics. During the past decade, the number of ordained priests has been insufficient to fill the needs of newly established parishes and other Catholic institutions, and to replace priests who retire or die. This situation is likely to persist and perhaps worsen, if the sharp drop in seminary enrollment continues.

In response to the shortage of priests, certain functions within the church, traditionally performed by priests are now being performed by lay deacons, and this trend is expected to increase in the future. Priests will continue to offer Mass, administer the sacraments, and hear confession, but probably will be less involved in teaching, administrative, and community work. An increasing number of lay deacons are being ordained to preach and perform liturgical functions such as distributing holy communion and reading the gospel at the Mass.

Earnings

Diocesan priests' salaries vary from diocese to diocese and range from $2,000 to $6,000 a year. The diocesan priest also may receive a car allowance of $25 to $50 a month, free room and board in the parish rectory, and fringe benefits such as group insurance and retirement benefits in the diocese.

Religious priests take a vow of poverty and are supported by their religious order.

Priests who do special work related to the church, such as teaching, usually receive a partial salary which is less than a lay person in the same position would receive. The difference between the usual salary for these jobs and the salary that the priest receives is called "contributed service." In some of these situations, housing and related expenses may be provided; in other cases, the priest must make his own arrangements. Some priests doing special work may receive the same compensation that a lay person would receive.

Sources of Additional Information

Young men interested in entering the priesthood should seek the guidance and counsel of their parish priests. For information regarding the different religious orders and the secular priesthood, as well as a list of the seminaries which prepare students for the priesthood, contact the diocesan Directors of Vocations through the office of the local pastor or bishop.

Cooperative Extension Service Workers

(D.O.T. 096.121, .127, .161, and .167)

Nature of the Work

Cooperative Extension Service workers, or extension agents as they are often called, conduct educational programs for rural residents in areas such as agriculture, home economics, youth activities, and community resource development. Extension agents generally specialize in one of these areas and have titles that match their specialties, such as extension agent for youth activities or extension agent for agriculture science and horticulture. They are employed jointly by State land-grant universities and the U.S. Department of Agriculture.

Extension agents usually work with groups of people. For example, the extension agent for youth activities leads meetings of local 4-H clubs, and during the summer, may plan and organize day camps to provide recreational activities for young people. Agents who work in home economics set up community meetings and programs on subjects of interest to homemakers. For example, they may discuss the benefits of good nutrition and offer advice on how to plan meals and buy and prepare food. Agriculture science extension agents conduct meetings on topics of special interest to area farmers. In a county which has much dairy farming, extension agents arrange seminars on subjects such as dairy herd health or the raising of forage crops. During these seminars, agents teach farmers how to selectthe proper feeds to meet cows' nutritional needs and raise their output of milk, and how to recognize and combat health hazards,including perhaps establishing a herd-inspection program. They also may help local farmers market their products.

Extension agents for community resource development meet with community leaders to plan and provide for economic development of the community. They also assist community leaders in developing recreational programs and facilities and in planning other public projects, such as water supply and sewage systems, libraries, and schools.

In addition to group work, agents also do fieldwork with individuals. If a farmer is having a problem with crops, an extension agent will visit the farm, examine the problem, and suggest remedies. Likewise, home economics extension agents occasionally visit homemakers to give personal help in solving problems.

An important part of each extension worker's job is to provide information that is important to people in the community. Many extension agents write articles dealing with their areas of specialization for local newspapers. Often these are regular feature columns that appear once a week. Other agents appear on local radio and television shows to give marketing reports for agricultural products important to the area, or present Saturday morning programs for young people. A few extension service workers produce documentary films on topics in which they have special training for broadcast on local television stations. Also, extension workers at some land-grant universities produce and broadcast programs on university-owned UHF and cable television stations.

In addition to the extension service workers at the county level, State extension specialists at land-grant universities coordinate the efforts of county agents. State extension agents keep abreast of the latest research in their fields of study and develop ways of using the research in extension work at the county level. Some State extension workers may be on a split assignment and teach at the university. Also, about 200 agricultural extension specialists are employed by the Extension Service of the U.S. Department of Agriculture in Washington, D.C.

Working Conditions

Cooperative Extension Service workers generally have very favorable working environments. The job has variety. Agents do much of their paperwork and planning in offices, but they also spend considerable time in the field. Agricultural extension agents, for example, may not go into the office at all on some days. Instead, they may visit farmers and help them develop more productive farming methods. They also may go to local radio stations to tape their weekly radio shows, or they may go to the State university to attend seminars on recent developments.

Extension work is not a 9 to 5 job, however. Farmers, for example, often are not able to attend meetings during the busy daylight hours, so extension agents often must conduct informational meetings during the evenings. During these meetings, they may discuss new farming methods or how new laws will affect farmers.

The job offers numerous opportunities for personal satisfaction. Helping a farmer become more productive or helping a family develop better nutritional habits, can be rewarding. Many extension agents also enjoy being asked their opinions on a variety of subjects.

Most extension service offices are located in small towns. As a result, extension work may be an ideal career for persons who wish to live outside the city.

Places of Employment

More than four-fifths of the approximately 16,000 Cooperative Extension Service agents in 1978 were employed by counties throughout the United States. Almost all of the more than 3,000 counties have county staffs. Depending on the population of the county, staffs range in size from one agent, who serves a wide variety of interests, to a dozen or more agents, each serving a highly specialized need. Most of the remaining extension agents are employed by State extension services located on the campuses of land-grant universities. A few work for regional staffs serving multicounty areas, and a small number are employed by the Extension Service of the U.S. Department of Agriculture. In addition, a few work in urban areas, mostly organizing 4-H activities for youth.

Training, Other Qualifications, and Advancement

Cooperative Extension Service agents are required to be proficient in disciplines related to the needs of their clientele. They must have a bachelor's degree in their subject-matter field. In addition, training in educational techniques and in a communications field, such as journalism, is extremely helpful.

Often, they receive specific instruction in extension work in a pre-induction training program, and can improve their skills through regular in-service training programs that cover both educational techniques and the subject matter for which they are responsible. Besides being proficient in their subject matter, extension workers must like to work with people and to help them.

In most States, specialists and agents assigned to multicounty and State staff jobs are required to have at least one advanced degree, and, in many, they must have a Ph. D.

Employment Outlook

The employment of Cooperative Extension Service workers is expected to increase more slowly than the average for all occupations through the 1980's. Nevertheless, as agricultural technology becomes more complicated, more extension workers trained in education and communications will be needed to disseminate information concerning advances in agricultural research and technology to the farm population. Also, modern farmers often are college educated and, thus, more likely to use innovative farm-

Many extension agents specialize in developing programs for young people.

ing practices. This may increase the demand for extension agents since extension agents relay advances in farming practices from researchers to farmers.

Earnings

According to the limited data available, county extension agents had average annual earnings of just over $17,000 in 1978. Earnings vary, however, by State, amount of education, and experience. Earnings also vary somewhat by area of specialization. Agricultural extension agents and community resource development specialists, for example, had the highest average annual earnings, almost $19,000, while home economics agents and 4-H club agents each had average annual earnings of under $16,000 in 1978.

Related Occupations

Extension workers spend most of their time working directly with others, passing on new ideas and helping farmers implement them. Other occupations that involve helping people to help themselves include counselors, dieticians, home economists, homemakers, teachers, social workers, and agricultural chemical salesworkers.

Sources of Additional Information

Additional information is available from County Extension offices, the State Director of the Cooperative Extension Service located at each land-grant university, or the Extension Service, U.S. Department of Agriculture, Hyattsville, Md. 20782.

Homemaker-Home Health Aides

(D.O.T. 309.354-010 and 354.377-014)

Nature of the Work

Many people, especially the elderly, are confined to a hospital or nursing home for a period of convalescence following a serious illness or surgery. Often, these patients only need occasional nursing care, but they are institutionalized because they cannot care for themselves completely. The services of homemaker-home health aides often are all that is needed to allow patients to return to the familiar surroundings of their homes. Employed and supervised by social and health agencies, homemaker-home health aides provide homemaking services, personal care services, instruction, and emotional support for their clients, and they keep records of their clients' progress and activities. Their schedules vary according to their clients' needs. For example, a person who is recuperating from an operation may need daily help for 1 or 2 weeks, while a person who has chronic medical problems may need help for 1 or 2 half-days a week for an indefinite period of time. At times, homemaker-home health aides work with families when the mother is convalescing from an illness and there are small children who need care. Most clients, however, are elderly persons who either live alone or with a spouse who also has medical problems. Usually the clients have no family or friends who can provide the care that is needed.

The homemaker-home health aide can provide many services. Basic duties include cleaning a client's room, kitchen, and bathroom, doing the laundry, and changing bed linens. Aides also plan meals (including special diets), shop for food, and prepare meals.

Among the personal care services that they perform are assisting with bathing or giving a bed bath, shampooing hair, and helping the client move from bed to a chair or another room. Homemaker-home health aides also check pulse and respiration, help with simple prescribed exercises, and assist with medications. Occasionally, they change dressings, use special equipment such as a hydraulic lift, or assist with braces or artificial limbs.

In addition to these practical duties, homemaker-home health aides offer instruction and psychological support. They often teach clients how to adapt their lives to cope with a new disability or how to prevent further illness. For example, an aide may teach a low-income client how to plan nutritious, low-cost meals. Another client may need instruction on the proper diet for a diabetic. Still another client, newly confined to a wheelchair, may need help in learning how to perform daily tasks. An aide may help a client establish a daily schedule that permits the accomplishment of necessary household duties and provides the exercise necessary for rehabilitation. Providing emotional support and understanding when a client is depressed and lonely is another aspect of the work. This often is more important than the practical jobs since, at times, a sick person's inability to gain strength and independence is more the result of a mental attitude than a physical problem. Lastly, the aide regularly reports changes in the client's condition and helps a professional team decide when the services being given to the client should be changed.

A homemaker home-health aide is assigned specific duties by a supervisor, usually a registered nurse or social worker who works as part of a professional team. The supervisor usually consults the client's physician, especially if the client recently has been discharged from the hospital. Many public or nonprofit agencies require physician certification of need for the service. The supervisor visits the client to decide what services are needed and to discuss the aide's schedule of duties with the client. Often the homemaker-home health aide gives the supervisor a daily report, signed by the client, listing the exact services performed and the hours worked.

The supervisor occasionally visits the client to determine if the service is satisfactory.

If the supervisor determines that extensive services will be required over a long period of time, attempts are made to coordinate the assignment of the aide with other in-home services such as Meals-on-Wheels, friendly visitors, and telephone reassurance. If satisfactory provision for the required care cannot be made, the supervisor will suggest an alternative arrangement such as transfer to a nursing home or a home for the aged. However, unless a client requires 24-hour care, it usually is possible to maintain care in the home through the services provided by homemaker-home health aides—coordinated, where needed, with other community services.

Working Conditions

Homemaker-home health aides work in patients' homes, so the work surroundings change from case to case. In accomplishing the housekeeping chores that are part of their work, aides must be able to stoop, lift, and perform other activities associated with cleaning and cooking. They must also be able to cope with clients suffering from any number of physical or emotional problems.

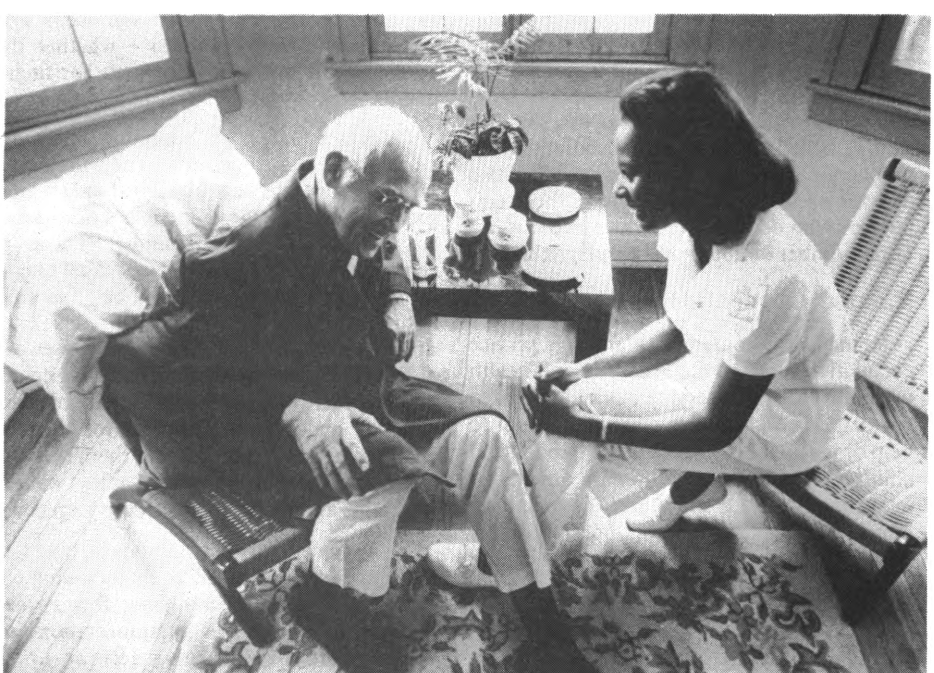
There are many reasons for homemaker-home health aides to enjoy their work. The occupation has status in comparison with many other jobs that do not require a high school education; aides are important members of a health care team since their regular reporting of changes in a client's condition is the basic information used to reassess the services provided. Another attractive aspect of the occupation is the availability of part-time work. Often persons who have full-time, strictly scheduled jobs as nursing aides in hospitals or nursing homes leave these jobs to work as homemaker-home health aides because they need a part-time or flexible work schedule. A third attractive element of the work is the independence and self-direction homemaker-home health aides have in carrying out day-to-day duties. This element increases as aides gain experience and need less detailed supervision.

The personal satisfaction that comes from helping people is just as important as status, independence, and a flexible schedule. Homemaker-home health aides provide essential services for persons who cannot live alone without help. The work they do keeps households functioning as normally as possible, and enables sick persons to remain at home instead of moving to a nursing home. Often homemaker-home health aides see depressed elderly people "come to life" because someone cared enough to brighten their homes and their lives. Persons who do not mind hard work and want to help people with basic human needs may find homemaker-home health aide a very satisfying occupation.

Places of employment

Approximately 110,000 persons were employed as homemaker-home health aides in 1978. Although they work in clients' homes, aides are employed and supervised by social and health agencies. These agencies include public health and welfare departments, private health care agencies, and nonprofit community health or welfare organizations such as visiting nurse associations. A few hospitals and nursing homes have extended their services into the community and employ homemaker-home health aides.

Some agencies provide only homemaker-home health aide services while others provide several health or welfare services. In the latter case, the aide is part of a team of professional and paraprofessional workers. For example, in a home health agency, a homemaker-home health aide may be part of a team of nurses, therapists, and other aides who have the same supervisor and who serve all clients in a particular area.



In addition to help with homemaking chores, personal care, and medications, homemaker home-health aides offer psychological support.

Training, Other Qualifications, and Advancement

Generally, the only educational requirement for employment as a homemaker-home health aide is the ability to read and write; completion of high school usually is not necessary. However, courses in home economics such as meal planning and family living are helpful, especially for younger persons with less personal experience in homemaking. A few agencies require previous training as a nursing aide; some of these agencies also require a year's experience working as a nursing aide in a hospital or nursing home.

Shortly after they are hired, homemaker-home health aides undergo orientation and training. The length and quality of this training vary greatly. Agencies that require experience as a nursing aide generally provide only a few hours of orientation. Most agencies, however, provide a 1- or 2-week training program. Topics covered include basic nutrition and meal planning and preparation; personal care of the sick, such as bathing, turning, and lifting bed patients; emotional problems accompanying illness; and the aging process and behavior of the elderly.

In addition to continuing training given on the job by supervisors for specific case assignments, many agencies offer seminars from time to time on topics such as diets for diabetics, exercises for clients with a heart condition, or coping with depression.

Successful homemaker-home health aides are mature persons who like to help people and don't mind hard work. They have a sense of responsibility, compassion, emotional stability, and a cheerful disposition. They are able to overcome an atmosphere of depression and bring brightness into the day of a sick, elderly person. Aides also must be tactful and able to get along with all kinds of people.

In addition to these personal qualities, homemaker-home health aides must have good health since some of their duties, such as lifting, moving, and supporting patients, require above-average physical strength. A physical examination usually is required of applicants.

Homemaker-home health aides usually are middle-aged women. However, younger women, elderly women, and men of all ages also are employed as aides. Although only a small number of men currently are employed in the occupation, additional men are needed, especially to care for those elderly men who prefer a male aide. The minimum age for a homemaker-home health aide is usually 17;

however, most agencies prefer people in their 20's at least. Many agencies employ persons who are elderly themselves. Most of these older aides desire part-time employment to supplement their Social Security income. Some agencies employ nursing students who want income from part-time work. College students in appropriate major fields such as home economics or social work occasionally can find summer work as aides, replacing regular employees who are on vacation.

As aides take on a variety of cases, they develop expertise in caring for persons with many types of illness. Some aides discover a special talent for caring for a specific type of client, such as a person who needs help with prescribed exercises, or a client with failing eyesight. In some larger agencies, experienced homemaker-home health aides can specialize in caring for clients with a specific type of problem. After gaining experience in different types of cases, aides can assume more responsibility and become more self-directing, within the scope of their assigned duties. In some agencies, experienced aides can be promoted to special assistant to the supervisor, relieving the supervisor of some of the more routine aspects of supervision and management.

Employment Outlook

Employment of homemaker-home health aides is expected to grow much faster than the average for all occupations through the 1980's. Over the next 10 years, employment will grow because of heightened awareness on the part of the public and the medical profession of the availability of home care services. Since home care is a relatively new approach to long-term care, many elderly persons and their doctors are not yet aware that it is possible to receive personal care without moving into a nursing home or a home for the aged. However, there is increasing interest in alternatives to institutional care.

Another important factor in determining how the occupation will grow is how much money is available to pay for the service. Federal legislation authorizing greater use of public funds for homemaker-home health services could be enacted in the future. Such legislation might take the form of changes in the Social Security Act to expand Medicare coverage for home health care; adoption of a national health insurance program providing for long-term care; or other measures. Public funds for home care already are available under Title XX of the Social Security Act. Since 1975, when this title took effect, nearly all States have given high priority to homemaker-home health services in allocating social service funds. The trend toward public financing of home care services is expected to continue.

Such trends indicate that the number of jobs for homemaker-home health aides is likely to grow very rapidly through the 1980's. A large number of jobs also will become available because of the need to replace persons who leave the occupation to take other jobs, devote more time to family responsibilities, or retire. Some job openings will arise from the need to replace aides who die. Although there is an abundant supply of persons for work of this type, with its minimal education and experience requirements, the personal qualifications required for the job greatly limit the number of applicants who are hired. Persons who are interested in this work and well suited for it should have no trouble finding and keeping jobs.

Earnings

Earnings for homemaker-home health aides vary considerably. In 1978, beginning wages ranged from $2.65 to $4.15 an hour or about $0.10 to $1.50 an hour higher than the minimum wage. Agencies in large cities that have a high cost of living generally pay higher wages. Agencies that have union contracts usually pay higher wages and offer more benefits. While some agencies pay the same rate to all aides, most agencies give pay increases as aides gain experience and are given more responsibility. A few agencies have career ladders, with the increasing responsibilities and wages of each step stated in detail.

Benefits vary even more than wages. Some agencies offer no benefits at all, while others offer a full package of holidays, vacation, sick leave, health and life insurance, and retirement plans. While some agencies hire only "on call" hourly workers, with no benefits, many agencies also employ aides on a full-time or part-time basis with many benefits and a minimum number of hours guaranteed. A typical full-time aide is guaranteed 36 hours of work a week; has 1 to 3 weeks of paid vacation each year, based on number of years of employment; earns 1 day of sick leave a month; is paid for major holidays; and can participate in health insurance and pension plans. A typical part-time employee works a regular schedule and is guaranteed 20 hours of work a week, receives the same hourly wage as full-time employees, and has similar benefits, allocated according to the number of hours worked. A few agencies also allocate vacation and sick leave to those employees who do not have a guaranteed minimum number of hours or a regular schedule.

Related Occupations

Homemaker-home health aide is a service occupation that combines duties of health workers and social service workers. Related occupations that involve personal contact to help or instruct others include: Attendants in children's institutions; child care attendants in schools; child monitors; companions; home attendants; nurses aides; nursery school attendants; occupational therapy aides; orderlies; physical therapy aides; playroom attendants; and psychiatric aides.

Sources of Additional Information

For information, contact:

National Council for Homemaker-Home Health Aide Services, 67 Irving Place, 6th Floor, New York, N.Y. 10003.

Social Service Aides

(D.O.T. 195.367-010 and 205.367-046)

Nature of the Work

Social service or human service aides enable social service agencies to help greater numbers of people by supplementing the work of professional social workers and rehabilitation counselors.

Social service aides, working under the close guidance and supervision of professional staff, serve as a link between these professional social workers or rehabilitation counselors and people who seek help. Aides explain the services and facilities of the agency, help new applicants fill out any required forms, and perform much of the routine paperwork required in welfare programs. They may update clients' records, maintain a filing system of reports or a control system for periodic case reviews, and fill out school enrollment, employment, medical, and compensation forms.

While such duties are an essential part of the job, the most important aspect of the work is being available when needed to offer encouragement and assistance to people in the community who need help.

Social service aides work in many different settings, perform a wide range of duties, and have a number of different job titles. *Income maintenance workers* interview applicants to determine whether they or their families are eligible for help. The aide's responsibilites may include visiting the applicant's home, interviewing friends and relatives, and checking documents such as marriage licenses or birth certificates to determine whether the applicant meets the requirements for financial assistance or other services.

Casework aides or *casework assistants* work directly with clients. They may help clients obtain adequate housing, food stamps, medical care, unemployment or social security benefits, or job training. Those in rehabilitation agencies also may assist clients in obtaining artificial limbs, for example. Some aides may counsel parents whose children are in trouble with the police. Casework aides serve as advocates for clients by accompanying them to clinics for necessary medical care, by making appointments for them at legal aid offices, or by helping them through the red tape that surrounds many welfare programs and employment security agencies.

Many social service aides spend most of their workday in the office interviewing clients and helping them fill out forms, telephoning other agencies for information and appointments, and keeping records up to date. Some aides, however, spend most of their time out of the office assisting clients in their neighborhoods or homes. *Neighborhood*

Social service aides are a link between professional social workers and people who seek help.

or *outreach workers* contact the residents of an area to explain and discuss agency services. They learn the needs of individuals and families and refer routine cases to a counselor or to the appropriate agency. They report more difficult problems to their supervisor. Neighborhood workers may inform residents about job openings, available housing, job training opportunities, and public services. On a broader scale, they assist in the organization of block and other neighborhood groups to conduct programs that benefit the neighborhood, foster a sense of community responsibility among residents, and encourage participation in the antipoverty programs of social service agencies. They also may assist in routine neighborhood surveys and counts, keep records, and prepare reports of their activities for their supervisor.

Employment aides also work with clients in their neighborhoods. These aides actively seek out the disadvantaged and help prepare them for employment by giving them assistance in getting special training and counseling. While working in neighborhood centers or mobile units, they locate candidates for available jobs and training programs by contacting unemployed residents in poolrooms, laundromats, on street corners, or through employment or welfare agency referrals. They give the unemployed information about the local State employment service office,available job and training opportunities, and help them fill out application forms. After clients are employed, aides maintain contact to help workers adjust to the new work environment and to iron out minor difficulties.

Homemaker-home health aides work in households where illness, old age, or an emergency makes it difficult for the client to manage everyday tasks. Aides help with such household activities as grocery shopping, cooking, cleaning, mending, child care, and personal care if the client is sick or bedridden. The occupation of homemaker-home health aide is described more fully in a separate statement elsewhere in the *Handbook*.

Working Conditions

Social welfare aides often must work evenings or weekends when clients can be reached and are usually granted compensatory time off in exchange.

Although dealing with people who have severe personal and financial problems can be upsetting, social service aides often gain personal satisfaction from assisting those in need of help.

Places of Employment

About 134,000 persons worked as social service aides in 1978, mostly in the inner cities of large metropolitan areas.

The overwhelming majority of social service aides work for welfare agencies run by local governments or by voluntary or religious organizations. These include public welfare departments, community and neighborhood centers, family service agencies, halfway houses, and rehabilitation agencies. Most of the remaining aides work in hospitals, clinics, community health programs, or in schools and public housing projects.

Training, Other Qualifications, and Advancement

Social service aides have a wide range of educational backgrounds, and the level of responsibility given to them often depends on their formal educational attainment. For example, persons with a grade school education may enter the field in clerical positions. On the other hand, those with a college degree may immediately assume more professional responsibilities, sometimes including duties normally given social workers.

Most social service aide jobs do not require graduation from high school. Many persons enter this field without significant prior work experience. In fact, personal qualities matter most. These include a genuine desire to help people and the ability to communicate with community agencies and clients. Typing skills are useful and, in some communities, knowledge of an appropriate foreign language also may be helpful.

To be hired as a social service aide an individual's need for work, potential for upgrading his or her skills, and ability to make a useful contribution to the agency often are chief considerations. As a result, agencies often hire former welfare recipients as social service aides. Some aides are hired as part of government programs to provide subsidized job opportunities for low-income people. For employment in some agencies, an examination or registration on a civil service list may be required.

Most employers provide opportunities for advancement through a combination of on-the-job training, work experience, and education. For example, an entry level position as an employment aide can lead to a job as an employment interviewer, and, after special training, to employment counselor. Aides usually are trained on the job by social workers, rehabilitation counselors, nurses and other professionals. They learn about the details of many social programs including social security, food stamps, and Medicare. Those without a high school diploma often receive classroom instruction to help them pass a high school equivalency examination. Employing agencies frequently pay part of the cost of further education.

About 140 community and junior colleges offer 2-year programs for social service aides under such diverse titles as "human service aide," "mental health aide," or "social service aide." Typically, these programs include courses in sociology and psychology; developing skills such as interviewing, observing and recording behavior; learning techniques of individual counseling, group dynamics, activity therapy, and behavior modification; and field experience at local helping agencies. Some college graduates with a degree in a field other than social service work as social service aides.

Employment Outlook

Employment of social service aides is expected to grow about as fast as the average for all occupations through the 1980's. Many opportunities are expected for part-time work. A large number of openings will arise from the need to replace aides who die, retire, or leave the occupation for other reasons.

Employment in this field will stem from population growth, coupled with this country's continuing commitment to aid those who are disadvantaged, disabled, or unable to care for themselves. The need to provide many kinds of social services for our growing elderly population is likely to spur an expansion of social welfare programs and create many new jobs for social service aides. Shifts in job duties within welfare agencies also may contribute to the anticipated increase in employment in this occupation. As social welfare services and programs expand, social service aides increasingly will be used for much of the routine work now done by professional personnel.

Earnings

Full-time social service aides with no prior experience or formal education in the field earned starting salaries in State government that averaged about $7,300 a year in 1978, according to a survey by the U.S. Office of Personnel Management. Those with experience or additional education usually earned more. Beginning social service aides in the Federal Government started at $9,391 in 1979; experienced aides started at $13,014. Many aides in both public and private agencies work part time. Average earnings for social service aides are about the same as those for nonsupervisory workers in private industry, except farming.

Related Occupations

Workers in other occupations that require skills similar to those of social service aides include case aides, home attendants, lay clergy, occupational therapy assistants and aides, physical therapy assistants and aides, and psychiatric aides.

Sources of Additional Information

Information on requirements for social service aide jobs is available from city, county, or State departments of welfare or social services, community or neighborhood development agencies, and local offices of the State employment service.

Social Workers

(D.O.T. 195.107, .117, .137, .164, and .167-010)

Nature of the Work

The ability of people to live effectively in society often is hampered by lack of resources and problems that range from personal to those arising from social unrest. The growing complexity of society has greatly increased the need for social workers to help individuals, families, groups and communities to solve their problems.

The nature of the problem and the time and resources available determine which of three traditional approaches— casework, group work, and community organization— social workers will use or combine to deal with these problems. However, recent curriculums and training have developed new approaches to social work. For example, social workers may now specialize in social institutions, a field which encompasses health and education, or in social problems such as poverty.

In casework, social workers interview individuals and families to understand their problems and secure the appropriate resources, services, education, or job training. In group work, social workers help people understand themselves and others to achieve a common goal. They plan and conduct activities for children, teenagers, adults, older persons, and other groups in community centers, hospitals, nursing homes, and correctional institutions. In community organization, social workers coordinate the efforts of political, civic, religious, business, and union organizations to combat social problems through community programs. For a neighborhood or larger area, they may help plan and develop health, housing, welfare, and recreation services. Social workers often coordinate existing services, organize fundraising for community social welfare activities, and aid in developing new community services.

Most social workers deal directly with individuals, families, or groups. However, a substantial number are directors, administrators, or supervisors. Like other administrators, directors of social service agencies hire and train personnel, make budgetary decisions, develop and evaluate agency problems, solicit new funds, supervise staff, and serve as spokespersons for the agencies' clients. Some social workers are college teachers, research workers, or consultants. Others work for community agencies and planning bodies of government, voluntary agencies, and other private organizations.

Social workers apply their training and experience in a variety of settings. Although many work for agencies or institutions, growing numbers are in private practice and provide counseling for a fee.

Social workers for family and child services in public and in voluntary agencies such as those run by religious charities, counsel individuals, work to strengthen personal and family relationships, and help clients to cope with problems. They provide information and referral services in many areas—family budgeting and money management, locating housing, homemaker assistance for the elderly, job training, and day care for parents trying to support a family.

Social workers in child welfare work to improve the physical and emotional well-being of deprived and troubled children and youth. They may advise parents on child care and child rearing, counsel children and youth with social adjustment difficulties, and arrange homemaker services during a parent's illness. Social workers may institute legal action to protect neglected or mistreated children, help unmarried parents, and counsel couples about adoption. After proper evaluation and home visits, they may place and oversee children in foster homes or institutions. When children have unsatisfactory school progress related to social problems, these workers consult with parents, teachers, counselors, and other school and community personnel to identify and solve the underlying problems.

Medical and psychiatric hospitals, clinics, mental health agencies, rehabilitation centers, and public welfare agencies employ social workers to help patients and their families with social problems that may accompany illness, recovery, and rehabilitation. Renal social workers (who deal with patients and families of patients and the families of patients suffering from kidney disease) and social workers specializing in drug addiction help patients readadjust to their homes, jobs, and communities. (The related occupation of rehabilitation counselor is discussed in a separate statement.)

A growing number of social workers specialize in the field of aging. They plan and evaluate services for the elderly, and help them deal with finanical and other changes brought about by retirement. In nursing homes, they help patients and their families adjust to illness and the need for institutionalization and health care service.

Social workers in correctional institutions and correctional programs help offenders and persons on probation readjust to society. They counsel on social problems in returning to family and community life, and also may help secure necessary education, training, employment, or community services.

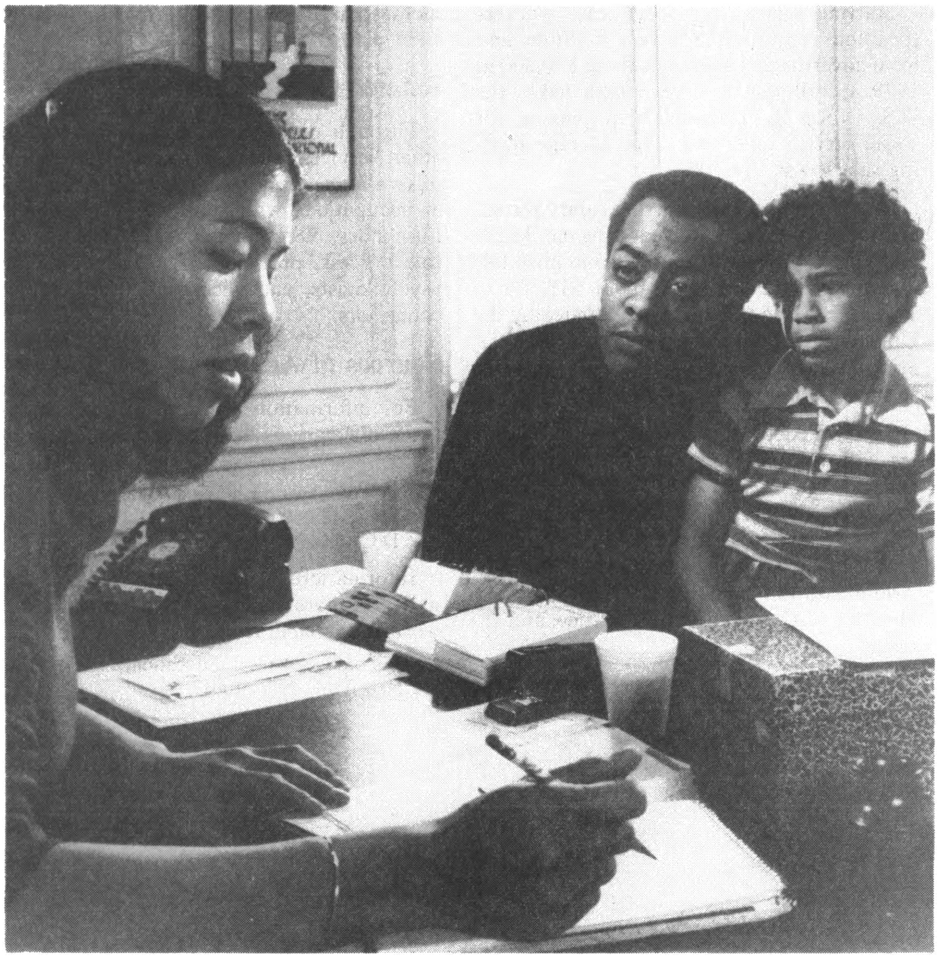
Working Conditions

Most social workers have a 5-day, 35- to 40-hour week. However, many, particularly in private agencies, work part time. Many work evenings and weekends to meet with clients, attend community meetings, and handle emergency situations. Compensatory time generally is granted for overtime. Because social workers spend a lot of time away from their office, the ability to drive a car often is necessary.

Places of Employment

About 385,000 social workers were employed in 1978. Among these, two-thirds provide direct social services for public and voluntary agencies, including State departments of public assistance and community welfare and religious organizations. Most of the remainder are involved in social policy and planning, community organization, and administration in government agencies, primarily on the state and local level; still others work for schools, hospitals, clinics, and other health facilities. A small but growing number of social workers are employed in business and industry.

Although employment is concentrated in urban areas, many work with rural families. A small number of social workers—employed by the Federal Government and the United Nations or one of its affiliated agencies—serve in other parts of the world as consultants, teachers, or technicians and es-



Social workers interview people to learn about their problems.

tablish agencies, schools, or assistance programs.

Training, Other Qualifications, and Advancement

Only in recent years has the bachelor's degree in social work (BSW), rather than the master's degree (MSW), been fully accepted as the minimum education of the professional social worker. The BSW programs generally provide content in the areas of social work practice, social welfare policies and service, human behavior and the social environment, social research, and supervised field experience. Generally, BSW programs prepare people for direct service positions such as case worker or group worker. Quite a few workers in this field have degrees in the liberal arts or humanities, sociology and psychology being the most prevalent majors. However, opportunities for advancement to high-level supervisory and administrative positions tend to be limited for those without graduate training in social work, and are particularly limited for persons with no formal training in this field.

For many positions, an MSW is preferred or required. Two years of specialized study and supervised field instruction generally are required to earn an MSW. Field placement affords one the opportunity to test his or her suitability for social work practice. At the same time the student may develop expertise in a specialized area and make personal contacts that later are helpful in securing a permanent job. Previous training in social work is not required for entry into a graduate program, but related courses such as psychology, sociology, economics, political science, history, social anthropology, and urban studies, as well as social work, are recommended. Some graduate schools offer accelerated MSW programs for a limited number of highly qualified BSW recipients.However, applicants to graduate programs in social work may face keen competition.

In 1978, about 250 colleges and universities offered accredited undergraduate programs and over 80 offered accredited graduate programs in social work. More than 20 have included courses in gerontology (study of aging). Graduate students may specialize in clinical social work, community organization, administration, teaching, research, social policy planning, and a variety of other areas.

A limited number of scholarships and fellowships are available for graduate education. A few social welfare agencies grant workers "educational leave" to obtain graduate education.

A graduate degree and experience generally are required for supervisory, administrative, or research work; the last also requires training in social science research methods. Many administrators have a background in social work, business or public administration, education, or health administration. For teaching positions, an MSW is required and a doctorate usually is preferred. With the exception of some high-level positions, most applicants for government employment must pass a written exam.

In 1978, 22 States had licensing or registration laws regarding social work practice and the use of professional titles. Usually work experience, an examination, or both, are necessary for licensing or registration, with periodic renewal required. The National Association of Social Workers allows the use of the title ACSW (Academy of Certified Social Workers) for members having a master's degree and at least 2 years of job experience who have passed the ACSW examination. In view of the emerging trend towards specialization at advanced levels of social work practice, efforts are being made to devise specialized examinations in addition to the general ACSW examination currently given.

Social workers should be emotionally mature, objective, and sensitive, and should possess a basic concern for people and their problems. They must be able to handle responsibility, work independently, and maintain good working relationships with clients and coworkers.

During high school and college, students should do volunteer, part-time, or summer work to determine whether they have the interest and capacity for professional social work. Some voluntary and public social welfare agencies occasionally hire students as assistants to social workers.

Employment Outlook

Employment of social workers is expected to increase about as a fast as the average for all occupations through the 1980's as a result of the expansion of social services. These services will include, in public education, programs for teenage mothers and delinquents; health services in hospitals, nursing homes, community mental health centers, and home health agencies; services for the aging; and counseling in the areas of consumerism, rape, and drug and alcohol abuse. Relatively high levels of unemployment coupled with problems caused by social change are expected to sustain a strong demand for persons in the social service field. The increasing need for social workers to assist other professionals in health planning, transportation, law, and public administration also should stimulate employment growth. In addition to jobs resulting from employment growth, thousands of openings will result annually from deaths and retirements.

If the number of students graduating from social work programs continues to increase at the same rate as in the 1970's, persons having a bachelor's degree in social work will face increasing job competition. Graduates of master's and doctor's degree programs in social work are qualified for a wider range of jobs including administrative, research, planning, and teaching positions, and are expected to have good opportunities through the 1980's.

Because many cities are experiencing budget cuts in human services programs, applicants in these departments may face keen competition. Inasmuch as graduates often prefer to work in major metropolitan areas, job opportunities may be more favorable in rural areas and small towns.

Earnings

Salaries for social workers at all levels vary greatly by type of agency (private or public, Federal, State, or local) and geographic region, but generally are highest in large cities and in States with sizable urban populations. Private practitioners, administrators, teachers, and researchers often earn considerably more than social workers in other settings. Average earnings are higher for social workers than for non supervisory workers in private industry, except farming.

Starting salaries for social case workers (positions requiring a BSW) in State and local governments averaged about $10,300 in 1978, according to a survey conducted by the U.S. Office of Personnel Management; for social service supervisors, the average starting salary was $13,700.

The average annual starting salary for social workers (positions requiring an MSW and 1 year of related experience) in hospitals and medical centers was about $13,300 in 1978, according to a survey conducted by the University of Texas Medical School. Top salaries for experienced social workers in these settings averaged $17,000.

In the Federal Government, social workers with an MSW and no other experience started at $15,920 in 1979. Graduates with a Ph. D. or job experience may start at a higher salary. Most social workers in the Federal Government are employed by the Veterans' Administration and the Departments of Health and Human Services, Justice, and Interior.

Most social work agencies provide benefits such as paid vacation, sick leave, and retirement plans.

Related Occupations

Through direct counseling or referral to other services, social workers help people solve a range of personal problems. Workers in occupations with similar duties include: Case aides, clergy members, counselors, parole officess, probation officers, counseling psychologists, and vocational rehabilitation counselors.

Sources of Additional Information

For information about career opportunities in the various fields of social work, contact:

National Association of Social Workers, 1425 H St. NW., Suite 600, Southern Building, Washington, D.C. 20005.

Information on accredited graduate and undergraduate college programs in social work is available from:

Council on Social Work Education, 345 East 46th St., New York, N.Y. 10017.

PERFORMING ARTS, DESIGN, AND COMMUNICATIONS OCCUPATIONS

Creativity, imagination, and talent are prerequisites for a career in the performing arts, design, or communications. People in these fields are involved in expressing ideas and emotions and often do so in a highly personal manner. Indeed, for people with the ability and the drive, careers in this cluster offer unparalleled opportunities for self-expression.

Performing artists express themselves through music, drama, or dance. They may use their talent to say something serious or profound about the human condition—or they may simply provide entertainment. Because communicating with an audience is such an integral part of the performer's art, stage presence and rapport with an audience are qualities an artist must develop and refine. Actors and actresses, singers, dancers, comedians, magicians, mimes, trapeze artists, gymnasts, and figure skaters are just a few of the many different occupations in the performing arts.

People in design occupations use visual means such as light, space, color, and texture to convey feelings or create a particular effect. They need esthetic sensitivity, color sense, and talent. A fine artist might create a painting primarily to express an emotion or feeling. Applied artists, however, create or design objects that serve a practical purpose as well as make our surroundings more pleasant to look at. The design field includes people as diverse as painters, sculptors, graphic artists, commercial artists, photographers, floral designers, architects, interior designers, exhibit designers, lighting designers, set designers, clothing designers, and furniture designers.

People in communications occupations deal with mental images created by words. For these workers, language is a "tool of the trade." They use the written or spoken word to inform, persuade, or entertain others and they need to be able to express themselves clearly, accurately, and in an interesting manner. Poets, novelists, playwrights, essayists, and short story writers are among the creative writers who use language primarily to express ideas and emotions. The writers who use language to inform or persuade include journalists, technical writers, education writers, medical writers, business writers, speechwriters, joke writers, script writers, and copywriters. Some people in communications occupations do relatively little writing. Among them are editors, who revise and coordinate the work of others; proofreaders, who read and correct copy; and literary agents, who appraise and try to get manuscripts published. Radio and television announcers and interpreters rely on the spoken word to do their jobs.

In many occupations in this cluster, what counts most in getting a job or establishing a reputation is ability or talent, not educational preparation. Practical experience—in local theatrical productions or on a community newspaper, for example—can help a great deal in getting started. Perseverance and self-discipline often are essential, too. Even very talented people must be willing to spend years of their lives mastering a skill and then wait for a "break"—an opportunity to perform, to exhibit their work, or to have a manuscript published. The performing arts in particular are highly competitive, and perennially attract many more jobseekers than there are paying jobs.

People who aspire to a performing arts, design, or communications career need to be realistic about their talent. Depending on their career goal, they may need to be flexible enough to cope with job insecurity and willing to live on an irregular income.

The following section of the *Handbook* provides information on job prospects, earnings, personal qualifications, and the kinds of training required for a variety of performing arts, design, and communications occupations.

Performing Artists

The excitement of opening night, the thrill of an audience's applause, the joy of public recognition and admiration—these are some of the attractions that induce people to enter the performing arts. In addition, the opportunity for creative self-expression and the development of one's artistic talents are other reasons why many people become performing artists.

The performing arts include the areas of instrumental music, singing, acting, and the dance. Varied as they are, the performing arts have in common the goal of communicating with and affecting the emotions of the audience. Through the media of music, speech, and movement, performing artists attempt to present a moving interpretation of human experience.

Within the performing arts, the number of talented persons seeking employment generally exceeds the number of full-time positions available. As a result, many performers supplement their incomes by teaching, and others work much of the time in different types of occupations.

The difficulty of earning a living as a performer is one fact young persons should remember when they consider such a career. They should consider, therefore, the possible advantages of making their art a hobby rather than a profession. Aspiring young artists usually must spend many years in intensive training and practice before they are ready for public performances. They not only need great natural talent but also determination, a willingness to work long and hard, an overwhelming interest in their chosen field, and some luck.

The statements that follow give detailed information on musicians, singers, actors, and dancers.

Actors and Actresses

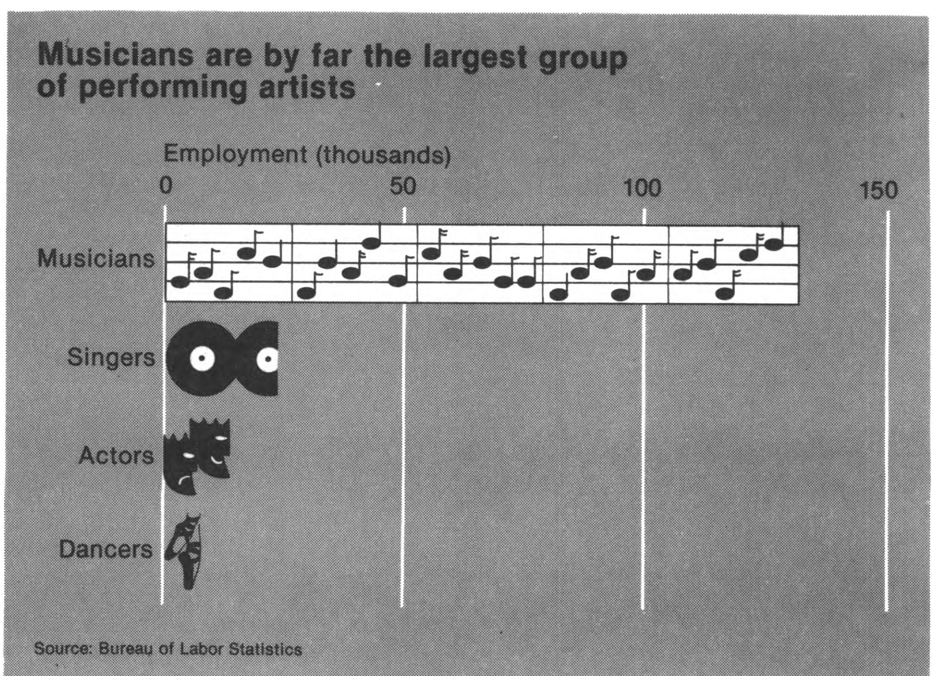
(D.O.T. 150.047)

Nature of the Work

Making a character come to life before an audience is a job that has great glamour and fascination. It is demanding and often uncertain work, however, which requires persistence, practice, and hard work as well as special acting talent.

Only a few actors and actresses achieve recognition as stars on the stage, in motion pictures, or on television or radio. A somewhat larger number are well-known, experienced performers, who frequently are cast in supporting roles. However, most actors and actresses struggle for a toehold in the profession and are glad to pick up parts wherever they can.

New stage actors generally start in "bit" parts where they speak only a few lines. If successful, they may progress to larger, supporting roles. They also may serve as understudies for the principals. Film and television actors, in contrast, may begin in large roles or move into programs from working in commercials.



In addition to the actors and actresses with speaking parts, "extras," who have no lines to deliver, are used in various ways in almost all motion pictures and many television shows and theatre productions. In "spectacular" productions, a large number of extras take part in crowd scenes.

Some actors find alternative jobs as coaches of drama or directors of stage, television, radio, or motion picture productions. A few teach in drama departments of colleges and universities, where they usually specialize in a particular aspect of drama, such as stage movement, stage speech and voice, or acting. Some professional actors employed by theater companies also teach acting in courses offered to the public.

Working Conditions

Acting demands patience and total commitment, since aspiring actors and actresses must wait for parts or filming schedules, work long hours, and often do much traveling. Evening work is a regular part of a stage actor's life. Rehearsals may be held late at night and on weekends and holidays. When plays are on the road, weekend traveling often is necessary. Flawless performances require the tedious memorizing of lines, which sometimes involves long rehearsal schedules. Other performances, such as television programs, often allow little time for rehearsal, so that the actor must deliver a good performance with very little preparation. The actor needs stamina to withstand the heat of stage or studio lights, or the adverse weather conditions that may exist "on location."

Places of Employment

About 13,400 actors and actresses worked in stage plays, motion pictures, industrial shows, and commercials in 1978. Many thousands more were available for work in these areas. In the winter, most employment opportunities on the stage are in New York and other large cities. In the summer, stock companies in suburban and resort areas provide employment. In addition, many cities have "little theaters," repertory companies, and dinner theaters, which provide opportunities for local talent as well as for professional actors and actresses. Normally, casts are selected in New York City for shows that go "on the road."

Employment in motion pictures and film television is centered in Hollywood and New York City, although a few studios are located in Miami and other parts of the country. In addition, many films are shot on location and

Acting requires talent, versatility, and stage presence as well as hard work and practice.

employ local professionals and nonprofessionals as "day players" and "extras." A number of American-produced films are shot in foreign countries. In television, most opportunities for actors are at the headquarters of the major networks—in New York, Los Angeles, and, to a lesser extent, Chicago. A few local television stations occasionally employ actors.

Training and Other Qualifications

Young persons who aspire to acting careers should take part in high school and college plays, or work with little theaters and other acting groups for experience.

Formal training in acting, which is increasingly necessary, can be obtained at schools of dramatic arts, located chiefly in New York, and in hundreds of colleges and universities throughout the country. About 740 colleges and universities confer bachelor's or higher degrees on students who major in dramatic and theater arts. College drama curriculums usually include courses in liberal arts, stage speech and movement, directing, playwriting, play production, and history of the drama, as well as practical courses in acting. From these, the student develops an appreciation of the great plays and a greater understanding of the roles he or she may be called on to play. Graduate degrees in fine arts or drama are needed for college teaching positions.

In all media, the best way to start is to use local opportunities and to build on the basis of such experience. Many actors who are successful in local productions eventually try to appear on the New York stage. Modeling experience may also be helpful in obtaining employment in television or motion pictures. Above all, persons who plan to pursue an acting career must have talent and the creative ability to portray different characters. They must have poise, stage presence, and aggressiveness to project themselves to the audience. At the same time, the ability to follow directions is important.

To become a movie extra, one must usually be listed by Central Casting, a no-fee agency that works with the Screen Extras Guild and supplies all extras to the major movie studios in Hollywood. Applicants are accepted only when the number of persons of a particular type on the list—for example, athletic young men, old ladies, or small children—is below the foreseeable need. In recent years, only a very small proportion of the total number of applicants have succeeded in being listed. An actor employed as an extra in a film has very little opportunity to advance to a speaking role in that film.

The length of an actor's or actress' working life depends largely on skill and versatility. Great actors and actresses can work almost indefinitely. Generally, however, employment becomes increasingly limited by middle age, especially for those who become typed in romantic, youthful roles. Due to the factors discussed, persons who intend to pursue an acting career may find that employment and earnings are irregular.

Employment Outlook

Overcrowding has existed in the acting field for many years, and this condition is expected to persist. In the legitimate theater, motion pictures, radio, and television, job applicants greatly exceed the jobs available. As a result, many actors and actresses are employed in their profession for only a part of the year.

Motion pictures and TV have greatly reduced employment opportunities for actors in the theater. Although a motion picture production may use a very large number of actors during filming, films are widely distributed and may be used for years. Also, some American-produced films are shot in foreign countries, resulting in reduced employment opportunities for American actors and actresses. Television employs a large number of actors and actresses. However, employment in this medium has been reduced by the Federal Communications Commission ruling that decreased major TV network prime time programming. Local stations often use reruns or low-cost game shows that employ few actors. Also, the trend toward 1- to 2-hour programs and more reruns shortens the period of employment and reduces the number of persons needed.

One possibility for future growth in the legitimate theater lies in the establishment of year-round professional acting companies in cities. The number of such acting groups is growing. The recent growth of summer and winter stock companies, outdoor and regional theaters, repertory companies, and dinner theaters also has increased employment opportunities. In addition, some increases may be likely in the employment of actors on television in response to expansion of the Public Broadcasting System, UHF stations, and cable TV. The development and wider use of video cassettes also may result in some employment opportunities. These media will have a positive influence on employment only if original material and programs result, not reruns or old movies.

Though the field of acting as a whole is expected to grow faster than the average for all occupations through the 1980's, the number of persons seeking to enter the profession is expected to exceed by far the available openings. Even the highly talented are likely to face stiff competition and economic difficulties.

Earnings

Actors and actresses in the legitimate theater belong to the Actors' Equity Association; in motion pictures, including television films, to the Screen Actors Guild, Inc., or to the Screen Extras Guild, Inc.; in television or radio, to the American Federation of Television and Radio Artists (AFTRA). These unions and the producers of the shows sign basic collective bargaining agreements which set minimum salaries, hours of work, and other conditions of employment. Each actor also signs a separate contract, which may provide for a higher salary than that specified in the basic agreement.

The minimum weekly salary for actors in Broadway productions was about $355 in 1978. Those in small "off-Broadway" theaters received minimums ranging from $140 to $270 a week, depending on the seating capacity of the theater. For shows on the road, the minimum rate was $27.50 extra per day. (All minimum salaries are adjusted upward automatically, by union contract, commensurate with increases in the cost of living as reflected in the Bureau of Labor Statistics Consumer Price Index.)

In 1978, motion picture and television actors and actresses earned a minimum daily rate of $225, or $785 for a 5-day week. The minimum rate for a 3-day week for actors employed on a 1 or 1/2-hour television show was $572. For extras, the minimum rate was $60 a day. Television actors also receive additional compensation for reruns.

However, annual earnings of actors and actresses are adversely affected by the frequent periods of unemployment experienced by many. According to data obtained by the Actors' Equity Association (which represents actors who work on the stage) and the Screen Actors Guild, between two thirds and three quarters of their members earned $2,500 or less a year from acting jobs in 1978, and less than 5 percent earned over $25,000 from such work. Because of the frequent periods of unemployment characteristic of this profession, many actors must supplement their incomes by maintaining other, nonacting jobs.

Many well-known actors and actresses have salary rates above the minimums, and salaries of the few top stars are many times the figures cited.

Eight performances amount to a week's work on the legitimate stage, and any additional performances are paid for as overtime. After the show opens, the basic workweek is 36 hours, including 12 hours for rehearsals. Before it opens, however, the workweek usually is longer to allow time for rehearsals.

Most actors are covered by a union health, welfare, and pension fund, including hospitalization insurance, to which employers contribute. Under some employment conditions, Equity and AFTRA members have paid vacations and sick leave. Most stage actors get little if any unemployment compensation solely from acting since they seldom have enough employment in any State to meet the eligibility requirements. Consequently, when they are between acting jobs, they often have to take any casual work they can find.

Related Occupations

Actors and actresses entertain people through their interpretations of dramatic roles. They rely on facial and verbal expressions as well as body motions for their creative expression. Related occupations for people with these skills include: clowns, comedians, directors, disc jockeys, drama teachers or coaches, impersonators, mimes, narrators, and radio and television announcers.

Sources of Additional Information

Information on colleges and universities and conservatories that offer a major in drama is available from:

American Theater Association, 1000 Vermont Ave. NW., Washington, D.C. 20005.

Dancers

(D.O.T. 151.047-010)

Nature of the Work

Dancing is an ancient and worldwide art that has many different forms. Dance movements may be used to interpret an idea or a story, or they may be purely physical expressions of rhythm and sound. Professional dancers may perform in classical ballet or modern dance, in dance adaptations for musical shows, in folk, ethnic and jazz dances, and in other popular kinds of dancing. In addition to being an important art form for its own sake, dance also is used to complement other types of entertainment, such as opera, musical comedy, and television.

In dance productions, performers most often work as a group, although a few top artists do solo work. Many dancers combine stage work with teaching, where their duties may include instruction in dance history, theory, and the practice of dance notation, as well as explaining and demonstrating dance techniques and choreographing and directing stage performances. Some dancers become choreographers, who create original dances, teach them to performers, and sometimes direct and stage the presentations of their work. Others become dance directors who train dancers in new productions. A few dancers with college backgrounds go on to receive graduate level training in dance therapy. Dance therapists focus on the healing properties of movement, posture, breathing, and interaction in their work with the elderly and the mentally and physically handicapped.

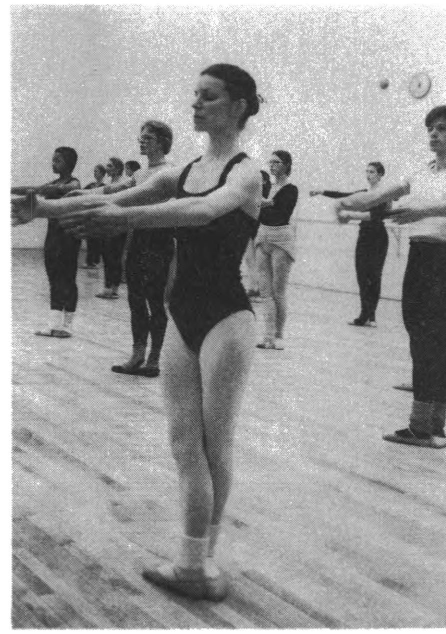
Working Conditions

Dancing is strenuous, and for this reason young dancers have an advantage over older dancers in competing for jobs. Rehearsals require very long hours, often on weekends and holidays. For shows on the road, weekend travel often is required. Most stage performances take place in the evening. Many dancers retire in their thirties or transfer to related fields such as teaching dance. However, some skillful dancers continue performing beyond the age of 50. Those who become choreographers or dance directors can continue to work as long as persons in other occupations.

Unemployment rates for dancers are higher than the average for all occupations. Many qualified people cannot obtain year-round work as dancers, and are forced to supplement their incomes by other types of work.

Places of Employment

About 8,000 dancers performed on the stage, screen, and television in 1978. Many others were available for such work. The shortage of performance jobs caused some dancers to take jobs in other fields. Many



Agility, coordination, grace, a sense of rhythm, and a feeling for music are important qualities for aspiring dancers.

taught dance in secondary schools, in junior colleges as well as four-year colleges and universities, in dance schools, and in private studios. Some dancers, trained in dance therapy, worked in mental hospitals, community mental health centers, correctional facilities, or special schools.

New York City is the hub for performing dancers. Other large cities that have promising employment opportunities, including major dance companies, include Los Angeles, Chicago, Houston, Salt Lake City, Cincinnati, Miami, San Francisco, Hartford, Pittsburgh, Minneapolis, Seattle, Boston, and Philadelphia. Dance teachers are located chiefly in large cities, but many smaller cities and towns have dance schools as well.

Training and Other Qualifications

Serious training for a career in dancing traditionally begins by age 12 or earlier. Ballet training is particularly disciplined, and persons who wish to become ballet dancers should begin taking lessons at the age of 7 or 8. Early and intense training also is important for the modern dancer. Most dancers have their professional auditions by age 17 or 18, but training and practice never end. For example, professional ballet dancers take from 10 to 12 lessons a week for 11 or 12 months of the year, and must spend many additional hours practicing and rehearsing. The early training a dancer receives is crucial to the later skill of the dancer, and therefore the selection of a professional dance school is very important.

Because of the strenuous training required, a dancer's general education may be minimal. However, the importance of a broad general education is becoming increasingly recognized by experts in the field. In particular, a dancer should study music, literature, and history along with the arts to help in the interpretation of dramatic episodes, ideas, and feelings. In addition, dancers should have an understanding of the structure of the human body and how it moves, of dance notation, and of historical dance styles.

Over 130 colleges and universities confer bachelor's or higher degrees in dance. College or university dance degrees are generally offered through the departments of physical education, music, theater, or fine arts.

A college education is not essential to obtaining employment as a professional dancer. In fact, ballet dancers who postpone their first audition until graduation may compete at a disadvantage with younger dancers. On the other hand, a college degree can be helpful for the dancer who retires at an early age, as often happens, and wishes to enter another field of work. Many modern dancers are college graduates.

Although a college education is an advantage in obtaining employment as a dance teacher in a college or university, it is not necessary for one who teaches professional dance or choreography in a studio situation. Professional schools usually require teachers to have experience as performers; colleges and conservatories generally require graduate degrees, but performance experience often may be substituted. Maturity and a broad educational background also are important.

The dancer's life is one of rigorous practice and self- discipline; therefore patience, perseverence, and a devotion to dance are essential. Good health and physical stamina are necessary, both to keep in good condition and to follow the rugged travel schedule which is often required.

Seldom does a dancer perform unaccompanied. Therefore, young persons who consider dancing as a career should be able to function as part of a team. They also should be prepared to face the anxiety of unstable working conditions brought on by show closings and audition failures.

Body height and build should not vary much from the average. Good feet and normal arches also are required. Above all, one must have agility, coordination, grace, a sense of rhythm, and a feeling for music, as well as a creative ability to express oneself through dance.

Employment Outlook

Employment of dancers is expected to grow faster than the average for all occupations. However, the number of dancers seeking professional careers will continue to exceed the number of available positions, and competition will be keen. Most employment opportunities will result from replacement needs.

Employment opportunities in stage productions are limited, and competition for such positions is great. Television is partly responsible for the reduction in stage productions, yet at the same time this medium offers new outlets for dance. New professional dance companies formed by civic and community groups offer additional employment opportunities. Dance groups affiliated with colleges and universities are another source of employment. The increased general popularity of dance in recent years has resulted in increased employment opportunities in teaching dance.

Earnings

Professional dancers who perform may be members of one of the unions affiliated with the Associated Actors and Artistes of America (AFL-CIO). Dancers in opera ballet, classical ballet, and the modern dance belong to the American Guild of Musical Artists, Inc.; those on live or videotaped television belong to the American Federation of Television and Radio Artists; those who perform in films and TV. belong to the Screen Actors Guild or the Screen Extras Guild; and those in musical comedies join Actors' Equity Association. Other dancers may be members of other unions, depending upon the fields in which they perform. The unions and producers sign basic agreements specifying minimum salary rates, hours of work, and other conditions of employment. However, the separate contract signed by each dancer with the producer of the show may be more favorable than the basic agreement regarding salary, hours of work, and working conditions. Many dancers employed by professional ballet or modern dance companies do not belong to unions, however.

In 1978, the minimum salary for dancers in opera and other stage productions was about $300 a week. The single performance rate for ballet dancers was $110. Dancers on tour received an allowance of $35 a day in 1978 for room and board, with the employer paying the cost of transportation. Minimum performance rates for dancers on television ranged from $340.50 to $360.25 for a 1-hour show, depending on the number of dancers in the group. The performance rate covers 18 hours of rehearsal over a 3-day period, in addition to the performance.

Salaries of dance teachers vary with the location and the prestige of the school in which they teach. Dance instructors in colleges and universities are paid on the same basis as other faculty members. (For more information, see the *Handbook* statement on College and University teachers.)

The normal workweek is 30 hours (6 hours per day maximum) spent in rehearsals and matinee and evening performances. Extra compensation is paid for additional hours worked.

Dancers are entitled to some paid sick leave and various health and welfare benefits provided by their unions, to which the employers contribute. Dance instructors in schools receive benefits comparable to those of other teachers.

Related Occupations

Dancers express ideas and emotions through their body movements. They need grace, rhythm, body control, and the creative ability to express themselves through dance. Some related occupations include acrobats, choreographers, dance critics, dance instructors, dance notators, dance therapists, and recreation workers.

Sources Of Additional Information

A list of colleges and universities that teach dance, including details on the types of courses offered, is available from:

National Dance Association, a Division of the American Alliance for Health, Physical Education, Recreation, and Dance, 1201 16th St. NW., Washington, D.C. 20036.

For information on all aspects of dance, including job listings, contact:

American Dance Guild, 152 W. 42nd St. Room 828, New York, N.Y. 10036. Enclose a stamped, self-addressed envelope.

Information about the field of dance therapy, along wih a list of schools that offer degrees in the field, is available from:

American Dance Therapy Association, Suite 230, 2000 Century Plaza, Columbia, Md. 21044.

Musicians

(D.O.T. 152.041-010)

Nature of the Work

The important role that music plays in most people's lives makes it difficult to imagine a world without musicians. Professional musicians are those whose livelihoods depend upon performing for the enjoyment of others. These professionals—whether they play in a symphony orchestra, dance band, rock group, or jazz combo—generally have behind them many years of formal or informal study and practice. As a rule, musicians specialize in either popular or classical music; only a few play both types professionally.

Musicians who specialize in popular music usually play the trumpet, trombone, clarinet, saxophone, organ, or one of the "rhythm" instruments—the piano, string bass, drums, or guitar. Dance bands play in nightclubs, restaurants, and at special parties. The best known bands, jazz groups, rock groups, and solo performers sometimes perform on television.

Classical musicians play in symphonies, opera, ballet, and theater orchestras, and for other groups that require orchestral accompaniments. These musicians play string, brass, woodwind, or percussion instruments. Some form small groups—usually a string quartet or a trio—to give concerts of chamber music. Many pianists accompany vocal or instrumental soloists, choral groups, or provide background music in restaurants or other places. Most organists play in churches; often they direct the choir.

A few exceptional musicians give their own concerts and appear as soloists with symphony orchestras. Both classical and popular musicians make individual and group recordings.

In addition to performing, many musicians teach instrumental and vocal music in schools and colleges, or give private lessons in their own studios or in pupils' homes. Others combine careers as performers with work as composers. Some work as arrangers, adapting musical compositions to different types of instruments or to styles for which they were not originally intended.

A few musicians specialize in library science for work in music libraries. Some receive training in music therapy to enable them to use music in treating persons with physical and mental disabilities. Others work as orchestra conductors or band directors, whose duties include selecting the music to be performed, auditioning and selecting members of the performing group, and directing the group at rehearsals and performances to achieve the desired musical effects.

Working Conditions

Musicians generally work at night and on weekends, and they must spend considerable time in practice and rehearsal. These long and irregular hours can be very exhausting. Performances often require travel. Many people cannot obtain year-round work as musicians, and are forced to supplement their incomes by other types of work.

Places of Employment

About 127,000 persons worked as performing musicians in 1978. Many thousands more taught in elementary and secondary schools and in colleges and universities. (See the statements on teachers elsewhere in the *Handbook*.) Almost every town and city has at least one private music teacher. Some musicians with training in music therapy work in psychiatric hospitals, centers for the mentally retarded, hospitals and schools, community mental health centers, day care centers, nursing homes, and special service agencies.

Most performing musicians work in cities where entertainment and recording activities are concentrated, such as New York City, Chicago, Los Angeles, Nashville, Miami Beach, and New Orleans. Many perform with one of the 31 major symphony groups, the 76 metropolitan orchestras, or the hundreds of community orchestras. Many communities have orchestras and dance bands which offer at least part-time work. The various branches of the Armed Forces also offer career opportunities in a number of different musical organizations.

Training and Other Qualifications

Most people who become professional musicians begin studying an instrument at an early age. To acquire great technical skill, a thorough knowledge of music, and the ability to interpret music, young people need intensive training. This training may be obtained through private study with an accomplished musician, in a college or university which has a strong music program, or in a conservatory of music. For advanced study in one of these institutions, an audition frequently is necessary. Many teachers in these schools are accomplished artists who will train only promising young musicians.

About 540 colleges, universities, and music conservatories offer bachelor's and/or higher degrees in musical performance, composition, and theory. In addition, about 750 conservatories and colleges and universities offer a bachelor's degree in music education to qualify graduates for the State certificate for elementary and secondary school teaching positions. College teaching positions usually require advanced degrees, but exceptions may be made for well-qualified artists.

Musicians who play popular music must have an understanding of and feeling for that style of music, but classical training may expand their employment opportunities. As a rule, they take lessons with private teachers when young, and seize every opportunity to play in amateur or professional performances. Establishing a reputation with other musicians is very important in getting started in a career in popular music. Some young people form small dance bands or rock groups. As they gain experience and become known, they may audition for other local bands, and still later, for the better known bands and orchestras.

Young persons who consider careers in music should have musical talent, versatility, creative ability, and poise and stage presence to face large audiences. Since quality performance requires constant study and practice, self-discipline is vital. Moreover, musicians who do concert and nightclub engagements must have physical stamina because of frequent traveling and schedules that often include night performances.

Employment Outlook

Employment of musicians is expected to grow faster than the average through the 1980's, but competition for jobs will be keen. Opportunities for concerts and recitals are not numerous enough to provide adequate employment for all the pianists, violinists, and other instrumentalists qualified as concert artists. Competition usually is keen for positions that offer stable employment, such as jobs with major orchestras, with the Armed Forces, and in teaching positions. Because of the ease with which a musician can enter private music teaching, the number of music teachers has been more than sufficient and probably will continue to be. Although many opportunities are expected for single and short-term engagements to play popular music in nightclubs and theaters, the supply of qualified musicians who seek such jobs is likely to exceed demand. On the other hand, first-class, experienced accompanists and outstanding players of stringed instruments are likely to remain relatively scarce.

Earnings

The amount received for a performance by either classical or popular musicians depends on their geographic location as well as on their professional reputation. Minimum salaries for musicians in the 31 major symphony orchestras in the United States in 1978 ranged from $232 to $490 a week, according to the American Symphony Orches-

The thrill of performing goes hand in hand with long and irregular hours and much traveling, which can be exhausting.

tra League. Minimum salaries for musicians in the 28 regional symphony orchestras ranged from $90 to $270 a week. Minimum wages for musicians in metropolitan symphony orchestras were generally between $20 and $40 per concert. Some musicians earned substantially more than the minimums, however.

The major symphony orchestras have seasons ranging from 45 to 52 weeks. None of the metropolitan or community orchestras have seasons of 50 to 52 weeks, however.

Musicians in large metropolitan areas who had steady engagement contracts to play at dances, clubs, variety shows, ballets, musical comedies, concerts, and industrial shows generally earned minimums ranging from $6.50 to $10.50 per hour, depending on the length and type of engagement. Wages for the same types of engagements tended to be less in smaller cities and towns. Musicians employed in motion picture recording earned a minimum of about $108 for a 3-hour session; those employed in television commercials earned a minimum of $54 each for 2 to 5 musicians and $50 each for more than 5 musicians for a 1-hour session. Musicians employed by recording companies were paid a minimum of about $127 for a 3-hour session.

Music teachers in public schools earn salaries comparable to those of other teachers. (See statements on elementary and secondary school teachers elsewhere in the *Handbook*.) Many teachers give private music lessons to supplement their earnings. However, earnings often are uncertain and vary according to the musician's reputation, the number of teachers and students in the locality, and the economic status of the community.

Many musicians, primarily those employed by symphony orchestras, work under master wage agreements, which guarantee a season's work up to 52 weeks. Musicians in other areas, however, may face relatively long periods of unemployment between jobs. Thus, their earnings generally are lower than those in many other occupations. Moreover, since they may not work steadily for one employer, some performers cannot qualify for unemployment compensation, and few have either sick leave or vacations with pay. For these reasons, many musicians take other types of jobs to supplement their earnings as musicians.

Most professional musicians belong to the American Federation of Musicians (AFL-CIO). Concert soloists also belong to the American Guild of Musical Artists, Inc. (AFL-CIO).

Related Occupations

Performing musicians express ideas and emotions through the music they play. Other occupations in the music field include arrangers, composers, copyists, music critics, music directors, music librarians, music teachers, music therapists, orchestra conductors, orchestrators, instrument repairers, music or instrument sales people, and radio music producers.

Sources of Additional Information

For information about wages, hours of work, and working conditions for professional musicians, contact:

American Federation of Musicians (AFL-CIO), 1500 Broadway, New York, N.Y. 10036.

The requirements for certification of organists and choir masters are available from:

American Guild of Organists, 630 Fifth Ave., New York, N.Y. 10020.

For information about a career in music therapy, contact:

National Association for Music Therapy, Inc., P.O. Box 610, Lawrence, Kans. 66044.

For programs in music teacher education, contact:

Music Educators National Conference, 1902 Association Dr., Reston, Va. 22091.

Information about certification of private music teachers is available from:

Music Teachers National Association, 2113 Carew Tower, Cincinnati, Ohio 45202.

A list of accredited schools of music is also available for $3.25 from:

National Association of Schools of Music, 11250 Roger Bacon Dr., Reston, Va. 22090.

A brochure entitled *Careers in Music* is available from any of the last three organizations listed above.

Singers

(D.O.T. 152.047-022)

Nature of the Work

Singing is an age-old form of entertainment which, in one form or another, can be understood and appreciated by almost everyone. Professional singing often requires not only a fine voice but also a highly developed technique and a broad knowledge of music. A small number of singing stars make recordings or go on concert tours in the United States and abroad. Somewhat larger numbers of singers obtain leading or supporting roles in operas and popular music shows, or secure engagements as concert soloists in oratorios and other types of performances. Some singers also become members of opera and musical comedy choruses or other professional choral groups. Popular music singers perform in musical shows of all kinds—in the movies, on the stage, on radio and television, in concerts, and in nightclubs and other places of entertainment. The best known popular music singers make and sell many recordings.

Some singers combine their work as performers with related jobs. Many give private voice lessons. A number of singers teach and direct choruses in elementary and secondary schools. (See the statements on teachers elsewhere in the *Handbook*.) Others give voice training or direct choral groups in churches, synagogues, music conservatories, or colleges and universities.

Working Conditions

Singers generally work at night and on weekends, and must spend much time in practice and rehearsals. Work in the entertainment field is seasonal and few performers have steady jobs. Except for a few well-known concert soloists, opera stars, and top recording artists of popular music, most professional singers experience difficulty in obtaining regular employment and have to supplement their incomes with other kinds of jobs. Moreover, a singing career sometimes is relatively short, since it depends on a good voice, physical stamina, and public acceptance of the artist, all of which may be affected by age.

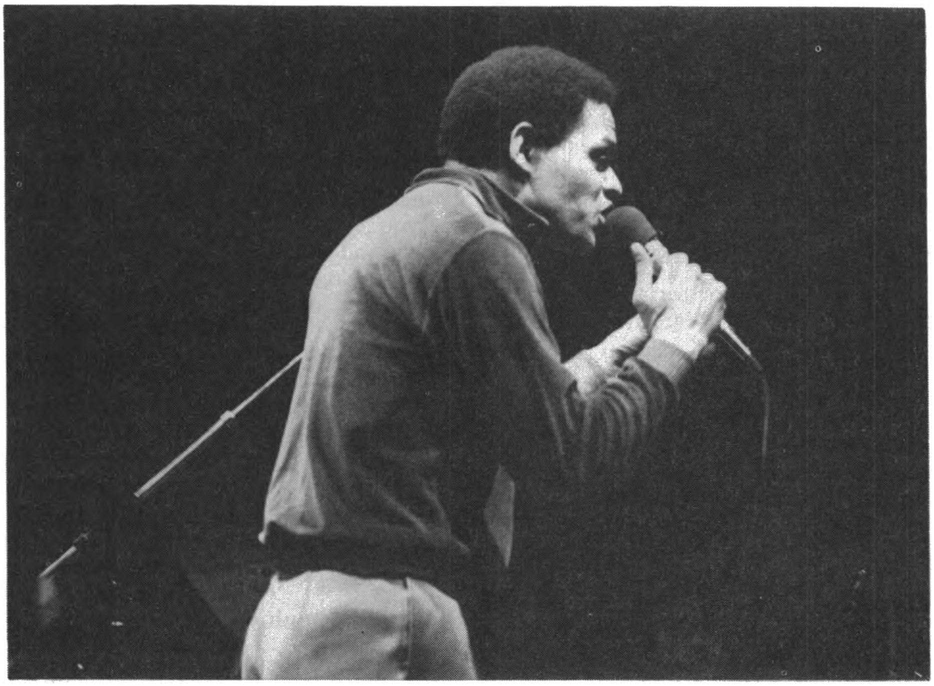
Places of Employment

About 22,000 persons worked as professional singers in 1978. Many others were employed as music teachers in elementary and secondary schools, colleges, universities, and conservatories throughout the country. Opportunities for singing engagements are concentrated mainly in New York City, Los Angeles, Las Vegas, San Francisco, Dallas, and Chicago—the Nation's chief entertainment centers. Nashville, Tenn., a major center for country and western music, is one of the most important places for employment of singers for "live" performances and recordings. Many singers work part time as singers and choirmasters for churches and synagogues. The various branches of the Armed Forces also offer career opportunities for vocalists.

Training and Other Qualifications

Persons who want to sing professionally should acquire a broad background in music, including its theory and history. The ability to dance may be helpful, since singers sometimes are required to dance. In addition, those interested in a singing career should start piano lessons at an early age to become familiar with music theory and composition. As a rule, voice training should not begin until after the individual has matured physically, although young boys who sing in church choirs receive some training before their voices change. An audition often is required for advanced voice training. Since voice training often continues for years after the singer's professional career has started, a prospective singer must have great determination.

To prepare for careers as singers of classical music, young people can take private voice lessons or enroll in a music conservatory or a school or department of music in a college or university. These schools provide voice training and training in understanding and interpreting music, including music-related training in foreign languages and,



Singers generally work at night and on weekends, and must spend much time in practice and rehearsals.

sometimes, dramatic training. After completing 4 years of study, the graduate may receive the degree of bachelor of music, bachelor of science or arts (in music), or bachelor of fine arts.

Singers who plan to teach in public schools need at least a bachelor's degree in music and must meet the State certification requirements for teachers. About 750 conservatories and colleges and universities offer a degree program in music education. In addition, about 540 colleges and universities offer training in musical performance, composition, and theory, leading to a bachelor's degree. Most college teachers must have a master's or a doctor's degree, but exceptions may be made for well-qualified artists.

Although voice training is an asset for singers of popular music, many with untrained voices have had successful careers. The typical popular song does not demand that the voice be developed to cover as wide a range on the musical scale as does classical music, and the lack of voice projection may be overcome by use of a microphone.

Young singers of popular songs may become known by participating in local amateur and paid shows. These engagements may lead to employment with local dance bands or rock groups and possibly later with better known ones.

In addition to musical ability, a singing career requires an attractive appearance, poise and stage presence, and perseverance. Singers also must have physical stamina to adapt to frequent traveling and rigorous time schedules, which often include night performances.

Employment Outlook

Employment of singers is expected to grow faster than the average through the 1980's, but competition for jobs will be keen. Many short-term jobs are expected in the opera and concert stage, movies, theater, nightclubs, and other areas. The demand is growing for popular singers who can do radio and television commercials. However, these short-term jobs are not enough to provide steady employment for all qualified singers.

Earnings

Concert singers who were part of a chorus earned a minimum daily rate of $35 in 1978, or $45 to $50 per performance. Members of an opera chorus earned a minimum daily rate of $40, or $45 per performance. A featured soloist received a minimum of $200 for each performance. A few opera soloists and popular singers, however, earned thousands of dollars per performance. Minimum wage rates for group singers on network or syndicated television ranged between $165 and $175 per singer for a 1-hour show. Solo or duo singers received per performance minimums of $350 each.

Professional singers usually belong to a branch of the AFL-CIO union, the Associated Actors and Artistes of America. Singers on the concert stage or in opera belong to the American Guild of Musical Artists, Inc.; those who sing on radio or television or make phonograph recordings are members of the American Federation of Television and Radio Artists; singers in the variety and nightclub field belong to the American Guild of Variety Artists; those who sing in musical comedy and operettas belong to the Actors' Equity Association; and those who sing in television or theatrical motion pictures belong to the Screen Actors Guild, Inc.

Related Occupations

Singers express themselves and entertain others through song. Some related occupations include arrangers, choral directors, copyists, music therapists, orchestrators, songwriters, and voice teachers.

Sources of Additional Information

A directory of accredited schools and departments of music is available for $3.25 from:

National Association of Schools of Music, 11250 Roger Bacon Dr., Reston, Va. 22090.

For information regarding programs in music teacher education, contact:

Music Educators National Conference, 1902 Association Dr., Reston, Va. 22091.

Information about certification of private music teachers is available from:

Music Teachers National Association, 2113 Carew Tower, Cincinnati, Ohio 45202.

A brochure entitled *Careers in Music* is available from any of the three organizations listed above.

Design Occupations

People in design occupations are concerned with the usefulness and appearance of the things we use and the places in which we live and work. Good design means creating objects that are not only "functional," serving the purpose for which they are intended, but pleasing to the eye as well. The aesthetic element is important because pleasant surroundings can boost our spirits and make us more satisfied with the time we spend in a particular place. Products and packaging that are designed for "eye appeal" are likely to attract more buyers than those that are not.

The design field includes people in a variety of specialties. Among them are architects, who design the buildings around us; landscape architects, who plan golf courses and public parks as well as the lawns around houses; artists and layout workers, who prepare advertisements of all kinds; photographers, who take pictures to convey an idea or tell a story; set designers, lighting designers, and costume designers, who work with theatrical productions; interior designers, decorators, and display workers, who arrange furnishings and spaces in homes, stores, and offices; and textile and clothing designers, who design the fabrics we use and the clothing we wear.

Different design careers require varying levels of training. While floral designers often learn their duties on the job and do not even need a high school diploma, architects must complete 4 or more years of college and work for several years before they can apply for a license. Regardless of the amount of formal training required, people in the design field must be creative and able to communicate ideas visually.

Artistic talent is crucial in all the design occupations. People in this field need strong color sense, an eye for detail, a sense of balance and proportion, and sensitivity to beauty. Also necessary is an inherent sense of what is good and what is not from an aesthetic point of view.

Because styles and tastes in art and fashion change with almost breathtaking speed, people in this field need to be versatile and open to new ideas and influences. Creative work can be frustrating, even discouraging, during periods when new ideas don't come—or when the designer's ideas clash with those of a client. Sometimes a concept or layout has to be changed to accommodate a client, which requires flexibility. Dealing with clients also calls for tact and sound professional judgment.

Problem-solving skills and the ability to work independently are important traits for people in the design field. It is the designer's job to come up with a solution to a client's design problem that is both aesthetic and practical. Since they often work on tight deadlines, these workers need the self-discipline to start projects on their own, to budget their time, and to complete everything as scheduled. Business acumen can be important, for many people in this field are freelancers or run their own businesses.

This section describes the work of people in seven design occupations: Architects, display workers, floral designers, industrial designers, interior designers, landscape architects, and photographers. Several other jobs that require design skills are descibed elsewhere in the *Handbook*. See the statements on urban planners and engineers.

Architects

(D.O.T. 001.061-010)

Nature of the Work

Attractive buildings and their surroundings enhance a community's appearance. But buildings must be safe as well as attractive and suit the needs of the people who use them. Architects take all these things into consideration and design buildings that are esthetically appealing, safe, and functional.

Architects provide a wide variety of professional services to individuals, organizations, corporations, or government agencies planning a building project. Architects are involved in all phases of development of a building or project, from the initial discussion of general ideas through construction. Their duties require a variety of skills—design, engineering, managerial, and supervisory.

The architect and client first discuss the purposes, requirements, and cost of a project. The architect then prepares schematic drawings that show the scale and the structural and mechanical relationships of the building.

If the schematic drawings are accepted, the architect develops a final design showing the floor plans and the structural details of the project. For example, in designing a school, the architect determines the width of corridors and stairways so that students may move easily from one class to another; the type and arrangement of storage space, and the location and size of classrooms, laboratories, lunchroom or cafeteria, gymnasium, and administrative offices.

Next the architect prepares working drawings showing the exact dimensions of every part of the structure and the location of plumbing, heating units, electrical outlets, and air-conditioning.

Architects also specify the building materials and, in some cases, the interior furnishings. In all cases, the architect must ensure that the structure's design and specifications conform to local and State building codes, zoning laws, fire regulations, and other ordinances.

Throughout this time, the architect may make changes to satisfy the client. A client may, for example, decide that an original design is too expensive and ask the architect to make modifications. Or the client may change the project requirements. Redesigning plans to suit the client requires flexibility, and sometimes considerable patience, on the part of the architect.

After all drawings are completed, the architect assists the client in selecting a contractor and negotiating the construction contract. As construction proceeds, the architect visits the building site from time to time to ensure that the contractor is following the design and using the specified materials. The architect also checks to be sure that work meets the specified standards. The job is not complete until construction is finished, all required tests are made, construction costs are paid, and guarantees are received from the contractor.

Architects design a wide variety of structures, such as houses, churches, hospitals, office buildings, and airports. They also design multibuilding complexes for urban renewal projects, college campuses, industrial parks, and new towns. Besides designing structures, architects also may help in selecting building sites, preparing cost and land-use studies, and long-range planning for site development.

When working on large projects or for large architectural firms, architects often specialize in one phase of the work, such as designing or administering construction contracts. This often requires working with engineers, urban planners, landscape architects, and others.

Working Conditions

Most architects spend a great deal of their time at the drawing board in well-equipped offices. It is at the drawing board that architects do most of their more creative and imaginative work, so much of the time can be very satisfying and rewarding. This work often is varied by interviewing clients and contractors and discussing the design, construction procedures, or building materials of a project with other architects, landscape architects, or engineers. Contract administra-

Architects spend many hours at the drawing board.

tors frequently work outdoors during inspections at construction sites.

Places of Employment

About 54,000 architects were employed in 1978. This included architecture school graduates who have not become registered (licensed), although they work in the field. They must work under the supervision of licensed architects.

Most architects work for architectural firms or for builders, real estate firms, or other businesses that have large construction programs. Some work for government agencies responsible for housing, planning, or community development. About 1,600 architects work for the Federal Government, mainly for the Departments of Defense, Interior, Housing and Urban Development, and the General Services Administration.

Although found in many areas, a large proportion of architects are employed in seven cities: Boston, Chicago, Los Angeles, New York, Philadelphia, San Francisco, and Washington.

Training, Other Qualifications, and Advancement

All States and the District of Columbia require individuals to be licensed before they may call themselves architects or contract for providing architectural services. To qualify for the licensing exam, a person must have either a Bachelor of Architecture degree followed by 3 years of acceptable practical experience in an architect's office or a Master of Architecture degree followed by 2 years of experience. As a substitute for formal training, most States accept additional experience (usually 12 years) and successful completion of a qualifying test for admission to the licensing examination. Many architecture school graduates work in the field even though they are not licensed. However, a registered architect is required to take legal responsibility for all work.

In 1978, the National Architectural Accrediting Board had accredited 87 programs of the 101 schools offering professional degrees in architecture. Most of these schools offer either a 5-year curriculum leading to a Bachelor of Architecture degree or a 6-year curriculum leading to a Master of Architecture degree. Students also may transfer to professional degree programs after completing a 2-year junior or community college program in architecture. Many architecture schools also offer graduate education for those who already have their first professional degree. Although such graduate education is not essential for practicing architects, it often is desirable for those in research and teaching. A typical college architecture program includes courses in architectural theory, design, graphics, engineering, and urban planning, as well as in English, mathematics, physics, economics, and the humanities.

Persons planning careers in architecture should be able to work independently, have a capacity for solving technical problems, and be artistically inclined. They also must be prepared to work in the competitive environment of business where leadership and ability to work with others are important. Working for architects or building contractors during summer vacations is useful for gaining practical knowledge.

New graduates usually begin as drafters in architectural firms, where they prepare architectural drawings and make models of structures under the direction of a registered architect. After several years of experience, they may advance to chief or senior drafter responsible for all major details of a set of working drawings and for supervising other drafters. Others may work as designers, construction contract administrators, or specification writers who prepare documents that specify the building materials, their method of installation, the quality of finishes, required tests, and many other related details. Employees who become associates in their firms may receive, in addition to a salary, a share of the profits. Usually, however, the architect's goal is to own his or her own business.

Employment Outlook

Architects are expected to face competition for jobs through the 1980's. Although employment of architects is expected to rise faster than the average for all workers during this period, the number of degrees granted in architecture is expected to continue growing as well. If so, supply in this small field could exceed the number of job openings arising from employment growth, deaths, and retirements.

Demand for architects is highly dependent upon the level of new construction, and the anticipated rapid growth of nonresidential construction is expected to be a major determinant of job opportunities through the 1980's. Any significant upswing or downturn in building could temporarily alter demand, however. Indeed, the cyclical nature of construction activity leads some architects to move in and out of the field from time to time. Their design skills and familiarity with building materials and techniques enable them to move into related areas such as graphic design, advertising, visual arts, product design, construction contracting and supervision, and real estate.

Although most job openings will be in architectural firms, some will occur in construction firms, colleges and universities, and government agencies. Construction firms employ architects to oversee various aspects of project design and actual construction. In colleges and universities, the anticipated increase in enrollments in architecture and environmental design programs may create a demand for additional faculty. Public concern about the quality of the environment is expected to heighten the demand for community and environmental planning projects. This should create opportunities in consulting firms and planning agencies of various kinds. (See the statement on urban planners elsewhere in the *Handbook*.)

Earnings

The average salary for architects in 1978 was well over $25,000, according to the limited information available. Architects with well-established private practices generally earn much more than even highly paid salaried employees of architectural firms. Although the range in their incomes is very wide, some architects with many years of experience and good reputations earn well over $40,000 a year. Architects starting their own practices may go through a period when their expenses are greater than their income. Annual income may fluctuate due to changing business conditions.

In 1979, the average salary for architects working in the Federal Government was about $25,000.

Related Occupations

Architects are concerned with the design and construction of buildings and related structures. Others who engage in related work are building contractors, civil engineers, urban planners, interior designers, industrial designers, landscape architects, drafters, and surveyors.

Sources of Additional Information

General information about careers in architecture, including a catalog of publications, can be obtained from:

The American Institute of Architects, 1735 New York Ave. NW., Washington, D.C. 20006.

Information about careers and schools in architecture is available from:

The Association of Collegiate Schools of Architecture, Inc., 1735 New York Ave. NW., Washington, D.C. 20006.

Information about the licensing examinations can be obtained from:

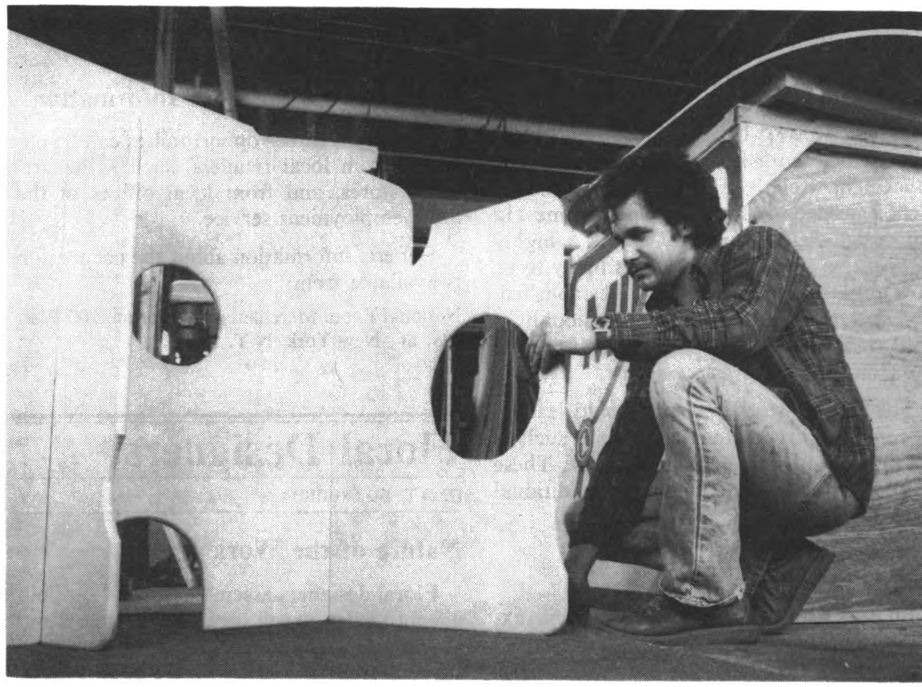
The National Council of Architectural Registration Boards, 1735 New York Ave. NW., Suite 700, Washington, D.C. 20006.

Display Workers

(D.O.T. 298)

Nature of the Work

It happens every day: A shopper browsing through a clothing store notices a mannequin wearing an attractive outfit and decides to buy one just like it. A fishing enthusiast sees a display of angling equipment in a store window, goes in, and buys a new reel. Displays in stores and store windows attract customers and encourage them to buy. Knowing how effective this form of advertising can be, some stores allot a large share of their publicity budget to displays.



Display workers often design and construct the props used in an exhibit.

Merchandise displayers (D.O.T. 298.081-010) design and install exhibits of clothing, accessories, and furniture in store windows and showcases and on the sales floor. Their aim is to develop attractive, eye-catching ways of showing merchandise to the best advantage. Display workers known as *model dressers* specialize in dressing mannequins for use in displays. Others are designated according to the area they decorate as *showcase trimmers* or *window dressers*.

To create a setting that enhances the merchandise, display workers need imagination as well as knowledge of color harmony, composition, and other fundamentals of art. They may, for example, choose a theme—a beach setting to advertise bathing suits or surfing equipment—and design a colorful display around this theme. After the design has been approved by the store's management, display workers obtain the props and other necessary accessories. Their craft skills come into play at this time.

Display workers often construct many of the props themselves using hammers, saws, spray guns, and other tools. They may be assisted in these tasks by a helper or by store maintenance workers. Sometimes display workers use merchandise from other departments of the store as props. Display workers also may use props out of storage, designed for previous displays, or order props from firms that specialize in them. The display workers install the props, background settings, and lighting equipment. They also dress mannequins and add finishing touches. Periodically, they dismantle and replace old displays with new ones.

In large stores that employ many display workers, each may specialize in a particular activity such as carpentry, painting, making signs, or setting up interior or window displays. Overall planning and administration in large stores are usually the responsibilities of a display director who supervises and coordinates the activities of each department. The director confers with other store executives, such as advertising and sales managers, to select merchandise for promotion and to plan displays.

Commerical decorators (D.O.T. 298.381-010) are employed by the promoters of trade exhibitions to prepare and install decorations and displays for trade and industrial shows, exhibitions, festivals, and other special events.

Working Conditions

Display personnel enjoy the satisfaction of doing creative work. Transforming an original design into reality can be a highly rewarding experience.

Display workers usually work 35 to 40 hours a week. During busy seasons, such as Christmas and Easter, they may work overtime, nights, and weekends to prepare special displays.

Constructing and installing props frequently require prolonged standing, bending, stooping, and working in awkward positions. Display workers risk injury from falls off ladders, from contact with sharp or rough materials, and from the use of power tools, but serious injuries are uncommon.

Places of Employment

About 44,000 persons were employed as display workers in 1978. Most worked in retail stores such as department, clothing, and home furnishing stores. Display workers were employed in many other kinds of retail stores, however, including variety, drug, and shoe stores and in book and gift shops. Several thousand more worked on a freelance basis or for design firms that handle professional window dressing for small stores.

Geographically, employment is distributed much like the Nation's population, with most jobs in large towns and cities.

Training, Other Qualifications, and Advancement

Most display workers learn their trade through informal on-the-job training. Beginners are hired as helpers to dismantle displays, carry props, and do other routine tasks. Gradually, they are given the opportunity to do more difficult work, such as building props, and, if they show artistic talent, planning simple designs. A beginner usually can become skilled in 1 to 2 years. Training time varies, however, depending on the beginner's ability and the variety and complexity of displays that the employer requires.

A high school diploma is the minimum requirement for most beginning jobs. Courses that provide helpful training for display work include art, woodworking, mechanical drawing, and merchandising. Some employers seek applicants who have completed college courses in art, interior decorating, fashion design, advertising, or related subjects.

Display work is included in the curriculum of many of the distributive education and marketing programs taught in high schools and community and junior colleges. Local chapters of Distributive Education Clubs of America (DECA) also offer students an opportunity to develop visual merchandising skills.

Creative ability, manual dexterity, and mechanical aptitude are among the most important personal qualifications needed in this field. Good physical condition and agility are needed to carry equipment, climb ladders, and work in close quarters without upsetting props.

Advancement may take several forms. A display worker with supervisory ability might become display director in a large store. A display director might in turn progress to sales promotion director or be placed in charge of store planning.

Freelance work is another avenue of advancement. Relatively little financial investment is needed to start a freelance business in the design field. However, this is a highly competitive area and business is likely to be slow until the firm's reputation is established. For this reason, some workers moonlight until they have enough clients for full-time work on their own.

The display worker's skills could lead to jobs in other art-related occupations such as interior decoration or photography. These occupations, however, require additional training.

Employment Outlook

Employment of display workers is expected to grow faster than the average for all occupations through the 1980's. Employment growth will reflect the expansion of retail trade as well as the growing popularity of the concept of visual merchandising, which involves extensive use of merchandise to decorate the store and frequent changes of displays. In addition to the jobs resulting from employment growth, openings will arise each year to replace experienced workers who retire, die, or transfer to other occupations.

Employment opportunities will continue to be concentrated in large stores, most of which are located in metropolitan areas.

Earnings

Among large employers, wages for beginners ranged from $2.90 to $3.50 an hour in 1978. Beginners who have completed college courses in art, interior decorating, or related subjects generally received the higher starting salaries. Experienced display workers' salaries ranged from $140 to $280 a week, depending largely on experience and ability. Most display managers earned between $15,000 and $25,000 a year. Experienced managers in large metropolitan department stores, particularly executives, may earn considerably more.

The earnings of freelancers depend on their talent and prestige, on the number and kinds of stores they service, and on the amount of time they work. Many highly skilled freelancers earn more than $25,000 a year.

Related Occupations

Display workers draw, paint, design, and construct displays that promote the sales of merchandise. An ability to recognize different shades and colors and to form a mental image of how shapes and forms can be combined and arranged in artistic ways are some of the skills needed to succeed in this kind of work. Others whose work requires these skills include exhibit designers, floral designers, graphic designers, interior designers, and set designers.

Sources of Additional Information

Details on career opportunities can be obtained from local retailers, such as department stores, and from local offices of the State employment service.

General information about the occupation is available from:

National Retail Merchants Association, 100 West 31st St., New York, N.Y. 10001.

Floral Designers

(D.O.T. 142.081-010)

Nature of the Work

Floral designers assemble flowers and foliage into a design to express the thoughts and sentiments of the sender. In performing their work, floral designers combine their knowledge of flower and plant forms and floral design techniques with their own creativity to produce floral and plant gifts, decorations, and tributes.

Designers must know the names and lasting qualities of flowers and growing information about flowering plants. They must also know the seasonal availability of flower and plant materials and the management's pricing structure for these materials.

In any given day, designers may receive a variety of orders, including decorative flowering plants, bouquets, corsages, funeral work, and dried-flower arrangements. Special orders, such as for weddings and parties, also incorporate the creative design and decorating talents of the floral designer.

Designers usually work from a written order indicating customer preference for color and type of flower, as well as the occasion, price, date, time, and place the arrangement or plant is to be delivered. Customers sometimes leave the choice of flowers, color, and design to the discretion of the designer.

A funeral order may read "easel spray of red and white flowers." For the foundation, the designer may attach a base (styrofoam, needle pack, etc.) near the top of a three-legged wire stand. Appropriate flowers are selected from the floral refrigerator. White gladiolas and red carnations are a possible combination. The price of the order and the cost of the flowers determine the number of flowers used. The flowers are cut to the needed length and wired for security. Stems may be strengthened with wooden sticks for easy insertion into the base.

To provide a background for the flowers, the designer may insert leafy branches, such as chamadorea or fern, into the base. If gladiolas are used, they are spaced so that the tips of the flowers approximate an oval or diamond shape. When carnations are used, they are placed among the gladiolas to provide contrasting form, color harmony, and depth. A bow may be placed at the focal point of the spray, and additional foliage added to conceal construction. On the back of the sympathy card are the description of the spray and the donor's name and address for easy acknowledgement. The spray is ready for delivery. This type of order usually is completed in about 15 minutes.

Floral designers often have other duties. They may help customers select flowers, plants, gifts, and floral accessories available in the shop. During slack periods, designers sometimes decorate flowering plants, arrange planters and terrariums, prepare accessories and containers for future use, or take inventory. The variety of duties performed by a floral designer depends on the size of the shop and the number of designers employed.

Working Conditions

Floral designers must be able to stand for long periods. Work areas are often cool and humid to preserve the flowers, and designers are exposed to sudden temperature changes when entering or leaving storage refrigerators. In general, however, florist shops are clean and well ventilated and provide a pleasant atmosphere.

Places of Employment

About 56,000 floral designers were employed in 1978. Nearly all designers work in the retail flower shops common to large cities, suburban shopping centers, and small towns. Most shops are small and employ only one or two floral designers; many designers manage their own stores. Geographically, employment is distributed much the same as population.

Training, Other Qualifications, and Advancement

An increasing number of people take courses in floral design to prepare for a career in this field. Courses in flower arranging and floral design are offered in many adult education programs, junior colleges, and commercial floral design schools. Longer programs provide training in flower marketing and shop management for floral designers who plan to operate their own shops. Formal training in floral design usually gives a prospective designer an advantage in obtaining a job over applicants who have no training. However, since speed and creative ability are the most important elements in successful floral designing, training acquired on the job through actual work experience also is valuable.

Many people who want to become designers are trained on the job by the manager or an experienced floral designer. Initially, they may copy simple arrangements that use one type of flower. If they work quickly with

Many floral designers acquire their skills on the job.

their hands and recognize the shape, color, and position of flowers that make attractive arrangements, instruction in more complex arrangements may be given. As experience is gained, original designs required for special orders can be attempted. Usually a person can become a fully qualified floral designer after 2 years of on-the-job training.

Good color vision, manual dexterity, and the ability to arrange various shapes and colors in attractive patterns are the primary qualifications for this occupation. A high school diploma usually is desired, although not essential. Applicants must be able to write legibly and do simple arithmetic in order to write up bills for customers. High school courses in business arithmetic, bookkeeping, selling techniques, and other business subjects are helpful. Experience gained by working part time in a flower shop while still in school is very helpful.

Floral designers with supervisory ability may advance to manager or design supervisors in large flower shops. Those who have the necessary capital may open their own shops.

Employment Outlook

Employment of floral designers is expected to increase faster than the average for all occupations through the 1980's. In addition to job openings created by employment growth, many openings will arise each year as workers retire, die, or change occupations.

Floral designer employment is related to sales of retail florist shops, which vary with ups and downs in the economy. Over the long run, however, it is expected that population growth and rising income will cause sales of flowers and floral arrangements to increase significantly. As a result, more floral designers will be needed.

Earnings

Experienced designers usually earned between \$3.50 and \$7 an hour in 1978, according to the limited information available. Inexperienced floral designers generally earned the minimum wage.

In small shops, floral designers often work 8 hours a day, Monday through Saturday. In many large shops, designers who work Saturday may get a day off during the week. Designers generally work long hours around certain holidays, such as Easter, Mother's Day, Valentine's Day, and Christmas when the demand for flowers and plants is great.

Most designers receive holiday and vacation pay. Because most shops are small, other fringe benefits are limited. Some employers pay part of the cost of group life and health insurance but few contribute to retirement plans other than social security. Floral designers in a few cities are members of the United Food and Commercial Workers International Union.

Related Occupations

Floral designers need to have an eye for detail and a sense of balance, proportion, and esthetic appeal. They must have good sense of color. Creating floral arrangements requires the imagination found in many other visual arts. Others whose jobs require similar skills include display workers, graphic designers, interior designers, set designers, and art teachers.

Sources of Additional Information

For additional information about careers in floral design and addresses of schools offering courses in this field, write to:

Society of American Florists, 901 N. Washington St., Alexandria, Va. 22314.

Industrial Designers

(D.O.T. 142.061-026)

Nature of the Work

When people buy a product, whether it's a home appliance, a new car, or a ballpoint pen, they want it to be as attractive, safe, and easy to use as possible. Industrial designers combine artistic talent with knowledge of marketing, materials, and methods of production to improve the appearance and functional design of products so that they compete favorably with similar goods on the market.

As the first step in their work, industrial designers gather information on how the product compares with competing products, the needs of the user of the product, fashion trends, and effects of the product on its environment. After the initial research, industrial designers sketch different designs and consult with managers, engineers, production specialists, and sales and market research personnel about the feasibility of each idea. This development team considers such factors as visual appeal, convenience, utility, safety, maintenance, and cost to the manufacturer, distributor, and consumer.

After company officials select the most suitable design, the industrial designer or a professional modeler makes a model, often of clay so that it can be easily modified. After any necessary revisions, a final or working model is made, usually of the material to be used in the finished product. The approved model then is put into production.

Although most industrial designers are product designers, many others are involved in different facets of design. To create favorable public images for companies and for government services, some designers develop trademarks or symbols that appear on the firm's product, advertising, brochures, and stationery. Some design containers and packages that both protect and promote their contents. Others prepare small display exhibits or the entire layout for industrial fairs. Some design the interior layout of special purpose commercial buildings such as restaurants and supermarkets.

Corporate designers usually work only on products made by their employer. This may involve filling day-to-day design needs of the company or long-range planning of new products. Independent consultants who serve more than one industrial firm often plan and design a great variety of products.

Working Conditions

Industrial designers generally work in clean, well-lighted, and well-ventilated rooms. They normally work 5 days, 35-40 hours a week, but occasionally, they work overtime to meet deadlines.

Designers may be frustrated at times when their designs are rejected. Independent consultants, who are paid by the assignment, are

Industrial designers often consult with engineers when designing new products.

sometimes under pressure to find new clients if their workload diminishes.

Places of Employment

About 13,000 persons were employed as industrial designers in 1978. Most worked for large manufacturing companies designing either consumer or industrial products or for design consulting firms. Others did freelance work, or were on the staffs of architectural and interior design firms. A few taught industrial design in colleges, universities, and art schools.

Industrial design consultants work mainly in large cities such as New York, Chicago, Los Angeles, and San Francisco. Designers with industrial firms usually work in or near the manufacturing plants of their companies, often in small and medium-sized cities.

Training, Other Qualifications, and Advancement

Completing a course of study in industrial design in an art school, in a university, or in a techncial college is the usual requirement for entering this field of work. Persons majoring in engineering, architecture, and fine arts may qualify as industrial designers if they have appropriate experience and artistic talent. Most large manufacturing firms hire only industrial deisgners who have a bachelor's degree in the field.

In 1978, 33 colleges and art schools offered programs in industrial design that were either accredited by the National Association of Schools of Art or recognized by the Industrial Designers Society of America. Most of these schools award a bachelor's degree in industrial design or art. A few also offer a master's degree in industrial design. Industrial design programs vary among schools, but most bachelor degree programs take 4 or 5 years. Many schools do not allow formal entry into the program until a student has successfully finished a year of basic art and design courses. Applicants may be required to submit sketches and other examples of their artistic ability.

Most college and university programs maintain a balance between science, humanities, and art; art schools generally stress a strong foundation in art. In most programs, students spend much time in the lab designing objects in three dimensions. In studio courses, students make models with clay, wood, plaster, and other easily worked materials. In schools that have the necessary machinery, students make models of their designs while learning to use metalworking and woodworking machinery. Students also take courses in drawing, drafting, and other visual communications skills.

Many industrial design programs, particularly in a liberal arts college or university, also include courses in basic engineering, in the physical and natural sciences, in the behavioral sciences, and in marketing and business administration.

Industrial designers must have creative talent, drawing skills, and the ability to translate abstract ideas into tangible designs. They must understand and meet the needs and tastes of the public, rather than design only to suit their own artistic sensitivity. Designers should not be discouraged when their ideas are rejected—often designs must be resubmitted many times before one is accepted. Since industrial designers must cooperate with engineers and other staff members, the ability to work and communicate with others is essential. A sound understanding of marketing, sales work, and other business practices also is important.

Applicants for jobs should assemble a "portfolio" of drawings and sketches to demonstrate their creativity and ability to communicate ideas.

Beginning industrial designers frequently do simple assignments. As they gain experience, they work on their own, and may become supervisors with major responsibility for the design of a product or a group of products. Those who have an established reputation and the necessary funds may start their own consulting firms.

Employment Outlook

Employment in this relatively small occupation is expected to grow about as fast as the average for all occupations through the 1980's. Although the trend in recent years has been away from frequent redesign of household products, automobiles, and industrial equipment, continued emphasis on issues such as ecology and product safety should increase demand for industrial designers.

Demand for industrial designers may fluctuate over short-run periods. During economic downturns when the market for new products is dampened, the need for these workers also tends to decline.

Employment opportunities are expected to be best for college graduates with degrees in industrial design. In addition to openings resulting from increased demand for industrial designers, some employment opportunities will arise each year as designers die, retire, or transfer to other fields.

Earnings

Salaries for inexperienced industrial designers with a bachelor's degree generally ranged from $10,000 to $14,000 a year in 1978, according to limited data. After several years' experience, it is possible to earn $15,000 to $20,000 a year. Salaries of those with many years of experience averaged more than $30,000 a year in 1978, but varied according to individual talent and the size and type of firm.

Earnings of industrial designers who own their consulting firms fluctuate greatly, but in general tend to be higher than the average earnings of corporate industrial designers.

Related Occupations

Workers in other occupations who design or arrange objects and materials to optimize their appearance, function, and value include architects, clothes designers, commercial artists, display designers, floral designers, interior designers, and set designers.

Sources of Additional Information

A brochure about careers and a list of schools offering courses and degrees in industrial design are available for 50 cents from:

Industrial Designers Society of America, 1717 N St. NW., Washington, D.C. 20036.

Interior Designers

(D.O.T. 142.051-014)

Nature of the Work

The creative work of interior designers helps make our living, working, and playing areas more attractive and useful. Interior designers plan and supervise the design and arrangement of building interiors and furnishings. They may work on either private homes or commercial buildings.

When planning any space, designers first consider the purpose of the area, the needs of the occupants, and the client's budget and taste. For instance, a very expensive couch that is easily soiled would not suit a family's needs for their recreation room, nor would it be appropriate for the reception area of a doctor's office.

The next step of the designer's job involves preparing sketches and detailed plans. These will show all the furniture and accessories the designer is considering as well as any changes in the structure itself. Changes may vary from planning a new wall to separate the dining and living rooms to creating a work cubicle in an office. Sometimes the clients do not approve the plans, in which case the designer will revise them.

Once the client approves both the plans and the cost, the designer may order the furnishings, supervise the work of painters, floor finishers, carpet layers, and other craft workers, if they are needed, and make sure the furnishings are installed and arranged according to the approved plan.

Designers who work in large department and furniture stores that have separate design departments advise customers on decorating and design plans. Although their principal function is to help sell the store's merchandise, they may suggest furnishings from other sources when essential to the customer's plans. Department store designers also frequently advise the store's buyers and executives about style and color trends in interior furnishings.

Interior designers who specialize in nonresidential structures often work for clients on large design projects such as the interiors of entire office buildings, hospitals, and libraries. Generally, they plan the complete layout of rooms without changes to the structure of the building. They also may redesign or renovate the interiors of old buildings. In these cases, an architect checks the plans to make sure that they comply with building requirements. Some interior designers also design the furniture and accessories to be used in various structures, and then arrange for their manufacture. A few design the interiors of ships and aircraft or stage sets used for motion pictures or television.

Regardless of where they are working, designers must deal with paperwork; they must place orders, figure estimates, and maintain records of where to purchase hundreds of different types of furnishings. Handling business matters such as these requires close attention to detail and accuracy.

Interior designers coordinating wall and floor coverings.

Working Conditions

Designers' work hours are sometimes long and irregular. They usually adjust their workday to suit the needs of their clients, meeting with them during the evening or on weekends when necessary. They may transact business in clients' homes or offices, in their own offices, or in a variety of other locations.

Each assignment offers a challenge to solve the client's problems with creativity and imagination. Designers generally work at their own pace in a quiet atmosphere, but sometimes the work is hectic. Most design jobs require coordinating the activities of building trades workers and suppliers, which is not an easy task when deadlines are tight and delivery problems crop up. The ability to handle details, even under pressure, is very important.

Places of Employment

About 79,000 persons worked as interior designers in 1978, primarily in large cities.

Most designers work for design firms. They work independently with the firm's clients or serve as assistants to senior designers. Others work as members of design teams.

Some interior designers advise customers in large department or furniture stores. Others work for hotel and restaurant chains, builders, government agencies, and other organizations that do a great deal of building or renovation. Some work for architects, furniture suppliers, antique dealers, furniture and textile manufacturers, or other manufacturers in the interior furnishings field. Interior designers also work for magazines that feature articles on home furnishings.

Some experienced interior designers run their own firms, either alone or in partnership with other designers.

Training, Other Qualifications, and Advancement

Formal training in interior design is increasingly important for entry into this field. Most architectural firms, well-established design firms, department and furniture stores, and other major employers accept only professionally trained people for beginning jobs. The types of training available include 3-year programs in a professional school of interior design, 4-year college or university programs that grant a bachelor's degree, or postgraduate programs leading to a graduate degree. The curriculum usually includes principles of design, history of art, freehand and mechanical drawing or architectural drafting, painting, study of the essentials of architecture as they relate to interiors, design of furniture and exhibitions, and study of various materials, such as woods, plastics, metals, and fabrics. A knowledge of furnishings, art pieces, and antiques is important. In addition, courses in sales and business techniques and management are valuable.

Membership in the American Society of Interior Design or in the Institute of Business Designers is a recognized mark of achievement in this profession. Membership usually requires the completion of 3 or 4 years of post high school education in design and several years of practical experience in the field, including supervisory work. In addition, satisfactory completion of a factual and design-problem examination is necessary for professional membership.

Persons starting in interior design usually serve a training period with a design firm, department store, or furniture store. They may act as receptionists, as shoppers with the task of matching materials or finding accessories, or as stockroom assistants, salespersons, assistant decorators, or junior designers. In most instances, from 1 to 5 years of on-the-job training are required before a trainee becomes eligible for advancement to designer. Beginners who do not get trainee jobs often sell fabric, lamps, or other interior furnishings in department or furniture stores to gain experience in dealing with customers and to become familiar with the merchandise. There is no guarantee, however, that this experience will result in a job in design, although it could lead to a career in merchandising.

After considerable experience, designers may advance to design department head or to other supervisory positions in department stores or in large design firms. If they have the necessary funds and aptitude for business, they may open their own firms.

Artistic talent is crucial for interior designers. People in this field also need a strong color sense, an eye for detail, and a sense of balance and proportion. An esthetic sense, or sensitivity to beauty, is absolutely essential. Because styles and tastes in art and fashion change quickly, people in this field need to be versatile and alert to new ideas and trends.

A successful designer must also be well organized and good at handling details. The ability to work well with people is very important, for a designer must be able to deal effectively with clients, suppliers, and workers.

Employment Outlook

Persons seeking beginning jobs in interior design are expected to face competition through the 1980's. Interior design is a competitive field that requires talent, training, and business ability, and many applicants vie for the better jobs. Talented college graduates who major in interior design and graduates of professional schools of interior design will find the best opportunities for employment. Those with less talent or without formal training will find it increasingly difficult to enter this field.

Employment of interior designers is expected to increase about as fast as the average for all occupations through the 1980's. Growth in population, personal incomes, expenditures for home and office furnishings, and the increasing use of design services in both homes and commercial establishments should contribute to a greater demand for these workers. In addition to new jobs, some openings will be created by the need to replace designers who die, retire, or leave the field.

Department and furniture stores are expected to employ an increasing number of designers as their share in the growing volume of design work for commercial establishments and public buildings increases. Interior design firms also are expected to continue to expand.

Employment of interior designers, however, is sensitive to changes in general economic conditions because people often forego design services when the economy slows down.

Earnings

Beginners usually are paid a straight salary plus a small commission. Starting salaries can range from the minimum wage plus a small commission to a fixed salary of $150 a week or higher. Firms in large metropolitan areas usually pay the highest salaries.

Some experienced interior designers are paid straight salaries, some receive salaries plus commissions based on the value of their sales, while others work entirely on commissions.

Incomes of experienced designers vary greatly. Many persons earn from $12,000 to $50,000 a year, and highly successful designers can earn much more. A small number of nationally recognized professionals earn well over $50,000 annually.

The earnings of self-employed designers vary widely, depending on the volume of business, their professional reputation, the economic level of their clients, and their own business competence.

Related Occupations

Interior designers must have artistic talent, be creative, and have good color sense and good taste. Other occupations that require similar skills include exhibit designers, fabric designers, display workers, and floral designers.

Sources of Additional Information

For information about careers in interior design and a list of schools offering programs in this field, contact:

American Society of Interior Design, 730 Fifth Ave., New York, N.Y. 10019.

Career information is also available from:

Institute of Business Designers, National Headquarters, 1155 Merchandise Mart, Chicago, Ill. 60654.

Landscape Architects

(D.O.T. 001.061-018)

Nature of the Work

Everyone enjoys attractively designed residential areas, public parks, and commercial zones. Landscape architects design outdoor areas that are functional as well as esthetically pleasing. Resource conservation is another important concern, one that requires a knowledge of scientific as well as artistic principles.

Landscape architects are hired by many types of organizations—from real estate firms starting new developments to municipalities constructing airports or parks. They usually plan the arrangement of vegetation, walkways, and other natural features of open spaces. They may also design areas where constructed materials predominate—as on streets that have been modified to improve pedestrian access and limit automobile traffic. They sometimes supervise the construction stages of outdoor projects.

Landscape architects first consider the nature and purpose of the project, the funds available, and the proposed elements in planning a site. Next, they study the site and map features such as the slope of the land and the position of existing buildings, roads, walkways, and trees. They also observe the sunny parts of the site at different times of the day, soil texture, existing utilities, and many other landscape features. Then, working sometimes as the leader of a design team or sometimes in consultation with the project architect or engineer, they draw up plans to develop the site. If the plans are approved, landscape architects prepare working drawings showing all existing and proposed features. Landscape architects outline in detail the methods of constructing features and draw up lists of building materials. They then may invite landscape contractors to bid for the work.

Some landscape architects specialize in certain types of projects such as parks and playgrounds, hotels and resorts, shopping centers, or public housing. Still others specialize in services such as regional planning and resource management, feasibility and cost studies, or site construction.

Working Conditions

Landscape architects spend a substantial amount of time in their offices preparing working drawings, cost estimates, and models, and also making presentations to clients. But this time indoors is balanced by the time they spend outdoors, studying and planning sites, and supervising actual landscape projects.

Places of Employment

About 14,000 persons worked as landscape architects in 1978. Most had their own businesses or worked for architectural, landscape architectural, or engineering firms. Others were employed by government agencies concerned with forest management, water storage, public housing, city planning, urban renewal, highways, parks, and recreation. The Federal Government employed over 600 landscape architects, mainly in the Departments of Agriculture, Defense, and Interior. Some landscape architects were employed by landscape contractors, and a few taught in colleges and universities.

Employment of landscape architects is concentrated around large metropolitan areas, primarily on the East and West Coasts.

However, employment opportunities have recently been growing in the Southwest.

Training, Other Qualifications, and Advancement

A bachelor's degree in landscape architecture, which takes 4 or 5 years, is usually the minimum educational requirement for entering the profession. The American Society of Landscape Architects accredits about 40 colleges and universities that offer such programs. About 60 other schools also offer programs or courses in landscape architecture.

A person interested in landscape architecture should take high school courses in mechanical or geometrical drawing, art, botany, and more mathematics than the minimum required for college entrance. Written and spoken English is important, too, since landscape architects must be able to communicate their ideas to their clients and make presentations before large groups.

College courses in this field include technical subjects such as surveying, landscape construction, sketching, design communications, and city planning. Other courses include horticulture and botany as well as English, science, mathematics, and the social sciences. Most college programs also include field trips to view and study examples of landscape architecture.

Thirty-eight States require a license, based on the results of a uniform national licensing examination, for independent practice of landscape architecture. Admission to the licensing examination usually requires a degree from an accredited school of landscape architecture plus 2 to 4 years of experience. Lengthy apprenticeship training (6-8 years) under an experienced landscape architect sometimes may be substituted for college training.

Persons planning careers in landscape architecture should have an appreciation for nature. Creativity and artistic talent are necessary, too, for landscape architects are primarily concerned with design. They employ lines, colors, textures, spaces, and light to create an esthetically pleasing land use plan. These elements of design are carried out in a project with trees, plants, stones, terrain, flower gardens, and other natural features as well as with constructed materials common to architecture and engineering that go into such outdoor features as plazas, fountains, kiosks, and rest areas.

Self-employed landscape architects must understand business practices. Working for landscape architects or landscape contractors during summer vacations helps a person understand the practical problems of the profession and may be helpful in obtaining employment after graduation.

New graduates usually begin as junior drafters, tracing drawings and doing other simple drafting work. After gaining experience, they help prepare specifications and construction details and handle other aspects of project design. After 2 or 3 years, they can usually carry a design through all stages of development. Highly qualified landscape architects may become associates in private firms; landscape architects who progress this far, however, often open their own offices.

Employment Outlook

Employment of landscape architects is expected to grow faster than the average for all occupations through the 1980's. Additionally, new entrants will be needed as replacements for landscape architects who retire or die.

The level of new construction plays a major role in determining demand for landscape architects, and anticipated growth in new construction is expected to spur demand over the long run. However, the cyclical nature of construction activity may cause employment to fluctuate from year to year.

Another factor underlying the increased demand for landscape architects is the growing interest in city and regional environmental planning. Metropolitan areas will require landscape architects to plan efficient and safe land use for growing populations. Legislation to promote environmental protection may spur demand for landscape architects to participate in planning and designing transportation systems, outdoor recreation areas, and land reclamation projects, as well as to ensure safe industrial growth. Recently enacted legislation in the areas of historic preservation and coastal zone management is also expected to affect employment in this field.

Earnings

Newly graduated landscape architects generally earned from $10,000 to $15,000 a year in 1978. Most experienced landscape architects earned between $15,000 and $25,000 a year, although some highly skilled persons earned salaries of over $30,000 a year. Earnings of self-employed landscape architects ranged from $10,000 a year to well over $25,000 a year, depending on the individual's educational background, experience, and geographic location.

The Federal Government, in 1979, paid new graduates with a bachelor's degree annual salaries of $10,500 or $13,000, depending their qualifications. Those with an advanced degree had a starting salary of about $15,900 a year. Landscape architects in the Federal Government averaged $24,456 a year in 1978.

Salaried employees both in government and in landscape archetectural firms usually work regular hours, although employees of private firms may also work overtime during seasonal rush periods to meet a deadline. Self-employed persons often work long hours.

Related Occupations

A sensitivity to beauty is essential in combining the elements of design and nature to develop a composite landscape project. Others whose work requires design skills include architects, ornamental horticulturists, environmental planners, urban planners, and land-use planners.

Sources of Additional Information

Additional information, including a list of colleges and universities offering accredited courses of study in landscape architecture, is available from:

American Society of Landscape Architecture, Inc., 1900 M St. NW., Washington, D.C. 20036.

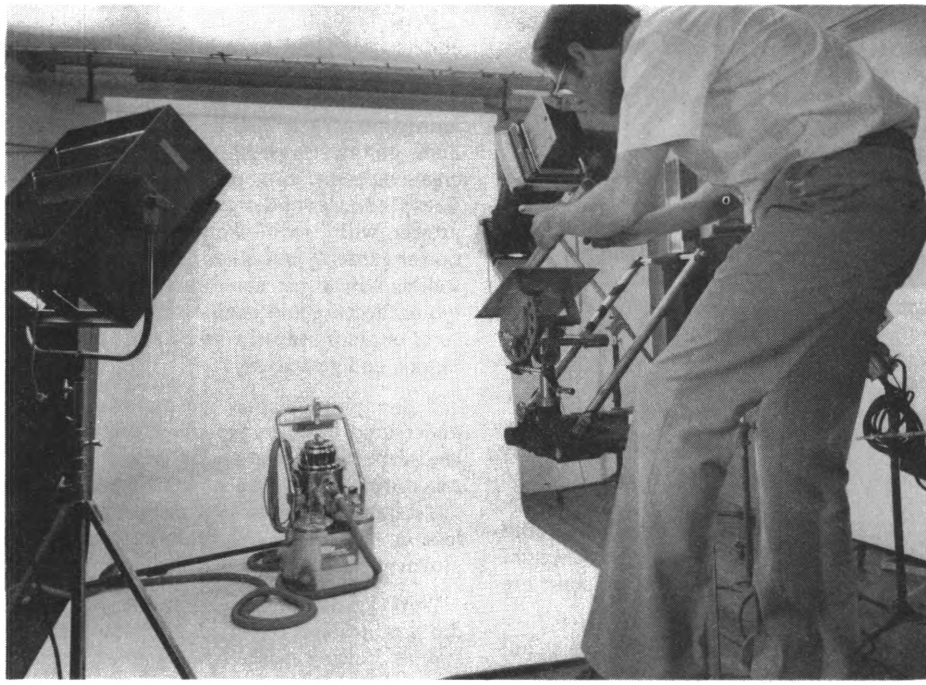
For information on a career as a landscape architect in the Forest Service, write to:

U.S. Department of Agriculture, Forest Service, Washington, D.C. 20250.

Landscape architects need a creative imagination and an appreciation for nature.

Photographers

(D.O.T. 143.062-014, -022, -026, -030, and -034; .362-010 and -014; .382-010 and .457-010)



Commercial photographers use many different techniques and types of equipment.

Nature of the Work

Photographers use their cameras and film to portray people, places, and events much as a writer uses words. Those who are skillful can capture the personality of individuals or the mood of scenes which they photograph. Some photographers specialize in scientific, medical, or engineering photography, and their pictures enable thousands of persons to see a world normally hidden from view.

Although their subject matter varies widely, all photographers use the same basic equipment. The most important piece, of course, is the camera, and most photographers own several. Unlike snapshot cameras, which have a lens permanently attached to the camera body, professional cameras are generally constructed to use a variety of lenses designed for close-up, medium-range, or distance photography.

Besides cameras and lenses, photographers use a variety of film and colored filters to obtain the desired effect under different lighting conditions. When taking pictures indoors or after dark, they may use electronic flash units, floodlights, reflectors, and other special lighting equipment.

Some photographers develop and print their own photographs in the darkroom and may enlarge or otherwise alter the basic image. Many photographers send their work to laboratories for processing.

Because the procedures involved in still photography are quite different from those in motion picture photography, many photographers specialize in one or the other. However, the demand is growing for photographers who have training in both areas.

In addition to knowing how to use equipment and materials, photographers must be able to compose the subjects of their photographs and recognize a potentially good photograph.

Many photographers specialize in a particular type of photography, such as portrait, commercial, or industrial work. *Portrait photographers* (D.O.T. 143.062-030) take pictures of individuals or groups of persons and often work in their own studios. For special events, such as weddings or christenings, however, they take photographs in churches and homes. Portrait photographers in small studios frequently do all the operations, including scheduling appointments and setting up and adjusting equipment before taking the pictures, as well as developing and retouching negatives, developing proofs, and mounting and framing pictures. They also may collect payments and keep records, and therefore must be good business persons.

Commercial photographers (D.O.T. 143.-062-030) photograph a wide range of subjects including livestock, manufactured articles, buildings, and large groups of people. They frequently do photography for catalogs. Those in advertising take pictures to promote items such as clothing, furniture, automobiles, and food, and may specialize in one such area. Advertising photographers must know how to use many different photographic techniques.

Industrial photographers (D.O.T. 143.062-030) are involved in a wide variety of activity. Companies use their work in publications to report to stockholders or to advertise company products or services. Industrial photographers also photograph groups of people for employee news magazines or take motion pictures of workers operating equipment and machinery for management's use in analyzing production or work methods. They may also use special photographic techniques as research tools. For example, medical researchers often use ultraviolet and infrared photography, fluorescence, and X-rays to obtain information not visible under normal conditions. Time-lapse photography (where time is stretched or condensed), photomicrography (where the subject of the photography may be magnified 50 or 70 times or more), and photogrammetry (surveying an area using aerial photography) are other special techniques.

Photojournalists (D.O.T. 143.062-034) photograph newsworthy events, places, people, and things for publications such as newspapers and magazines or for television news shows. They may also prepare educational slides, filmstrips, and movies for use in the classroom.

Working Conditions

Working conditions for photographers vary. Those who have salaried jobs usually work a 5-day, 35-40 hour week. Photographers in business for themselves usually work longer hours. Depending upon the employment, working hours for freelance photographers vary.

Freelance, press, and commercial photographers travel frequently and may work in uncomfortable surroundings. Sometimes the work can be dangerous, especially for photojournalists assigned to cover stories on natural disasters or military conflicts.

Many photographers work under pressure. Deadlines and demanding customers must be satisfied. Freelance photographers may find soliciting new clients frustrating and tedious.

Places of Employment

About 93,000 photographers were employed in 1978. The greatest proportion worked in commercial studios; many others worked for newspapers and magazines. Government agencies, photographic equipment suppliers and dealers, and industrial firms also employed large numbers of photographers. In addition, some taught in colleges and universities, or made films. Still others worked freelance, taking pictures to sell to advertisers, magazines, and other customers. About one-third of all photographers were self-employed.

Jobs for photographers are found in all parts of the country—both small towns and large cities—but are concentrated in the more populated areas.

Training, Other Qualifications, and Advancement

Although a high school education is desirable, photography has no set entry requirements for formal education or training. Employers usually seek applicants who have a broad technical understanding of photography as well as other photographic talents, such as imagination, creativity, and a good sense of timing. Technical expertise can be obtained through practical experience, post-secondary training, or some combination of the two. Some jobs do require that applicants specialize areas outside of photography.

Photographic training is available in colleges, universities, junior colleges, and art schools. About 75 colleges and universities offer 4-year curriculums leading to a bachelor's degree in photography. Some colleges and universities grant master's degrees in specialized areas, such as photojournalism. In addition, some colleges have 2-year curriculums leading to a certificate or an associate degree in photography. A formal education in photography gives a solid fundamental background in a variety of equipment, processes, and techniques. Art schools offer useful training in design and composition, but not the technical training needed for professional photographic work. The Armed Forces also train many young people in photographic skills.

People may prepare for work as photographers in a commercial studio through 2 or 3 years of on-the-job training as a photographer's assistant. Trainees generally start in the darkroom where they learn to mix chemicals, develop film, and do photoprinting and enlarging. Later they may set up lights and cameras or help an experienced photographer take pictures.

Amateur experience is helpful in getting an entry job with a commercial studio, but post-high school education and training usually are needed for industrial or scientific photography. Here success in photography depends on being more than just a competent photographer, and adequate career preparation requires some knowledge of the field in which the photography is used. For example, work in scientific, medical, and engineering research, such as photographing microscopic organisms, requires a background in the particular science or engineering specialty as well as skill in photography.

Photographers must have good eyesight and color vision, artistic ability, and manual dexterity. They also should be patient and accurate and enjoy working with detail. Some knowledge of mathematics, physics, and chemistry is helpful for understanding the use of various lenses, films, light sources, and development processes.

Some photographic specialties require additional qualities. Commercial or freelance photographers must be imaginative and original in their thinking. Those who specialize in photographing news stories must recognize a potentially good photograph and act quickly; otherwise, an opportunity to capture an important event on film may be lost. Writing ability sometimes is important for photojournalists, who may write captions and accompanying articles for their photographs.- Photographers who specialize in portrait photography need the ability to help people relax in front of the camera.

Newly hired photographers are given relatively routine assignments that do not require split-second camera adjustments or decisions on what subject matter to photograph. News photographers, for example, may be assigned to cover civic meetings or photograph snow storms. After gaining experience they advance to more demanding assignments, and some may move to staff positions on national news magazines. Photographers with exceptional ability may gain national recognition for their work and exhibit their photographs in art and photographic galleries, or publish them in books. A few industrial or scientific photographers may be promoted to supervisory positions. Magazine and news photographers may eventually become heads of graphic arts departments or photography editors.

Employment Outlook

Employment of photographers is expected to grow about as fast as the average for all occupations through the 1980's. In addition to openings resulting from increased demand for photographers, others will occur each year as workers die, retire, or transfer to other occupations.

Employment may grow as business and industry place greater importance upon visual aids in meetings, stockholders' reports, sales campaigns, and public relations work. Video and motion picture photography are becoming increasingly important in industry. Photography also is becoming an increasingly important part of law enforcement work, as well as scientific and medical research, where opportunities are expected to be good for those possessing a highly specialized background.

The employment of portrait and commercial photographers is expected to grow slowly, and competition for jobs as portrait and commercial photographers and photographers' assistants is expected to be keen. These fields are relatively crowded since photographers can go into business for themselves with a modest financial investment, or work part time while holding another job. Increased use of self-processing cameras in commercial photography also has contributed to crowding in this field, since little training is required for such work.

Earnings

Beginning photographers who worked for newspapers that have contracts with The Newspaper Guild had weekly earnings between $135 and $457 in early 1979, with the majority earning between $200 and $275. Newspaper photographers with some experience (usually 4 or 5 years) averaged about $368 a week in early 1979. Almost all experienced newspaper photographers earned over $250; the topsalary was $560 a week.

Photographers in the Federal Government earned an average of $16,500 a year in 1978. Depending on their level of experience, newly hired photographers in the Federal Government earned from $9,390 to $13,010 a year. Most experienced photographers earned between $13,010 and $19,260 a year.

Experienced photographers generally earn salaries that are above the average for nonsupervisory workers in private industry, except farming. Although self-employed and freelance photographers often earn more than salaried workers, their earnings are affected greatly by general business conditions and the type and size of their community and clientele.

Related Occupations

Besides photographers, other workers who rely on their visual arts talents in their jobs include commercial artists, floral designers, illustrators, industrial designers, painters, and sculptors.

Sources of Additional Information

Career information on photography is available from:

Professional Photographers of America, Inc., 1090 Executive Way, Des Plaines, Ill. 60018.

Communications Occupations

The art of communications is as old as humanity. Its importance in modern society becomes apparent when you try to imagine the world without radio, television, newspapers, magazines, or books. From the earliest discoveries of papermaking techniques to today's use of computers that transmit information with hitherto unimagined speed, people have sought ways of recording the events around them and conveying the information to others. Communication is a process that begins with observing what is happening, analyzing and interpreting that information, and transmitting it to an audience through a variety of media.

The communications field includes a broad range of occupations having to do with research, writing, editing, and production; it encompasses educational, medical, business, speech, joke, screen, and fiction writing; interpreting, translating, public relations, advertising, and many other specialties. The following section of the *Handbook* describes four of these occupations—newspaper reporters, public relations workers, radio and television announcers, and technical writers. Other communications jobs are described elsewhere in the *Handbook*, in the statements on radio and TV broadcasting, printing and publishing, and photographers.

The four occupations described below all require a broad education, with preparation either in the liberal arts and humanities or in a scientific or technical field, depending on specific career interest. The intellectual habits acquired during college are important. Acute powers of observation and the ability to think clearly and logically are necessary traits, because people in these jobs need to understand the significance of the events they observe. An excellent command of language—both written and oral—is essential. It is through appropriate choice of words or phrases that technical writers, for example, put complex matter into language that is readily understood. A feeling for language enables newspaper reporters and broadcast journalists to breathe life and meaning into the overwhelming number of events that occur every day. A knack for dramatization through the spoken word makes radio and television announcers attractive to audiences of all kinds.

In addition to a broad education and outstanding language skills, people in communications jobs may need to be very well informed about a particular subject. Depending on the job, they may need to be versed in economics, law, politics, science, engineering, computer science, education, music, or sports. They may be called upon to explain legal issues discussed by experts at an international conference on the law of the sea; national economic and political events for readers of a small-town newspaper; the latest developments in data communications technology for readers of a trade journal; or the history of jazz, classical, bluegrass, or other music featured on a radio show.

Communications workers must perform well under pressure. A reporter who submits a story late may delay a newspaper edition, resulting in a loss of newsstand sales. A television announcer who does not react quickly to emergencies on the air can cause the show's ratings to decline. An artist who produces mediocre work may cause an advertising agency to lose an important account.

Competition for most communications jobs is keen, for the field traditionally attracts many more jobseekers than there are job openings. Some people are attracted by the "glamorous" image of media jobs—the opportunities to meet public figures, to appear before nationwide audiences, to attend special events. This glamorous aspect of the job obscures the hard work most of these jobs entail. Journalists, for example, spend hours every day on the tedious but essential task of making contacts, checking facts, and following leads.

Despite the keen competition, jobs will be available through the 1980's for talented people who have acquired appropriate education and experience. For some, willingness to take a job where one is available—in a small town instead of Los Angeles or New York City—and willingness to "start at the bottom" may make the difference between success and failure in breaking into the field. After that, a combination of talent, education, motivation, imagination, and "luck" can lead to a rewarding career.

Newspaper Reporters

(D.O.T. 131.067-010, 018, and 022; 131.267-014 and 018)

Nature of the Work

A free press is one of the most important institutions in a democratic society. Newspapers inform us about local, State, national, and international events; present differing points of view on current issues; and monitor the actions of public officials and others who exercise power. Newspaper reporters, therefore, play a vital role in American society. They gather information on current events and use it to write stories for daily or weekly newspapers. In covering events, they may interview people, review public records, and do research. As a rule, reporters take notes or use tape recorders while out of the office collecting facts and write their stories upon returning to the office. Sometimes, to meet deadlines, they telephone their information or stories to rewriters who write or transcribe the stories for them.

Large dailies frequently assign teams of reporters to investigate social, economic, or political conditions and some reporters to "beats," such as police stations or the courts, to gather news originating in these places. General assignment reporters write up local news, such as a story about a school board meeting or an obituary of a community leader. Specialized reporters with a background or interest in a particular subject interpret and analyze the news in fields such as medicine, politics, foreign affairs, sports, fashion, art, theater, consumer affairs, travel, finance, social events, science, education, business, labor, and religion. Critics review literary, artistic, and musical works and performances while editorial writers present viewpoints on topics of public interest.

Reporters on small newspapers cover all aspects of local news, and also may take photographs, write headlines, lay out pages, and write editorials. On some small weeklies, they also may solicit advertisements, sell subscriptions, and perform general office work.

Working Conditions

The work of newspaper reporters is usually hectic. Reporters are under pressure to meet deadlines and work under the most trying conditions—the continuous disturbance of noisy typewriters and loud conversation and the confusion of people constantly on the go. Some assignments covering wars, political uprisings, fires, floods, and other events may be dangerous.

Reporters working for morning papers often work from late afternoon until midnight. Employees of afternoon or evening papers generally work from early in the morning until early or midafternoon. However, reporters must be prepared to gather news whenever it occurs. Their work may demand long hours, irregular schedules, and some travel. Foreign correspondents often work late at night to send news to papers in time for printing.

Places of Employment

About 45,000 persons worked as newspaper reporters in 1978. Many worked for urban daily newspapers; others worked for suburban, community, or smalltown weekly papers and national press services.

Reporters work in cities and towns of all sizes, but the great majority of the approxi-

Newspaper reporters lead hectic lives when meeting deadlines.

mately 1,760 daily and 7,670 weekly newspapers in existence in 1978 were in medium-sized towns. However, most reporters work in big cities, since big city dailies employ many reporters, whereas a smalltown paper generally employs only a few.

Training, Other Qualifications, and Advancement

Most newspapers consider only applicants who have a college education. Graduate work is increasingly important. Most editors prefer graduates who have a degree in journalism, which includes training in the liberal arts along with professional training in journalism. Some editors consider a liberal arts degree sufficient. Others prefer applicants who have a bachelor's degree in liberal arts and a master's degree in journalism. High school courses that are important include English, journalism, social studies, and typing.

In 1978, the majority of journalism graduates who landed jobs on daily newspapers prepared specifically for news work while they were in college by majoring in news-editorial journalism. News-editorial majors generally found news jobs more easily than journalism graduates majoring in other specialties—advertising, public relations, or broadcasting.

Bachelor's degree programs in journalism are available in about 240 colleges. About three-fourths of the courses in a typical undergraduate journalism curriculum are in liberal arts. Required journalism courses include introductory mass media, basic reporting and copy editing, history of journalism, and press law and ethics. Other journalism courses are elected in the student's specific area of interest.

About 350 community and junior colleges offer journalism courses or programs. Credit earned may be transferable to 4-year college programs in journalism. Some junior colleges also offer programs especially designed to prepare the student directly for employment as a general assignment reporter on a small weekly or daily newspaper. However, such graduates find it increasingly difficult to compete with graduates of 4-year programs. The Armed Forces also provide some training in journalism.

A master's degree in journalism was offered by about 70 schools in 1978; about 20 schools offered the Ph. D. degree. Some graduate programs are intended primarily as preparation for news careers, while others concentrate on preparing journalism teachers, researchers and theorists, and advertising and public relations workers.

Liberal arts courses useful to persons preparing for newspaper work include English courses with an emphasis on writing, sociology, political science, economics, history, psychology, computer science, business, and speech. The ability to read and speak a foreign language is desirable. Those who aspire to reporting in a specialized field—science or finance, for example—should concentrate on course work in their subject area.

Skill in typing is essential because reporters type their own news stories. Also, familiarity with a typewriter keyboard is important because a growing number of reporters work in newsrooms where computerized word-processing equipment is used for writing and editing stories. The ability to take shorthand also is useful. On small papers, knowledge of news photography is valuable.

The Newspaper Fund and individual newspapers offer summer internships that provide college students with an opportunity to practice the rudiments of reporting or editing. Experience acquired through such internships helps immeasurably in job placement after graduation. In addition, more than 3,000 journalism scholarships, fellowships, and assistantships were awarded to college journalism students by universities, newspapers, foundations, and professional organizations in 1978.

News reporting involves a great deal of responsibility, since what a reporter writes frequently influences the opinion of the reading public. Reporters should be dedicated to serving the public's need for accurate and impartial news. Although reporters work as part of a team, they have an opportunity for self-expression. The ability to express facts and opinions clearly and succinctly is, of course, essential for success in this field. Accuracy and objectivity are equally important, because untrue or libelous statements could involve newspapers in costly lawsuits.

Important personal characteristics include a "nose for news," curiosity, persistence, initiative, poise, resourcefulness, an accurate memory, and the physical stamina and emotional stability to deal with pressing deadlines, irregular hours, and sometimes dangerous assignments. Because some assignments lead reporters to unfamiliar places, they must be able to adapt to strange surroundings and feel at ease around different kinds of people.

Some who compete for full-time reporter jobs find it is helpful to have had experience as a newspaper "stringer"—a part-time reporter who covers the news in a particular area of the community and is paid on the basis of the stories printed. High school and college newspapers, and church or community newsletters, also provide writing and editing experience that may be helpful in getting a job.

Most beginners start on weekly or on small daily newspapers as general assignment reporters or copy editors. A few outstanding journalism graduates are hired by large city papers, but this is the exception rather than the rule. Large dailies generally require several years of reporting experience, which usually is acquired on smaller newspapers.

Beginning reporters are assigned duties such as reporting on civic and club meetings, summarizing speeches, writing obituaries, interviewing important visitors to the community, and covering police court proceedings. As they gain experience, they may report more important events, cover an assigned "beat," or specialize in a particular field.

Newspaper reporters may advance to reporting for larger papers or press services. However, competition for such positions is fierce and news executives are flooded with applications from highly qualified reporters every year. Some experienced reporters become columnists, correspondents, editorial writers, editors, or top executives; these positions represent the top of the field and competition for them is extremely keen. Other reporters transfer to related fields such as public relations, writing for magazines, or preparing copy for radio and television news programs.

Employment Outlook

Employment of newspaper reporters is expected to grow about as fast as the average for all occupations through the 1980's. This growth will come about because of an increase in the number of smalltown and suburban daily and weekly newspapers, for the most part; little or no increase is anticipated in the number of big city dailies, although some of them may increase the size of their reporting staffs. In addition to the openings that result from employment growth, openings will arise from the need to replace newspaper reporters who die, retire, transfer to other fields of work, or leave the profession for other reasons.

Overall, journalism graduates who have taken the news-editorial sequence and completed a newspaper internship while in school should have the best prospects for newspaper reporting jobs. Most editors prefer to hire the top graduates of accredited programs. Talented writers who are able to handle news about highly specialized scientific or technical subjects will be at an advantage on the job market. Small papers often look for beginning reporters who are acquainted with the community and who can help with photography and other aspects of newspaper production. Persons without at least a bachelor's degree in journalism will face increasingly stiff competition for entry level positions.

Weekly or daily newspapers located in small towns and suburban areas are expected to continue to offer the best opportunities for beginning reporters. Journalism graduates who are willing to relocate and start at relatively low salaries are likely to find reporting jobs on these newspapers. Openings arise on small papers as reporters gain experience and move up to editorial positions, or transfer to reporting jobs on larger newspapers.

Competition for reporting jobs on large metropolitan newspapers will be keen. Most big city dailies require experience and do not ordinarily hire new graduates. Sometimes, however, new graduates find newsroom jobs on major dailies because they have credentials in an area for which the paper has a pressing need. Occasionally, the experience and contacts gained through an internship program or summer job lead to a reporting job directly after graduation.

Because enrollments in journalism education programs are expected to rise through the 1980's, college teaching opportunities are expected to be good for qualified applicants —generally, Ph. D.'s with practical reporting experience. Some highly qualified reporters with a master's degree will find teaching positions in journalism departments of colleges and junior colleges. This favorable outlook for journalism educators contrasts with the generally bleak prospect for college faculty in many other academic disciplines.

In addition to newspaper reporting, college graduates who have majored in journalism have the background for work in such closely related fields as advertising, public relations, trade and technical publishing, magazine publishing, and radio and television broadcasting. Every year, a substantial number of journalism graduates take media jobs in fields such as these. For example, journalism graduates with strong backgrounds in science or mathematics are well suited for jobs on scientific and industrial publications. Other graduates accept sales, managerial, and other nonmedia positions, while still others continue their training in fields such as law, business, public administration, and politics.

Earnings

Reporters working for daily newspapers having contracts negotiated by the Newspaper Guild had starting salaries ranging from about $135 to about $460 a week in early 1979. The majority earned between $200 and $275 a week.

Reporters having 4 or 5 years of experience who worked for daily newspapers with Guild contracts averaged about $370 a week in early 1979. Virtually all experienced reporters earned over $250 a week while the top contractual salary was $560 a week. A number of top reporters on big city dailies earned even more, on the basis of merit. The minimum salaries of experienced reporters working for the two national wire services were around $410 and $430 a week. In general, earnings of newspaper reporters are above average earnings of nonsupervisory workers in private industry, except farming.

Most newspaper reporters generally work a 5-day, 35- or 40-hour week and receive extra pay for overtime work. Benefits may vary widely according to length of service and the size and location of the newspapers. Most reporters, however, receive benefits such as paid vacations, group insurance, and pension plans.

Related Occupations

Newspaper reporters must write clearly and effectively to succeed in their profession. Others for whom writing ability is essential include technical writers, translators, advertising copy writers, public relations workers, educational writers, humorists, fiction writers, biographers, screen writers, and editors.

Sources of Additional Information

Career information, including a pamphlet entitled, "Your Future in Daily Newspapers," is available from:

American Newspaper Publishers Association Foundation, The Newspaper Center, Box 17407, Dulles International Airport, Washington, D.C. 20041.

A pamphlet entitled, "Facts About Newspapers," is available from:

American Newspaper Publishers Association, The Newspaper Center, Box 17407, Dulles International Airport, Washington, D.C. 20041.

Information on careers in journalism, colleges and universities that offer degree programs in journalism or communications, and journalism scholarships and internships may be obtained from:

The Newspaper Fund, Inc., P.O. Box 300, Princeton, N.J. 08540.

For a list of junior and community colleges offering programs in journalism, contact:

National Community College Journalism Association, San Antonio College, 1300 San Pedro Avenue, San Antonio, Texas 78284.

Information on union wage rates is available from:

The Newspaper Guild, Research and Information Department, 1125 15th St. NW., Washington, D.C. 20005.

For a list of schools with accredited sequences in their journalism departments, send a stamped, self-addressed envelope to:

American Council on Education for Journalism, School of Journalism, University of Missouri, Columbia, Mo. 65205.

For general information about careers in journalism, contact:

Association For Education in Journalism, 102 Reavis Hall, Northern Illinois University, Dekalb, Ill. 60115.

The Society of Professional Journalists, Sigma Delta Chi, 35 East Wacker Dr., Chicago, Ill. 60601.

Information on opportunities for women in newspaper reporting and other communications fields is available from:

Women In Communications, Inc., P.O. Box 9561, Austin, Tex. 78766.

Names and locations of newspapers and a list of schools and departments of journalism are published in the *Editor and Publisher International Year Book*, available in most public libraries and newspaper offices.

Public Relations Workers

(D.O.T. 165.067-010)

Nature of the Work

How successfully an organization presents its goals and policies to the public may affect its acceptance, prosperity, and even its continued existence. Public relations workers help businesses, government, universities, and other organizations build and maintain a positive public image. In improving communication, they aid understanding and cooperation among the diverse groups that make up our society.

Public relations workers apply their talents and skills in many different areas. They may handle press, community, or consumer relations, political campaigning, interest-group representation, fundraising, or employee recruitment. Public relations is more than "telling the employer's story," however. Understanding the attitudes and concerns of customers, employees, and various other "publics"—and communicating this information to management to help formulate policy—is an important part of the job.

Public relations departments are found in a variety of organizations, and workers must tailor their programs to an employer's particular needs. A public relations director of a college or university, for example, may spend most of the time recruiting students, while one in a large corporation may work with stockholders, government agencies, and community groups.

Public relations workers put together information that keeps the public aware of their employer's policies, activities, and accomplishments, and keeps management aware of public attitudes. After preparing the information, they may contact people in the media who might be interested in publicizing their material. Many radio or television announcements, special reports, newspaper items, and magazine articles start at public relations workers' desks. Sometimes the subject is a company and its policies towards its employees or its role in the community. Often the subject is a public issue, such as health, nutrition, energy, or the environment.

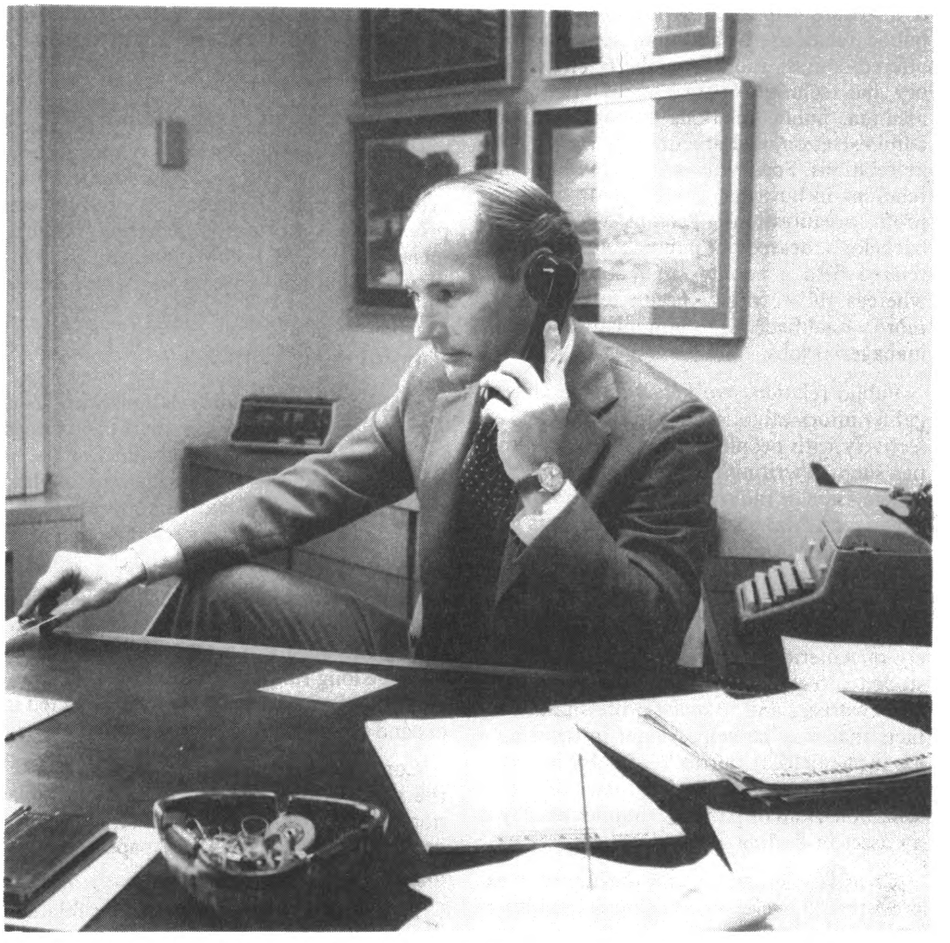
Public relations workers also arrange and conduct programs in which company representatives will have direct contact with the public. Such work includes setting up speaking engagements and helping prepare speeches for company officials. These workers often represent employers at community projects or occasionally may show films at school assemblies, plan conventions, or manage fundraising campaigns.

Public relations staffs in very large firms may number 200 or more, but in most firms the staff is much smaller. The director of public relations, who is often a vice president of the company, may develop overall plans and policies with a top management executive. In addition, large public relations departments employ writers, research workers, and other specialists who prepare material for the different media, stockholders, and other groups the company wishes to reach.

Workers who handle publicity for an individual or direct public relations for a university or small business may handle all aspects of the job. They contact people outside the organization, do the necessary planning and research, and prepare material for publication. These workers may combine public relations duties with advertising or sales promotion work; they may be top-level officials or in more junior positions. The most skilled public relations work of making overall plans and maintaining contacts usually is done by the department director and highly experienced staff members.

Working Conditions

Although the workweek for public relations staffs generally is 35 to 40 hours, schedules may be rearranged because public relations programs operate against deadlines. Preparing and delivering speeches, attending meetings and community activities, and out of town travel may all be a part of the public relations worker's routine. Thus, any of their regular assignments or special events may require workers to be at the job or on call around the clock.



In many firms, public relations workers set up speaking engagements for the company's officials.

Places of Employment

About 131,000 persons were public relations workers in 1978. Manufacturing firms, public utilities and transportation companies, insurance companies, and trade and professional associations employ many public relations workers. A sizable number work for government agencies (the Federal Government alone employs several thousand public information specialists), or for schools, colleges, museums, and other educational, religious, and human service organizations. The rapidly expanding health field also offers opportunities for public relations work, in hospitals, pharmaceutical companies, and medical associations, for example. A number of workers are employed by public relations consulting firms which furnish services to clients for a fee. Some work for advertising agencies.

Public relations workers are concentrated in large cities where press services and other communications facilities are readily available, and where many businesses and trade associations have their headquarters. More than half of the estimated 2,000 public relations consulting firms in the United States are in New York, Los Angeles, Chicago, and Washington, D.C. A major trend however, is the dispersal of public relations jobs throughout the Nation, including smaller towns.

Training, Other Qualifications, and Advancement

A college education combined with public relations experience is excellent preparation for public relations work. Although most beginners have a college degree in journalism, communications, or public relations, some employers prefer a background in a field related to the firm's business—science, finance, or engineering, for example. Some firms want college graduates who have worked for the news media. In fact, many editors, reporters, and workers in closely related fields enter public relations work.

In 1978, about 90 colleges and more than 30 graduate schools offered degree programs or special curriculums in public relations, usually administered by the journalism or communications department. In addition, about 200 colleges offered at least one course in this field. Courses in advertising, journalism, business administration, political science, communications, psychology, and creative writing help in preparing for a career in public relations. In addition, some colleges offered courses such as public relations theory and techniques, organizational communication, public relations management and administration, and practical courses in public relations. Specialties are offered in public relations in business, government, and nonprofit organizations. Persons who have a bachelor's degree in public relations or a related field generally enter staff positions whereas those with a graduate degree are more qualified for administrative and managerial jobs.

Public relations workers must be able to gather information, write, speak, and deal effectively with people. Extracurricular activities such as writing for a school publication or television or radio station provide valuable experience. Many schools help students gain part-time or summer internships in public relations which provide training that can help in competing for entry positions. Membership in the Public Relations Student Society of America provides an opportunity for students to exchange views with public relations workers and to make professional contacts that may be helpful later in securing a job in the field. A portfolio of published articles, television or radio programs, slide presentations, and other work samples usually is an asset in finding a job.

Creativity, initiative, and the ability to express thoughts clearly and simply are important to the public relations worker. Fresh ideas are so vital in public relations that some experts spend all their time developing new ideas.

People who choose public relations as a career need an outgoing personality, self-confidence, and an understanding of human psychology. They should have the enthusiasm to motivate people. The ability to be competitive but function as part of a team are important qualifications.

Public information positions in the Federal Government generally require a college degree. Media, writing, or editing experience may help in gaining such a position. Requirements for similar positions in State and local governments vary.

Some companies—particularly those with large public relations staffs—have formal training programs for new workers. In other firms, new employees work under the guidance of experienced staff members. Beginners often maintain files of material about company activities, scan newspapers and magazines for appropriate articles to clip, and assemble information for speeches and pamphlets. After gaining experience, they work on more difficult assignments, such as writing press releases, speeches, and articles for publication. In some firms, workers get all-round experience whereas in other firms they specialize.

Promotion to supervisory jobs may come as workers show they can handle more demanding and creative assignments. Some experienced public relations workers start their own consulting firms.

The Public Relations Society of America accredits public relations workers who have at least 5 years' experience in the field and have passed a comprehensive 6-hour examination (4 hours written, 2 hours oral). However, because of disagreements over the appropriateness of formal licensing requirements in this field, such requirements for employment are not expected in the immediate future.

Employment Outlook

Employment of public relations workers is expected to increase faster than the average for all occupations through the 1980's. In addition to new jobs resulting from growth in the demand for these workers, openings will occur each year as workers die, retire, or leave the field for other reasons.

Demand for public relations workers may slacken as employers delay expansion or cut their staff during business slowdowns, but over the long run, corporations, associations, and other large organizations are expected to expand their public relations staffs.

Competition for beginning jobs is keen, for the glamour and excitement of public relations attracts large numbers of jobseekers, including transfers from newspaper, advertising, and closely related jobs.

Prospects for a career in public relations are best for highly qualified applicants—talented people with sound academic preparation and some media experience. Most openings are expected to occur in large organizations—corporations, public relations consulting firms, manufacturing firms, educational institutions, and others.

Earnings

Starting salaries for college graduates beginning in public relations work generally ranged from $9,600 to $13,800 a year in 1978; persons with a graduate degree generally started at a higher salary.

The salaries of experienced workers generally are highest in large organizations with extensive public relations programs. According to a 1978 survey, median annual salaries of public relations workers were as follows: Presidents of public relations consulting firms, $36,000; public information or relations directors and managers in the Federal Government, $31,200, in State government, $24,000, in local government, $22,700, and in educational organizations, $25,000.

Public relations consulting firms often pay higher salaries than organizations with their own public relations departments. Many firms offer incentive compensation. Salaries in manufacturing firms are among the highest while salaries in social welfare agencies, nonprofit organizations, hospitals, and universities are among the lowest.

In the Federal Government, bachelor's degree holders generally started at $10,000 a year in 1978, master's degree holders generally started at $15,300 a year; additional education or experience could qualify applicants for a higher salary. Public information specialists averaged about $26,150 a year in 1978.

Related Occupations

Public relations workers develop and distribute persuasive material in order to create a favorable public reputation. Other workers with similar jobs include fundraisers, account executives, lobbyists, promotion managers, goodwill ambassadors, advertising managers, and police officers involved in community relations.

Sources of Additional Information

For career information and a list of schools offering degrees and courses in the field, write to:

Career Information, Public Relations Society of America, Inc., 845 Third Ave., New York, N.Y. 10022.

Current information on the public relations field, salaries, and other items is available from:

PR Reporter, Dudley House, P.O. Box 600, Exeter, N.H. 03833.

For additional information on job opportunities and the public relations field in general, write to:

Service Department, *Public Relations News*, 127 East 80th St., New York, N.Y. 10021.

Radio and Television Announcers

(D.O.T 159.147)

Nature of the Work

Most radio announcers act as disc jockeys, introducing recorded music, presenting news and commercials, and commenting on other matters of interest to the audience. They may "ad-lib" much of the commentary, working without a detailed script. They also may operate the control board, sell time for commercials, and write commercial and news copy. In large stations, however, other workers handle these jobs. (See the statement on occupations in the radio and television broadcasting industry elsewhere in the *Handbook*.)

Announcers employed by television stations and large radio stations usually specialize in particular kinds of announcing such as sports, news, or weather. They must be thoroughly familiar with their particular area. If a written script is needed for parts of the program, the announcer may do the research and writing. Announcers frequently participate in community activities. A sportscaster, for example, might be the master of ceremonies at a touchdown club banquet or greet customers at the opening of a new sporting goods store. Some announcers become well-known and highly paid personalities.

Working Conditions

Announcers generally work in well-lighted, air-conditioned, soundproof studios. When working outside the studio, however, they may be subject to noise, crowds, and other unpleasant working conditions.

Maintaining a program schedule requires split second timing and can be physically and mentally demanding. Those who enjoy the work, however, feel that the intangible rewards—the many personal contacts and the satisfaction from becoming well known in the area their station serves—far outweigh the disadvantages of irregular hours, work pressures, and disrupted personal lives.

Places of Employment

About 27,000 announcers were employed by radio and television broadcasting stations in 1978. In addition to staff announcers, many freelance announcers sell their services for individual assignments to networks and stations, or to advertising agencies and other independent producers.

Training, Other Qualifications, and Advancement

Entry to this highly competitive profession is very difficult. While formal training in a college or technical school is valuable, station officials pay particular attention to taped auditions that contain samples of an applicant's style on commercials, news, interviews, and music copy. Some inexperienced persons accept clerical, routine technical, and other nonannouncing jobs with the hope of being assigned announcing duties after gaining on-the-job experience.

Announcers must have a pleasant and well-controlled voice, a good sense of timing, and excellent pronunciation. Correct English usage and a knowledge of dramatics, sports, music, and current events improve chances for success. Good judgment and the ability to react quickly in emergencies are important since announcers may be required to "ad-lib" all or part of a show. A neat, pleasing appearance is essential, of course, for television announcers. The most successful announcers have a combination of personality and a knack for dramatization that makes them attractive to audiences.

High school courses in English, public speaking, dramatics, foreign languages, and electronics, plus sports and music hobbies, are valuable background for prospective announcers. A college liberal arts education provides an excellent background for an announcer, and many universities offer courses of study in the broadcasting field. Students at these institutions also may gain valuable experience by supplementing their courses with part-time work at the campus radio station and summer work at local stations, filling in for vacationing staff members. A number of private broadcasting schools offer training in announcing.

Persons considering enrolling in any school, whether public or private, that offers training for a broadcasting career should contact the personnel managers of stations, broadcasting trade organizations, and the Better Business Bureau in their area to determine the school's performance in producing suitably trained candidates.

Announcers generally get their first broadcasting jobs in small stations. Because announcers in small radio stations sometimes operate transmitters, prospective announcers often obtain an FCC (Federal Communications Commission) restricted radiotelephone operator permit. This qualifies them to become involved in the routine operation of radio transmitters and makes them much more useful to these stations. Of course, employers may be even more attracted to those who have a first class radiotelephone operator license. (For additional information on licensure, see the *Handbook* statement on broadcast technicians.)

Announcers usually work in several different stations in the course of their careers. After acquiring experience at a station in a small community, an ambitious and talented announcer may move to a better paying job in a large city. An announcer also may advance by getting a regular program as a disc jockey, sportscaster, or other specialist. In the national networks, competition for jobs is particularly intense, and announcers often must be college graduates and have several years of successful announcing experience before they are given an audition.

Employment Outlook

Competition for beginning jobs as announcers will be very keen through the 1980's. The great attraction of the broadcasting field will continue to mean many more jobseekers than jobs. It will be easier to get jobs in radio than in television because more radio stations hire beginners. These jobs generally will be located in small stations, and the pay will be relatively low. Stations in major metropolitan areas seek highly experienced announcers in this extremely competitive industry.

Employment of announcers is expected to increase about as fast as the average for all occupations through the 1980's as new radio and television stations are licensed. Some jobs will become available as more cable television stations begin their own programming. Employment of announcers is not expected to keep pace with the increase in the number of stations, however, because of the increased use of automatic programming equipment. Some jobs in this relatively small occupation will result from the need to replace experienced announcers who transfer to other occupations, retire, or die.

Earnings

In 1978, announcers generally started at $150 to $160 a week in small stations, according to the limited information available. Earnings among experienced announcers were much higher, and some well-known announcers in major metropolitan areas earned extremely high salaries. As a rule, salaries increase with the size of the community and the station, and salaries in television are higher than those in radio. Announcers employed by educational broadcasting stations generally earn less than those who work for commercial stations.

Most announcers in large stations work a 40-hour week and receive overtime pay for additional hours. Many announcers in small

The glamour of the occupation attract many aspiring announcers.

stations work a considerable amount of overtime. Working hours consist of both time on the air and time spent in preparing for broadcasts. Evening, night, weekend, and holiday duty occurs frequently since many stations broadcast 24 hours a day, 7 days a week.

Related Occupations

The success of radio and television announcers is largely dependent upon their ability to speak effectively to their audiences. Others for whom oral communications skills are vital are interpreters, narrators, actors, comedians, and impersonators.

Sources of Additional Information

For general career information, write to:

National Association of Broadcasters, 1771 N St. NW., Washington, D.C. 20036.

For a list of schools that offer programs and courses in broadcasting, contact:

Broadcast Education Association, National Association of Broadcasters, 1771 N St. NW., Washington, D.C. 20036.

For information on FCC licensure, write to:

Federal Communications Commission, Policy Analysis Branch, 1919 M St. NW., Washington, D.C. 20554.

Technical Writers

(D.O.T. 131.267-026)

Nature of the Work

Technological innovations are being introduced faster than ever. By putting scientific and technical information into language that can readily be understood, technical writers play an important role in our society. They research, write, and edit technical materials and also may produce publications or audiovisual materials. To ensure that their work is accurate, technical writers must be expert in the subject area in which they are writing—laser beams or pharmacology, for example. At the same time, their writing must be clear and easy to follow. Command of the language and versatility of style are tools of the trade that enable technical writers to convey information in a way that is helpful to people who use it—scientists, technicians, executives, sales representatives, and the general public. In addition to their primary function of clarifying technical information, technical writers often are involved in marketing, advertising, and public relations work in which they utilize their writing skills.

Some organizations use job titles other than "technical writer." Depending on the employer, people in technical writing jobs may be called staff writers, publications engineers, communications specialists, industrial writers, medical writers, communicators, or instructional materials developers.

Technical writers set out either to instruct or to inform, and in many instances they do both. They prepare manuals, catalogs, parts lists, and instructional materials needed by the sales representatives who sell machinery or scientific equipment and by the technicians who install, maintain, and service it. Instructional aids must be prepared to assist the people who operate complex equipment—for example, the technicians who monitor sophisticated diagnostic equipment in a hospital's coronary care unit. Writing manuals and training aids for military weapons and equipment is a highly specialized field of technical writing. Sometimes technical writers are asked to write scripts for training films, or to prepare instructional materials for self-teaching cassettes, filmstrips, or kits. Technical writers often are part of a team, working closely with scientists, engineers, accountants, and others.

Many technical writers prepare reports on research. By communicating research developments to other scientists, engineers, and technicians, these reports help prevent duplication of effort and speed scientific and technical progress. Reports also play an important part within a company; hundreds of progress reports may be sent from one department to another within the course of a year. Detailed reports also must be prepared for government regulatory agencies and for agencies that fund research and development projects. Some reports—environmental impact statements, for example—require such a detailed treatment of technical subjects that they usually are prepared by scientists with the assistance of technical writers. Annual reports to stockholders sometimes are an additional responsibility.

Proposal preparation is another important duty of technical writers. Proposals are requests for the money or facilities to conduct a project, develop a prototype of a new product, or do research. When a proposal is being prepared, scientists and engineers provide the technical information, management provides cost estimates, and a team of technical writers usually shapes the final proposal.

Manuals, reports, and proposals make up the bulk of technical writing today; however, the work may take other forms. Technical writers may write specifications; prepare speeches and news releases; edit and write technical books; prepare articles for popular magazines; develop advertising copy, promotional brochures, and texts for exhibits and displays; and handle technical documentation.

Technical writers usually start an assignment by learning as much as they can about the subject. They study reports, blueprints, sketches, drawings, parts lists, specifications, mockups, and product samples to become familiar with product technologies and production methods. They also read technical journals; consult with engineers, scientists, and technicians who have worked on the project; and examine the equipment. After they have assembled as much information as appropriate, given the time they have and the purpose of the document, they draw up an outline. Then they prepare a rough draft, which may undergo several revisions before being accepted in final form. Technical writers usually arrange for the preparation of tables, charts, illustrations, and other artwork that accompany a finished document and may work directly with technical illustrators, drafters, or photographers.

Working Conditions

Most technical writers work for government agencies or private firms, and have structured work schedules. However, they sometimes must work overtime and often are under considerable pressure to meet publication deadlines. Acquiring and assembling needed information and interpreting highly technical data can be stressful. Onsite inspection of new scientific projects and other research may require travel.

Freelance writers set their own hours and often work at home. Well-established writers with high incomes may rent offices. They, too, may work under pressure to meet editors' deadlines. They conduct research in libraries, hospitals, factories, newspaper offices, museums, private homes, or wherever information is available. Freelance writers may interview people on the street or on public transit. Like other technical writers, self-employed writers must be willing to travel when necessary.

Places of Employment

An estimated 24,000 technical writers and editors were employed in 1978. Many work for large firms in the electronics, aviation, aerospace, ordnance, chemical, pharmaceutical, and computer manufacturing industries. Firms in the energy, communications, and computer software fields employ many technical writers, and research laboratories employ significant numbers. Some laboratories are affiliated with manufacturing companies and concentrate on developing products or improving the manufacturing process. Other research laboratories—including those connected with universities, government agencies, or private foundations—engage in both basic and applied research.

The Federal Government employs about 1,700 technical writers and editors in areas as diverse as the physical sciences, weapons development, agriculture, and health. About three-fourths work for the Department of Defense, writing manuals that keep military personnel informed on the construction, maintenance, and use of weapons and instruments. Many other agencies employ technical writers, including the Departments of Interior; Agriculture; Health, Education, and Welfare; and the National Aeronautics and Space Administration.

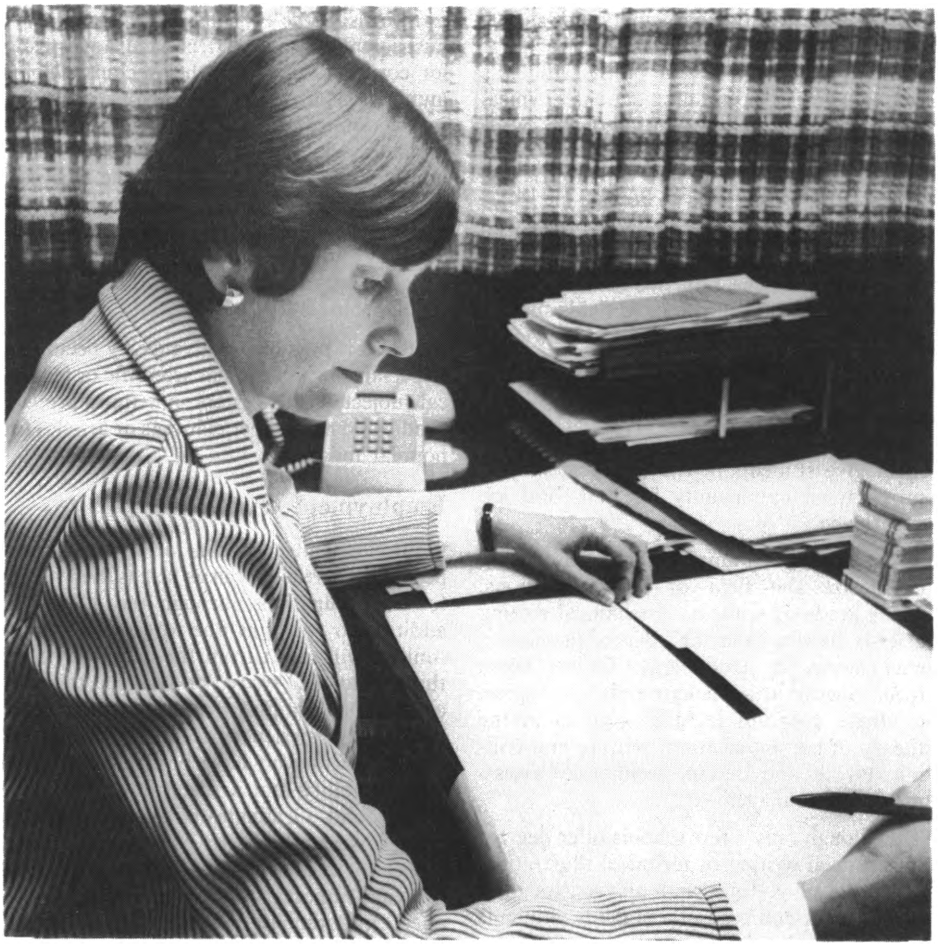
Many people in this occupation work directly for publishing houses. They hold writing and editing jobs with business and trade publications; on professional journals in engineering, medicine, physics, chemistry, and other sciences; and with publishers of scientific and technical literature. Technical writers also work in publishing programs in colleges and universities.

Medical writers keep health professionals and the public informed about current developments and discoveries in health and medicine. They work in a wide range of settings including hospitals, drug firms, universities, medical journals and associations, laboratories, publishing houses, public relations firms, and advertising agencies.

The rapidly growing information industry provides another area of employment for technical writers. Commercial firms that provide their clients with access to a computerized data base employ technical information specialists to collect, process, and manage a vast amount of information. Technical writers are particularly well suited for such jobs because of their combination of technical and communications skills. Such jobs also are available at the technical information centers run by major industrial firms and research laboratories.

Established technical writers may work on a freelance basis or open their own agencies or consulting firms. Freelance writers sell their work to publishers, corporations, manufacturing firms, and advertising agencies. They usually are hired to complete specific assignments such as writing about a new product or technique.

Technical writers are employed all over the country but the largest concentrations are in the Northeast, Texas, and California.



Technical writers must possess both strong writing skills and appropriate scientific or technical knowledge.

Training, Other Qualifications, and Advancement

There are no rigid requirements for entry into the field. As a result, people having a variety of backgrounds find jobs as technical writers. Employers seek people whose educational background, work experience, and personal pursuits indicate that they possess both writing skills and appropriate scientific or technical knowledge. Knowledge of graphics and other aspects of publication production may be helpful in getting a job. An understanding of current trends in communication technology is an asset, and familiarity with computer operations and terminology is increasingly important.

A college degree is helpful, and many employers insist on it. Hiring criteria vary, however. Many employers prefer candidates with a degree in science or engineering plus a minor in English, journalism, or technical communications. Other employers emphasize writing ability and, in turn, look for candidates whose degrees are in journalism, English, or the liberal arts. Depending on their line of business, these employers almost always require course work or practical experience in a specific subject as well—computer science or biochemistry, for example.

Besides having writing skills and scientific or technical expertise, technical writers should be intellectually curious and able to think logically. They must be very accurate in their work and able to organize a mass of detailed material. Persistence and patience are important because getting and assembling information is not always easy. Because they often are part of a team of scientists, engineers, and technicians, they should be able to work with others; this requires tact and a cooperative attitude. Technical writers sometimes work alone for long periods with little or no supervision, so they must also be disciplined about work habits and schedules.

Freelance writers in particular must be self-starters. They must be disciplined, motivated, and good at budgeting both time and money in order to deal with periods when there is too much work—or not enough.

Most technical writers do not enter the occupation directly from college. The majority work initially in other jobs, usually as technicians, scientists, or engineers. Some begin as research assistants, editorial assistants, or trainees in a company's technical information or advertising departments. In time, these people may assume writing duties and develop technical communication skills. When a flair for writing becomes evident, they may seek a technical writing position in the same company or find a writing job elsewhere.

While many employers consider only seasoned, experienced writers in filling vacancies, not all do. Some firms hire college graduates for writer trainee positions. People with solid backgrounds in science or engineering are at an advantage in competing for such jobs. Those with bachelor's or master's degrees in technical writing are often preferred over candidates who have little or no writing background. However, a degree in almost any field may be acceptable, providing the candidate has the necessary technical and communications skills. Beginners can develop experience and demonstrate their ability through writing material for local weekly newspapers and by publishing articles in student or technical journals. A portfolio of writing samples is invaluable when applying for a job.

In 1978, about 10 colleges and universities offered programs leading to a bachelor's degree in technical communication, while fewer had master's degree programs. Several schools offered an associate degree in this field. These programs have various names, including science or medical writing, science information, or technical journalism.

Most undergraduate programs in technical writing are interdisciplinary. While such programs may be based in the communications, journalism, or language and literature departments, they generally are given in close cooperation with the mathematics, engineering, and science departments. At most schools, about 30 percent of the student's course work is in communications. Typical courses include communication theory, writing and editing, layout and design, and graphics. From 25 to 40 percent of the courses are in science or technology. The remainder of the program may be in the social sciences and humanities, or may be devoted entirely to electives. Students usually are advised to take courses in related fields such as computer science and statistics. Knowledge of a foreign language, such as Latin, can be helpful for learning roots of words and for understanding English better. At many schools, internships in industry or government give students in the technical writing program an opportunity for first-hand job experience.

Graduate programs in technical writing emphasize the field of communications. Many graduate students in technical writing already have a bachelor's degree in science, engineering, or technology. Others come from liberal arts backgrounds. A typical graduate program includes courses in the theory of communication, writing and editing, layout and design, technology assessment, and management.

Although only a few schools offer degrees in technical writing or technical illustrating, hundreds of colleges and universities offer one or more courses in these fields. Students with such diverse majors as agriculture, chemistry, engineering, and business administration can elect courses in advanced composition, copy editing, typography, technical advertising, industrial communications, and proposal writing, for example. Many engineering schools offer English courses to sharpen writing skills, and several have developed extensive course offerings in technical writing. Several schools of journalism offer courses in medical journalism.

Numerous special institutes, seminars, and workshops are available to bring technical writers up to date. Some are intensive 1- or 2-week summer seminars sponsored by colleges and universities. Others are workshops run by technical communication consultants or by organizations that specialize in employee training and development.

Beginners often assist experienced technical writers by doing library research and preparing drafts of reports. Experienced writers in companies with large technical writing staffs may move to the job of technical editor or shift to an administrative position in the publications or technical information departments. The top job is that of publications manager, who normally supervises all of the people directly involved in producing the company's technical documents. The manager supervises not only the technical writers and editors, but also the staff responsible for illustrations, photography, reproduction, and distribution.

After gaining experience and contacts, some technical writers freelance or form their own firms. Some consulting firms handle industrial publicity and technical advertising for corporate clients. Other technical communications firms do the actual writing and production of the catalogs, manuals, and brochures that may be needed for the promotion of a new product, for example. Successful technical writers are frequently in demand to conduct writing seminars in industry and government, and some teach at colleges and universities in addition to their regular jobs.

It also is possible to advance by becoming a specialist in a particular scientific or technical subject. These writers sometimes prepare syndicated newspaper columns or articles for popular magazines.

Employment Outlook

Employment of technical writers is expected to increase about as fast as the average for all occupations through the 1980's. In addition to openings due to growth, opportunities will result from the need to replace those who die, retire, or transfer to other occupations. Employment opportunities will be best for experienced technical writers and for beginners who have both demonstrated writing ability and a scientific or technical background. Graduates of technical writing programs should be in particular demand, especially those with backgrounds in areas of growing importance such as computer science, environmental science, and electronics. People who cannot demonstrate both a technical background and communications skills may face stiff competition for beginning jobs.

Demand for technical writers is expected to increase because of the continuing expansion of scientific and technical information and the need to communicate research results to the scientific community as effectively as possible. Also contributing to the demand for technical writers is the growing need to put scientific and technical information into language that corporate managers, sales representatives, and service technicians can understand. With the increasing sophistication and complexity of industrial and scientific equipment, more and more users will depend on the technical writer's ability to prepare explanations and instructions in precise but simple terms. However, the tendency for many scientists and engineers to do their own writing may limit demand for additional technical writers.

Government expenditures for research and development (R & D) will continue to have a significant effect on job opportunities for technical writers. Their employment, like that of scientists and engineers, is linked to spending levels for basic research and for product development in such important areas as national defense, space exploration, energy development and conversion, medicine, environmental health and safety, and communications technology. Through the 1980's, R & D expenditures are expected to increase, but growth will be slower than it was during the peak period of the 1960's.

Relatively few job openings are expected in the Federal Government. The number of technical writers and editors employed by Federal agencies has remained about the same since the late 1960's, and most vacancies will occur as these employees retire or transfer to other jobs.

Earnings

Salaries depend not only on the amount and kind of education a technical writer has, but also on experience and the ability to produce. The type, size, and location of the employer also are important. Earnings generally are higher on the East Coast and in California than in other parts of the country. Freelancing can be an important source of additional income, but freelance earnings vary greatly because they depend on the writer's ability and reputation. Prospective full-time freelance writers should be able to support themselves until they establish contacts in the publishing world and receive regular assignments.

Starting salaries for technical writers ranged from $8,000 to $10,000 a year to as much as $18,000 to $19,000 a year for some graduates of master's degree programs in 1978, based on the limited information available. Experienced technical writers and editors earned $20,000 to $25,000 a year or more, depending upon their level of responsibility.

In the Federal Government in 1979, beginning technical writers with a bachelor's degree, including 15 semester hours in technical fields such as science, engineering, or computer science, were paid $10,507 a year; those with superior academic records or 1 year's specialized experience could start at $13,014 a year. In 1978, the average salary for technical writers in Federal agencies was around $21,500.

Related Occupations

Technical writers must make their writing clear and meaningful to their audiences. Other occupations in which writing ability is essential include specification writers, journalists, translators, advertising copy writers, public relations workers, educational writers, fiction writers, biographers, and screen writers.

Sources of Additional Information

For information on careers in technical writing and illustrating, contact:

Society for Technical Communication, Inc., Suite 506, 815 15th St. NW., Washington D.C. 20005. *Academic Programs in Technical Communication*, a listing of colleges and universities that offer programs in technical writing, is available from the Society for $6.

For information on careers in business communication, contact:

American Business Communication Association, c/o University of Illinois, 911 South 6th St., Champaign, Ill. 61820.

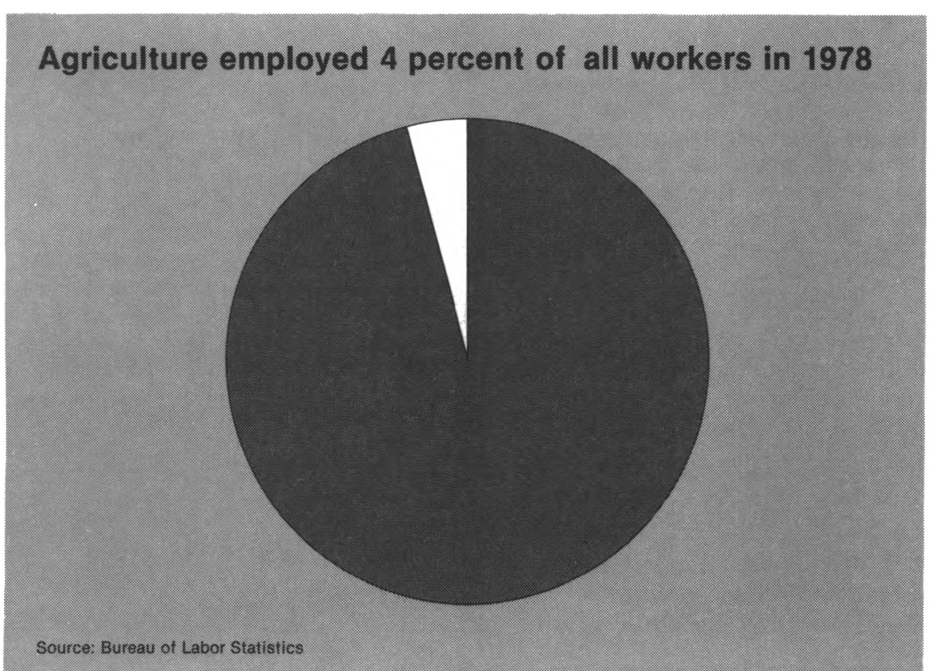
The Outlook for Industries

AGRICULTURE

For decades, the word agriculture has referred to agricultural production or farming—a major American industry that employed over 3 million workers in 1978. But today, this word encompasses more than just farm production. Agriculture is closely related to many other industries—food and fiber processing, marketing and distribution, farm implement production and sales, and feed and fertilizer manufacturing.

Although jobs requiring agricultural knowledge or skills long have been available in off-farm locations, the number and variety of these jobs have increased dramatically in recent years. At the same time, significant improvements in agricultural productivity have reduced the number of jobs available on the Nation's farms. During the last two decades, employment on U.S. farms and ranches has declined to only half its former level. Improved agricultural technology, including the introduction of new and larger farm machinery, has been among the factors that have reduced employment on farms and created a need for workers with agricultural skills in off-farm occupations.

Although future growth in agricultural employment will be in off-farm occupations and industries, over 2.5 million workers still will be needed in basic agricultural production in 1990. This section discusses the occupations in basic farm production and the factors to consider in making the decision to farm. It also describes the increasing variety of work available in off-farm businesses, occupations, and professions utilizing agricultural skills.



Occupations in Farm Production

Farmers and farm workers accounted for over 95 percent of all farm employment in 1978. Although most farmers and farm workers are engaged in growing crops, over 1 million raise livestock. Because activity on many farms is seasonal, some farm employees work 3 months or less during the year. This seasonality of farm production enables many small farmowners to hold another job while working their farms part time.

Although employment on most farms is limited to the farm operator and one or two family workers or hired employees, large farms often have 100 full-time workers or more. Some of these are in nonfarm occupations, such as truckdrivers, sales representatives, and clerks.

Farm Operators. Three out of every four farms are operated by an owner or a renter; the remainder are run by hired farm managers or partners. The specific tasks of a farm operator are determined by the type of farm, but, in general, farmers are responsible for planning, tilling, planting, fertilizing, cultivating, and harvesting crops. Those who raise livestock must feed and care for their animals and keep barns, pens, milking parlors, and other farm buildings clean. Farmers also perform various other tasks, ranging from setting up and operating machinery to erecting fences and sheds. The size of the farm often determines which of these tasks operators will handle themselves. Operators of large farms have employees do much of the physical work that small farm operators do themselves.

In addition to the physical work, farm operators also must make the management decisions required for modern agricultural production. They must determine the best time to seed, fertilize, cultivate, and harvest. They must carefully plan the combination of crops they grow so that, if the price of one crop goes down, they will have sufficient income from another to make up for it. Also, prices of crops and livestock change from one month to another, and farmers who plan ahead may be able to store their crops or keep their livestock to take advantage of better prices later in the year.

After harvesting, they make sure that products are packaged, loaded, and delivered promptly to market. If necessary, they secure loans from credit agencies to finance the purchase of machinery, fertilizer, livestock, and feed. They also keep financial records of the farm operation and train and supervise workers in the use of equipment and performance of farm chores.

Tenant farmers rent their land. Although they often manage their farm operations, they sometimes consult the landowner or hired manager when deciding what to plant or scheduling the harvest. Tenant farmers also supervise the work of family and hired laborers. Although tenant farmers generally provide their own machinery, livestock, seed, and fertilizer, under special agreements the landowner may furnish one or more of these. Most tenant farm operators turn over an agreed-upon percentage of the crop to the landowner for the use of the land. Others may pay a flat yearly rent to the landowner.

Farm laborers and farm labor supervisors. Very few farms today can be run by only one person. In 1978, approximately 975,000 hired workers, 300,000 family workers, and 40,000 farm labor supervisors were employed on farms.

On many farms, especially those that rely on a few family workers or hired employees, farm laborers perform a variety of duties. For example, *farm hands* (D.O.T. 421.683-010) on a farm with diversified agriculture may care for livestock and crops as well as maintain structures and equipment.

Livestock generally require a great deal of attention on a day-to-day basis. Farmhands must mix feed and additives and fill feed and water troughs. They clean barns and animal pens; check livestock regularly for signs of disease or infection; and often vaccinate livestock, such as cattle and poultry, against diseases or spray them with insecticides to protect against harmful parasites. Also, farmhands on dairy farms must clean and milk cows twice a day.

In contrast, hands on crop farms have duties that vary with the seasons. Before seeding, they must prepare the soil by plowing, harrowing, and fertilizing. Once the crops are partially grown, workers cultivate fields to loosen soil and reduce the number of weeds. Often, crops are sprayed to control weeds, harmful insects, and fungi. Farmhands also assist in harvesting, storing, packing, and transporting crops.

Many of the tasks performed by farmhands require machinery, such as milking machines, hay balers, and cotton-pickers. In addition to setting up and operating machinery, hands maintain and clean it and may do minor repairs, if necessary. Also, they maintain and repair farm structures, including barns, fences, and irrigation systems.

Farmhands generally perform some, or all, of these duties regardless of farm location or what crops are grown. However, many types of crops require special attention. For example, a farmhand working in an orchard (D.O.T. 403.683-010) may have to transplant seedlings, prune fruit trees, thin immature fruit to improve quality, and prop up overloaded branches.

Other farm laborers may perform specialized duties depending on the location of the farm. In areas where rain is insufficient, *irrigators* (D.O.T. 409.684-010) water crops by controlling the flow of water from irrigation ditches, through gates or portholes, to the fields. They also operate portable sprinkling systems that pump water through pipes spread on the ground and move the pipes from one area to another.

Farms producing fruit or vegetables often need a large number of workers to harvest their crops. These farms employ laborers with more specialized duties. For instance, if produce is packed on the farm for shipment, then *produce sorters* (D.O.T. 529.687-186) and *produce packers* (D.O.T. 920.687-134) will be employed. Other laborers may spend most of their time operating a particular piece of machinery. Still others may be full-time maintenance workers.

When many workers are employed in specialized jobs, *farm labor supervisors* (D.O.T. 401.137-010, -014; 402.131-010; 404.131-010) are needed to coordinate work activities. They schedule the work of crews and may hire additional hands, especially during the harvesting season. Farm labor supervisors also teach new employees how to use machinery and tools and keep records of production and crop conditions. (For additional information on labor supervisors, see the chapter on blue-collar worker supervisors elsewhere in the *Handbook*.)

Working Conditions

Many types of agriculture are seasonal in nature and many farm operators and farm laborers on crop farms may have to work from sunup to sundown during the planting and harvesting seasons. Farm workers often work fewer than 6 to 7 months a year and, while many can find off-farm employment, others are often unable to find employment during the winter months.

On farms which raise animals for meat or dairy products, the work is distributed more evenly throughout the year since animals must be fed and watered regularly, and cows must be milked twice daily. Owners and operators of these farms may rarely get the chance to be away.

For many people, living on a farm or in a rural area is an attractive alternative to the fast-paced life of a metropolitan area. However, farm work can be extremely hazardous; each year, many farm workers suffer debilitating injuries from machinery. Also, farmworkers are subject to illnesses and diseases from handling and breathing dangerous pesticides and chemicals and from handling crops that have been sprayed with insecticides. In addition to these problems, health care in rural areas sometimes is inadequate or too expensive to meet the needs of farm workers.

Places of Employment

Some farming is done in nearly every county in the United States, but more than one-third of all farms are in the following States: Texas, Missouri, Iowa, North Carolina, Illinois, Kentucky, and Tennessee. Thus, employment of farm operators is concentrated in these States. Farms in some of these States, however, are smaller on the average than those in other areas of the country, and more than one-third of all farm products are raised in Iowa, California, Texas, Illinois, and Kansas.

Often the topography of the land and the climate of an area determine the type of farming that is done. For example, wheat, corn, and other grains are most efficiently grown on large, flat farms on which large and sophisticated machinery can be best used. Thus, these crops are ideal for the plains of Kansas, Nebraska, Iowa, and Illinois. Other States, such as Wisconsin, Minnesota, and New York, have rolling hills, sufficient rainfall to provide good pastures, and denser populations, and thus, smaller farms that are ideal for grazing dairy herds. Climate is the main reason why crops which require longer growing seasons, such as cotton, tobacco, and peanuts, are grown chiefly in the South.

About three-fifths of all farmers and farm workers are employed raising crops; the remainder raise cattle, hogs, sheep, and poultry.

Raising fruits and vegetables, which must be picked and packaged by hand, generally requires a large number of employees during the harvesting season, and many hired laborers work on these farms on a seasonal basis. Almost one-half of all commercial vegetables grown in the United States are produced in California, and large amounts of fruits and vegetables also are grown in Texas and Florida. Two-fifths of all farm labor supervisors and one-third of all hired farm laborers are employed in these three States.

Much of the work on farms that produce animals and dairy products must be done daily throughout the year. These farms often rely on the farm operator and several unpaid family laborers to do most of the work. Unpaid family workers and farm operators also

Preparing the soil for planting is just one of many steps in producing crops.

provide most of the labor on farms that produce crops, such as wheat, corn, or cotton, that can be machine harvested and packaged without damage. Therefore, only a small number of hired farm laborers and almost no farm labor supervisors are employed in the regions that produce these farm products.

Training, Other Qualifications, and Advancement

Modern farming is very costly and usually requires a large initial investment. The prices of farmland, fertilizer, hybrid seeds, and other resources needed by farmers have risen dramatically over the past decade. Also, more expensive machinery is needed today to farm efficiently. To obtain the financing necessary to get started in farming, prospective farmers must be able to show that they are well trained and knowledgeable in their field.

Growing up on a family farm and participating in farming programs for young people, such as the Future Farmers of America or the 4-H Clubs, is still an important source of training for tomorrow's farmers. However, because of the complexities of modern scientific farming and the need to keep up with advances in farming methods, an increasing number of young farmers find it desirable to receive additional training at a 2- or 4-year college of agriculture. Also, a degree in agriculture is almost essential for persons who wish to farm but who have not had the advantage of living or working on a farm in their youth.

Most colleges of agriculture offer major programs of study in areas such as dairy science, agricultural economics, horticulture, crop science, and animal science. Also, colleges usually offer special programs of study concerning products important to the area in which they are located, such as grain science programs at colleges in the Plains States.

In addition to a knowledge of agricultural practices, a wide variety of building, maintenance, and business skills often are needed on farms. On corporate farms and on large, established, family farms, there may be many workers, each supplying a particular skill. However, beginning farmers may wish to supply as much labor as possible themselves in order to hold down costs, so it often is helpful for them to have these other skills. The carpentry skills needed to erect or repair fences and farm buildings may be learned in courses at vocational schools, as can farm machinery maintenance and repair. Sound business practices can be learned through high school courses in bookkeeping, and knowledge of financial management, accounting, and tax accounting almost essential to today's farmer, can be obtained through college courses.

In contrast to the extensive and varied training needed to be a farm operator, most farm laborers, such as field and livestock workers and packinghouse workers, learn their jobs in a matter of hours on the farm and require little or no outside training. Some farm laborers on large farms perform more specialized jobs, such as machine operator, for which limited experience may be helpful, but previous experience and training are not necessary.

Farm laborers and farm operators should be in excellent physical condition. Physical stamina and strength are important to farm workers, since they must often work long days on their feet or stooped over under the hot sun, and they may be required to lift and carry heavy objects, such as hay bales, or to restrain animals.

Over 1.5 million acres of farmland in the United States are lost each year to suburbanization, and, in many areas of the country, farmland for sale is scarce. The scarcity of available land and the cost of getting started in farming may make it necessary for a beginning farmer to start out as a hired hand on a nearby farm, or as a tenant farmer for a landowner who supplies the machinery, seed, and fertilizer in return for a percentage of the crop. Hired hands and tenant farmers may later find jobs as farm managers or one day become owners of their own farms.

Opportunities for advancement for farm laborers are limited; however, they may advance to farm labor supervisors, and a few may have the opportunity to become working farm managers, tenant farmers, or to one day own their own farms.

Making the Decision to Farm

Farming may be the ideal career for people who enjoy working outdoors and being their own bosses. The desire to live in a rural area, away from urban congestion, also may be an important consideration in choosing farming as an occupation. However, farming is a very demanding career, and only persons with a great deal of initiative and a sense of responsibility can expect to be successful.

Farmers often must work long hours, and a 6- or 7-day workweek is common during busy seasons and the rule on certain types of farms, such as dairy and livestock farms. Farmers should be willing to try new processes and adapt to constantly changing technologies to produce their crops or raise their livestock more efficiently. Farmers also must have enough technical knowledge of crops and growing conditions and plant and animal diseases to be able to make decisions that insure the sucessful operation of their farms. They also must have the managerial skills necessary to organize and operate a business. Mechanical aptitude and the ability to work with tools of all kinds also are valuable skills for the operator of a small farm who often must maintain and repair machinery or farm structures. A basic knowledge of accounting and bookkeeping can be helpful in keeping financial records, and a knowledge of credit sources is essential.

Both the average size of farms and the price of farmland have increased greatly in recent years, thus considerably raising the cost of buying a farm. Therefore, young people interested in farming may wish to start by farming part of a relative's farm or by leasing land from an absentee owner. However, even if the beginning farmer does not purchase land and buildings, financing is generally necessary to purchase livestock, seed, feed, fertilizer, and machinery.

The Federal Land Bank is the largest source of credit for farmers. In addition, many commercial banks and savings and loan institutions, especially those in rural areas, and many life insurance companies, extend credit to farmers. Also, the Farmers Home Administration extends credit for purchasing farms and paying for yearly operating costs to people who have been unable to obtain loans from any other source.

Employment Outlook

Employment in agriculture is expected to continue to decline through the 1980's, as the trend toward fewer but larger farms continues. Fewer farms means fewer farm operators, and as farms become larger, the additional use of more and larger machinery makes it unnecessary to hire more farm laborers.

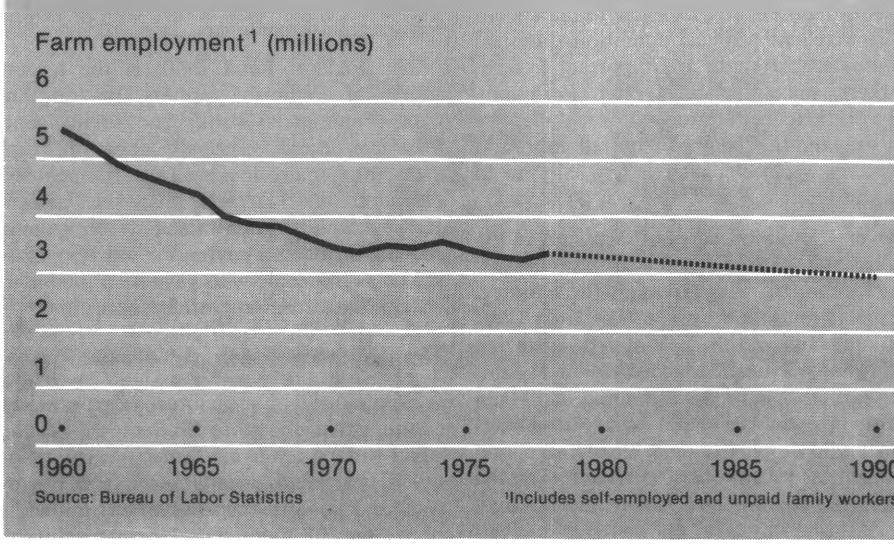
Beginning farmers who wish to grow crops such as grain crops or cotton, which often are profitably produced on farms of 1,000 acres or larger, will find extremely limited opportunities, since farms of this size rarely are available for purchase, and those that are cost a great deal. Beginning farmers should find more opportunities in specialty farming that requires less land and in which they have some expertise. For example, a successful family dairy farm may require only 100-160 acres of pasture and cropland. Specialty crops, such as tomatoes, strawberries, or watermelons, may be profitably grown on even smaller farms using intensive farming methods.

Opportunities for beginning farmers may be best in rural areas in the eastern and southern regions where there are many small farms. However, many farms on the fringes of metropolitan areas in these regions are being lost each year to suburbanization, and the price of this farmland should continue to increase.

Employment of farm laborers will decline as the number of farms declines and as machinery replaces much of the work that laborers now do. For example, an improved hybrid tomato has been developed that has a hard skin and can be machine harvested without damage. Now one machine can do the harvesting work that formerly required many hand laborers.

As the cost of farming increases, fewer individuals will be able to afford the initial investment needed to get started in farming, and the number of large corporate and partnership farms that employ more workers per farm will increase. Since these types of farms usually are operated by farm managers, employment of farm managers is expected to increase about as fast as the average for all

Although farm output has increased significantly since 1960, employment has dropped by two-fifths and is expected to continue to decline



occupations through the 1980's, and beginning farmers may find opportunities in this field.

Earnings

Earnings of farm operators vary greatly from year to year and by type and size of farm. Prices of many farm products fluctuate greatly depending on weather conditions which determine the amount and quality of products that are produced. A farm that shows a large profit in one year may show a loss in the following year.

Farm laborers are generally among the lowest paid workers; in 1978, average hourly earnings of all hired farm workers were only $3.07. In comparison, average hourly earnings of all production workers in private nonagricultural industries were $5.69 in the same year. Average wage rates for hired farm workers ranged from $2.84 an hour for field and livestock workers to $4.91 an hour for farm labor supervisors. In general, workers paid on a piece-rate basis earned more than those who received a straight hourly wage. In addition to their wages, some hired farm workers receive room and board allowances; however, almost no farm workers receive paid vacations, sick leave, or health benefits.

Many farm laborers, especially those in California, are represented by the United Farmworkers Union (UFW); others are represented by the International Brotherhood of Teamsters, Chauffeurs, Warehousemen, and Helpers. Many farmers are members of local and regional cooperatives that enable them to reduce the cost of their supplies and to market their products.

Agricultural Service Occupations

Agricultural services offer careers in hundreds of occupations, many requiring specialized skills or the ability to operate farm equipment. In 1978, approximately 250,000 people provided crop and animal services to farmers and farm cooperatives. Most worked for small companies or were self-employed. Although about half of these people were employed as laborers, many others were professionals, such as veterinarians or agricultural scientists. Others worked as managers, agricultural technicians, writers, mechanics, machine operators, clerks, and secretaries.

Many occupations in agricultural services are well suited to individuals who enjoy working with animals. These occupations vary greatly in skill requirements, from professions requiring college training to jobs that may be learned in a few days or by merely growing up on a farm and observing the tasks being performed.

Veterinarians (D.O.T. 073.101-010, 014) provide health care services to livestock and small pets. They inspect livestock at public stockyards and at points of entry into the United States to keep diseased animals out of the country and prevent the spread of disease. They also administer tests for animal diseases, conduct programs for disease eradication, and carry out research to develop vaccines for disease control. (Veterinarians are discussed in more detail elsewhere in the *Handbook*.) *Animal breeders* (D.O.T. 410.-161-010) use their knowledge of genetics and ranch or dairy management to develop improved breeds of animals that will be more productive. They conduct tests on new breeds of livestock to determine growth rates for beef cattle and milk production for dairy cattle. Breeders also maintain records on offspring of new breeds with an animal breeding association or on their own. *Artificial-breeding technicians* (D.O.T. 418.384-014) and *artificial inseminators* (D.O.T. 418.384-010) collect semen from male livestock such as bulls and rams, and artificially impregnate cows and ewes. These workers may be employed by animal breeding associations or by *artificial breeding distributors* (D.O.T. 180.-167-010) who manage insemination distributorships.

Several occupations in livestock services may be learned easily. Cow testers employed by dairy herd improvement associations travel from farm to farm to test the milk from each cow in a herd for acidity and butterfat content and record the results. Cattle dehorners remove the horns from cattle to prevent injuries to other animals in the herd and often provide castrating and vaccinating services. Poultry hatcheries employ several types of animal caretakers to vaccinate poultry, place eggs on trays in incubators, and care for baby chicks being used in experimental tests.

In addition to workers who supply animal services, others provide custom crop services or other general crop services, often on a contract basis. Although most crop services are provided by self-employed individuals or small businesses with 10 or fewer employees, larger service businesses employ people with professional and technical skills, as well as laborers and machine operators. Professional managers are needed to direct the work of employees as well as manage the business. Also, professional farm managers, who are generally college trained, provide farm management services to absentee landowners and their tenants. They schedule the plowing, fertilizing, planting, cultivating, and harvesting of fields, and the marketing of crops and livestock. Often they work for businesses which specialize in supplying these services; however, some are self-employed.

Other occupations in this field require specialized equipment or technical skills which can be learned through technical training, on-the-job training, or training in another job. For example, *agricultural pilots* (D.O.T. 196.263-010) and their assistants mix agricultural chemicals and apply them while flying airplanes or helicopters over fields at low altitudes. They also seed an increasing number of fields from the air. Also, some airplane mechanics are employed to repair and maintain agricultural aircraft.

In contrast to those occupations that require professional or technical training, farm service laborers work in occupations that may be entered merely by having the necessary equipment or by being familiar with farm operations. For example, grain elevator operators who have grain drying equipment may provide grain drying and storage services, and agricultural chemical dealers may provide fertilizer hauling and spreading and crop dusting services. Sometimes farmers who own special equipment supplement their incomes by providing services such as corn shelling, hay baling, and threshing to farmers in their area. Employees of seasonal service businesses often must work long hours and 6 or 7 days a week during the busy season.

Farm labor contractors and crew leaders also require no special training. However, they must establish contacts with farmers and farm managers to whom they supply farm laborers, especially harvest laborers, on a contract basis at specified times of the year. (Farm laborers employed by contractors and crew leaders receive better social security coverage by having only one employer.)

Sources of Additional Information

The most significant sources of information and guidance available to farmers are the services provided by the land-grant colleges and universities and the U.S. Department of Agriculture, Washington, D.C. 20250. These services include research, publication, teaching, and extension work. The county agricultural agent is often the best contact for a young person seeking advice and assistance in farming. The Farmers' Home Administration system of supervised credit is one example of credit facilities combined with a form of extension teaching. Organized groups, such as the Future Farmers of America and the 4-H Clubs, also furnish valuable training.

For information about opportunities in off-farm activities, contact individual colleges of agriculture or the U.S. Department of Agriculture.

Jobs in Agribusiness

Agribusiness occupations, broadly speaking, are those in off-farm settings that demand agricultural knowledge or skills. Some can be learned in a few days by persons who have lived or worked in rural areas or on farms. Others require training in technical schools, junior colleges, colleges, and universities from a few months duration to as long as several years. Although all industries offer some agribusiness jobs, they tend to be concentrated in the manufacturing, trade, agricultural services, and government sectors.

Since agribusiness occupations are so varied and numerous, this section deals only with selected jobs in the field—those that best represent the different types of work available. See the "Sources of Additional Information" portion of this statement for a guide to other materials on specific agribusiness jobs.

Professional and Technical Occupations in Agribusiness. One of the oldest areas of professional work in agribusiness involves collecting, compiling, and analyzing data. Workers in these jobs have titles that reflect the particular setting in which they are employed; most are agricultural accountants, marketing specialists, and agricultural economists or statisticians.

Agricultural accountants prepare and analyze financial reports that managers use to make important decisions. They may specialize in tax matters, such as preparing income tax forms and advising about tax advantages and disadvantages of business decisions. Accountants employed by hardware and farm supply retail businesses, such as dairy equipment stores and farm machinery stores, often need a knowledge of agriculture.

Agricultural marketing specialists survey wholesalers, retailers, and consumers; analyze data on products and sales; and prepare sales forecasts that businesses use to make decisions relating to product design and advertising. The results of their research are used by food processing companies to create food products that consumers will buy, and by agricultural suppliers to develop products for agribusiness and industrial firms. Marketing specialists also work for commodity brokerage firms, farm organizations, cooperative marketing and purchasing organizations, and research divisions of the Federal Government.

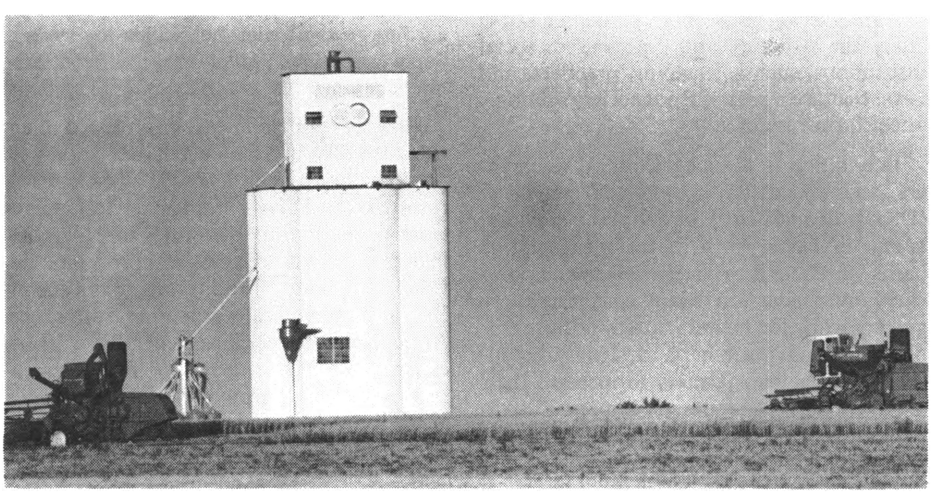
Agricultural economists (D.O.T. 050.067-010) deal with problems related to production, financing, pricing, and marketing of farm products. They provide information to policymakers, agribusinesses, farmers, and other sectors of the agriculture industry. Many work for the U.S. Department of Agriculture, developing cost-benefit analyses for evaluating farm programs at the national, State, and local levels. As part of their analyses, economists study the effects of mechanization and technological advances, for example, on the supply of and demand for farm products and the resulting impact on costs and prices. Others work for farm lending institutions, such as rural banks, the Farmers Home Administration, the Federal Land Bank, and insurance companies that make loans to farmers, determining the feasibility of loan programs and individual loans. Many agricultural economists also work for businesses that manufacture products and provide services for farmers, such as farm equipment. Still others work for agribusiness firms that market agricultural products at both retail and wholesale levels. Agricultural economists who have advanced degrees may teach at colleges and universities. There also are opportunities for agricultural economists in the Foreign Service, conducting research to improve the productivity of agriculture abroad.

A more recent, but expanding, field in agriculture is agricultural communications. Persons employed in this area perform the vital job of keeping farmers, consumers, and others concerned with the agriculture industry abreast of current developments in farm technology, research, and consumer products. Crop reporters and market news reporters are employed by the U.S. Department of Agriculture in field offices throughout the United States. Crop reporters gather information on crop production throughout the growing season. Market news reporters collect information on the movement of produce from farm to market.

Other agricultural journalists, such as reporters and editors, collect farm news and data for publication in farm journals, magazines, bulletins, and for broadcast. Some may have job titles, such as livestock editor, that reflect their area of special knowledge. Agricultural journalists also are employed as farm directors for radio and television broadcast stations in farming areas to report on prices, sales, crop conditions, and other agricultural information of importance to farm residents. Still others are employed in communications departments of agribusiness firms to develop advertisements and public relations bulletins.

Agricultural education is an important and growing area of employment of professional workers in the field of agriculture. Because of the constant changes in production processes and technological innovations in farming, teachers are a vital link between agricultural researchers and future farmers. *School teachers* (D.O.T. 091.227-010) in vocational agriculture instruct secondary school and adult education classes in farm management, agricultural production, agricultural supplies and services, operation and repair of farm equipment and structures, inspection and processing of farm equipment and structures, processing of farm products, and ornamental horticulture. An increasing number of 2-year programs that require trained educators are taught at junior colleges. Colleges and universities employ many agricultural professors to teach as well as to do research and publish their findings.

Cooperative extension service workers (D.O.T. 096.127-014) also do educational work in fields such as agricultural production and home economics and may conduct agri-



The average size of farms and the price of farmland have both increased greatly in recent years.

cultural educational programs through youth groups such as the 4-H Clubs. This occupation is discussed in detail elsewhere in the *Handbook*.

Another very important area of agriculture involves scientists who conduct research vital to the development of more productive plants and animals and better food products for consumers. Although agricultural researchers are employed in almost all sectors of the economy, the largest concentrations are in government agencies. The U.S. Department of Agriculture employs researchers in various parts of the country, including Washington, D.C.; the Agricultural Research Center at Beltsville, Md.; and at State land grant colleges. State agricultural experiment stations employ researchers, as do other government agencies such as the Food and Drug Administration. Still other agricultural scientists do research at private colleges or for agribusiness firms, such as food processors, fertilizer and agricultural chemical manufacturers, and manufacturers of feed, seed, and farm equipment.

The following list of occupations is not complete, but is a representative sample of agricultural researchers. Many of these occupations are discussed in more detail elsewhere in the *Handbook* (see index).

Agronomists (D.O.T. 040.061-010) conduct experiments in field crop problems and develop new methods of growing crops to make farming more efficient, obtain higher yields, and improve quality. They study methods of planting, cultivating, and harvesting field crops such as cereals, grains, legumes, grasses, cotton, and tobacco. They also study the effect of various climates on crop production.

Plant pathologists (D.O.T. 041.061-086) study the causes of plant diseases to develop methods to control noxious weeds, insects and plant diseases.

Plant physiologists (D.O.T. 041.061-078) study the structure of plants and factors which affect their growth, such as respiration, metabolism, and reproduction. They also are concerned with methods of improving the storage life of fruits and vegetables.

Geneticists (D.O.T. 041.061-050) try to develop strains, varieties, breeds, and hybrids of plants and animals that are better suited than those presently available for the production of food and fiber.

Microbiologists (D.O.T. 041.061-058) study bacteria and other micro-organisms to understand better their relation to human, plant, and animal health, and to learn how these microorganisms function in the production of vitamins, antibiotics, amino acids, alcohols, and sugars.

Animal physiologists (D.O.T. 041.061-078) study the functions of various parts of the body of livestock.

Animal scientists (D.O.T. 040.061-014) are concerned with production and management of farm animals. They conduct research in the selection, breeding, feeding, and marketing of farm animals and develop improved methods of housing, sanitation, and parasite and disease control. Some are called animal nutritionists and specialize in finding feed requirements that will maximize production and in developing new livestock and poultry feeds.

Entomologists (D.O.T. 041.061-046) study beneficial and harmful insects. They identify the populations and distributions of insects that injure agricultural products during growth, shipping, storage, processing, and distribution. Their research is directed toward finding ways to control harmful insects and manage beneficial ones.

Human nutritionists (D.O.T. 096.121-014) study the means by which the body utilizes foods and nutrients, and their relation to health and disease. They also study social, economic, and cultural aspects of food to determine how the diets of people may be improved.

Seed analysts (D.O.T. 040.361-014) conduct tests on samples of seeds to determine their rate of germination, purity, and noxious-weed content.

Agricultural chemists (D.O.T. 022.061-010) conduct research to improve crop yield and promote soil conservation. They develop chemical compounds for use in controlling insects, weeds, fungi, and rodents. They also perform experiments to determine proper usage of fertilizers and investigate the problems of nitrogen fixation in soils.

Food chemists (D.O.T. 022.061-014) such as dairy product chemists and cereal chemists, develop new foods, food preservatives, and similar products. They study how various methods of preserving foods affect nutrient content and taste and test food samples to ensure that they meet government standards for quality and purity.

Soil scientists (D.O.T. 040.061-058) study the physical, chemical, and biological characteristics and behavior of soils and classify them according to a national system. They determine the ability of various soils to produce certain crops.

Rural sociologists (D.O.T. 054.067-014) study the structure and functions of social institutions, such as customs, practices, and laws, that are a part of rural society and thus affect farm residents.

In addition to these agricultural researchers and scientists, *agricultural engineers* (D.O.T 013.061-010) develop the physical layout of farms, such as the placement of barns, sheds, and irrigation systems, used to carry out production. Many agricultural engineers work for manufacturers of farm implements and machinery, designing equipment that enables farmers to increase their production. Others design improved farm structures, such as dairy barns or irrigation systems, and some work for electric utility companies developing efficient methods of utilizing electric power on farms and in food processing. Still others are employed by the Federal Government in soil and water management. Agricultural engineers with advanced degrees may also teach at colleges and universities.

In addition to the many agriculture-related professional occupations for which a college degree is necessary, there are a number of occupations of a technical nature that do not always require college training. Often, practical work experience is sufficient to qualify a person for a job in these fields, although college training may be required of persons without work experience.

One important group of these occupations is made up of inspectors and graders of agricultural products. Meat and poultry inspectors, for example, are employed by the U.S. Department of Agriculture and by many of the State departments of agriculture. They work under the supervision of veterinarians and inspect meat and poultry slaughtering, processing, and packaging operations to insure that proper sanitation is maintained throughout all phases of processing. They also inspect meat additives and make sure that processed meats are labeled correctly.

Agricultural commodity graders (D.O.T. 168.267-042) inspect samples of agricultural products to determine their quality and grade, and then issue grading certificates. They generally specialize in the inspection and grading of one particular commodity, such as eggs, vegetables, fresh fruits, dairy products, or grain. Grain inspectors inspect large quantities of grain for the presence of parasites, spoilage, or impurities, such as weeds. They also inspect ships for sanitation prior to loading for transport. Most grain inspectors are employed by Federal and State agencies; however, some also are employed by large buyers of grain, such as breweries.

Cotton classers (D.O.T. 429.387-010) use the standards for various grades of cotton established by the U.S. Department of Agriculture to classify cotton samples on the basis of color, fiber length, and presence of impurities. *Tobacco graders* (D.O.T. 409.687-010) examine the size, color, and texture of tobacco at auctions and certify the quality according to the Federal classification system. Some are employed at tobacco processing plants and use less complex grading systems.

Persons with technical skills related to agriculture also are employed in a variety of positions to assist agricultural and biological research scientists. Biolgical technicians work primarily in laboratories in which biological scientists are engaged in research, development, control, and testing of the chemical and biological properties of crops. Agricultural technicians generally work in experimental areas, such as fields, greenhouses, barns, or growth houses. They assist agricultural scientists in experiments conducted under actual growing conditions.

Research technicians may perform a variety of duties. For example, they generally are responsible for preparing human subjects, animals, insects, plants, soils, and food samples for tests. Other responsibilities include setting up and adjusting instruments and equipment, conducting experiments, and tabulating and recording data. Additional duties, such as caring for laboratory animals, may be part of the job in some areas of specialization; technicians employed at Federal research facilities may specialize in microbiology, biochemistry, laboratory animals, animal science, plants, insects, or soils.

Other Jobs in Agribusiness. In addition to the many professional and technical jobs that require a knowledge of and training in agriculture, many industries that supply raw materials to farmers and process and distribute agricultural products employ persons in occupations that require some agriculture-related training and others in jobs that are nonagricultural. Together with agricultural production, these industries make up an efficient food production and distribution system. This section will briefly discuss some of the career opportunities available in this system, in both rural and urban areas.

Many farmers are members of local and regional cooperatives.By joining cooperatives, farmers can buy many of their supplies, such as seeds, feeds, and fertilizers, as well as food and household goods, in large volumes and thus at lower wholesale prices. In addition, cooperatives provide marketing services so that individual farmers do not need to locate buyers for their products. Some also operate local stores. Local branches of cooperatives are found in nearly every rural community and in many small and medium-sized cities, although regional offices of large cooperatives often are located in large metropolitan areas.

Cooperatives employ persons with many different skills. Stock clerks and feedstore managers are employed in local stores. Cooperatives also employ college-trained business managers to operate the cooperatives. Regional cooperatives employ sales representatives, wholesalers, and brokers to contact buyers for large grocery chains, food processing firms, and agricultural exporters to arrange contracts to sell agricultural products. They also employ purchasing agents and buyers to arrange volume purchases of seed, feed, fertilizers, and other supplies.

Farm equipment dealerships in agricultural areas employ persons in farm-related and nonfarm occupations. *Farm equipment sales workers* (D.O.T. 272.357-014) must know the needs of farmers in their area and stock the latest equipment and machinery to meet those needs. Dealers and sales workers demonstrate and sell equipment, and farm equipment mechanics service and repair the machinery that is sold. Dealerships often have parts departments and thus employ parts sales workers. In addition, large dealerships often employ secretarial and other clerical employees.

Many farmers are members of local and regional cooperatives.

The agricultural chemical industry, including manufacturing, distribution, and application, employs professional and technical workers with agricultural training. Chemists, agronomists, soil scientists, and other professional workers, along with research technicians, conduct research to develop new fertilizers and pesticides as well as to improve other chemicals for better agricultural uses. Many agricultural chemicals are sold by cooperatives; however, retail dealerships also are found in many small towns in farming areas. Retail dealerships employ store managers, stock clerks, sales workers, and clerical employees; large dealerships often employ agricultural pilots and their assistants to apply chemicals.

These are just some of the many businesses that employ persons with agricultural training and also offer opportunities in nonagricultural occupations to people in farming areas. Over the past quarter century, the agricultural supply and distribution system has become more diverse and now employs persons in most major industries, including the transportation, communications, and manufacturing industries.

Sources of Additional Information

Many of the occupations discussed in this section are described in more detail elsewhere in the *Handbook*.

Opportunities in Research. Additional information on research opportunities at land-grant colleges may be obtained from the dean of agriculture at the State land-grant college. Information on employment in the U.S. Department of Agriculture is available from the USDA recruitment representatives at land-grant colleges and from the Office of Personnel, U.S. Department of Agriculture, Washington, D.C. 20250.

The following publication will be valuable:

Careers in Agriculture and Natural Resources—Agriculture, American Association of Land-Grant Colleges and State Universities, Washington, D.C. Copies can be obtained free from State agricultural colleges.

Opportunities in Agricultural Finance. For information about employment opportunities in agricultural finance, contact:

Farm Credit Administration, Washington, D.C. 20578.

Farmers Home Administration, U.S. Department of Agriculture, Washington, D.C. 20250.

Agricultural Director, American Bankers Association, 1120 Connecticut Ave. NW., Washington, D.C. 20036.

Opportunities with Cooperatives. Cooperatives in the individual communities are a good source of information on jobs either in their own organizations or in other cooperatives. Most States have a State council or association of cooperatives that can provide information on cooperative locations and some job information.

Opportunities as Vocational Agriculture Teachers. Prospective teachers should contact the head of the department of agricultural education at the land-grant college or the State supervisor of agricultural education at the State department of public instruction in their respective States.

Also, many books discuss job opportunities in agribusiness in much greater detail and may be available in your local high school and public libraries.

MINING AND PETROLEUM

The mining and petroleum industry provides most of the basic raw materials and energy sources for industry and consumer use. Metal mines provide iron, copper, gold, and other ores. Quarrying and other nonmetallic mining yield many of the basic materials such as limestone and gravel that are used to build schools, offices, homes, and highways. Nearly all of the Nation's energy for industrial and home use comes from oil, gas, and coal.

The mining and petroleum industry employed about 837,000 workers in 1978. As shown in the accompanying chart, almost half of these worked in the exploration for and removal of crude petroleum and natural gas. Coal mining accounted for over one-fourth of the industry's workers. The remaining workers were in metal mining and quarrying and nonmetallic mineral mining.

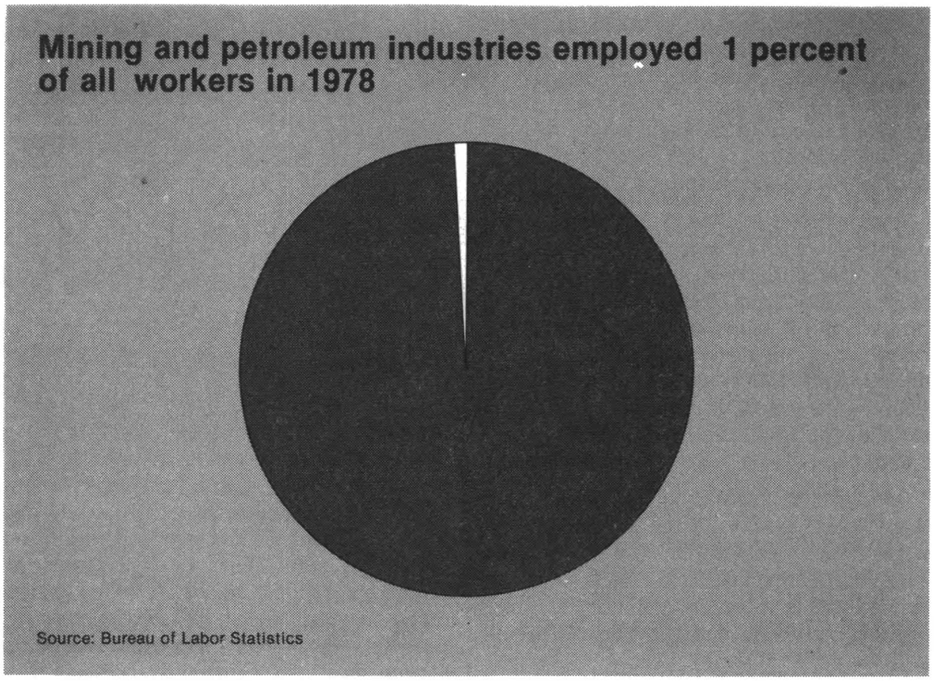
Blue-collar workers (craft workers and operatives) account for nearly seven-tenths of the industry's employment. Operatives, the largest occupational group in the industry, include oil well drillers, mining machinery operators, and truck and tractor drivers. Craft workers, the second largest occupational group, include both mechanics and repairers who maintain mining and oil drilling equipment and operators of power shovels and bulldozers in open pit mining. Large numbers of pumpers, gaugers, and engine workers hold jobs in the production and transportation of petroleum and natural gas. Supervisors of blue-collar workers also are an important part of the craft worker group.

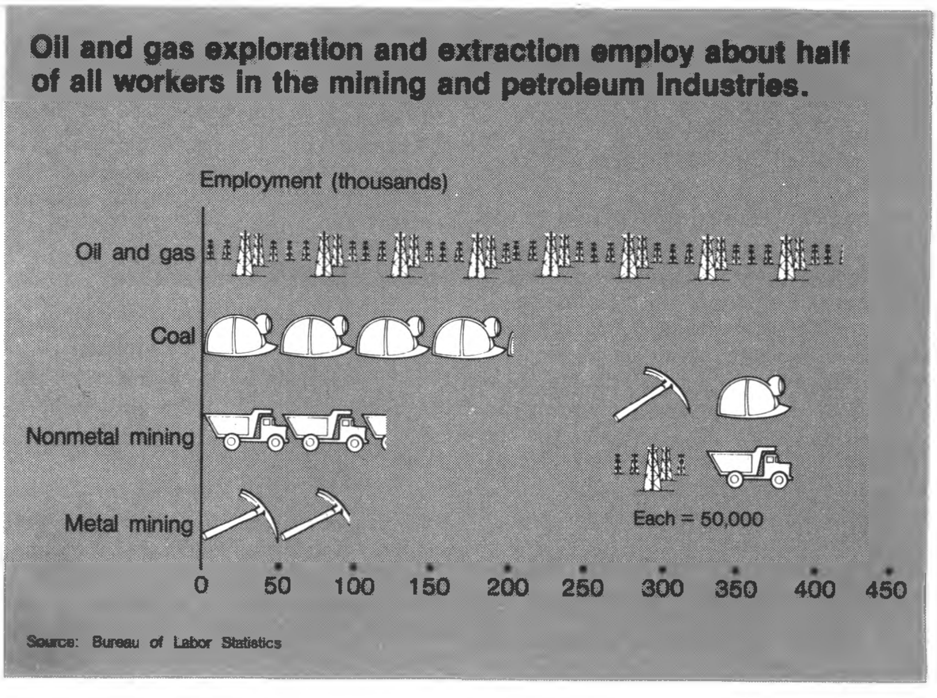
The industry's white-collar employees are divided among three occupational groups—professional and technical, clerical, and managerial workers. Taken together, these groups constitute the remaining three-tenths of the industry's employment.

Professional and technical workers are concentrated largely in petroleum and gas extraction. Most are engineers, geologists, or technicians engaged in exploration and research. Two out of three clerical employees work in petroleum and gas extraction. Most are secretaries, office machine operators, and typists.

Employment in the mining and petroleum industry is expected to increase faster than the average for all industries through the 1980's, but different growth patterns are likely within the industry. Employment in coal mining and in petroleum and natural gas extraction should increase rapidly as the Nation strives to become self-sufficient in energy sources. Employment in metal mining also is expected to grow. Employment in quarrying and nonmetallic mining, on the other hand, is expected to decline as laborsaving equipment leads to higher output with fewer workers.

The chapters that follow provide information on employment opportunities in the petroleum and natural gas extraction industry and the coal mining industry. More detailed information about many of the major occupations in the mining and petroleum industry also appears elsewhere in the *Handbook*.





Coal Mining

Nature of the Industry

Coal has played a vital role in the development of this Nation. Originally used only as a source of heat, coal grew rapidly as a source of power with the coming of the steam engine. By the beginning of the 20th century, coal had become vital, not only for heating homes and powering locomotives, but also as a source of energy for producing electric power and a necessary ingredient for making steel. Although coal has been largely replaced by other fuels for heating and transportation, it is used in products ranging from lipstick to chemicals, and most importantly as a source of electric power.

Coal usually is divided into two classes, bituminous and anthracite. Bituminous, or "soft" coal, is the most widely used and the most plentiful, and accounts for most coal production. Production of anthracite, or "hard" coal, on the other hand, is steadily declining due to dwindling reserves and difficulty of recovery. Other forms of coal, such as lignite and peat, are used in only limited amounts.

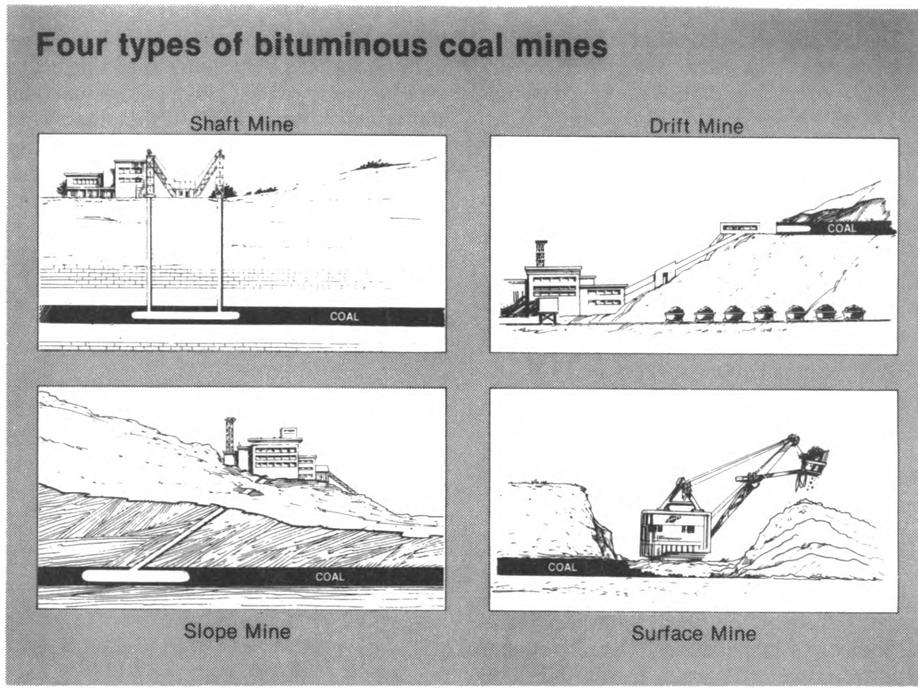
Most of the Nation's coal is mined in the Appalachian area that extends from Pennsylvania through Eastern Ohio, West Virginia, Virginia, Kentucky, Tennessee, and Alabama. Large amounts of coal also are mined in Indiana, Illinois, and in the Rocky Mountain States.

Types of Mines

Coal is either mined underground or extracted from the earth's surface. Underground mines employ most of the workers in the industry but produce less than half of all bituminous coal. Surface mining, a more productive type than underground mining, employs fewer miners to produce more coal.

The type of mine a company decides to open depends on the geological formation and the depth and location of the coal seam. Underground mines are used to reach coal that lies deep below the surface. A series of entries must be constructed so that air, miners, and equipment can reach the seam and coal can be carried out. Depending on the depth of the coal seam, the entry may be vertical (shaft mine), horizontal (drift mine), or at an angle (slope mine). (See chart.) Shaft mines are used to reach coal lying far below the surface. Drift and slope mines are usually not as far underground as shaft mines.

After the coal seam has been reached, nearly all underground mines are constructed the same way. Miners make a network of interconnecting tunnels so that the mine resembles a maze with passageways going off in predetermined directions, some-



times extending over many miles. As coal is removed, the tunnelsbecome longer and longer. Throughout this process, a significant amount of coal (pillars) is left between the tunnels to support the roof. When miners reach the end of the company's property, they start working back toward the entrance, mining most of the remaining coal as they retreat. This is called retreat mining.

If the coal seam is not too far below ground, surface mining is practiced. Two types of surface mines are strip and auger. At strip mines, huge machines remove the earth and expose the coal. Auger mining is used to remove coal from extremely steep hillsides. A large auger (drill) bores into the hill and pulls the coal out.

Occupations in the Industry

In 1978 nearly 200,000 people worked in the bituminous coal and lignite mining industry. An additional 3,000 people were employed by companies producing anthracite coal. About 85 percent of all persons in these industries were production workers who mined and processed coal.

Mining jobs range from apprentice miners who usually act as helpers in several occupations to highly skilled and experienced miners who operate equipment worth several hundred thousand dollars. Jobs available in a mine vary by type and method of mining.

Mining Occupations. Two basic methods of mining underground coal, conventional and continuous, account for 95 percent of total underground production. A third method, longwall, makes up most of the remaining production and is increasing in importance. The hand loading method is rarely used.

Conventional mining is the oldest method and requires the most workers and procedures. This type of mining, however, is rapidly being phased out. In conventional mining, the *cutting machine operator* (D.O.T. 930.683-014) uses a huge electric chain saw, with a cutter ranging in length from 6 to 15 feet, to cut a strip, or kerf, underneath the coal seam to control the direction of the coal as it falls after it has been blasted. Next the *drilling machine operator* (D.O.T. 930.482-010) drills holes into the coal where the *shot firer* (D.O.T. 931.261-010) places explosives. This work can be dangerous and must be timed very carefully. The shot firer, for example, must allow enough time for miners to leave the area before the blast.

After the blast, the *loading machine operator* (D.O.T. 932.683-014) scoops up and dumps the coal into small rubber-tired cars, which are run by the *shuttle car operator* (D.O.T. 932.683-022). Depending on the type of haulage system used, these cars take the coal to a conveyor belt for shipment to the main entry or to the surface, or onto mine cars that are transported on tracks to the surface.

The continuous mining method eliminates the drilling and blasting operations of conventional mining. The *continuous-mining machine operator* (D.O.T. 930.683-010) sits or lies in a cab and operates levers to cut or

Miner fastens a brattic cloth, which helps control ventilation underground.

rip out the coal and load it directly onto a conveyor or shuttle cars.

Longwall mining is basically an extension of continuous mining. In this method, the *longwall machine operator* (D.O.T. 930.665-010) runs a huge machine with drums which shear and automatically load coal onto a conveyor. At the same time hydraulic jacks reinforce the roof. As the coal is cut and the face progresses, the jacks are hydraulically winched forward and the roof is allowed to cave behind.

Many other workers are required to run a safe and efficient underground mine. Before miners are allowed underground, the *mine inspector* (D.O.T. 168.267-074) checks the work area for loose roof, dangerous gases, inadequate ventilation, and other hazards. If safety standards are not met, the mine inspector will not allow the mine to open until the dangers are corrected. The *rock-dust machine operator* (D.O.T. 939.687-026) sprays limestone on the mine walls and ground to hold down dust since coal dust is extremely explosive and interferes with breathing.

The *roof bolter* (D.O.T. 930.683-026) operates a machine to install roof support bolts. This operation is extremely important because of the ever-present threat of roof cave-ins, the biggest cause of mine injuries. The *stopping builder* (D.O.T. 869.684-058) constructs doors, walls, or partitions in the passageways to force air through the tunnels to working areas. The supervisor, called a *shift boss* (D.O.T. 939.137-018), is in charge of all operations at the work site where coal is actually mined.

Teamwork is very important in all types of underground mining. Miners are dependent upon each other when accidents occur for first aid and, if necessary, assistance in leaving the mine. A simple slip around a continuous mining machine, for example, could result in severed limbs.

Most surface miners operate the large machines that either remove the earth above the coal or dig and load the coal. The number of workers required to operate a surface mine depends on the types of machines used and the amount of overburden above the coal seam. The more overburden present, the greater the number of workers usually required.

In many strip mines, the overburden is first drilled and blasted. Then the *overburden stripping operator* or *dragline operator* (D.O.T. 850.683-018) scoops the earth away to expose the coal. Sometimes, a dragline is so huge and complicated to run that a team of persons is required to operate the levers.

Once the overburden is removed, the *coal loading machine operator* (D.O.T. 932.683-014) rips coal from the seam and loads the coal into trucks to be driven to the preparation plant. *Tractor operators* (D.O.T. 929.-683-014) drive bulldozers to move materials or pull out imbedded boulders or other objects. Helpers assist in operating these machines.

Other workers, not directly involved in the mining processes, work in and around coal mines. For example, skilled repairers are needed to fix the wide variety of mining machinery, and electricians are needed to check and install electrical wiring. Carpenters construct and maintain benches, bins, and stoppings. Many mechanics and electricians assemble, maintain, and repair the machines used in mines. While these workers generally need the same skills as their counterparts in other industries, they require additional training to work under the unusual conditions in the mines. Mechanics, for example, may have to repair machines while on their knees with only their headlamp to illuminate the working area. Truckdrivers haul coal to railroad sidings or preparation plants and supplies to the mine.

Preparation Plant Occupations. Rocks and other impurities must be removed before coal is crushed, sized, or blended to meet the buyer's wishes. These processes take place at the preparation plant.

Many preparation plants are located next to the mine. The plant's size and number of employees vary by the amount of coal processed and degree of mechanization. Some plants have all controls centrally located and require few workers to oversee all washing, separating, and crushing operations. Among these workers is the *preparation plant supervisor* (D.O.T. 549.137-014) who oversees all operations. Plants that are not as mechanized, however, need workers at each step, such as the *wash box operator* (D.O.T. 541.-382-010) and *shaker tender* (D.O.T. 934.685-018). Wash box attendants operate equipment that sizes and separates impurities from coal. The shaker tender operates a device that further cleans and sizes coal with a vibrating screen. Most jobs in the preparation plant are very repetitive.

Administrative, Professional, Clerical, and Technical Occupations. A wide range of administrative, professional, technical, and clerical personnel work in the coal industry. At the top of the administrative group are executives who make all policy decisions. A staff of specialists, such as accountants, attorneys, and market researchers, supply legal, technical, and market information for decisionmaking. Clerical and secretarial workers assist the administrative staff.

A variety of engineering and scientific personnel work in the coal industry. *Mining engineers* (D.O.T. 010.061-014) examine coal seams for depth and purity, determine the type of mine to be built, and supervise the construction and maintenance of mines. *Mechanical engineers* (D.O.T. 007.061-014) oversee the installation of equipment, such as centralized heat and water systems, while *safety engineers* (D.O.T. 010.061-026) are in charge of all health and safety programs.

The scientific staff conducts research on means to make coal a cleaner, more efficient, and more easily transportable energy source. For instance, many physicists, chemists, and geologists are studying feasible alternatives for converting coal into a gas or liquid.

Other technical personnel are required to assist scientists and engineers. For example, *surveyors* (D.O.T. 018.167-050) help map out the mining areas. Engineering and science technicians may assist in research efforts.

Working Conditions

Miners have unusual and harsh working conditions. Underground mines are damp, dark, noisy, and cold. At times, several inches of water may be on tunnel floors. Although mines have electric lights, many areas are illuminated only by the lights on the miners' caps. Workers in mines with very low roofs have to work on their hands and knees, back, or stomach in cramped areas.

Though safety conditions have improved considerably, miners must constantly be on guard for hazards. There also is the risk of developing pneumoconiosis (black lung) from coal dust and silicosis from the rock dust generated by the drilling in the mines. Surface mines and preparation plants are usually less hazardous than underground mines.

Training, Other Qualifications, and Advancement

Most miners start out as helpers to experienced workers and learn skills on the job. Formal training, however, is becoming more important due to the growing use of technologically advanced machinery and mining methods. As a result, most companies supplement on-the-job training with formal programs and actively seek recent graduates of high school vocational programs in mining, or of junior college or technical school programs in mine technology.

Mine technology programs are available in a few colleges throughout the country, mostly in coal mining areas. The programs lead either to a certificate in mine technology after 1 year or an associate degree after 2 years. Courses cover areas such as mine ventilation, roof bolting, and machinery repairs. Prospective students do not need a high school education but must pass an entrance examination in basic math and English.

The type of formal training administered by coal companies varies. For example, some companies have training mines where skills are taught; others give classroom instruction for a few weeks before allowing workers into a mine. All miners working at mines covered by the United Mine Workers of America contract, however, must receive both preservice and annual retraining sessions from their employers. These programs include subjects such as machine operation, first aid, and health and safety regulations. The U.S. Mine Safety and Health Administration also conducts classes on health, safety, and mining methods, and mine machinery manufacturers offer courses in machine operation and maintenance.

As miners gain more experience, they can move to higher paying jobs. When a vacancy occurs, an announcement is posted and all workers qualified may bid for the job. A mining machine operator's helper, for example, may become an operator. The position is filled on the basis of seniority and ability. A small number of miners advance to supervisory positions and, in some cases, to administrative jobs in the office.

Hydraulic jacks support the roof as the coal is sheared from the face of a seam.

Miners must be at least 18 years old and in good physical condition. A high school diploma is not required. All miners should be able to work in close areas and have quick reflexes in emergencies.

Requirements for scientific and engineering, administrative, and clerical jobs are similar to those in other industries. College graduates are preferred for jobs in advertising, personnel, accounting, and sales. For clerical and secretarial jobs, employers usually hire high school graduates who have training in stenography and typing.

Employment Outlook

Coal is expected to play an increasingly important role as a basic energy source. Rising demand for electric power coupled with greater emphasis on developing domestic energy supplies should result in accelerated coal production. The extent of growth in production, however, is uncertain. Oil, natural gas, and nuclear energy also are used to generate electricity, and the demand for coal will be determined, to some extent, by the price and availability of these energy sources. Growth in production also depends on how quickly economical methods of coal gasification and liquefication are developed. Environmental standards relating to strip mining and the use of high sulfur content coal, which causes air pollution, may also affect coal output. More coal however, will be needed to make steel, chemicals, and other products.

Employment is expected to increase but the amount of growth will depend on the level of production, the types of mines opened, and the mining methods and machinery used. In addition to openings due to increased need for miners, several thousand openings will occur each year as experienced miners retire, die, or transfer to other fields of work.

Earnings

Production workers in coal mining had average hourly earnings of $9.53 in 1978. Workers in underground mines generally earned slightly more than those in surface mines or preparation plants. In comparison, production workers in manufacturing averaged $6.17 an hour.

Because underground miners spend time traveling from the mine entrance to their working areas, they have a slightly longer day than surface miners. Those in surface occupations work a 7 1/4-hour shift (36 1/2-hour week), while underground miners work an 8-hour day (40-hour week).

Union miners receive 10 holidays and 14 days of paid vacation each year. To assure a continuous supply of coal, however, miners generally must take their vacations during one of three separate regular vacation periods. As their length of service increases, they gain extra vacation days up to a maximum of 13 extra days after 18 years of continuous employment. Union workers also receive benefits from a welfare and retirement fund, and workers suffering from pneumoconiosis (black lung) receive Federal aid.

Sources of Additional Information

For details about job opportunities in mining, contact individual coal companies. General information on mining occupations is available from:

United Mine Workers of America, 900 15th St. NW., Washington, D.C. 20005.

National Coal Association, 1130 17th St. NW., Washington, D.C. 20036.

Mine Safety and Health Administration, 4015 Wilson Blvd., Arlington, Va. 22203.

Occupations in Petroleum and Natural Gas Production and Gas Processing

Nature and Location of the Industry

Petroleum is a natural fuel formed from the decay of plants and animals. Buried beneath the ground for millions of years under tremendous heat and pressure, this organic matter became petroleum, or what is usually called oil. Natural gas was formed by a similar process.

Oil and natural gas now furnish more than three-fourths of our energy needs. They fuel our factories and transportation systems, heat our homes and places of work, and are basic raw materials for many products such as plastics, chemicals, medicines, fertilizers, and synthetic fibers. In spite of efforts to decrease our Nation's dependence on oil as a principal source of energy, oil and natural gas will continue to supply the major portion of our energy needs for many years to come.

U.S. proved oil reserves have been on the decline in recent years, in spite of increased drilling activity, but most experts feel that there are large amounts of oil in this country that have not yet been discovered. Locating and extracting these reserves will make a significant contribution to the country's energy independence.

People with many different skills are needed to explore for oil and gas fields, drill new wells, improve existing wells, and process natural gas. In 1978, about 471,000 workers were employed in these activities. Firms that work on contract for oil companies employed many of these workers, and the major oil companies employed the rest. Occupations in oil refining are discussed in a separate chapter of the *Handbook*.

Since oil and gas are difficult to find, exploration and drilling are key activities in the petroleum industry. After scientific studies indicate the possible presence of oil, the company selects a well site and installs a tower-like steel rig to support the drilling equipment. A hole is drilled deep into the earth until oil or gas is found or the company decides to write the effort off as a loss. Although a few large oil companies do their own drilling, most is done by contractors. Hundreds of firms are engaged in the search for and production of oil and natural gas.

When oil or gas is discovered, pipes, valves, tanks, and other equipment are installed to control the flow of these raw materials from the well. There were more than 650,000 wells in this country in 1978, and many of the petroleum industry's 290,600 production workers were involved in operating and maintaining them.

Oil is transported to refineries by pipeline, ship, railroad, barge, or truck. Natural gas is ordinarily transported to gas processing plants by pipelines. Many refineries are thousands of miles from oilfields, but gas processing plants usually are near the fields so that natural gas liquids, water, sulfur compounds, and other impurities can be removed before the gas is piped to customers.

Although drilling for oil and gas is carried out in 32 States, most of the industry's workers are employed in just 10 States. Texas leads in the number of oilfield jobs, followed by Louisiana, Oklahoma, California, Wyoming, Kansas, New Mexico, Colorado, Ohio, and Illinois. In addition, thousands of Americans are employed by oil companies overseas—in the Middle East, Africa, Western Europe, South America, and the Far East.

Occupations in the Industry

Workers with a wide range of education, experience, and skills are needed to find oil and gas and to drill, operate, and maintain wells and process natural gas.

Exploration. Exploring for oil is the first step in petroleum production. Small crews of specialized workers search for geologic formations that are likely to contain oil. Exploration parties study the surface and subsurface of the earth in order to locate places where oil might be concentrated in underground rock formations. They seek clues to the presence of oil by examining types of rock formations on and under the earth's surface. Besides detailed ground surveys, aerial exploration and magnetic surveys also are used for a broad picture of the area.

Several methods are used to determine the nature and location of underground rock formations. A technique called seismic prospecting is widely used to map underground rock formations. In this technique, a large shock is set off at the earth's surface. This can be caused by explosives or, more commonly, by a "thumper," which is a heavy weight dropped on the ground. The time it takes for the sound waves to reach the rock formations and return to the surface is carefully measured to locate the depth and position of underground features. Subsurface evidence also is collected by boring and bringing up core samples of the rock, clay, and sand that form the layers of the earth. Similar techniques are used to explore offshore areas.

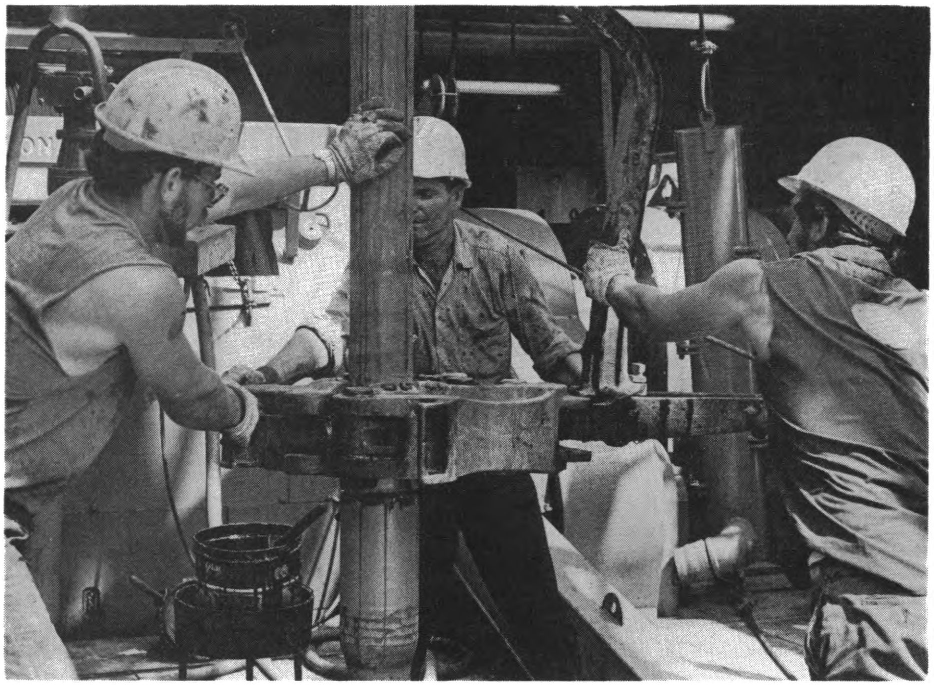
Exploration parties are led by a *petroleum geologist* (D.O.T. 024.061-022), who analyzes and interprets the information gathered by the party. In addition to the petroleum geologist, exploration parties may include other geology specialists. *Paleontologists* (D.O.T. 024.061-042) study fossil remains in the earth to locate oil-bearing layers of rock; *mineralogists* (D.O.T. 024.061-038) study physical and chemical properties of mineral and rock samples; *stratigraphers* (D.O.T. 024.061-054) determine the rock layers most likely to contain oil and natural gas; *photogeologists* (D.O.T. 024.061-018) examine and interpret aerial photographs of land surfaces; and *petrologists* (D.O.T. 024.061-046) investigate the history of the formation of the earth's crust. Often a geologist must have knowledge of some or all of these specialties since not all exploration parties include all these specialists. Exploration parties also include *drafters* (D.O.T. 010.281-014) and *surveyors* (D.O.T. 018.167-042), who assist in surveying and mapping operations.

Many geologists also work in district offices of oil companies or exploration firms where they prepare and study geological maps. They also study samples from test drilling to find any clues to oil.

A *geophysical prospector* (D.O.T. 024.061-026) usually leads a crew of *gravity prospecting observers* (D.O.T. 010.261-018) and *seismic prospecting observers* (D.O.T. 010.161-018), who operate and maintain electronic seismic equipment. Other workers whose activities are related to exploration are *scouts* (D.O.T. 010.267-010), who investigate the drilling, exploration, and leasing activities of other companies in order to identify promising areas to explore and lease, and *lease buyers* (D.O.T. 191.117-030), who make the necessary business arrangements with landowners or owners of mineral rights to obtain the right to use the land.

Drilling. Exploration methods are used to find places where the presence of oil is likely, but only drilling can prove the presence of oil. Overall planning and supervision of drilling usually are the responsibilities of the petroleum engineer.

Rotary drilling is the normal way of drilling a well. A revolving bit bores a hole in the ground by chipping and cutting rock. The bit is attached to a length of revolving pipe. As



Exploration and drilling are the key activities in the petroleum industry.

the bit cuts deeper into the earth, more pipe is added. Drilling pipe is hollow and runs the entire depth of the well. A stream of drilling mud is continuously pumped into the hollow pipe and comes out through holes in the drill bit. This mud is a mixture of clay, chemicals, and water. Its purpose is to cool the drill bit, plaster the walls of the hole to prevent cave-ins, carry crushed rock to the surface, and prevent blowouts by equalizing the pressure of an encountered formation. Drilling is continuous until the bit wears out. When a new bit is needed, all of the pipe must be pulled up out of the hole, a section at a time, a new bit placed on the end of the pipe, and the pipe returned to the hole. The *tool pusher* or *drilling superintendent* (D.O.T. 930.130-010) supervises one or more drilling rigs and supplies materials and equipment to rig crews.

A typical rotary drilling crew consists of four or five workers: Driller, derrick operator, engine operator, and one or two helpers. Because drilling rigs are operated 24 hours a day, 7 days a week, several crews are needed for each rig.

The *rotary driller* (D.O.T. 930.382-026) supervises the crew and operates machinery that controls drilling speed and pressure, and records operations. The *rotary-rig engine operator* (D.O.T. 950.382-022) is in charge of engines that provide the power for drilling and hoisting. The *derrick operator* (D.O.T. 930.683-018), who is second in charge, works on a small platform high on the rig to help run pipe in and out of the well hole, and operates the pumps that circulate mud through the pipe. *Rotary-driller helpers* (D.O.T. 930.684-026), also known as roughnecks, guide the lower end of the pipe to and from the well opening and connect and disconnect pipe joints and drill bits.

Roustabouts (D.O.T. 869.684-046) or general laborers, though not considered part of a drilling crew, do general oilfield maintenance and construction work, such as cleaning tanks and building roads.

Well Operation and Maintenance. When oil is found, the drill pipe and bit are pulled from the well, and metal pipe known as casing is lowered into the hole and cemented in place. The upper ends of the casing are fastened to a system of valves called a "Christmas tree." Pressure in the well forces crude oil and gas to the surface, through the Christmas tree, into gas- oil separations and storage tanks. If natural pressure is not great enough to force the oil to the surface, pumps are used.

Petroleum engineers (D.O.T. 010.061-018) generally plan and supervise well operation and maintenance. To prevent waste, they decide the rate of oil flow and anticipate performance of oil reservoirs by analyzing information such as pressure readings from the well. Computers are used for analytical work of this kind. Some engineers specialize in areas such as overcoming effects of corrosion on well casing, the selection and design of production equipment and processes, or the prevention of pollution. Some companies hire engineer aides to make tests, keep records, post maps, and otherwise assist engineers.

Oil pumpers (D.O.T. 914.382-010) and their helpers operate and maintain motors, pumps, and other surface equipment to force oil from wells. Their chief duty is to regulate the flow of oil according to a schedule set up by the petroleum engineer and production supervisor. Generally, a pumper operates a group of wells. *Switchers* work in fields where oil flows under natural pressure and does not require pumping. Pumpers open and close valves to regulate the oil flow from wells to tanks or into pipelines. *Gaugers* (D.O.T. 914.384-010) measure and record the flow and take samples to check quality. *Treaters* (D.O.T. 549.362-014) test the oil for water and sediment and remove these impurities by opening a drain at the tank's base or by using special chemical or electrical equipment. In some fields, pumping, switching, gauging, and treating operations are automatic.

Many skilled workers are employed in maintenance operations. Welders, pipefitters, electricians, and machinists repair and install pumps, gauges, piping, and other equipment.

Natural Gas Processing. Most gas processing workers are operators. The *gas treater* (D.O.T. 541.382-014) tends an automatically controlled treating unit which removes water and other impurities from natural gas. The *gas-pumping-station operator* (D.O.T. 953.-382-010) tends compressors that raise the pressure of the gas for transmission in the pipelines. The *gas-compressor operator* (D.O.T. 950.382-014) assists either of these two employees.

Many workers in the larger natural gas processing plants are employed in maintenance activities. These include instrument repairers, electricians, welders, and laborers.

In numerous smaller natural gas plants, workers combine skills, usually of operator and maintenance worker. Many small plants are so highly automated they are virtually unattended. They are checked at periodic intervals by maintenance workers or operators, or they are checked continuously by instruments that automatically report problems and shut down the plant if an emergency develops.

Other Oilfield Services. Companies that offer services on a contract basis provide another important source of employment. Among these employees are skilled workers such as *oil well cementers* (D.O.T. 939.462-010), who mix and pump cement into the space between the steel casing and the well walls to prevent cave-ins; *acidizers* (D.O.T. 939.462-010), who pump acid down the well and into the producing formation to increase the flow of oil; *perforator operators* (D.O.T. 931.382-010), who use subsurface "guns" to pierce holes in the casing to make openings for oil to flow into the well bore; *sample-taker operators* (D.O.T. 931.361-010), who take samples of soil and rock formations from wells to help geologists determine the presence of oil; and *well pullers* (D.O.T. 930.-382-030), who remove pipes, pumps, and other subsurface devices from wells for cleaning, repairing, or salvaging.

Offshore Operations. Most exploration, drilling, and producing activities are on land, but an increasing amount of this work is done offshore, particularly in the Gulf of Mexico off the coasts of Louisiana and Texas. Additional work is being done off the east and west coasts of the United States. Some wells have been drilled over 100 miles from shore and in water more than 1,000 feet deep.

These offshore operations require the same type of drilling crews as are employed on land. In addition, offshore operations require radio operators, cooks, ships' officers and sailors, and pilots for work on drilling platforms, crewboats, barges, and helicopters.

(Detailed discussions of professional, technical, mechanical, and other occupations found not only in the petroleum and natural gas production industry, but in other industries as well, are given elsewhere in the *Handbook* in the sections covering individual occupations.)

Working Conditions

Most oilfield jobs involve rugged outdoor work in all kinds of weather. They often are in remote areas in settings as varied as a western desert, the Arctic Circle, or the Gulf of Mexico. Physical strength and stamina are important because the work involves standing most of the time, lifting moderately heavy objects, and climbing and stooping to work with tools that often are oily and dirty.

Drilling employees may expect to move from place to place since their work in a particular field may be completed in a few months. Exploration field personnel may be required to move even more frequently. They may be away from home for weeks or months at a time. Well operation and maintenance workers and natural gas processing workers usually remain in the same location for long periods.

Oil and gas well drilling and servicing is more hazardous than many other kinds of work. In 1977, the injury rate in this industry was about four times the rate for all industries in the private sector; more than twice as many workdays were lost due to accident or injury. Work in oil and gas production is less hazardous.

Training, Other Qualifications, and Advancement

Most workers in nonprofessional jobs with an exploration crew begin as helpers and advance into one of the specialized jobs. Their training may vary from several months to several years. New workers usually are hired in the field by the crew chief or by local company representatives. College students majoring in physical or earth sciences or in engineering may work part time or summers with exploration or production crews, and get full-time jobs after graduation.

Members of drilling crews usually begin as roughnecks. The major qualifications needed are mechanical ability and adequate physical strength and stamina. Previous experience is desirable but not necessary. As they acquire experience, they may advance to more skilled jobs. For example, a worker hired as a roughneck may advance to derrick operator and, after several years, become a driller. A driller can advance to the job of tool pusher in charge of one or more drilling rigs.

Companies generally hire people who live near wells for well operation and maintenance jobs. They prefer applicants who have mechanical ability and a knowledge of oilfield processes. Because this type of work is less strenuous than drilling and offers the advantage of a fixed locale, members of drilling crews or exploration parties who prefer not to travel often transfer to well operation and maintenance jobs. New workers may start as roustabouts and advance to jobs as switchers, gaugers, or pumpers. Training usually is acquired on the job; at least 2 years of experience are needed to become an all-round pumper.

Many different skills are needed to explore for oil and gas.

For scientists, such as geologists and geophysicists, college training with at least a bachelor's degree is required. The preferred educational qualification for a petroleum engineer is a degree in engineering with specialization in courses on the petroleum industry. However, college graduates having degrees in chemical, mining, civil, or mechanical engineering, or in geology, geophysics, or other related sciences often are hired for petroleum engineering jobs. Petroleum engineering aides include people with 2-year technical degrees as well as former roustabouts or pumpers who have been promoted.

Scientists and engineers usually start at junior levels; after several years of experience they can advance to managerial or administrative jobs. Scientists and engineers who have research ability, particularly those with advanced degrees, may transfer to research or consulting work.

Information on training, qualifications, and advancement in natural gas processing plants is similar to that for petroleum refining, discussed elsewhere in the *Handbook*.

Employment Outlook

Employment in petroleum and natural gas production is expected to increase faster than the average for all industries through the 1980's. Besides the job openings created by growth, many openings will occur as workers retire, die, or leave the industry for other reasons.

Greatly increased prices for crude oil and natural gas and a national policy to move toward energy self-sufficiency are expected to provide the incentives for the industry to expand rapidly. Growth will be concentrated in occupations in exploration and drilling. Opportunities should be particularly good in offshore drilling.

Earnings

In 1978, nonsupervisory employees in oil and gas extraction averaged $7.01 an hour. In comparison, the average for all nonsupervisory workers in private industry, except farming, was $5.69 an hour. Earnings usually are higher in offshore operations than in land operations.

On land, drilling crews usually work 7 days, 8 hours a day, and then have a few days off. In offshore operations, they may work 7 days, 12 hours a day, and then have 7 days off. If the well is far from the coast, they live on the structure containing the drilling rig or on ships anchored nearby. Most workers in well operations and maintenance and natural gas processing work 8 hours a day, 5 days a week.

Sources of Additional Information

Further information about occupations in this field is available from:

American Association of Petroleum Geologists, P.O. Box 979, Tulsa, Okla. 74101.

Society of Petroleum Engineers of AIME, 6200 N. Central Expressway, Dallas, Tex. 75206.

American Geological Institute, 5205 Leesburg Pike, Falls Church, Va. 22041.

MANUFACTURING

Our Nation's economy, which provides a tremendous variety of goods and services, is composed of nine major divisions: Agriculture, mining, contract construction; manufacturing; transportation and public utilities; wholesale and retail trade; finance, insurance, and real estate; services; and government. Manufacturing employs the most workers and may have the greatest influence on our lives.

Almost everything we use in our work, leisure, and even in sleep is manufactured. Factories produce goods ranging in complexity from simple toys to intricate electronic computers, and in size from miniature electronic components to gigantic aircraft carriers. Workers in the many diverse manufacturing industries process foods and chemicals, print books and newspapers, spin textiles and weave them, make clothing and shoes, and produce the thousands of other products needed for our personal and national welfare.

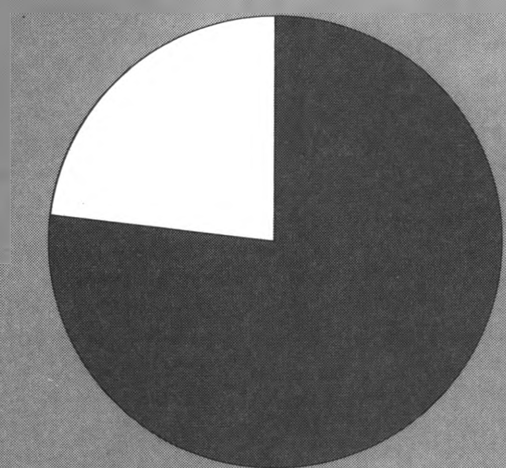
In terms of employment, manufacturing, with over 20 million workers in 1978, was the largest of the major industry divisions. As is shown in the acompanying chart, about three-fifths of all manufacturing employees worked in plants that produced durable goods, such as steel, machinery, automobiles, and household appliances. The rest worked in plants that produced nondurable goods, such as processed food, clothing, and chemicals.

The occupational distribution of the major industry divisions differs according to each industry's particular needs. Industries such as wholesale and retail trade, for example, require large numbers of sales and service workers while mining needs very few. Like all industries, manufacturing has its own unique occupational composition.

Blue-collar workers (craft workers, operatives, and laborers) make up about two-thirds of the industrys employment. Operatives, who run the machines to manufacture goods, account for over four-tenths of total employment in manufacturing. Many are spinners and weavers, sewing machine operators, machine tool operators and welders, or operators of the specialized processing equipment used in the food, chemical, paper, and petroleum industries.

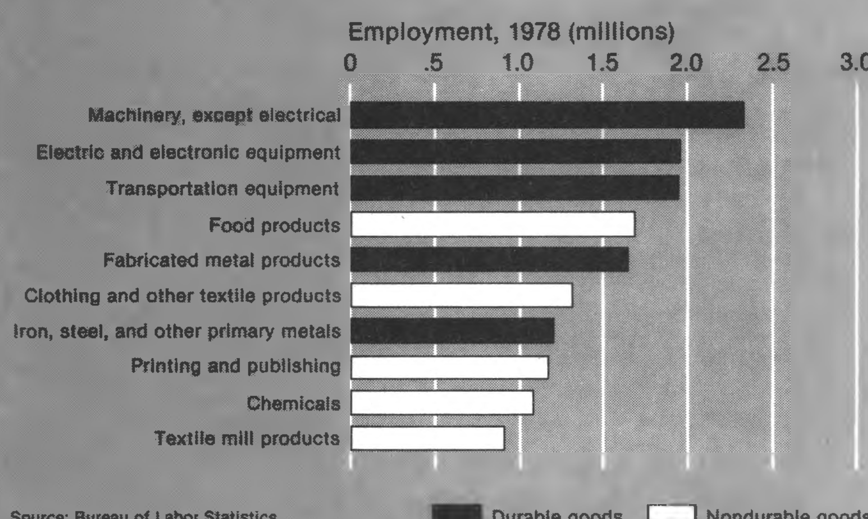
Craft and kindred workers make up the next largest group and account for nearly one-fifth of employment in manufacturing. Many of these skilled workers help support the production processes by installing and maintaining the wide assortment of machinery and equipment in factories. Others are involved directly in production. For example, machinists, skilled inspectors, and assemblers are especially important in metalworking. In printing lithographers, and pressworkers make up a large share of the work force. The craft group also includes supervisors of blue-collar workers.

Manufacturing industries employed 23 percent of all workers in 1978



Source: Bureau of Labor Statistics

Ten industries account for more than three-fourths of all workers in manufacturing



Source: Bureau of Labor Statistics

Laborers account for about 1 out of every 20 jobs in manufacturing. Many support the production process by moving and storing raw materials and by helping more skilled workers prepare equipment for use.

White-collar workers (professional, managerial, clerical, and salesworkers) account for nearly one-third of the employment in manufacturing. Clerical workers, including secretaries and office machine operators, constitute the largest white-collar group, holding about 1 out of every 8 jobs in the manufacturing sector. Clerical workers help handle the necessary paperwork including payroll accounting billing.

Professional, technical, and kindred workers account for about 1 out of every 10 jobs in manufacturing. Engineers, scientists, and technicians represent a large share of the professional workers. They not only oversee and guide production but also carry out research and development in aerospace, electronics, chemical, petroleum, and other industries.

Managers and administrators account for about 1 out of every 16 workers. In addition to factory managers, this category includes workers who buy the goods and raw materials for manufacturing. Sales workers, who constitute only about 1 out of every 50 workers, sell the final product goods.

Through the 1980's, rising personal income and expanding business activity will substantially increase the demand for manufactured products. Employment in manufacturing, however, is expected to increase more slowly than production as technological advances and improved methods increase productivity.

The employment outlook for individual manufacturing industries, however, will vary widely. Employment in the industries manufacturing rubber and miscellaneous plastic products, medical and dental instruments, and computers and peripheral equipment, for example, should increase faster than the average. While employment in most manufacturing industries is expected to increase through the 1980's, employment in some—including tobacco, food, and radio and television sets—is expected to decline.

The chapters that follow provide information on employment opportunities in several of the manufacturing industries. More detailed information about occupations in manufacturing as well as in many other industries appears elsewhere in the *Handbook*. (See index in the back of the book.)

Occupations in Aircraft, Missile, and Spacecraft Manufacturing

Firms that manufacture and assemble aircraft, missiles, and spacecraft make up what is known as the "aerospace" industry. In 1978, almost 600,000 people worked in the industry—over 500,000 in the manufacture and assembly of complete aircraft, aircraft engines, propellers, and auxiliary parts and equipment; and 80,000 in the manufacture of missiles and spacecraft. Also, thousands of workers in other industries produced parts, machinery, and equipment used in the manufacture of aerospace vehicles.

Nature and Location of the Industry

All aircraft, missiles, and spacecraft have the same basic components—a frame, an engine, and a guidance and control system. Ballistic missiles and spacecraft travel into space at speeds many times faster than sound, while aircraft fly in the earth's atmosphere at much slower rates. Missiles are powered by either jet or rocket engines; spacecraft are rocket powered only. Aircraft are powered by piston, jet, or rocket engines.

Types of aircraft vary from small personal or business planes that do not cost much more than an automobile to multimillion-dollar jumbo transports and supersonic fighters. In dollar value, aircraft production for military use is about equal to the value of planes made for commercial and private use.

Missiles are for military use and generally carry destructive warheads. Although some are designed to travel only a few miles, such as those that support ground troops and defend against low-flying aircraft, others have intercontinental ranges of 7,000 miles or more. Some missiles are launched from land; others from aircraft, submarines, or ships.

Most spacecraft are built for the National Aeronautics and Space Administration (NASA) and the Department of Defense to explore outer space, to examine the earth's surface and atmosphere, and for communications. NASA sometimes places communications or research satellites into orbit for private companies or other countries. NASA's manned space shuttle will provide greatly increased capabilities for transporting materials into space.

Major aircraft, missile, and spacecraft firms contract with government or private business to produce an aerospace vehicle. As a contractor, the firm is responsible for managing and coordinating the entire project. This involves design, production, assembly, and inspection of the vehicle.

Although aircraft, missile, and spacecraft manufacturers generally make many components of a craft and do final assembly work themselves, thousands of subcontractors are involved in the production of parts or supplies the original firm cannot or does not want to produce, such as bearings, specialized metal parts, or even entire sections of an aircraft. Other subcontractors produce subassemblies such as communication or guidance equipment or jet engines. Some firms depend on still other subcontractors to supply parts for subassemblies.

In producing an aerospace vehicle, the engineering department first prepares design drawings and specifications, usually after much consideration of the purchaser's needs. Then the production department works on details for machines, materials, and operations needed to manufacture the vehicle. Often, special tools and machines must be designed and produced to make parts or to assemble the aerospace vehicle, especially when a firm is developing an experimental or ultrasophisticated vehicle requiring specially designed parts or assemblies.

After parts and components are developed, they are tested and inspected many times before being assembled. Once the tests prove satisfactory, assembly of the entire craft may begin. Finally, the finished vehicle is checked out by a team of mechanics and flight-tested, if it is an aircraft, before it is delivered.

Although aerospace jobs exist in almost every State, the largest concentration is in California. Other States with large numbers of aerospace jobs include New York, Washington, Connecticut, Texas, Missouri, and Kansas. Almost 1,700 establishments are involved in aerospace manufacturing, but employment is concentrated in large plants.

Occupations in the Industry

Because of the complex nature of aerospace technology, firms need workers with many different types of skills, depending on the specific function of an aerospace plant. For example, a plant primarily engaged in research and development or in experimental prototypes requires many more scientists and engineers than one producing large quantities of parts for aircraft.

Most jobs in aerospace manufacturing can be grouped into three categories: Professional and technical; administrative, clerical, and related occupations; and plant occupations. Many of these jobs are in other industries as well and are discussed in greater detail elsewhere in the *Handbook*.

Professional and Technical Occupations. Research and development (R&D) are vital to the aerospace industry. The pace of discovery in aerospace technology is so rapid, in fact, that much equipment becomes obsolete while still in an experimental stage or soon after being put into production. Today, research is conducted in areas such as developing safer, quieter vehicles with higher performance and greater efficiency. Metals and plastics also are being developed for wider capabilities, as are electronic guidance, navigation, and communication systems.

Emphasis on R&D makes the aerospace industry an important source of jobs for technical personnel. In 1978, about one-fourth of all employees were engineers, scientists, and technicians, a considerably higher proportion than in most other manufacturing industries.

Engineers, scientists, and technicians work together in developing designs for aircraft, missiles, and spacecraft. Scientists often do research on how materials withstand certain conditions, such as intense heat or stress, or create new materials that are needed. Engineers apply the information obtained by scientists to develop new designs. Before an engineering department approves a design for production, it conducts tests to determine which designs can best withstand expected operating conditions. A scale model may be made from a preliminary drawing and tested in wind, temperature, and shock tunnels and other areas that simulate actual flight conditions. Next, a full-sized experimental model, or prototype, is thoroughly tested in the air and on the ground. The design is modified many times during this process until the test results are satisfactory. Then actual production may begin. Even after production has started, however, further changes often are made.

Due to the wide range of projects, many types of engineers and scientists work in the aerospace industry. Aerospace, chemical, electrical, electronic, industrial, and mechanical engineers are among the larger groups of engineering specialists employed. Scientists in the industry include physicists, mathematicians, chemists, metallurgists, and astronomers. These engineers and scientists work in a wide range of applied fields such as materials and structures, energy and power systems, and space sciences.

Among the many types of workers assisting scientists and engineers are drafters and engineering and science technicians. Drafters use tools such as compasses and protractors to prepare detailed drawings of a design based on rough sketches and calculations made by engineers. The drawing details the exact measurement of every part, specifications for materials to be used, and procedures to be followed in producing it.

By collecting information, making computations, and performing laboratory tests, engineering and science technicians aid engineers in preparing design layouts and models of structures, control systems, or equipment installations. Technicians in production may prepare specifications for materials, or supervise production workers to be sure prescribed plans and procedures are followed. Some technicians work as manufacturers' field service representatives, serving as the link between the company and the military services, commercial airlines, and other customers.

Other workers who help scientists and engineers include *production planners* (D.O.T. 012.167-050), who plan the layout of machinery, movement of materials, and sequence of operations for efficient manufacturing processes and *technical illustrators* (D.O.T. 017.-281-034), who help prepare manuals and other technical literature describing the operation and maintenance of aerospace products.

Administrative, Clerical, and Related Occupations. Managerial and administrative jobs generally are comparable to similar jobs in other industries, except that in the aerospace industry these positions are often filled by people with technical backgrounds in engineering or science. These positions include executives responsible for the direction and supervision of research and production, and officials in sales, purchasing, accounting, and industrial relations departments. Many thousands of clerks, secretaries, computer personnel, and other office personnel work in aerospace firms.

Plant Occupations. About one-half of all workers in the aerospace industry have plant- or production-related jobs. Plant jobs can be classified in the following groups: Sheet-metal work; machining and tool fabrication; other metal processing; assembly and installation; inspecting and testing; flight check-out; and materials handling, maintenance, and custodial.

Sheet-Metal Occupations. Following blueprints and other engineering information, *sheet-metal workers* (D.O.T. 804.281-010) shape complicated parts from sheets of thin metal by hand or machine. When shaping parts by hand, these workers either pound them with mallets or bend, cut, or punch them with handtools. Machine methods use power hammers and presses, saws, tube benders, and drill presses. This work requires much precision since parts must fit perfectly.

Less skilled workers operate machines to fabricate parts required in large numbers. Some of these workers are *punch press operators* (D.O.T. 615.482-022, .682-014, .685-030, and 617.685-026), *power hammer operators* (D.O.T. 617.682-014) and *power shear operators* (D.O.T. 615.482-034 and .685-034).

Machining and Tool Fabrication Occupations. Machining and tool fabrication workers use a wide variety of machines and handtools to make metal parts of machines or other products. Many of these workers are in engine and propeller plants, which are basically metalworking establishments; fewer are required in plants that assemble complete aerospace vehicles.

The most skilled machinists are the *all-round machinists* (D.O.T. 600.280-022) who plan the work and set up and operate several types of machine tools. They perform highly varied, nonrepetitive machining operations, frequently producing parts for experimental and prototype vehicles.

Machine tool operators (D.O.T. 601.280-054), who produce metal parts in large volume, use machine tools such as lathes, drill presses, or milling machines. Skilled operators set up work on a machine and handle more difficult and varied jobs. Less skilled operators do more repetitive work.

Other machining and tool fabrication workers produce parts needed for the manufacture of aerospace vehicles. On the basis of information received from an engineering department, *jig and fixture builders* (D.O.T. 693.280-010) build jigs—metal devices used as guides for tools. *Tool-and-die makers* (D.O.T. 601.280-046) make the cutting tools and fixtures used in machine tool operations, and the dies used in forging and punch press work.

Other Metal Processing Occupations. Some of the many other metalworking occupations are *tube benders* (D.O.T. 709.684-090 and .687-050), who form tubings used for oil, fuel, hydraulic, and electrical conduit lines and *riveters* (D.O.T. 800.684-010) and *welders* (D.O.T. 810.384-014; 811.684-014; and 819.281-022, .361-010, .381-010, .384-010 and .684-010), who use mechanical and electrical devices to join fabricated parts. Metalworking jobs also are located in foundry plants where workers produce castings by pouring molten metal into molds.

Many workers chemically treat and heat-treat aircraft, missile, and spacecraft parts during their manufacture to clean, change, or protect their surfaces or structural condition. For example, *heat treaters* (D.O.T. 504.382-014 and .682-018) heat sheet-metal parts to keep the metal soft and malleable for metal-shaping work. *Painters* (D.O.T. 845.381-014) and *platers* (D.O.T. 500.380-010) either paint or plate surfaces.

Assembly and Installation Occupations. Practically all plants in the aerospace industry employ assembly and installation workers. Some assemble engines, electronic equipment, and auxiliary components, but most assemble major subassemblies or install major components in aircraft or spacecraft. In an aircraft, for example, this work involves joining wings and tail to the fuselage and installing the engine and auxiliary equipment such as the fuel system and flight controls. Assemblers rivet, drill, bolt, weld, and solder parts together.

Many assemblers are skilled mechanics and installers who read blueprints and interpret other engineering specifications as they take apart, inspect, and install complex mechanical and electronic assemblies. Often, assembly work is not as repetitive as in other industries. An assembler in an aerospace plant, for example, may spend a few months assembling a large commercial transport and be involved in several different assembly operations. Some assemblers specialize in cer-

About one-half of all workers in the aerospace industry have plant or production-related jobs.

tain kinds of assembly, such as *aircraft power plant assemblers* (D.O.T. 806.381-022), *aircraft structures and surfaces assemblers* (D.O.T. 806.381-026), *electro-mechanical assemblers* (D.O.T. 806.381-030), *tubing assemblers* (D.O.T. 806.381-034), and *experimental aircraft assembly mechanics* (D.O.T. 806.381-038).

Inspecting and Testing Occupations. Because aircraft, missiles, and spacecraft are extremely complex and affect the life and safety of people, firms employ workers to conduct thousands of painstaking inspections and tests. Inspectors thoroughly test each component and part as it moves through the production and assembly process, as well as just before delivery. If, for example, a part must withstand a great deal of heat, it will be tested under very high temperatures. Using complex machinery, inspectors check to assure that all parts and assemblies were made according to engineering specifications. Among the most skilled inspectors, especially in final assembly plants, are *outside production inspectors* (D.O.T. 806.281-046), who examine machined parts, subassemblies, and tools and dies ordered from other firms. They also serve as a link between their own engineering department and supplying companies. Inspections are made not only by employees of the manufacturers but also by commercial firms or agencies of the Federal Government that have contracted for the equipment. *Aircraft accessories inspectors* (D.O.T. 709.261-010) inspect and test electrical, hydraulic, and other accessories. *Assemblies and installations inspectors* (D.O.T. 806.281-022) inspect complete major assemblies and installations such as fuselage, wing, and nose sections to ensure their proper fit. They also check the functioning of hydraulic, plumbing, and other systems. Less skilled inspectors check subassemblies.

Flight Checkout Occupations. Checking out every part of an aircraft or spacecraft before its first flight requires a team of mechanics. The *crew chief*, the most skilled mechanic of the team, directs other workers in the entire checkout operation. *Engine mechanics* check out the powerplant of a craft, including the engine, propellers, and oil and fuel systems; and *electronics checkout* workers do the final examination of the operation of radio, radar, automatic pilot, fire control, and electronic guidance systems. The checkout process may require making minor repairs and, in some cases, even returning the craft to the plant for extensive adjustments.

Materials Handling, Maintenance, and Custodial Occupations. Aerospace plants employ many materials handlers such as truckdrivers, shipping clerks, and toolroom attendants. Maintenance workers, such as electricians, maintenance mechanics, carpenters, and plumbers, keep equipment and buildings in good operating condition and make changes in the layout of the plant. Guards, firefighters, and janitors provide protective and custodial services.

Working Conditions

Most employees work in modern factory buildings that are clean, well lit, and well ventilated. Some work outdoors. Operations such as sheet-metal processing, riveting, and welding may be noisy, and some assemblers may work in cramped quarters. Aerospace plants, however, are relatively safe. The injury rate for the industry is much lower than the average rate for all industries.

Training, Other Qualifications, and Advancement

A college degree in engineering or in one of the sciences usually is the minimum requirement for an entry level position as an engineer or scientist in the aerospace industry. Technicians sometimes can advance to these positions without a college degree, but only after years of work experience and some college level training.

New entrants usually qualify for technician positions by attending a technical institute or junior college or by receiving technical training in the Armed Forces. Highly skilled plant workers who take courses in areas such as electronics may advance to technician positions.

Entry level plant occupations generally do not require a high school diploma although a diploma and vocational courses in electronics or mechanics are preferred, especially for entry into more skilled and higher paying jobs. Inexperienced plant workers generally start out in semiskilled positions and learn skills on the job or sometimes in courses provided by employers. As they gain experience, they can move on to more highly skilled positions. For example, it usually takes 2 to 4 years of plant experience to become a skilled assembler.

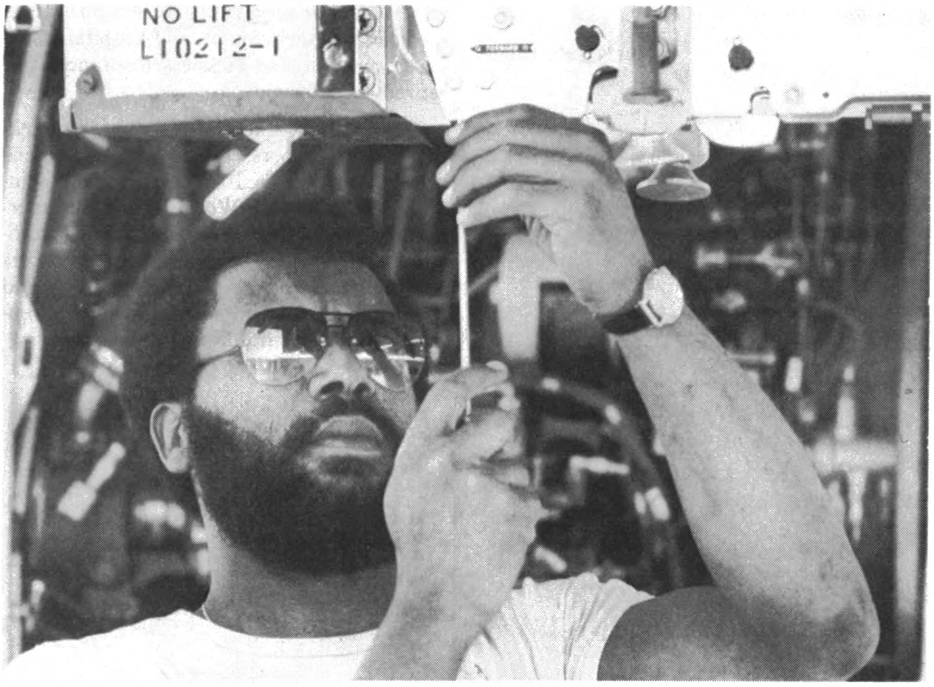
Skilled inspectors often have several years of machine shop experience and must be able to install and use various kinds of testing equipment and instruments, read blueprints and other specifications, and use shop mathematics.

Mechanics who do final checkout of aircraft and spacecraft may qualify for their jobs by working in earlier stages of the production line, by receiving training in checkout work, or by working as "line maintenance" mechanics with commercial airlines.

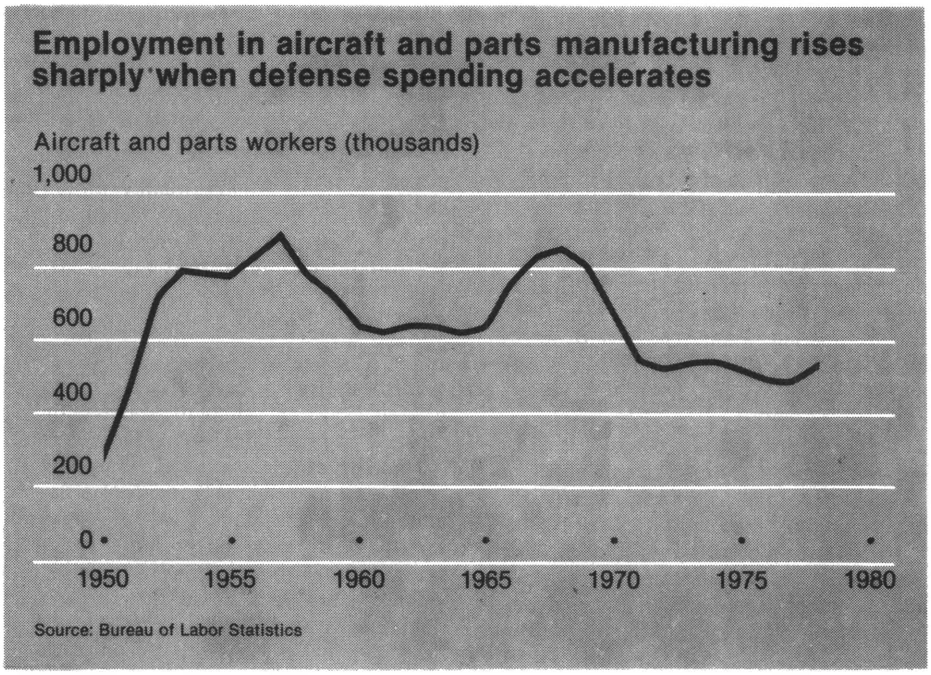
Chief mechanics usually need 3 to 5 years of experience in the manufacture of aircraft, missiles, and spacecraft, including at least 1 year as a checkout mechanic. Specialized mechanics, working under the supervision of a chief mechanic, usually need at least 2 years' experience. Less experienced helpers or assistants learn on the job, with plant training courses.

There are apprenticeship programs for craft occupations such as machinists, tool-and-die makers, sheet-metal workers, aircraft mechanics, and electricians. The programs last about 4 years. During this time, the apprentice handles work of progressively increasing difficulty and also receives classroom instruction. Such instruction for a machinist apprentice, for example, includes courses in blueprint reading, mechanical drawing, shop mathematics, and physics.

Because complex and rapidly changing products require highly trained workers, aerospace plants sometimes support formal training to supplement day-to-day experience and to help workers advance more rapidly. Although most are short-term programs to meet immediate needs, some firms conduct training classes or pay tuition and related costs for outside courses. Some classes are held during working hours; others are after working hours.



Flight-line mechanic tightens wing pylon during final assembly.



Employment Outlook

Employment in the aerospace industry is expected to rise above recent levels by 1990. The number of people working in this industry, however, probably will remain below the peak levels of the late 1960's.

Thousands of jobs will open each year because of the growth expected in the industry and to replace workers who retire, die, and transfer to jobs in other industries. Job opportunities are expected to increase for highly trained workers, such as scientists, engineers, and skilled plant personnel, in all areas of the industry, especially with firms engaged in R&D and the manufacture of prototype and other technologically advanced aircraft. Less skilled and unskilled workers also will be needed to fill entry-level plant positions.

Since many aerospace products are military hardware and space vehicles, the industry's future depends, to a great extent, on the level of Federal expenditures. Changes in these expenditures usually have been accompanied by sharp fluctuations in aerospace employment. For example, employment declined sharply from the high levels of the late 1960's, partly because of decreased aircraft requirements for Vietnam and reduced expenditures for space exploration. The outlook for this industry is based on the assumption that defense spending will increase moderately from the 1978 level, but will be slightly below the peak levels of the late 1960's. R&D spending also is expected to be above current levels. If actual expenditures should differ substantially from these assumed levels, the outlook will be affected accordingly.

Civilian aircraft production also is an important determinant of aerospace employment. Overall employment in this area is expected to rise through the 1980's due to increased sales of commercial transports to airlines and increases in the production of other nonmilitary aircraft. Also, thousands of new workers will be required to replace those who die, retire, or transfer to other fields.

Table 1. Average hourly earnings in selected aerospace occupations, 1978

Occupation	Hourly rate range
Jig and fixture builder	$7.73–$9.31
Tool-and-die maker	7.73– 9.31
Machinist	7.61– 9.31
Inspector and tester	6.72– 9.31
Maintenance craft worker	7.04– 8.84
Welder	7.20– 8.30
Heat treater	7.20– 8.22
Assembler	6.57– 7.89
Riveter	6.86– 7.73

SOURCE: Bureau of Labor Statistics.

Earnings

Plant workers' earnings in the aerospace industry are higher than those in most other manufacturing industries. In 1978, for example, production workers in plants making aircraft and parts averaged $7.40 an hour; production workers in all manufacturing industries as a whole averaged about $6.07 an hour.

The following tabulation indicates an approximate range of hourly wages for selected occupations in 1978 obtained from the collective bargaining agreements of a number of major aerospace companies; these rates do not include incentive earnings. The ranges in various jobs are wide, partly because wages within an occupation vary according to workers' skills and experience and partly because wages differ from plant to plant, depending upon type of plant, locality, and other factors.

Fringe benefits in the industry usually include 2 weeks of paid vacation after 1 or 2 years of service, and 3 weeks after 10 to 12 years. Employees generally get 8 to 12 paid holidays a year and 1 week of paid sick leave. Other major benefits include life insurance; medical, surgical, dental, and hospital insurance; accident and sickness insurance; and retirement pensions.

Most plant workers in the aerospace field are union members. The two largest unions are the International Association of Machinists and Aerospace Workers, and the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America. Some craft workers, guards, and truckdrivers are members of unions that represent their specific occupational groups.

Occupations in the Aluminum Industry

Aluminum was once considered a specialty metal having limited applications. Today it is used in products that range from household appliances and cooking utensils to automobiles, aircraft, and missiles. In recent years, many new uses for aluminum have been developed, including house siding, food and beverage containers, and electrical cables. In 1978, more aluminum was produced than any other metal except steel.

This chapter describes occupations in plants that produce ingots, large blocks of primary aluminum. It also describes occupations in plants that shape the ingots into sheets, wire, and other forms by rolling, stretching, or forcing the aluminum through an opening. Occupations concerned with casting, forging, stamping, machining, and fabricating aluminum are discussed separately in the *Handbook* statements dealing with forge shop, foundry, and metalworking occupations.

More than 100,000 persons worked in the aluminum industry in 1978. Approximately one-third helped make primary aluminum; the remainder helped convert large pieces into sheets, cables, and other industrial products.

Since the huge machinery necessary for making aluminum is very expensive, the production of primary aluminum is concentrated in a relatively small number of plants. These plants generally are located near abundant sources of alumina and electricity. Many are in Arkansas, Louisiana, Texas, Alabama, and Tennessee, where bauxite ore is mined locally or imported from the Caribbean area, and electricity is obtained from the Tennessee Valley Authority or generated from local deposits of natural gas or oil. About two-fifths of the employees who make aluminum work in these States. Another one-fifth work in the State of Washington, where plants obtain electricity from the Bonneville Power Authority and serve customers on the West Coast. A significant number of employees also work in plants located in Ohio, Indiana, and New York.

Plants that shape aluminum into sheets, wire, and other products are more dispersed geographically. Over one-half of the employment in these plants is in California, Pennsylvania, Tennessee, Illinois, Alabama, New York, and Ohio. The remainder is widely scattered throughout a large number of States.

Occupations in the Industry

Employment in the aluminum industry falls into several categories. The largest group of workers—about three-fourths— are the production workers directly involved in operating or maintaining the industry's production equipment. The remaining one-fourth are in professional, technical, administrative, clerical, and supervisory positions.

Production Occupations. To illustrate the production occupations found in the industry, a description of the major steps in making and shaping aluminum follows.

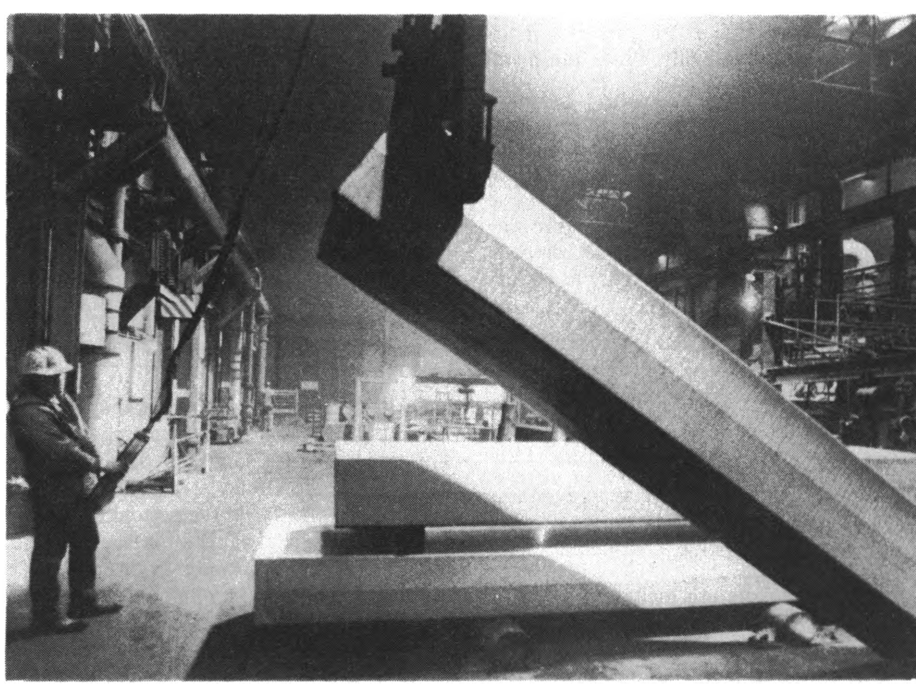
Making Aluminum. Aluminum is obtained from alumina, a fine, white powder processed from bauxite ore, by using electricity to create chemical changes that separate pure aluminum from other materials. Alumina is placed in large containers called "pots" that are filled with a special liquid. Suspended in the liquid are poles (anodes), and electric cables are attached to the pots and poles. When the process is in operation, electricity flows from the poles, through the liquid containing the alumina, to the walls and floors of the pots. As the electricity passes through the liquid, it heats and chemically changes the alumina to pure, liquid aluminum. Because the aluminum is heavier, it settles to the bottom of the pot, While waste materials go to the top of the liquid. Periodically, pure aluminum is removed from the bottom of the pot.

Pot tenders (D.O.T. 512.685-018) see that the pots operate continuously. Each is responsible for a number of pots. As a result of the chemical changes, the alumina in each pot is slowly used up. Instruments monitor the level of alumina and signal the tender when to add alumina from the overhead storage compartment.

Every 24 to 72 hours, molten aluminum is drawn from the bottom of the pots into huge brick-lined, steel containers or "crucibles." The *tappers* (D.O.T. 514.664-014) signal the *hot-metal crane operator* (D.O.T. 921.663-010) to place the overhead crane near the pot. Using automatic equipment, they break a hole in the crust of waste materials on top of the liquid and insert one end of a curved, cast iron tube into the pot; the other end of the tube is placed in a crucible. The molten metal is drawn from the pot into the crucible.

After aluminum has been taken from several pots and the crucible is full, *charge gang weighers* (D.O.T. 509.687-022) weigh and take samples of the molten metal for laboratory analysis. Weighers also select chemicals that the analysis indicates should be blended with the molten aluminum. Then, workers operating overhead cranes pour the molten metal from the crucible into a remelting furnace. A *remelt operator* (D.O.T. 512.685-022) adds portions of aluminum scrap, other molten metal, or chemicals to produce metal with the desired properties. Finally, hand skimmers remove the waste products from the surface of the molten metal.

The metal is then transferred to the holding compartment of the furnace until a sufficient supply is obtained for pouring. The *casting operator* (D.O.T. 514.662-010) has charge of the pouring station where the mol-



Using a portable control box, worker positions a crane to lift an aluminum ingot.

ten metal is cast into ingots. To produce ingots of uniform size and quality, the operator controls the cooling conditions by keeping the molds full of metal and spraying water against them.

After a number of months, the heat and chemical reactions make holes in a pot's lining so that the liquid metal contacts the steel container. The pot is then shut down and the liquid drained so that *pot liners* (D.O.T. 519.-664-014) can make repairs. Depending on the condition of the pots, liners may patch holes in the lining or may completely replace the lining.

Shaping aluminum. The large ingots must be reduced in size before the aluminum is useful to customers. Depending on the final product, several methods may be used to shape ingots. Aluminum products such as plate, sheet, and strip are produced by rolling.

The first step in rolling is to remove surface impurities from the ingots. The *scalper operator* (D.O.T. 605.682-022) manipulates levers of a scalper machine and cuts thin layers of the rough metal from the ingots so that the surfaces are smooth. Then, workers operating overhead cranes lower the ingots into furnaces, or "soaking pits," where they are kept sealed for 12 to 18 hours and heated to proper working temperatues for rolling. *Soaking pit operators* (D.O.T. 613.462-014) manage the furnace and control the temperature and heating time.

After being heated, the huge ingots are converted into elongated slabs on the "breakdown" or hot rolling mill. *Rolling mill operators* (D.O.T. 613.462-018) manipulate the ingots back and forth between powerful rollers until they are reduced in thickness to about 3 inches. The slabs then move down the line on the rollers to additional hot mills that work them down to a thickness of about one-eighth of an inch. At the end of the hotline, a *coiler operator* (D.O.T. 613.685-010) tends a coiler that automatically winds the metal onto reels.

The coiled aluminum cools at room temperature before being cold-rolled still thinner. Cold-rolling produces a better surface finish and increases the metal's strength and hardness. Since continuous cold-rolling could make the metal too brittle, an *annealer* (D.O.T. 504.682-010) occasionally heats (anneals) the metal.

To relieve internal stress or surface contours created during the rolling process the metal may be stretched. *Stretcher-level operators* (D.O.T. 619.582-010) and *stretcher-level operator helpers* (D.O.T. 619.686-030) position the finished plate or sheet in clamps, determine the stretch required, and operate the machine that pulls the metal from end to end to stretch it.

Sometimes ingots are melted and cast in molds to produce "billets." Besides being smaller and easier to handle than ingots, billets can be molded into shapes which make it easier to produce the final product.

Worker watches a sheet of aluminum pass through cold rolling machinery.

In a rod and bar factory, billets are heated to make them softer and then are rolled through progressively smaller openings, until the desired size is obtained. To produce wire, hot-rolling continues until the rod is about three-eighths of an inch in diameter. Then, *wire draw operators* (D.O.T. 614.382-010) operate machines that pull the cold wire through a series of dies (holes) that gradually reduce its size. The machines also automatically coil the wire on revolving reels.

Structural products such as I-beams and angles may be hot-rolled or extruded. Hot-rolled products are made by passing a square billet with rounded corners between grooved rolls that gradually reduce the thickness and change the shape of the metal.

Extruding of metal often is compared with squeezing toothpaste from a tube. Extruded aluminum shapes are produced by placing hot billets inside a cylinder in a powerful press. A hydraulic ram that usually has a force of several million pounds pushes the metal through a die at the other end of the cylinder. The metal takes the shape of the die and may be cut into desired lengths. By using dies of varying design, almost any shape of aluminium product may be formed. *Extrusion press operators* (D.O.T. 614.482-018) regulate the rate at which the metal is forced through the press.

Of increasing importance in shaping aluminum is the continuous casting process. This process uses a tall, curved mold that is wider at the top than at the bottom. The mold has an opening at the bottom that is the shape of the final product—for example, it is square if billets are being made. As space becomes available, molten aluminum is added to the top of the mold and moves down through the mold while being cooled by water sprays. When the now solid aluminum comes out of the mold, it moves onto a conveyor belt where it is cut to the desired lengths.

During the production and the shaping processes, workers and machines inspect the metal to assure quality. *Radiographers* (D.O.T. 199.361-010) operate various types of X-ray equipment to inspect the metal. Computers monitor operations and automatically adjust metal temperature and mill speed.

Other production workers in the aluminum industry keep machines and equipment operating properly. Some move materials, supplies, and finished products throughout the plants; still others are in service occupations such as guard and custodian.

Since electricity is vital to making aluminum, the industry needs many electricians to install and repair electrical fixtures, apparatus, and control equipment. Other employees, such as millwrights and maintenance machinists, make and repair mechanical parts for plant machinery. Stationary engineers operate and maintain the powerplants, turbines, steam engines, and motors used in aluminum plants.

Other important groups are the diemakers who assemble and repair the dies used; the bricklayers who build and reline furnaces, soaking pits, and similar installations; and the welders who join metal parts together with gas or electric welding equipment. In addition, plumbers and pipefitters lay out, install, and maintain piping and piping systems for steam, water, and other materials used in aluminum manufacturing.

Professional, Technical, Administrative, Clerical, and Sales Occupations. About 1 employee in 5 is a professional, clerical, or managerial worker. The remaining workers are in administrative and sales positions.

Aluminum companies employ a variety of professional specialists. Quality control chemists analyze the aluminum and the raw materials used in its production. Process metallurgists determine the most efficient methods of producing aluminum from raw materials. Physical metallurgists test aluminum and aluminum alloys to determine their physical characteristics and also develop new alloys and new uses for aluminum.

Chemical engineers and mechanical engineers design and supervise the construction and operation of production facilities. Mechanical engineers may design new rolling mills or improve existing mills and related equipment. Electrical engineers plan and oversee the installation, operation, and maintenance of the electric generators and distribution systems used in the manufacture of aluminum. Industrial engineers conduct work measurement studies and develop management control systems to aid in financial planning and cost analysis.

Engineering technicians, laboratory technicians, and chemical analysts assist engineers and chemists in research and development work. Drafters prepare the working drawings required to make or repair production machinery.

A wide range of other professional and administrative workers is needed in the manufacture of aluminum, such as accountants, lawyers, statisticians, economists, and mathematicians. Clerical workers, including bookkeepers, secretaries, stenographers, clerk typists, and keypunch and computer operators keep company records and do other routine office work.

Working Conditions

Making aluminum requires high temperatures and some potrooms may be hot, dusty, and smoky. However, working conditions in plants have improved as a result of environmental control programs and other projects. Because making aluminum is a continuous process, some production employees have to work nights and weekends.

Workers involved with shaping aluminum generally have favorable working conditions, although workers in certain jobs are subjected to heat and loud noises.

The industry stresses safe working conditions and conducts safety education programs. Plants where aluminum is made have had a lower rate of injuries than the average for all metal industries, while aluminum rolling and drawing mills have had about the average rate.

Training, Other Qualifications, and Advancement

Most production workers are hired as unskilled laborers. They generally begin their careers in a labor pool and substitute for absent workers until they become eligible for a permanent position.

Production workers, such as pot tenders or liners, receive their training on the job. Under the guidance of experienced workers, they begin by doing simple tasks and progress to operations requiring progressively greater skill as they acquire experience. As they gain additional skills and seniority, they usually move to more responsible and better paying jobs within their department.

Craft workers usually are trained on the job. A number of companies, particularly the larger ones, have craft apprenticeship programs that include classroom or home study courses, as well as on-the-job training. Generally, candidates for these programs are chosen from promising workers already employed by the company. The length of the apprenticeship varies according to the craft, although most require 3 to 4 years. Examples of crafts that can be learned through apprenticeship are: welding, bricklaying, carpentry, machining, pipefitting, and general mechanical maintenance.

Applicants and current employees who demonstrate an aptitude for technical work have opportunities to qualify as technicians, laboratory assistants, and other semiprofessional workers. However, some college background in engineering and science, or graduation from a technical institute or community college, is required for many technical jobs.

Most professional jobs require at least a bachelor's degree. Graduate degrees in science or engineering are preferred for research and development work. Administrative and managerial positions usually are filled by workers within the company who have an engineering or science background and have been promoted. Some new graduates with degrees in business administration or liberal arts may fill entry level administrative jobs. Sales positions often are filled by persons with engineering or related technical backgrounds.

Employment Outlook

Employment in the aluminum industry is expected to grow about as fast as the average for all industries through the 1980's. In addition to openings created by growth of the industry, job opportunities will arise from the need to replace workers who retire, die, or leave the industry for other reasons. The number of job opportunities may vary from year to year, however, because the demand for aluminum fluctuates with the ups and downs in the economy.

Over the long run, the demand for aluminum is expected to grow as aluminum is substituted for other metals. Industries that represent major markets for aluminum are growing industries with potential for new product development. For example, aluminum studs are replacing wooden studs in commerical and residential construction and remodeling. With the growing emphasis on fuel economy, car and truck manufacturing are expected to use more aluminum to reduce the weight of vehicles. Employment, however, will grow more slowly than the demand for aluminum.

The aluminum industry supports an aggressive marketing program and a strong research and development program which should continue to develop new alloys, processes, and products. As a result, the employment of engineers, scientists, and technical personnel is expected to increase as a proportion of total industry employment. Technological developments, however, such as continuous casting and computer-controlled rolling operations, will limit employment growth among some production occupations.

Earnings

Hourly earnings of plant workers in the aluminum industry are higher than the aver-

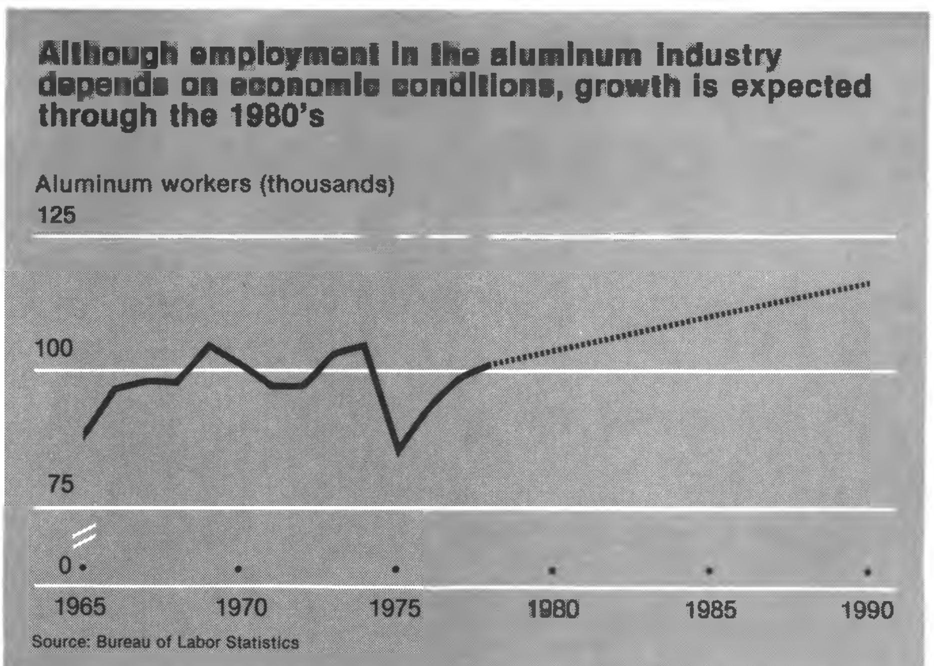


Table 1. Average hourly earnings in selected occupation in the aluminum industry, 1978

Occupation	Hourly rate[1]
Making Aluminum:	
Anode rebuilder	$8.84
Head tapper	8.74
Pot tender	8.45
Pot liner	8.26
Shaping Aluminum:	
Continuous mill operator	9.42
Hot mill operator, junior	9.13
Extrusion press operator	8.64
Scalper operator	8.45
Inspector	8.26
Soaking pit operator	8.16
Stretcher and flattener operator	8.06
Annealer	7.96
Maintenance	
Electrician	9.42
Machinist	9.42
Boiler operator	9.32
Brickmason	9.23
Welder	9.13
Pipefitter	9.13
Millwright (maintenance mechanic)	9.13

[1]Excludes overtime and premium pay.

SOURCE: United Steelworkers of America.

age for manufacturing industries. In 1978, production workers in plants which make aluminum averaged $9.17 an hour, and those in aluminum rolling and drawing plants averaged $8.75. In comparison, production workers in manufacturing industries as a whole averaged $6.17 an hour.

Skilled operators and skilled maintenance and craft workers hold the highest paying plant jobs. Hourly rates in 1978 for selected occupations in a number of plants covered by one major union-management contract are shown below.

Aluminum workers receive many fringe benefits, such as paid vacations and holidays, retirement benefits, life and health insurance, shift differentials, supplemental jury-duty pay, education and scholarship benefits and supplemental unemployment benefits. Most workers receive paid vacations ranging from 1 to 4 weeks, depending on length of service. In addition, there are extended vacation plans that provide a 10-week vacation with 13 weeks' pay every 5 years.

Most process and maintenance workers in the aluminum industry belong to labor unions. In addition, labor organizations represent some office and technical personnel. The unions having the most members in the industry are United Steelworkers of America; Aluminum Workers International Union; and International Union, United Automobile, Aerospace and Agricultural Implement Workers of America.

Sources of Additional Information

Information on careers in the industry may be obtained from:

The Aluminum Association, Inc., 818 Connecticut Ave. NW., Washington, D.C. 20006.

Occupations in the Apparel Industry

Nature and Location of the Industry

The apparel industry produces clothes that not only are appropriate for the occasion—be it work, sleep, or leisure activities—but in such a wide variety of colors and styles that we can select apparel to match our mood and express our personality. In addition to clothes, the industry produces linens, drapes, and other products made from cloth, such as tents and parachutes. To do all this, the industry employs over 1.3 million people.

At the beginning of this century, the buildings and streets of Manhattan's Lower East Side bustled with apparel manufacturing activity. New York's styles became the standard for the rest of the country. Buyers for large, out-of-town department stores came to New York City to view new designs and to place orders for winter and summer fashions. Apparel firms in this city not only had the advantage of being near a concentration of buyers, but newly arrived immigrants provided them with workers. New York City was then the undisputed apparel manufacturing capital of the country.

Today, other areas also are manufacturing centers. Many firms have moved to the South so as to lower their taxes and labor costs. As a result, over 25 percent of the industry's employees work in North Carolina, Georgia, Texas, Tennessee, and South Carolina. Other firms have moved to large cities such as Los Angeles, Chicago, Boston, St. Louis, and Dallas, where large clothing markets exist.

Over 3 out of 5 of the industry's workers are employed in firms that have over 100 employees. Only 1 plant in 7, however, is this large. The limited investment required to cut and sew garments, and the specialization of firms in one operation, such as cutting, allow small firms to enter this industry with relative ease. In the women's and misses' outerwear sector of this industry, for instance, the majority of the cut and sewn garments originate in New York City, but much of the sewing is contracted out to firms spread throughout the Middle Atlantic States. Plants manufacturing men's wear usually are larger than those making women's garments because men's clothing undergoes less frequent changes in design and style and thus is better suited to mass production methods.

Markers arrange pattern pieces to get the greatest number of garments from the smallest quantity of cloth.

Occupations in the Industry

Apparel industry employees, most of whom are directly involved in the production process, carry out the major operations of designing and patternmaking, cutting and marking, sewing, and pressing. About half of all apparel employees are hand sewers or sewing-machine operators. Generally, high-grade and style-oriented apparel is more carefully designed and involves more handwork than cheaper, more standardized items. For example, some hand detailing goes into a fashionable dress or a high-priced suit or coat, while items such as undershirts and overalls usually are sewn entirely by machine. To make the many different kinds of garments, workers with various skills and educational backgrounds are needed.

Designing Room Occupations. Typically, the manufacturing process begins with the designer, who creates new types and styles of apparel. Inspiration for a new design may come from any of a variety of experiences—traveling, observing lifestyles, or looking at paintings and other sources of information about how people dressed in the past, to name but a few. In addition to creativity, designers must have practical knowledge of the apparel business so that they can translate their ideas into styles that can be produced at competitive prices. They must, for example, be familiar with labor processes and costs for various factory operations such as patternmaking, cutting, sewing, and pressing.

A large manufacturer generally has a head designer and several assistants. Many small firms, however, do not employ designers but purchase readymade designs or patterns or copy higher priced designs.

A designer usually works with one type of apparel, such as suits or dresses, although some work with several. For a high-quality dress, designers usually start by drawing sketches or draping muslin on a manikin and choosing fabrics, trim, and colors. Using these sketches as guides, designers and their assistants make an experimental dress. They cut materials and pin, sew, and adjust the dress on a form or a live model until it matches the sketch.

Sample makers (D.O.T. 785.361-018) use this experimental dress as a guide in cutting and sewing fabrics to make a finished sample of the dress. After managers have approved the sample, a *patternmaker* (D.O.T. 781.381-026) constructs a master pattern. Working closely with the designer, the patternmaker translates the sketch or sample dress into paper or fiberboard pieces, each one representing a part of the garment. A *pattern grader-cutter* (D.O.T. 781.381-022) measures the pieces that make up this master pattern and modifies them to fit various sizes. To speed up this process, some large plants use computers to draw up the patterns for each size.

Styles for many items, such as men's suits and jackets, do not change significantly from year to year; thus, some of the steps described above are not required. A designer may alter the style of a suit, for example, by simply making minor changes on the master pattern.

Cutting Room Occupations. Workers in the cutting room prepare cloth for sewing. There are five basic operations in the cutting department: Spreading, marking, cutting, assembling, and ticketing. Small shops may combine two or more of these operations into a single job.

Spreaders (D.O.T. 781.687-058) lay out bolts of cloth into exact lengths on the cutting table. *Machine spreaders* (D.O.T. 781.-685-010) are aided by machines in laying the cloth evenly across the table.

Markers (D.O.T. 781.384-014) trace the fiberboard pattern pieces on large sheets of paper, and may make several carbons of these tracings. In some cases, they trace the pattern pieces with chalk directly on the cloth itself, rather than on paper. In some plants, computers are used to mark the cloth.

Following the pattern's outline on the cloth, a *machine cutter* (D.O.T. 781.684-014) cuts out the various garment pieces from layers of cloth. Sometimes these layers are as high as 9 inches. Using an electrically powered knife, the cutter slices through all the layers at once. The work of a cutter and a marker frequently is combined into a single job. Computer-guided lasers are increasingly being used to cut the cloth.

The pieces of cloth that have been cut are prepared for the sewing room by another group of specialized workers. *Assemblers*, sometimes called *bundlers* or *fitters* (D.O.T. 781.687-010), bring together and bundle the pieces and accessories (linings, tapes, and trimmings) needed to make a complete garment. They match color, size, and fabric design and use chalk or thread to mark locations for pockets, buttonholes, buttons, and other trimmings. They identify each bundle with a ticket, which is also used to figure the earnings of workers who are paid according to the number of pieces they produce. The bundles then are routed to the various sections of the sewing room.

Following the patterns outlined on the cloth, a cutters out garment pieces from layers of cloth.

Sewing Room Occupations. Most production workers in the apparel industry are hand sewers and sewing-machine operators. Although hand sewers are needed in the production of expensive garments and to put the finishing touches on moderatelypriced clothing, sewing-machine operators constitute the great majority of workers in this area.

Using industrial machines that are heavier and run faster than the ones found in homes, *sewing machine operators* (D.O.T. 787.682-046) generally specialize in a single operation, such as sewing shoulder seams, attaching cuffs to sleeves, or hemming blouses. Some make sections such as pockets, collars, or sleeves; others assemble and join these completed sections to the main parts of the garment.

Sewing-machine operators generally are classified by the type of machine they use, such as single-needle sewing machine operator or blind-stitch machine operator, and by the type of work performed, such as collar stitcher or sleeve finisher.

Most hand sewing is done on better quality or highly styled dresses, suits, and coats. *Hand sewers* (D.O.T. 782.684-058) use needle and thread to perform various operations ranging from simple sewing to complex stitching. Many hand sewers specialize in a single operation, such as lapel basting or lining stitching.

Instead of being sewn, parts such as collars and lapels may be "fused" together by heat and pressure. A *fusing machine tender* (D.O.T. 583.685-046) places the garment part on the loading platform of a fusing press that is adjusted to apply the precise amount of pressure and temperature needed for a permanent bond.

In a typical apparel plant, each operator in the sewing department performs one or two assigned tasks on each piece in a bundle of cut garment pieces, and then passes the bundle to the next operator. Many plants employ *material handlers* (D.O.T. 929.687-030) who move garment bundles from one sewing operation to another.

At various stages of the sewing operations, *garment inspectors* (D.O.T. 789.687-070) examine garments. They mark defects, such as skipped stitches or bad seams, which the inspectors return for repair before the garments are passed on to the next sewing operation.

Tailoring Occupations. *Tailors* (D.O.T. 785.-261-014) and *dressmakers* (D.O.T. 785.361-010) are skilled workers who do difficult kinds of hand and machine sewing. Most are employed in making expensive clothing that needs precise shaping and finishing. Although some tailors and dressmakers make complete garments, most specialize in a few operations such as collar setting and lapel padding.

Bushelers (D.O.T. 785.261-010) are tailors who repair defects in finished garments rejected by the inspector. They alter parts that have not been sewn correctly, rearrange padding in coats and suits, and do other sewing necessary to correct defects.

Pressing Occupations. The shape and appearance of the finished garments depend, to a large extent, on the pressing that is done during and after sewing operations. *Pressers* (D.O.T. 363.682-018, .684-018, and .685-018), sometimes working with manikins and body forms, use various types of steam pressing machines or hand irons to flatten seams and shape parts and finished garments. There are two basic types of pressers—underpressers and finish pressers. Underpressers specialize on particular garment parts, such as collars, shoulders, seams, or pockets. Their duties vary from simple smoothing of cloth and flattening of seams to skillful shaping of garment parts. Finish pressers generally do final pressing and ironing at the end of the sewing operations.

Fur Shop Occupations. Because furs are expensive and difficult to work with, making a fur garment requires workers who have special skills not found in plants that make other types of apparel.

The most skilled worker in a fur garment plant is the *fur cutter* (D.O.T. 783.381-010), who also may be the supervisor. The cutter selects and matches enough fur skins to make a single garment, such as a coat or jacket, and arranges and cuts the skins on pattern pieces so that the choice sections of fur are placed where they will show. Following the sewing instructions given by the cutter, *fur machine operators* (D.O.T. 783.682-010) sew these pelts together to make garment sections. A *fur nailer* (D.O.T. 783.684-014), after wetting and stretching the garment sections, either staples or nails them on a board so that they will cover the pattern. When the sections are dry, this worker removes them from the board. To complete the garment, the fur machine operator then finishes sewing the various sections, and *fur finishers* (D.O.T. 783.381-014) sew in the lining, tape edges, make pockets, and sew on buttons and loops.

Administrative, Sales, and Maintenance Occupations. Most administrative positions in an apparel plant are in the production department. Production managers are responsible for estimating production costs, scheduling the flow of work, hiring and training workers, controlling quality, and supervising the overall production activities of the plant. In some small apparel firms, the production manager also is a designer.

Industrial engineers advise management about the efficient use of machines, materials, and workers. (Further discussion of industrial engineers is included elsewhere in the *Handbook*.)

Clerks, bookkeepers, stenographers, and other office workers make up payrolls, prepare invoices, keep records, and attend to other paperwork. In some large plants, many clerical functions are handled with computers. This requires keypunch operators, computer programers and operators, and systems analysts. Sales representatives, fabric buyers, models, accountants, and sewing machine mechanics and technicians are among other types of workers in the apparel industry. Discussions of many of these jobs can be found elsewhere in the *Handbook*.

Working Conditions

While many plants are housed in old buildings, others are located in modern buildings that have ample workspace, good lighting, and air-conditioning. Because most employees sit when they sew, the work is not physically strenuous, but the pace is rapid and many tasks are monotonous. Compared with other industries, the work is relatively safe and healthly.

Working conditons in cutting and designing rooms are more pleasant than in the sewing and pressing areas. The cutting and designing rooms are in an area away from the hustle and bustle of the sewing and pressing operations, and designing, patternmaking, and cutting jobs are more interesting and less monotonous than most other apparel jobs.

Training, Other Qualifications, and Advancement

Most workers in the apparel industry pick up their skills on the job by helping and observing experienced workers. The length of time required for on-the-job training ranges from a few weeks to several years, depending on the type of occupation, the worker's aptitude, and the employer's training program. A relatively small number of employees are trained in formal apprenticeship programs for highly skilled occupations, such as patternmaker, cutter, and tailor. Some employees take courses in patternmaking, cutting, and tailoring, as well as machine and hand sewing, at private and public schools in apparel manufacturing centers.

Many production jobs do not require much physical exertion. Good eyesight and manual dexterity, however, are vital.

Entry into beginning hand- or machine-sewing jobs is relatively easy, since there are few restrictions regarding education and physical condition. An increasing number of workers, however, are receiving training in high school and vocational schools. New workers start by sewing straight seams, under the supervision of a skilled worker or supervisor, and progress to more complicated sewing as they gain experience. Many large companies have special in-plant training programs for sewing-machine operators. The operator is taught how to perform each operation with minimal finger, arm, and body movement. The ability to do routine work rapidly is essential, since nearly all sewers are paid by the number of pieces they produce. Some sewers advance to supervisory positions. Most, however, stay on the same general operation throughout their working lives and can look forward only to moving from simple sewing tasks to more complicated ones that pay higher piece rates.

New workers in cutting rooms usually begin as assemblers (bundlers or fitters). Speed, patience, and the ability to match colors are necessary for these jobs. An assembler may be promoted to spreader and, after a few years, to marker or cutter.

Most patternmakers pick up the skills of the trade by working for several years as helpers to experienced patternmakers.Cutters and pattern graders occasionally are promoted to patternmaking. Patternmakers must be able to visualize from a sketch or model the size, shape, and number of pattern pieces required for a particular garment. They also must have a knowledge of fabrics, body proportions, and garment construction.

For beginning tailor and dressmaking jobs, many employers prefer to hire vocational school graduates who have had courses in these subjects. With a few years of additional apprenticeship or informal on-the-job training, graduates can qualify as skilled workers. Some of these workers eventually become designers or supervisors. They can also transfer to jobs outside the apparel manufacturing industry as fitters and alteration tailors in clothing stores and drycleaning shops.

Pressers usually begin as underpressers, working on simple seams and garment parts. Underpressing can be learned in a short time, and the worker can progress to the more difficult job of finish presser. These workers also can transfer to pressing jobs in drycleaning shops.

Many apparel firms prefer to recruit designers from colleges that offer specialized training in this field. Graduates usually start as assistant designers or sample makers. Some designers, however, have come up through the ranks by advancing from cutting, patternmaking, or tailoring jobs.

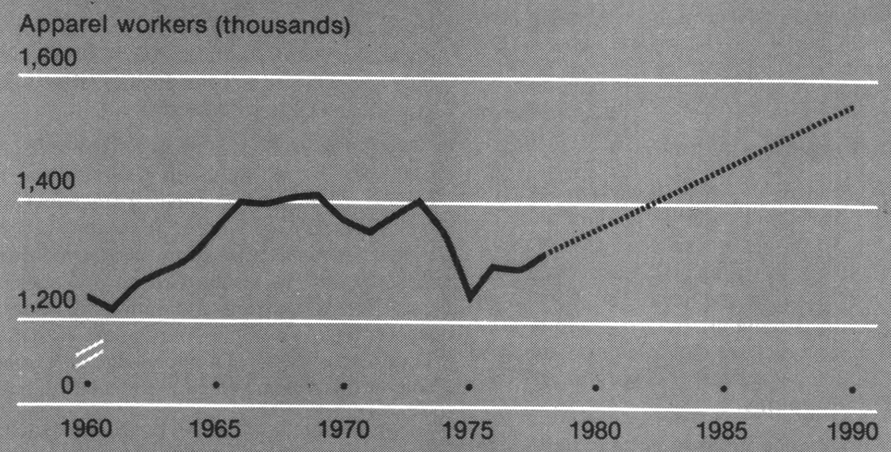
Designers need a thorough knowledge of fabrics, a keen sense of color, and the ability to translate design ideas into a finished garment. They should also acquaint themselves with garmentmaking techniques by working briefly in various plant jobs, such as samplemaking, patternmaking, cutting, and machine sewing. Designers should know how to sketch.

Production managers and industrial engineers often begin as management trainees. A college education increasingly is being required for these jobs. For those without a college background, many years of on-the-job training in all production processes, ranging from selection of fabrics to shipment of finished apparel, are required to qualify as a production manager.

Employment Outlook

Apparel industry employment is expected to grow about as fast as the average for all industries through the 1980's. However,

Employment in the apparel industry depends on the state of the economy, but growth is expected through the 1980's



Source: Bureau of Labor Statistics

most job openings will arise from the need to replace experienced workers who retire, die, or transfer to other fields of work rather than from growth in the industry. The number of openings may fluctuate greatly from year to year, as the demand for apparel is highly sensitive to changes in the economy.

Demand for apparel is expected to increase through the 1980's as population and incomes continue to grow. The industry's greater emphasis on styling also may stimulate demand. However, much of the increased demand may be filled by imported apparel rather than by apparel produced in this country. Also, employment is not expected to keep pace with the production of apparel because new mechanized equipment and improved methods of production and distribution are expected to result in greater output per worker. Examples of laborsaving equipment include sewing machines that can position needles and trim threads automatically; devices that automatically position fabric pieces under the needle and remove and stack completed pieces; and computer-controlled patternmaking, grading, and cutting. Computers also are improving managerial control over sales, inventories, shipping, and production.

Despite technological advances in equipment, extensive application of automatic laborsaving equipment to the production process is difficult because of the variety of items produced and the frequent style and seasonal changes. For these and other reasons, apparel manufacturing operations will continue to require much manual labor. Most employment opportunities will be for sewing-machine operators, as this occupational group constitutes approximately 50 percent of total industry employment.

Opportunities are expected to be particularly favorable for production managers and engineers with college degrees in apparel management, engineering technology for apparel, and industrial engineering, as well as for sales workers, fabric buyers, and sewing-machine mechanics. Job opportunities also should be favorable for the more highly skilled craft workers such as patternmakers, cutters, pressers, finishers, and tailors. People who plan to become designers, on the other hand, will face keen competition, because the number of people trying to get into this field exceeds the number of available jobs.

Table 1. Average hourly earnings in the men's and boys' shirt industry, 1978

Occupation	Hourly rate
All production workers	$3.28
Machine cutter	4.36
Spreader	3.49
Garment folder	3.41
Assembler	3.28
Sewing-machine operator	3.23
Hand finish presser	3.20
Bagger and boxer	3.15
Work distributor	3.06

SOURCE: Bureau of Labor Statistics.

Earnings

Earnings in the apparel industry are relatively low. In 1978, production workers in apparel averaged $3.94 an hour, compared with $5.69 an hour for those in all private industries, except farming.

Average hourly earnings of production workers varied among different kinds of apparel plants, ranging from $3.47 in plants that made men's and boys' shirts and nightwear to $4.79 in those that made men's and boys' suits and coats. Earnings of apparel workers also varied by occupation. Table 1 gives estimated average hourly earnings in 1978 for selected occupations in one segment of the industry.

Because most production workers in the apparel industry are paid by the number of pieces they produce, their total earnings depend upon speed as well as skill.

Many apparel workers are union members, particularly those who work in metropolitan areas. The major unions in this industry are the International Ladies' Garment Workers' Union, the Amalgamated Clothing and Textile Workers' Union, and the United Garment Workers of America. Some of these unions sponsor health care and child day care centers, cooperative housing, and vacation resorts for the benefit of their members.

Workers may be laid off for several weeks during slack seasons, particularly in plants that make seasonal garments, such as women's coats and suits. Employment is usually more stable in plants that produce standardized garments, such as pajamas and men's shirts, which are worn all year. In many plants, the available work during slack periods is divided so that all workers can be assured of at least some earnings.

Sources of Additional Information

Information on vocational and high schools that offer training in designing, tailoring, and sewing may be obtained from the Division of Vocational Education of the Department of Education in each State capital.

Information on apprenticeships may be obtained from the Apprenticeship Council of the State labor department or the local offices of State employment services. Some local employment service offices administer tests to determine aptitudes that are important for many apparel industry jobs.

For general information on jobs in the industry and for specific information on the following organizations and the part of the industry each represents, write to:

American Apparel Manufacturers Association, Suite 800, 1611 N. Kent St., Arlington, Va. 22209.

Amalgamated Clothing and Textile Workers' Union, 1770 Broadway, New York, N.Y. 10003.

Fur Information and Fashion Council, 101 W. 30th St., New York, N.Y. 10001.

International Ladies' Garment Workers' Union, 1710 Broadway, New York, N.Y. 10019.

National Outerwear and Sportswear Association, Inc., 1 Pennsylvania Plaza, New York, N.Y. 10001.

United Garment Workers of America, Room 1614, 200 Park Ave. South, New York, N.Y. 10003.

Apparel Manufacturers' Association, 1440 Broadway, New York, N.Y. 10018.

National Knitted Outerwear Association, 51 Madison Ave., New York, N.Y. 10010.

Occupations in the Baking Industry

The aisles of supermarkets everywhere are laden with mouth-watering arrays of cakes, pies, doughnuts, cookies, crackers, pretzels, rolls, bagels, and breads of all kinds. Such items come from industrial bakeries, where they are produced in large quantities, then packaged and delivered to retail stores and other distribution centers. Thousands of workers throughout the country are employed in the production of these goods.

The baking industry includes jobs to suit a wide variety of interests, skills, and talents. Production workers make, wrap, and pack bakery products. Maintenance workers maintain and repair plant machinery and delivery trucks. Drivers deliver the goods and may also have sales duties. On the administrative end, managers and sales specialists direct operations, and clerical workers perform such office duties as typing, stenography, and filing.

Nature and Location of the Industry

About 228,400 persons worked in the Nation's 3,000 industrial bakeries in 1978, making the baking industry one of the Nation's largest food-processing employers. More than 4 out of 5 industrial bakery workers worked in bakeries that produced perishable goods such as bread, rolls, pies, cakes, and doughnuts. The remainder worked in those that made "dry" goods such as cookies, crackers, and pretzels.

Although there are many small bakeries, the larger plants account for most of the employment. About three-fourths of the industry's employees are in plants with more than 100 workers.

Most jobs are concentrated in metropolitan areas, and most of the industry's employees are production or maintenance workers who do the baking, handle raw materials, maintain equipment, wrap and pack products, and keep the bakeries clean. Nearly 1 out of 4 industry employees drives a truck to deliver the industry's products; most of these workers sell to retail stores. Other drivers with no sales duties deliver bakery products to distribution centers, hotels, restaurants, and stores. About 20 percent of the baking industry's work force are in administrative, professional, technical, and clerical jobs.

Production Occupations. Production workers blend, sift, and mix ingredients to form a dough; shape and bake the dough; and wrap and pack the final product. Since bread is the main product of the industry, the occupations described here are those found in a bread bakery. Jobs may differ somewhat in a bakery that makes other products or is more automated.

The first step in baking is to combine the ingredients needed to make dough. *Dough mixers* (D.O.T. 520.582-010) load blending machines with the exact amounts of flour, water, and yeast, and other ingredients needed for the bread. Using instruments, they carefully control the temperature, timing, and mixing speed of the machines to make sure the dough is uniform and well blended. They drop the mixed dough into a trough and push it to a warm proofing room where the yeast ferments and the dough rises. The risen dough is poured back into the blender, and sugar, salt, shortening, and more flour and water are added. The dough is allowed to rise again before it is shaped into loaves.

Dividing machine operators (D.O.T. 520.-685-086) run machines that divide, round, proof, and shape dough into loaf-size balls. They observe the progress of the units as a conveyor carries these balls of dough to molding machines, which press out the air bubbles, form the balls into loaves, and drop the loaves into pans. If bread or rolls are to be made in fancy shapes, *bench hands* (D.O.T. 520.384-010) knead and form the dough by hand.

The pans of dough go back to the proofing room for about an hour before being placed in the oven. *Oven tenders* (D.O.T. 526.685-030) load and unload the ovens and adjust the temperature and timing of the ovens to make sure that the bread is properly baked.

Some bakeries use an automatic process called "continuous mix" that eliminates many of the steps described above. With this process, all ingredients are mixed at once and the dough is divided, shaped, put into pans, and then proofed only once before baking.

In small bakeries, *bakers* (D.O.T. 526.381-010), assisted by helpers, usually handle all the steps needed to turn out finished baked products. In large bakeries, bakers are employed as working supervisors. They direct their employees and coordinate their activity with other departments to meet production schedules.

A considerable number of *baker helpers* (D.O.T. 526.686-010) are employed in baking operations to move bakery supplies and products around the production area; help load and unload machines, bins, and racks; clean equipment; and grease pans. They may assist bakers and other workers. They have job titles such as doughmixer helper and dividing machine operator helper.

After baked goods are cooled, several types of workers prepare them for delivery to customers. *Slicing machine operators* (D.O.T. 521.685-302) feed loaves of bread onto conveyors leading to the machines, watch the slicing operation, adjust the machines, and transfer the sliced loaves to conveyors leading to wrapping machines. From the wrapping machines, a conveyor takes the wrapped loaves to the shipping platform.

Bakery employees in icing departments give finishing touches to cakes, pastries, and other sweet goods following special formulas of the bakery. *Icing mixers* (D.O.T. 520.685-114) weigh and measure ingredients and mix cake icings and fillings by machine. They also prepare cooked fillings for pies, tarts, and other pastries. *Hand icers* (D.O.T. 524.684-022) are skilled workers who decorate special products such as wedding cakes, birthday cakes, and fancy pastries. When the product is uniform or requires no special decoration, the frosting may be applied by *machine icers* (D.O.T. 524.685-034).

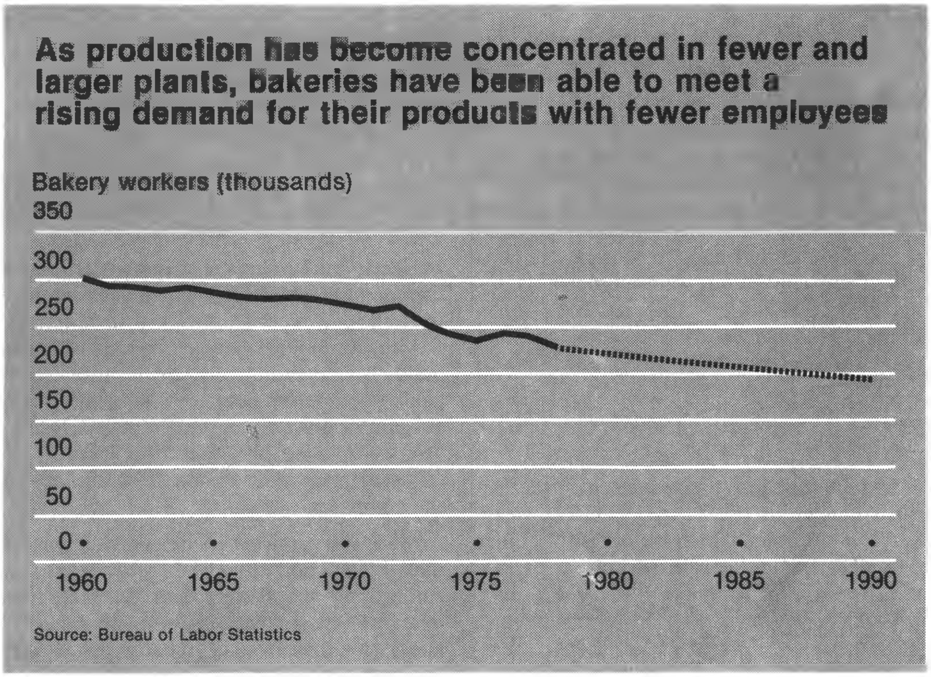
Bakeries also employ many workers in storage, warehousing, and shipping departments. Receiving and stock clerks check, record, and deliver incoming supplies and ingredients to various departments. Packers and checkers make up orders of bakery products for delivery by route drivers.

Maintenance Occupations. Bakeries employ skilled maintenance workers, such as machinists, electricians, and stationary engineers, to keep machinery and equipment in good condition. Large plants need many of these workers because their baking operations are highly mechanized. Many bakeries also employ truck mechanics to service their delivery trucks.

Sales and Driving Occupations. Selling and delivering finished baked foods requires many thousands of workers. Some sell baked goods, some drive trucks, and many do both.

Sales route drivers (D.O.T. 292.353-010) work for wholesale bakeries. They deliver baked foods to grocery stores along their routes and collect payment. Attracting new customers and urging old customers to buy new products are major parts of their job. Sales route drivers usually arrange their baked goods on shelves or display racks in grocery stores, although some stores have begun to use their own employees to stock shelves. Drivers also list the items they think the grocers will buy the next day; these lists are used to help make up the bakery production schedule for the next morning.

Route supervisors (D.O.T. 292.137-014) assign delivery routes and check delivery schedules. They train new route drivers and may temporarily replace those who are absent. A large bakery may employ several



supervisors, each in charge of 6 to 10 route drivers.

Grocery store and retail chain bakeries employ *truckdrivers* (D.O.T. 906.683-022) rather than route drivers to deliver baked foods to each of their company's stores. Truckdrivers do not have sales duties, nor, in most areas, do they stock shelves. Each store's stock clerks or sales clerks arrange the displays of baked foods.

Administrative, Clerical, and Professional and Technical Occupations. Administrators in large bakeries and owners of small bakeries coordinate all the baking activities, from the purchase of raw materials to the production and delivery of finished goods. In large firms, activities are divided into separate departments or functions and are supervised by plant managers, comptrollers, sales managers, and other executives. Some administrative employees specialize in fields such as accounting, purchasing, advertising, personnel, and industrial relations. Bakeries employ many types of clerical workers, including bookkeepers, cashiers, clerks, business machine operators, typists, and switchboard operators. Some large baking companies have laboratories and test kitchens where chemists, home economists, and their assistants test ingredients and prepare formulas and recipes. (Detailed discussions of the duties, training, and employment outlook for maintenance, sales, driving, administrative, clerical, and technical personnel appear elsewhere in the *Handbook*.)

Working Conditions

Some plant employees work night shifts and weekends because many bakeries operate around the clock. Many bakery jobs involve some strenuous physical work, despite the considerable mechanization of baking processes. Work near ovens can be uncomfortably hot.

Training, Other Qualifications, and Advancement

Training requirements for occupations in the baking industry range from a few days on the job to several years of experience or advanced education. Slicing-machine operators can learn their job in a few days, but skilled workers, such as bakers, mixers, oven tenders, and other baking specialists, need 3 or 4 years of training. Professional personnel and some administrative workers must have a college degree or considerable experience in their specialty.

Most inexperienced production workers in the baking industry are hired as helpers. They usually are assigned such tasks as carrying ingredients to mixing machines or pushing troughs of dough to the proofing room. Many workers who become bakers begin as bakers' helpers. They learn more advanced baking skills while working alongside experienced bakers. Some workers take courses in vocational schools or learn baking in the Armed Forces.

Bakers may be promoted to jobs such as working or department supervisors. Some bakers who have developed special skill in fancy cakemaking or piemaking may find jobs in hotel or restaurant bakeries. Bakers with some business ability sometimes open their own bakeshops.

Production employees must be in good health. Most States require a health certificate indicating that the worker is free from contagious diseases.

Some bakeries have apprenticeship programs for maintenance workers such as machinists, electricians, and mechanics. Others train maintenance workers informally on the job. Some bakeries hire only maintenance workers who are already skilled.

For route drivers or truckdrivers, baking firms generally hire inexperienced people with a high school education. These workers often begin as stock clerks, packers, or checkers, and are promoted to driving jobs. Applicants must be able to get a chauffeur's license and generally are tested by the baking companies to determine whether they are safe drivers. Classroom instruction in sales, display, and delivery procedures is sometimes given to new route drivers, but most training is given on the job by supervisors. Route drivers may be promoted to route supervisors or sales managers.

More than 4 out of 5 industrial bakery workers work in bakeries that produce perishable goods such as bread, rolls, pies, cakes, and doughnuts.

Administrative jobs usually are filled by upgrading personnel already employed in the firm. Some owners and production managers of bakeries have been plant workers or were in sales occupations. Large baking firms generally require their new administrative workers to have a college degree in an administrative field, such as marketing, accounting, labor relations, personnel, or advertising. Kansas State University at Manhattan offers a bachelor of science degree in bakery science and management. The American Institute of Baking conducts a school of baking for persons who wish to qualify for managerial positions. Applicants must have a high school diploma and 2 years of baking experience or equivalent time in college.

Persons who have completed a commercial course in high school, junior college, or a business school usually are preferred for secretarial, stenographic, and other clerical jobs.

Employment Outlook

Employment in the baking industry is expected to decline through the 1980's. Nevertheless, several thousand job openings are anticipated each year because of the need to replace workers who retire, die, or transfer to other fields of work.

A major influence on future demand for bakery products will be the growing recognition of their important nutritional contribution. Population growth will also increase the demand for bakery products. However, a continuation of the trend toward larger and fewer baking plants will allow these larger bakeries to make more use of labor-saving technology and thus meet the demand with fewer employees. Pneumatic handling systems and pumps quickly and easily transfer ingredients from trucks or railroad cars to storage containers. The "continuous mix" process eliminates doughmixing and proofing operations, and conveyor systems move panned dough from ovens to labeling machines in one continuous process.

Earnings

In 1978, earnings of production workers in the baking industry averaged $233.22 a week, or $5.98 an hour, which was slightly higher than the average for all workers in private industry, except farming.

Under the terms of union contracts covering employees in some wholesale bakeries producing bread and related products, minimum hourly rates in major occupations in 1978 were as shown in the table below.

Most plant workers are on a 40-hour workweek, but some work 35 or 37 1/2 hours, and others 44 to 48 hours.

Route drivers usually receive a guaranteed minimum salary plus a percentage of their sales. According to limited information from union contracts in 1978, route drivers for wholesale bakeries had weekly salaries ranging from $120 (plus a percentage of sales) to $302. By selling more baked products to more customers, route drivers can increase their earnings. Companies generally pay for uniforms and their maintenance.

Nearly all employees of industrial baking firms get paid vacations, which usually range from 1 to 5 weeks according to length of service. Employees also get from 5 to 11 paid holidays, depending on the locality. Most baking companies have life and health insurance programs and retirement pension plans. Many employees are covered by joint union-industry plans that are paid for entirely by the company.

Many bakery workers belong to labor unions. Bakers and other plant workers are organized by the Bakery and Confectionery Workers' International Union of America, and route drivers and truckdrivers usually are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.). Some maintenance workers are members of craft unions, such as the International Association of Machinists and Aerospace Workers and the International Union of Operating Engineers.

Table 1. Average hourly earnings in selected bakery occupations, 1978

Occupation	Hourly rate range
Working supervisor	$6.13–$8.64
Mixer	5.66– 8.19
Baker	5.66– 8.19
Molding machine operator	5.47– 8.19
Divider	5.47– 8.19
Baker's helper	5.29– 8.10
Wrapping machine operator	5.47– 7.33

SOURCE: Bakery, Confectionery, and Tobacco Workers' Union.

Sources of Additional Information

Information on baking jobs and training opportunities may be obtained from bakeries in the community, local offices of the State employment service, or locals of the labor unions noted previously.

For general information on job opportunities in the industry and on schools that offer courses or degrees in baking science and technology, write to:

American Bakers Association, 2020 K St. NW., Suite 850, Washington, D.C. 20006.

Occupations in the Drug Industry

References to potions and spells for the cure and prevention of pain and disease are numerous in medical folklore. But 20th century science has created a supply of drug products undreamed of by even the most imaginative apothecaries of the past.

More than 10,000 individual or combination drug products are available to today's physician for diagnostic, preventive, and therapeutic uses. These drugs have resulted in the control of venereal disease, tuberculosis, influenza, cardiovascular disease, malaria, pneumonia, and even some forms of cancer. Hormones have relieved the pain and crippling effects of arthritis and other diseases. Tranquilizers and other drugs have done much to reduce the severity of mental illness. Vaccines have reduced dramatically the toll of polio, whooping cough, and measles. Discoveries in veterinary medicine have increased animal productivity and controlled various diseases, some of which are transmissible to humans. New drugs which control symptoms of various diseases and disorders have resulted in remarkable benefits to society by increasing life expectancy and allowing many ill people to lead reasonably normal lives.

The American drug industry has achieved worldwide prominence through its activities in research and development of new drugs, and spends a higher proportion of its funds for research than any other industry in the United States. About 80 percent of research and development expenditures is devoted to the advancement of scientific knowledge and the development of new products. The remaining funds are allocated to the improvement of existing products. Each year the industry tests more than 150,000 new substances which may eventually yield only 10 to 20 completely new, useful medicines. In recent years, most research has been devoted to infections, diseases of the central nervous and cardiovascular systems, and to neoplasm therapy (treatment of abnormal tissue growth).

Drug firms also are involved in research and the development of other types of products and chemicals. Closely related to drugs as important adjuncts to modern medical care are medical devices and diagnostic products. Many pharmaceutical as well as other manufacturers in the past few years have entered the fast growing production of radiological equipment, radio-pharmaceuticals, heart pacemakers, dialysis machines, and numerous other products. These are used to diagnose disease, on the one hand, or, like drugs, to help alleviate symptoms and restore health and well-being. Many firms also produce agricultural chemicals. Many of the same type of employees required in the research and quality control-oriented production of human and animal-use drugs also are required in these other areas.

Nature and Location of the Industry

In 1978, nearly 185,000 persons worked in the drug industry. About 145,000 worked for companies that made pharmaceutical preparations (finished drugs), such as tranquilizers, antiseptics, antibiotics, and analgesics. The remainder worked for firms that made biological products, such as serums, vaccines, toxins, plasmas, and bulk medicinal chemicals and botanicals used in making finished drugs.

Drug manufacturing companies typically employ many workers. About two-thirds of the industry's employees work for firms with more than 500 workers; over one-half work for firms employing over 1,000 workers. Some of the largest firms employ more than 5,000 workers. The Pharmaceutical Manufacturers Association (PMA) represents about 130 companies that produce most of the Nation's pharmaceuticals, accounting for over 90 percent of total drug sales.

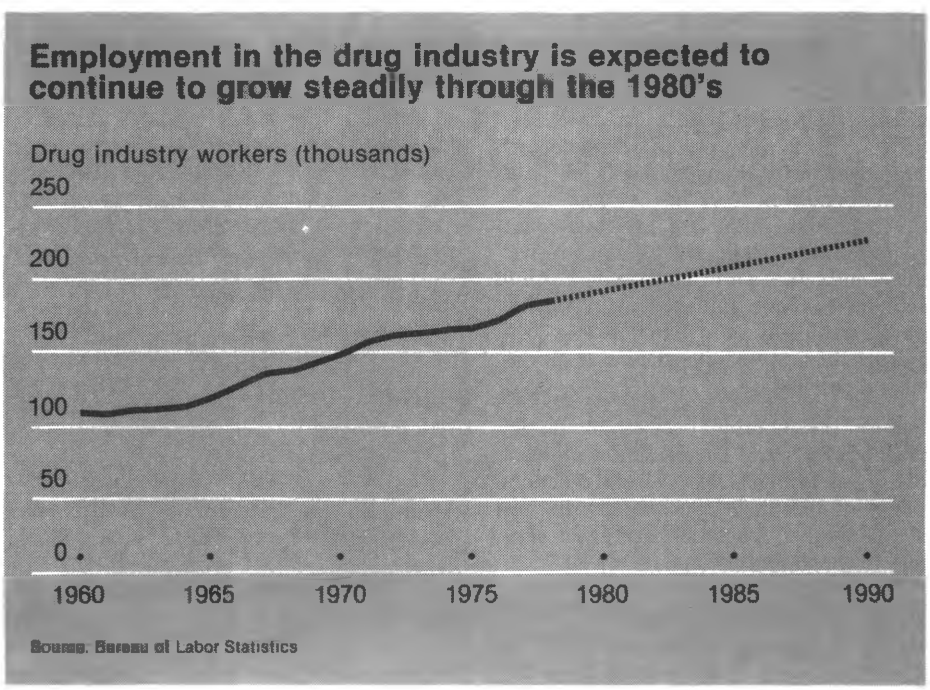
About three-fourths of the industry's employees worked in seven States: New Jersey, New York, Illinois, Pennsylvania, Indiana, California, and Michigan. Large drug manufacturing installations are located in Indianapolis, Ind.; Chicago, Ill.; Nutley and Rahway, N.J.; Philadelphia, Pa.; Detroit and Kalamazoo, Mich.; Pearl River and Brooklyn, N.Y.; and in the Los Angeles and San Francisco, Calif., areas.

For testing new drugs, a primary research method called screening is used. In screening an antibiotic, for example, a sample is first placed in a bacterial culture. If the antibiotic is effective, it is next tested on infected laboratory animals. Each year research personnel study the effects of potential new medicines on millions of animals including mice, rats, chickens, and guinea pigs. Promising compounds are studied further for evidence of useful-and harmful-effects. A new drug is selected for testing in humans only if it promises to have therapeutic advantages over comparable drugs already in use, or if it offers the possibility of being safer.

After laboratory screening, a clinical investigation, or trial of the drug on human patients, is made. Supplies of the drug are given to a small group of doctors who administer it to carefully selected consenting patients. The patients are then observed closely and special studies made to determine the drug's effect. If a drug proves useful, arrangements are made for more tests with a larger group of physicians.

Once a drug has successfully passed animal and clinical tests, problems of production methods and costs must be worked out before manufacturing begins. If the original laboratory process of preparing and compounding the ingredients is complex and expensive, pharmacists, chemists, chemical engineers, packaging engineers, and production specialists are assigned to develop processes economically adaptable to mass production.

Drug manufacturers have developed a



high degree of automation in many production operations. Milling and micronizing machines (which pulverize substances into extremely fine particles) are used to reduce bulk chemicals to the required size. These finished chemicals are combined and processed further in mixing machines. The mixed ingredients may then be mechanically capsulized, pressed into tablets, or made into solutions. One type of machine, for example, automatically fills, seals, and stamps capsules. Other machines fill bottles with capsules, tablets, or liquids, and seal, label, and package the bottles.

Quality assurance or control is vital in this industry. A quality control system involves selection and training of personnel; product design; establishment of specifications, procedures, and tests; design and maintenance of facilities and equipment; selection of materials; and recordkeeping. In an effective system, all these aspects of quality control are evaluated on a regular basis, and modified and improved when appropriate. Quality-conscious manufacturers may assign 1 of every 6 production workers to quality assurance functions alone, while all other employees may devote part of their time to these functions. For example, although pharmaceutical company representatives called detailers primarily work in marketing, they engage in quality control when they assist pharmacists in checking for outdated products.

A drug may undergo hundreds of complex, time-consuming quality control checks at various stages during the manufacturing process to insure that it conforms to specifications. Although some inspection operations are mechanized, many are performed manually.

The pharmaceutical industry is closely regulated. The Food and Drug Administration (FDA) has legal authority to inspect manufacturing plants, test drugs and examine drug imports, and monitor drug research, testing, development, marketing, and consumption.

Occupations in the Industry

Employees with many different levels of skill and education work in the drug industry. About three-fifths are in white-collar jobs (scientific, technical, administrative, clerical, and sales), a much higher proportion than in most other manufacturing industries; the other two-fifths are in plant jobs (processing or production, maintenance, transportation, and service).

Some of the important occupations are described briefly below. Detailed discussions of professional, technical, clerical, and other occupations found in drug manufacturing, as well as in other industries, are given elsewhere in the *Handbook*.

Scientific and Technical Occupations. About 1 out of every 6 employees in the industry is a scientist, engineer, or technician—a far greater proportion than in most other industries. The majority conduct research to develop new drug products. Others work to streamline production methods and improve environmental and quality control.

Chemists (D.O.T. 022.061) make up the largest group of scientific and technical personnel in the industry. Organic chemists combine new compounds for biological testing. Physical chemists separate and identify substances, determine molecular structure, help to create new compounds, and improve manufacturing processes. Biochemists study the action of drugs on body processes. Radiochemists trace the course of drugs through body organs and tissues. Pharmaceutical chemists set standards and specifications for the form of products and for storage conditions and see that labeling and literature meet the requirements of State and Federal laws. Analytical chemists test raw and intermediate materials and finished products for quality.

A large number of *biological scientists* (D.O.T. 041.061) work in the drug industry. Biologists and bacteriologists study the effect of chemical agents on infected animals. Microbiologists grow strains of microorganisms that produce antibiotics. Physiologists investigate the effect of drugs on body functions and vital processes. Pharmacologists and zoologists study the effect of drugs on animals. Virologists grow viruses, develop vaccines, and test them in animals. Botanists, with their special knowledge of plant life, contribute to the discovery of botanical ingredients for drugs. Other biological scientists include pathologists, who study normal and abnormal cells or tissues, and toxicologists, who are concerned with the safety, dosage levels, and compatibility of different drugs. Pharmacists perform research in product development, studying many forms of medicines at various stages of production. Some set specifications for the purchase and manufacture of materials, and handle correspondence relating to products. Drug manufacturers also employ physicians and veterinarians.

Engineers account for a small fraction of scientific and technical workers, but make significant contributions toward improving quality control and production efficiency. *Chemical engineers* (D.O.T. 008.061) design equipment and devise manufacturing processes. *Industrial engineers* (D.O.T. 012.061, .067, .167, and .187) plan equipment layout and workflow to maintain efficient use of plant facilities. *Mechanical engineers* (D.O.T. 007.061, .151, and .161) coordinate the installation and maintenance of sterilizing, heating, cooling, humidifying, and ventilating equipment.

Technicians (D.O.T. 073.361, 078.261 and .687) represent about one-third of the drug industry's scientific and technical workers.

The drug industry spends a higher proportion of its funds for research than any other industry.

Laboratory tests play an important part in the detection and diagnosis of disease and in the discovery of medicines. Laboratory technicians perform these tests under the direction of scientists in such areas as bacteriology, biochemistry, microbiology, virology (study of viruses), and cytology (analysis of cells).

Administrative, Clerical, and Sales Occupations. About 1 out of every 3 workers in drug manufacturing is in an administrative, clerical, or sales job. At the top of the administrative group are the executives who make policy decisions concerning matters of finance, marketing, and research. Other administrative and executive workers include accountants, lawyers, purchasing agents, personnel and labor relations workers, public relations workers, economists, technical writers, computer specialists, and advertising and marketing research workers. Clerical employees include secretaries, typists, office machine operators, and others who keep records on personnel, payroll, raw materials, sales, shipments, and plant maintenance.

Pharmaceutical detailers (D.O.T. 262.-157), often called pharmaceutical sales representatives, describe their companies' products to physicians, pharmacists, dentists, and health services administrators, and serve as lines of communication between their companies and clients.

Plant Occupations. About one-third of the industry's employees work in plant jobs. The majority of these workers can be divided into three major occupational groups: Production or processing workers, who operate the drug-producing equipment; maintenance workers, who install, maintain, and repair this equipment; and shipping clerks, truckdrivers, and material handlers, who help transport the drugs.

Various types of chemical operators are involved in the production of pharmaceutical preparations and biological products. *Pharmaceutical operators* (D.O.T. 559.382) control machines that produce tablets, capsules, ointments, and medicinal solutions. *Granulator machine operators* (D.O.T. 559.382) tend milling and grinding machines that reduce mixtures to particles of designated sizes. *Compounders* (D.O.T. 550.685) tend tanks and kettles in which solutions are mixed and compounded to make up creams, ointments, liquid medications, and powders. *Compressors* (D.O.T. 556.382) operate machines that compress ingredients into tablets. *Pill and tablet coaters* (D.O.T. 554.382), often called capsule coaters, control a battery of machines that apply coatings to tablets which flavor, color, preserve, add medication, or control disintegration time. *Tablet testers* (D.O.T. 559.667) inspect tablets for hardness, chippage, and weight to assure conformity with specifications.

Ampoule fillers (D.O.T. 559.685) operate machines that fill small glass containers with measured doses of liquid drug products. *Ampoule examiners* (D.O.T. 559.687) examine the ampoules for discoloration, foreign particles, and flaws in the glass.

After the drug product is prepared and inspected, it is bottled or packaged. Most of the packaging and bottle filling jobs are done by semiskilled workers who operate machines that measure exact amounts of the product and seal containers.

The drug industry employs many skilled maintenance workers to assure that production equipment is operating properly and to prevent costly breakdowns. Included among maintenance workers are powerplant operators who are responsible for high pressure boilers, turbogenerators, compressors, refrigeration equipment, and plant water systems; electricians who install, maintain, and repair the various types of electrical equipment; plumbers who install and maintain heating, plumbing, and pumping systems; machinists who make and repair metal parts for machines and equipment; and instrument repairers who periodically inspect instruments and controls and repair or replace malfunctioning parts. Drug firms also employ pipefitters, millwrights, and many other skilled workers.

Plant workers who do not operate or maintain equipment perform a variety of other tasks. Some drive trucks to make deliveries to other parts of the plant; some load and unload trucks and railroad cars; others keep inventory records. The industry also employs service workers, such as guards, cooks, and janitors, whose duties are similar to those of such workers in other industries.

Working Conditions

Working conditions in drug plants are better than in most other manufacturing plants. Much emphasis is placed on keeping equipment and work areas clean because of the danger of contamination of drugs. Plants usually are air-conditioned, well lighted, and quiet. Ventilation systems protect workers from dust, fumes, and disagreeable odors. Special precautions are taken to protect the relatively small number of employees who work with infectious cultures and poisonous chemicals. With the exception of work performed by material handlers and maintenance workers, most jobs require little physical effort. The frequency and severity of injuries in drug manufacturing have been about half the average for all manufacturing industries.

Training, Other Qualifications, and Advancement

Training requirements for jobs in the drug industry range from a few hours of on-the-job training to years of formal educational preparation plus job experience. Because quality control is of paramount importance, the drug industry places a heavy emphasis on continuing education for employees, and many firms provide classroom training in safety, environmental and quality controls, and other areas.

For production and maintenance occupations, drug manufacturers generally hire inexperienced workers and train them on the job; high school graduation is not essential but generally is preferred by most firms. Beginners in production jobs assist experienced workers and learn the operation of the processing equipment. With experience, employees may advance to more skilled jobs in their departments. Most maintenance jobs are filled by people who start as helpers to electricians, plumbers, machinists, and other craft workers.

Many companies encourage production and maintenance workers to take courses related to their jobs in local schools and technical institutes, or to enroll in correspondence courses. College courses in chemistry and related areas are particularly encouraged for highly skilled production workers who operate sophisticated equipment. Some companies reimburse the workers for part, or all, of the tuition. Skilled production and maintenance workers with leadership ability may advance to supervisory positions.

For technicians in the drug industry, methods of qualifying for jobs vary. Some technicians enter the field with a high school education and advance to jobs of greater responsibility with experience and additional formal education. However, companies increasingly prefer to hire graduates of technical institutes or junior colleges, or those who have completed college courses in chemistry, biology, mathematics, or engineering. In many firms, newly hired workers begin as laboratory helpers or aides, performing routine jobs such as cleaning and arranging bottles, test tubes, and other equipment.

The experience required for higher level technician jobs varies from company to company. Generally, employees advance over a number of years from assistant technician, to technician, to senior technician, to technical associate. Some companies require senior technicians and technical associates to complete job-related college courses.

For most scientific and engineering jobs, a bachelor of science degree is the minimum requirement. Some companies have formal training programs for college graduates with engineering and scientific backgrounds. These trainees work for brief periods in the various divisions of the plant to gain a broad knowledge of drug manufacturing operations before being assigned to a particular department. In other firms, newly employed scientists and engineers are immediately assigned to a specific activity such as research, process development, production, or sales. Drug manufacturing companies prefer to hire college graduates, particularly those with strong scientific backgounds, as pharmaceutical detailers. Newly employed pharmaceutical representatives complete rigorous formal training programs revolving around their companies' product lines.

Job prospects and advancement usually are best for professionals with advanced degrees. Over half of all professionals involved in research and development have a doctoral or master's degree. Some companies offer training programs to help scientists and engineers keep abreast of new developments in their fields and to develop administrative skills. These programs may include meetings and seminars with consultants from various fields. Many companies encourage scientists and engineers to further their education; some provide financial assistance for this purpose. Publication of scientific papers also is encouraged.

Employment Outlook

Drug manufacturing employment is expected to grow about as fast as the average for all industries through the 1980's. In addition to growth arising from increased demand for drug products, many job openings will result from deaths, retirements, and other separations from the labor force.

The demand for drug products is expected to grow in the future. Demand will be stimulated primarily by population growth, particularly the growing number of older people who require more health care services, and by the growth of public and private health insurance programs, which generally cover the cost of drugs and medicine. Adoption of a national health insurance program could further expand the market for drugs. Other factors expected to increase the demand for drugs include greater personal income, the rising health consciousness of the general public, and the discovery of new drugs. A continued rise in foreign drug sales, particularly to developing countries, also is anticipated.

The industry's employment will not increase as rapidly as the demand for drug products, however, because technological improvements in production methods will increase output per worker. The more widespread use of automatic processing and control equipment in operations formerly done by hand will tend to reduce labor requirements, particularly in plants where common drugs are mass-produced. For example, mixing and granulating processes, which precede tableting, have become completely mechanized in some plants. In addition, computers increasingly are used in quality control systems to eliminate computational errors in analysis and testing and to speed up production and shipment. Computers, thus, have tended to take over some of the tasks of professional, technical, and production workers.

The rate of employment growth over the last few decades is not expected to continue. Only moderate increases are anticipated in the number of scientists, engineers, and technicians engaged in pharmaceutical research and development. Demand for skilled maintenance workers (such as electricians, machinists, plumbers, and instrument repairers) will be spurred by the need to service the growing amount of automatic processing and control equipment. Employment of administrative and clerical workers is expected to increase moderately. Demand for laborers and many semiskilled plant occupations is not expected to increase significantly, as more processes are adapted to automatic equipment. However, demand for highly skilled production workers to operate the increasingly sophisticated equipment used in drug manufacturing is expected to rise.

Unlike many other manufacturing industries, drug industry employment is not highly sensitive to changes in economic conditions. Thus, even during periods of high unemployment, work is likely to be relatively stable in the drug industry.

Earnings and Working Conditions

Earnings of plant workers in the drug industry are higher than the average for all manufacturing industries. In 1978, production workers in the drug industry averaged $6.42 an hour, while those in manufacturing as a whole averaged $6.17 an hour.

According to a recent Bureau of Labor Statistics survey, earnings of office employees in the drug manufacturing industry were about two-thirds higher than earnings for production workers. Earnings generally were highest in the North Central region and lowest in the South. Employees generally received bonuses, vacation and sick leave, paid holidays, life, health, and accident insurance, workers' compensation, and retirement plans.

National wage data are not available for individual occupations in the drug industry. However, statements on specific occupations, such as chemist, pharmacist, and technician, found in other parts of the *Handbook*, will give general earnings information.

Some employees work in plants that operate around the clock—3 shifts a day, 7 days a week. In most plants, workers receive extra pay when assigned to second or third shifts. Since drug production is subject to little seasonal variation, work is steady.

Some of the industry's production and maintenance employees are members of labor unions. The principal unions in the industry are the Oil, Chemical and Atomic Workers International Union; the International Chemical Workers Union; and the United Steelworkers of America.

Sources of Additional Information

For additonal information about careers in drug manufacturing and the industry in general, write to the personnel departments of individual drug manufacturing companies and to:

Pharmaceutical Manufacturers Association, 1155 Fifteenth St. NW., Washington, D.C. 20005.

Quality control is a vital aspect of drug manufacturing.

Occupations in the Electronics Industry

An astronaut, a doctor, a mechanic, and a business executive all have something in common—without electronic devices they would be unable to do much of their work. Without the thousands of people working in electronics research and production, space exploration would be impossible and doctors would not have modern electronic equipment to help them diagnose and treat many diseases. Mechanics rely on electronic testing equipment to locate malfunctioning engine and machine parts, while business executives depend on electronic computers to provide more and better information, speed up payroll and billing procedures, and reduce the cost of their operations.

Nature and Location of the Industry

The electronics industry dates back to the early 1900's when the first radios were produced. By 1930, the industry had expanded its research to include, for example, the development of crude television pictures in color. It wasn't until World War II, however, that electronics production really began to diversify. Efforts to develop a wide range of military products resulted in scientific advances such as electronic measuring and detecting equipment, air flight control equipment, and the digital computer. Today, the industry produces about 30,000 types of electronic goods.

The electronics industry is divided into four main market areas: Government products, industrial products, consumer products, and components. Products sold to the government make up a large portion of electronic sales and include a wide array of items, such as missile and space guidance systems, communications systems, and other electronic goods used in medicine, education, crime detection, and traffic control. Industrial purchases include computers, radio and television broadcasting equipment, telecommunications equipment, electronic office equipment, and production control equipment—all vital to daily business operations.

Consumer products are probably the most familiar types of electronic products. Every day thousands of people buy television sets, radios, stereos, and calculators. No electronic products could be developed, however, without their main ingredient—components. Some of the most well-known components are capacitors, switches, transistors, relays, television picture tubes, and amplifiers.

About 1.3 million persons were employed in the development, production, and sales of these products in 1978. Over half of them worked in plants that produced end products for government, industrial, and consumer use. The rest worked in plants that made electronic components.

Electronics manufacturing workers are located in all parts of the country, but the majority of jobs in 1978 were in 10 States: California, New York, Illinois, Massachusetts, Florida, Pennsylvania, Indiana, New Jersey, Maryland, and Texas. Metropolitan areas with large numbers of electronics manufacturing workers include Los Angeles, Chicago, New York, Philadelphia, Newark, Boston, Baltimore, Indianapolis, and Dallas.

Occupations in the Industry

Electronics manufacturing calls for a wide variety of jobs. More than half of all workers are in plant jobs that include production, maintenance, transportation, and service occupations. The rest are scientists, engineers, and other technical workers, and administrative, clerical, and sales workers.

Professional and Technical Occupations. The electronics industry is dependent on research and development. As a result, a large proportion of its workers are in engineering, scientific, and other technical jobs. Engineers and scientists alone make up about 1 out of every 9 electronics workers.

Scientists in the electronics industry work in a number of areas. Many are involved in pure research—learning about why and how things react the way they do. Some apply this information to develop processes or products.

Physicists work with solid-state materials. They may develop uses for semiconductors and design integrated circuits for satellites. Chemists and metallurgists work mainly in materials preparation and testing, but also work in research and development of new processes. Mathematicians and statisticians use computer models to assist engineers and scientists on complex mathematical and statistical problems, such as the design of military and space equipment and computers. Statisticians also are employed in quality control, production scheduling, and sales analysis and planning.

Engineers use their knowledge of mathematics and science to develop new products, processes, procedures, or systems to solve problems. Electrical and electronics engineers, the largest group in the industry, work on research and development, production, and quality control problems. Most of these engineers are highly specialized and work in a specific area, such as in the design and implementation of solid-state circuitry in radar, computers, and calculators.

Mechanical engineers help develop new products, tools, and equipment by setting requirements for the strength of materials and designs. They may, for example, develop calculators and television antennas. Industrial engineers determine the most efficient methods to produce these products. They evaluate plant layout, machinery, and the number and type of personnel utilized in the plant, and make suggestions to lower cost and increase production.

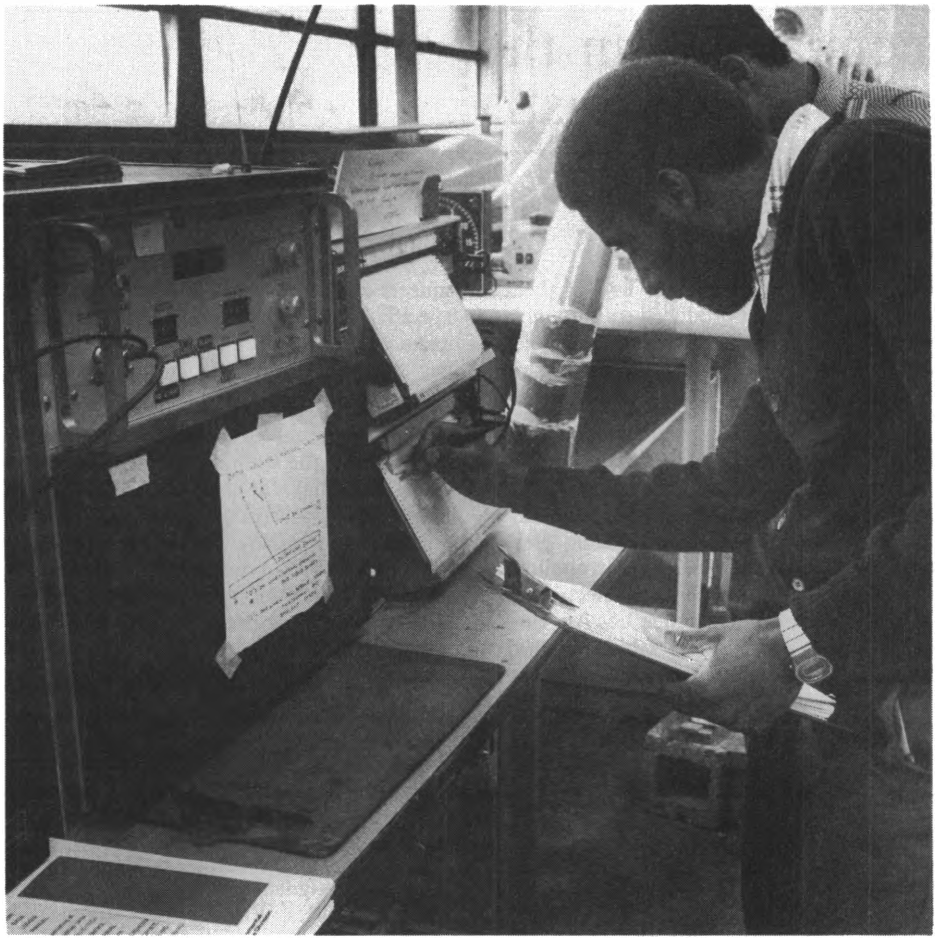
Chemical, metallurgical, and ceramic engineers also work for electronics companies. Chemical engineers may design chemical plants and processes while metallurgical engineers determine the most efficient way to use metals in the company's products.

Industrial designers design the exteriors of electronic products. When designing a television set, for example, they must insure that all components fit, that the set is easy to use and repair, and that it is attractive enough to compete with others on the market.

Technicians—such as electronics technicians, drafters, engineering aides, laboratory technicians, and mathematical assistants—make up about 1 out of every 20 electronics manufacturing workers. Many electronics technicians help engineers design and build experimental models. They also set up and repair electronic equipment for customers. Other electronics technicians do complex inspection and assembly work. Drafters prepare detailed drawings from sketches or specifications furnished by engineers that show the exact dimensions of the entire object and its parts.

Engineering aides make calculations, sketches, and drawings, and test electronic components and systems. Laboratory technicians help physicists, chemists, and engineers in laboratory analyses and experiments. Mathematical assistants follow procedures outlined by mathematicians to solve problems. They also operate test equipment to develop computers and other electronic products.

Technical writers prepare training and technical manuals that describe the operation and maintenance of electronic equipment. They also prepare catalogs, product literature, and contract proposals. Technical illustrators draw pictures of electronic equipment for technical publications and sales literature.



Many electronics technicians help engineers design and build experimental models.

Administrative, Clerical, and Related Occupations. About 1 out of 5 workers in electronics manufacturing has an administrative or other office job. Administrative workers include purchasing agents, sales executives, personnel specialists, advertising workers, and market researchers. Secretaries, typists, and business machine operators are among the thousands of other office workers employed by electronics firms. A growing proportion of these office workers operate computers.

Plant Occupations. About half of electronics manufacturing employees work in plant operations: Assembly, capacitor and coil winding, inspecting, machining, fabricating, processing, and maintenance.

Assembly Occupations (D.O.T. 590.684-022, 726.684-010, 018, 026, and 728.684-010). Assemblers, most of whom are semiskilled workers, make up the largest group of employees. Most end products are assembled by hand with small tools—such as pliers and wire cutters—soldering irons, and light welding machines. Assemblers use diagrams to guide their work. Some assembly is done by following instructions presented on color slides and tape recordings. Projectors flash a picture of an assembly sequence on a screen, while the assembler listens to recorded directions.

Precision assemblers and electronics technicians install components and subassemblies in complex products such as missiles. They also help make experimental models. Most of these workers are employed in the manufacture of military and industrial electronic equipment.

Machines are used in some assembly work. For example, in putting together circuit boards, automatic machines often are used to position components on boards and to solder connections. Here the assemblers work as machine operators or loaders. Machines assemble most components which involve simple and repetitive operations, including some types of miniaturized semiconductors made with parts small enough to pass through a needle's eye.

Some items, such as television picture tubes and some types of resistors and diodes, need to be assembled by hand. As components move down the production line, assemblers may perform a single operaton or put together complete components. Tiny parts are assembled under magnifying lenses or microscopes. Precision welding equipment may be used to weld connections in microminiature components and circuit assemblies.

Machining Occupations. Machining workers are needed in most electronics manufacturing plants, particularly for military, space, and industrial products. Machine-tool operators and machinists make precise metal parts. Toolmakers construct and repair jigs and fixtures that hold metal while it is being stamped, shaped, or drilled. Diemakers build metal forms (dies) used in stamping and forging metal.

Fabricating Occupations. Fabricating workers are employed in many electronics manufacturing plants, but most are in plants that make industrial products. Sheet-metal workers make frames, chassis, and cabinets. *Glass blowers* and *glass lathe operators* (D.O.T. 674.382-010) make tubes for experimentation and development work.

In electron tube manufacturing, special fabricating workers are employed. For example, *grid lathe operators* (D.O.T. 725.384-010) wind fine wire around two heavy parallel wires to make grids (devices in tubes that control the flow of electrons). Other fabricating workers include *coil winders* (D.O.T. 724.684-026 and 725.384-010), *crystal grinders* and *finishers* (D.O.T. 590.684-022), and *punch press operators* (D.O.T. 617.685-026, -030).

Processing Occupations. Many electronics workers process or prepare parts for assembly. *Electroplaters* and *tinners* (D.O.T. 501.-685-010) coat parts with metal; *anodizers* (D.O.T. 500.682-010) treat these parts in electrolytic and chemical baths to prevent corrosion. Other processing workers also coat electronic components with waxes, oils, plastics, or other materials. Some operate machines that encase microminiature components in plastic. *Silk screen printers* (D.O.T. 726.687-018) print patterns on circuit boards and on parts of electronic components. *Etching equipment operators* (D.O.T. 590.685-030) do chemical etching of copper on circuit boards.

Operators of infrared ovens and hydrogen furnaces (D.O.T. 590.684-014 and .685-034) remove moisture and foreign deposits from ceramic, metal, and glass parts. In tube manufacturing, *exhaust operators* (D.O.T. 725.384-010) and *sealers* (D.O.T. 692.685-158, 162, and 166) operate gas flame machines that clear tubes of impurities, exhaust the gas, and seal the tubes.

Inspection Occupations. Inspection begins when raw materials enter the plant and continues through manufacturing. Some inspection jobs require electronics technicians who have years of experience. These jobs are commonly found in complex production work such as the manufacture of computers and spacecraft. Most inspectors, however, do not need extensive technical training.

Some inspectors check incoming parts and components supplied by other firms. They may have job titles that indicate the work they do, such as incoming materials inspector or plating inspector.

During manufacturing, components are either checked manually by workers using test meters or routed mechanically through automatic test equipment. Although many of these workers simply are called testers, others have job titles that reflect the type of components they inspect, such as transformer-tester or coil-tester. Some automatic equipment can check components, produce a punched tape of the results, and sort the components into batches for shipping. Workers who feed or monitor automatic equipment often are called test-set operators or testing-machine operators.

Electronic assembly inspectors (D.O.T. 726.381-010) examine assembled products to make certain that they conform to blueprints and specifications. They inspect wiring, electrical connections, and other critical items to make sure everything will work properly.

Maintenance Occupations. Many workers repair and maintain machinery and equipment. Skilled electricians are responsible for the proper operation of electrical equipment; machine and equipment repairers make mechanical repairs; maintenance machinists and welders build and repair equipment and fixtures. Air-conditioning and refrigeration mechanics work in air-conditioned plants that have special refrigerated and dust-free rooms to protect sensitive parts. Painters, plumbers, pipefitters, carpenters, and sheet-metal workers also are employed in electronics plants.

Other Plant Occupations. Many workers move and handle materials. Forklift operators stack crates in warehouses, and load and unload trucks and boxcars. Truckdrivers move freight outside the plant. The industry also employs guards and building and grounds maintenance workers.

(Detailed discussions of professional, technical, mechanical, and other occupations, found not only in electronics manufacturing plants, but also in other industries, are presented elsewhere in the *Handbook* in sections covering the individual occupations.)

Working Conditions

Working conditions in electronics manufacturing compare favorably with those in other industries. Plants usually are well lighted, clean, and quiet. Many plants are relatively new, and are located in suburban and semirural areas. The work in most occupations is not strenuous but assembly-line jobs may be monotonous.

The injury rate in electronics manufacturing has been far below the average in manufacturing as a whole, and injuries usually have been less severe.

Training, Other Qualifications, and Advancement

Training requirements for jobs in electronics manufacturing plants range from a few hours of on-the-job training to years of specialized preparation. Beginning engineering jobs usually are filled by recent college graduates, but some positions call for advanced degrees. A small number of workers without college degrees, however, are upgraded to professional engineering classifications from occupations such as engineering assistant and electronics technician. Workers who become engineers in this way usually take advanced electronics courses in night school or in other training programs. To keep up with new developments and to qualify for promotion, professional and technical personnel obtain additional training, read technical publications, and attend lectures and technical demonstrations.

Almost all mathematicians, physicists, and other scientists employed in electronics manufacturing have college degrees; most have advanced degrees.

Technicians generally need specialized training to qualify for their jobs. Most electronics technicians attend either a public, private, or Armed Forces technical school. Some complete 1 or 2 years of college in a scientific or engineering field, and some receive training through a 3- or 4-year apprenticeship program. High school graduates who have had courses in mathematics and science are preferred for apprenticeship programs.

Some workers advance to electronics technician positions from such jobs as laboratory assistant. A relatively small number of plant workers become technicians. Opportunities for advancement are improved by taking courses either in company-operated classes, night school, junior college, or technical school, or by correspondence.

Electronics technicians need good color vision, manual dexterity, and good eye-hand coordination. Some technicians who test radio transmitting equipment must hold licenses from the Federal Communications Commission as first- or second-class commercial radio-telephone operators.

Drafters usually take courses in drafting at a trade or technical school; a few have completed a 3- or 4-year apprenticeship. Under an informal arrangement with their employers, some qualify for both on-the-job training and part- time schooling. Because many drafters in this industry must understand the basic principles of electronic circuits, they should study basic electronic theory.

Technical writers must have a flair for writing and usually are required to have some technical training. Employers prefer to hire those who have had some technical institute or college training in science or engineering. Many, however, have college degrees in English or journalism and receive their technical training on the job and by attending company-operated evening classes. Technical illustrators usually have attended art or design schools.

Many tool-and-die makers, machinists, electricians, and other craft workers learn their trades by completing a 4- or 5-year apprenticeship; others are upgraded from helpers' jobs.

Formal training is not necessary for workers entering plant jobs, but a high school diploma or its equivalent is sometimes required. Job applicants may have to pass aptitude tests and demonstrate skill for particular types of work. A short period of on-the-job training generally is provided for inexperienced workers. Assemblers, testers, and inspectors need good vision, good color perception, manual dexterity, and patience.

Requirements for administrative and other office jobs are similar to those in other industries. Some beginning administrative jobs are open only to college graduates who have degrees in business administration, law, accounting, or engineering. For clerical jobs, employers usually prefer high school graduates with training in stenography, typing, bookkeeping, and office machines.

Employment Outlook

Employment growth patterns will vary among the different sectors of the industry. While employment in some areas is expected to grow faster than the average for all industries through the 1980's, employment in other areas either will grow more slowly or possibly decline. In addition to the jobs resulting from employment growth, large numbers of openings will arise in all areas as experienced workers retire, die, or take other jobs.

Production of industrial electronic products will increase as businesses buy more computers and other electronic equipment to automate paperwork and production processes. Business spending for electronic communication and testing equipment also will grow. Although the demand for television sets, video tape recorders, stereo systems, calculators, and two-way car radios will rise as population and personal incomes grow, the increasing level of imports may adversely affect production. Government purchases for defense will continue to account for a large proportion of electronics manufacturing output. An increasing share of government purchases, however, is likely to be for electronic equipment used in medicine, energy conservation, education, and pollution abatement.

Employment in the electronics industry may fluctuate from year to year, because of changes in economic activity and defense spending. As a result, job openings may be plentiful in some years, scarce in others.

Employment growth also will vary among occupational groups and individual occupations. For example, employment of skilled maintenance workers and service technicians is expected to rise at a more rapid rate than total employment because of the need to repair the increasing amounts of complex machinery used to produce goods, or sold to consumers. On the other hand, employment of assemblers probably will rise at a slower rate because of the growing mechanization and automation of assembly-line operations.

Employment of engineers, scientists, and technicians is expected to increase faster than total employment, because of continued high expenditures for research and development and the manufacture of more complex products. Among professional and technical workers, the greatest demand will be for engineers, particularly those who have a background in certain specialized fields, such as quantum mechanics, solid-state circuitry, product design, and industrial engineering. Many opportunities also will be available for engineers in sales departments because the industry's products will require sales personnel with highly technical backgrounds. The demand for mathematicians and physicists will be particularly good because of expanding research in computer and laser technology.

Earnings

As shown in the accompanying table, in 1978 electronics production workers who made products for government and industrial use had higher average hourly earnings than production workers in manufacturing as a whole. Those making other electronic products, however, made less than the average for all manufacturing industries.

Table 1. Average hourly earnings of electronics production workers by type of product manufactured, 1978

Product	Hourly rate
All manufacturing industries	$6.17
Major electronics manufacturing industries:	
Radio and television receiving sets	5.49
Radio and television communication equipment	6.62
Telephone and telegraph apparatus	6.73
Semiconductors and related devices	5.44
Other electronic components	4.57

SOURCE: Bureau of Labor Statistics.

Many workers in electronics manufacturing are union members. The principal unions are the International Union of Electrical, Radio and Machine Workers; International Brotherhood of Electrical Workers; International Association of Machinists and Aerospace Workers; and the United Electrical, Radio and Machine Workers of America (Ind.).

Sources of Additional Information

Information about careers in this field can be obtained from the public relations departments of electronics manufacturing companies, the unions previously listed, and from:

Electronic Industries Association, 2001 Eye St. NW., Washington, D.C. 20006.

Occupations in Foundries

Metal castings produced by foundry workers are essential parts of thousands of products—from missiles to cooking utensils. They range in weight from just a few ounces to hundreds of tons. The strength of metal that has been cast makes it suitable for many household and industrial items, and the development of improved alloys, or combinations of metals, has widened the range of products made by casting.

In 1978, about 335,000 people worked in the foundry industry producing bathtubs, plumbing fixtures, sports equipment, jewelry, and thousands of other products. Thousands of other workers were employed in the foundry departments of other industries that make castings to use in their final product, such as crank shafts and engine blocks for automobiles and compressors for refrigerators.

Casting is a method of forming metal into intricate shapes. To cast metal, a mold is created that has a cavity sized and shaped exactly like the object to be produced. Molten metal, usually iron, is poured into the mold where it cools and solidifies.

Nature and Location of the Foundry Industry

Nearly three-fourths of the foundry industry's employees work in iron and steel foundries. The remainder work in plants that cast nonferrous metals, such as aluminum, bronze, copper-based alloys, and zinc. Foundries usually specialize in a limited number of metals, because different methods and equipment are needed to melt and cast different alloys.

There are six principal methods of casting, each named for the type of mold used. In the most common method, green-sand molding, a special sand mixture is "rammed" or packed tightly around a pattern in a boxlike container called a flask. The pattern is withdrawn and molten metal is poured into the mold cavity to form the desired shape. Because sand molds can be used only once, a second method, called permanent molding, was developed which employs a metal mold that can be used many times. Permanent molding is used chiefly for casting nonferrous metals and high volume production.

Precision investment casting, a third method, often called the lost wax process, uses ceramic molds. A wax or plastic pattern is coated with clay; after the coating hardens, the wax or plastic is melted and drained so that a mold cavity is left. Unlike the first two methods, castings produced from these molds are precise and require little finishing. Jewelry and dental inlays are generally produced by this process.

Shell molding, a fourth process, is important because castings produced from these molds not only are precise but also have a smooth surface that requires almost no finishing. In this method, a heated metal pattern is covered with a mixture of sand and resin. The sand forms a thin shell mold next to the hot pattern. The shell is then cured, and once hardened, it is peeled from the pattern.

Diecasting, a fifth process, is done mostly by machines. Dies are impressions that are carved by machines into metal blocks or plates. Molten metal is forced under high pressure into dies from which the castings are later automatically ejected or removed by hand. Because of the rapid cooling rate, diecasting offers the advantages of strong and high quality products.

A sixth method, centrifugal casting, is used to make piping and other products that have cylindrical cavities. In this process, molten metal is poured into a mold that is spinning at a very high speed. The spinning motion forces the metal against the walls of the mold where it then hardens.

Most foundries are small. More than 90 percent employ fewer than 250 workers, although several of the largest employ more than 5,000 workers.

Small foundries generally produce a variety of castings in small quantities. They employ hand and machine molders and coremakers (the key foundry occupations) and a substantial number of unskilled laborers. Large foundries often are highly mechanized and produce great quantities of identical castings. These shops employ relatively few unskilled laborers because cranes, conveyors, and other types of equipment replace manual labor in the moving of materials, molds, and castings. Since much of the casting in large shops is automated, they also employ proportionately fewer skilled molders and coremakers than small shops. However, many skilled maintenance workers, such as millwrights and electricians, service and repair the large amount of machinery.

Though foundries are located throughout the country, jobs are concentrated in areas that are readily accessible to raw materials. Some States that have considerable metalworking activity are Michigan, Ohio, Pennsylvania, Illinois, Indiana, Alabama, New York, California, and Wisconsin.

Occupations in the Foundry Industry

Most of the industry's 335,000 employees in 1978 were plant workers. To illustrate more clearly the duties of these workers, a brief description of the jobs involved in the most common casting process—sand molding—follows:

After a casting is designed, a *patternmaker* (D.O.T. 600.280-050 and 661.281-022), fol-

When large numbers of identical castings are needed, high-production molding machines are used.

lowing the design blueprint, makes a wood or metal pattern in the exact shape and size of the casting. Next, a *hand molder* (D.O.T. 518.361-010) makes sand molds by packing and ramming sand, specially prepared by a *sand mixer* (D.O.T. 570.682-018), around the pattern. A *molder's helper* (D.O.T. 519.-687-022) may assist in these operations. If large numbers of identical castings are to be made, high production molding machines may be used to make the molds at a faster speed than is possible by hand. The operator of this equipment is called a *machine molder* (D.O.T. 518.682-010).

A *coremaker* (D.O.T. 518.381-014 and .685-014,-018,-022) shapes sand into cores (tightly packed bodies of sand that are placed in molds to make hollow spaces in castings). *Core-oven tenders* (D.O.T. 518.685-010) bake most cores in ovens to harden and strengthen them so that they can be handled without breaking. When a sufficient number of cores are assembled, they are positioned in the molds by *core setters* (D.O.T. 518.684-010) or molders. After closing, clamping, or weighting, the molds are ready for the molten metal.

A *furnace operator* (D.O.T. 512.362-018) controls the furnace that melts the metal which a *pourer* (D.O.T. 514.684-022) lets flow into molds. When the castings have cooled and solidified, a *shakeout worker* (D.O.T. 519.687-022) removes them from the sand and sends them to the cleaning and finishing department.

Sandy and rough surfaces of castings are cleaned and smoothed. A *shotblaster* (D.O.T. 503.687-010) operates a machine that cleans large castings by blasting them with a mixture of air and metal shot or grit. Smaller castings may be smoothed by tumbling. In this process, the castings, together with sand or another abrasive material, are placed in a barrel that is rotated at high speed. The person who controls the barrel is called a *tumbler operator* (D.O.T. 599.685-110). Sandblasters and tumbler operators also may operate a machine that both tumbles and blasts the castings. A *chipper* (D.O.T. 809.-684-026) and a *grinder* (D.O.T. 809.684-026) use pneumatic chisels, power abrasive wheels, powersaws, and handtools, such as chisels and files, to remove excess metal and to finish the castings.

Castings frequently are heat-treated in furnaces to strengthen the metal; a *heat treater*, or *annealer* (D.O.T. 504.682-010, -018) operates these furnaces. Before the castings are packed for shipment, a *casting inspector* (D.O.T. 514.687-010) checks to make sure they are structurally sound and meet specifications. This includes a visual inspection for surface defects, chemical analysis, and a measurement inspection using gauges to check height and thickness. Often, castings are X-rayed to check for internal flaws such as separations in the metal.

Many foundry workers are employed in occupations that are common to other industries. For example, maintenance mechanics, machinists, carpenters, and millwrights maintain and repair foundry equipment. Crane and derrick operators and truckdrivers move materials from place to place. Machine tool operators finish castings. Foundries also employ thousands of workers in unskilled jobs, such as guard, janitor, and laborer.

About one-sixth of all foundry workers are employed in professional, technical, administrative, clerical, and sales occupations. Of these personnel, the largest number are clerical workers, such as secretaries, typists, and accounting clerks.

Foundries employ engineers, chemists, and metallurgists to do research, design machinery and plant layout, develop improved alloys, control the quality of castings, and supervise plant operations and maintenance. In recent years, many of these workers have been hired to sell castings and to assist customers in designing cast parts. Most foundry technicians are concerned with quality control. For example, they may test molding and coremaking sand, make chemical analyses of metal, and operate machines that test the strength and hardness of castings. Administrative workers employed in foundries include office managers, personnel workers, purchasing agents, and plant managers.

Detailed discussions of three principal foundry occupations—patternmakers, coremakers, and molders—appear elsewhere in the *Handbook*.

Working Conditions

Working conditions in foundries have improved in recent years. Many foundries have changed plant layouts and installed modern ventilating systems to reduce heat, fumes, dust, and smoke.

The injury rate in foundries is higher than the average for manufacturing: Foundry workers are subject to burns from hot metal and cuts and bruises from handling metal castings. However, employers and unions are attempting to reduce injuries by adhering to safety regulations and by promoting safety training.

Training, Other Qualifications, and Advancement

Most foundry workers start in unskilled jobs, such as laborer or helper, and, after receiving on-the-job training from a supervisor or experienced worker, gradually learn more skilled jobs. This is the usual practice in training workers for casting process jobs such as melter, chipper, and grinder.

Some skilled foundry workers—particularly hand molders, handcoremakers, and patternmakers—learn their jobs through for-

Cores must be carefully positioned into molds to produce an accurate casting.

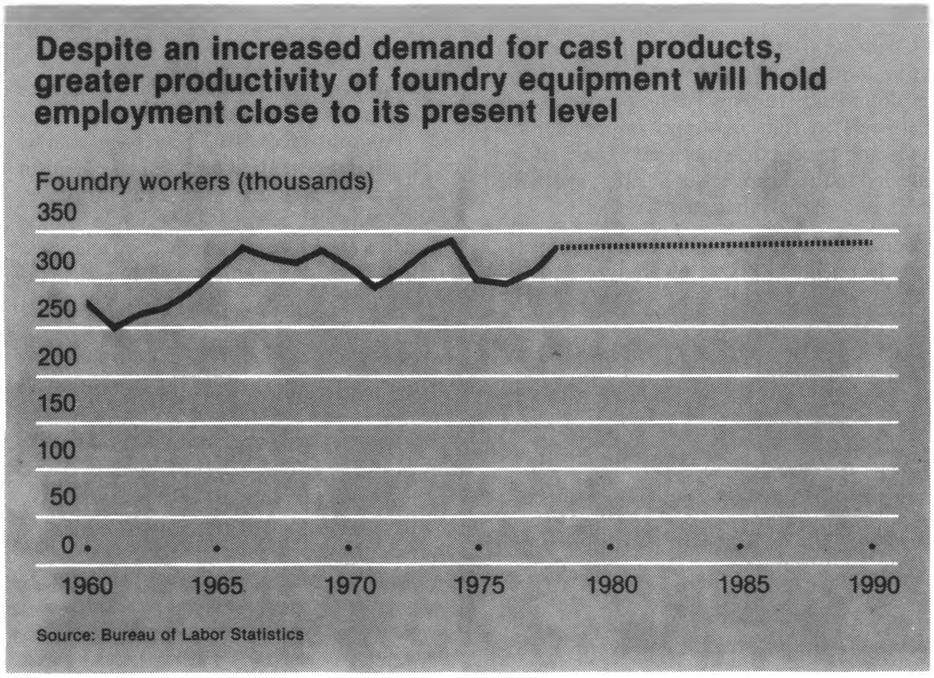
mal apprenticeship. Apprentices receive supervised on-the-job training for 2 to 4 years, usually supplemented by classroom instruction in related subjects such as shop mathematics, mechanical drawing, and metallurgy. High school graduates are preferred for most apprenticeship programs, but applicants with less education sometimes are hired. For some apprenticeship programs, especially patternmaking, a high school education is the minimum requirement. Workers who have completed an apprenticeship have a greater knowledge of all foundry operations, and therefore are better qualified to fill supervisory jobs.

Skilled foundry workers also can learn their trades informally on the job or through a combination of trade school and on-the-job training. In some cases, trade school courses may be credited toward completion of formal apprenticeships. Some foundries and the American Foundrymen's Society's Cast Metals Institute conduct training programs to update and upgrade the skills and knowledge of experienced workers.

Employment Outlook

Over the long run, population growth and higher incomes will create a demand for more automobiles, household appliances, and other consumer products that have cast parts. More castings also will be needed for industrial machinery as factories expand and modernize. Despite the increasing demand for castings, employment in the foundry industry is expected to grow more slowly than the average for all industries through the 1980's. Technological developments will enable foundries to meet the increased demand for castings with only a slight increase in employment. Continued improvements in production methods will result in greater output per worker. In addition to those job openings that result from employment growth, many other openings will arise due to the need to replace experienced workers who die, retire, or transfer to other fields of work. The number of openings fluctuates from year to year, since demand for castings is sensitive to ups and downs in the economy.

Some of the employment increase in the foundry industry will be in production jobs. However, employment will increase in other occupations, as well. For example, employment of scientists and engineers is expected to increase because of expanding research and development activities. Technicians also will be needed in greater numbers to help improve quality control and production techniques. More maintenance workers will be hired to keep pace with the industry's growing amount of mechanization. In contrast, machine molding and coremaking will be substituted for hand processes, and will limit the need for additional hand molders and hand coremakers. Improved molding techniques, such as quick set molding in which the mold hardens quickly and without baking in an oven, also will limit employment of molders. As more machinery for materials handling is introduced, employment of laborers and other unskilled workers may decline.



Earnings

Production workers in foundries have higher average earnings than those in manufacturing as a whole. In January, 1979, production workers in iron and steel foundries averaged $7.64 an hour, and those in nonferrous foundries averaged $6.48. By comparison, production workers in all manufacturing industries averaged $6.48 an hour.

Most foundry industry employees work under union contracts that provide periodic pay increases. In those foundries that operate 24 hours a day, 7 days a week, contracts generally provide for extra pay for evening shifts and for work done on weekends and holidays. Also, most contracts provide paid vacations according to length of service. Typically, an employee receives 1 week of vacation after 1 year of service, 2 weeks after 2 years, and 3 weeks after 10 years. In addition, many employees are covered by paid sick leave plans, group insurance, accident and death benefits, and retirement and disability pensions.

Foundry workers belong to many unions, including the International Molders' and Allied Workers' Union; the United Steelworkers of America; and the International Union of Electrical, Radio and Machine Workers. Many patternmakers are members of the Pattern Makers' League of North America.

Sources of Additional Information

Further information about work opportunities in foundry occupations may be obtained from local foundries, the local office of the State employment service, the nearest office of the State apprenticeship agency, or the Bureau of Apprenticeship and Training, U.S. Department of Labor. Information also is available from the following organizations:

American Foundrymen's Society/Cast Metals Institute, Golf and Wolf Rds., Des Plaines, Ill. 60016.

International Molders' and Allied Workers' Union, 1225 E. McMillan St., Cincinnati, Ohio 45206.

Occupations in the Industrial Chemical Industry

Industrial chemical products are the raw materials from which plastics, synthetic fibers, and many manufactured materials are made. Automobiles, for example, have increasing amounts of plastics for everything from bumpers to upholstery. Even the tires contain synthetic rubber made from industrial chemicals.

Making these many, very different kinds of products requires a large number of workers with different skills. About 550,000 people worked in the industrial chemical industry in 1978. Training varies from a few days on the job for some plant workers to college degrees for engineers and chemists.

Nature and Location of the Industry

The industry produces organic and inorganic chemicals, plastics, and synthetic rubber and fibers. Unlike drugs, paints, and other chemical products sold directly to consumers, industrial chemicals are used by other industries to make their own products.

Chemical products are made from coal, petroleum, natural gas, mineral ores, and many other raw materials. Since these materials usually go through several chemical changes, the finished products are vastly different from the original ingredients. Some plastics, for example are made from natural gas.

In a modern chemical plant, electronic and other automated equipment controls the dissolving, heating, cooling, mixing, filtering, and drying processes that convert raw materials to finished products. This equipment regulates the combination of ingredients, flow of materials, and the temperature, pressure, and processing time. Materials also move automatically from one part of the plant to another by conveyors or through pipes. The use of such automated equipment enables a relatively small number of workers to produce tons of chemicals in one continuous operation.

About two-thirds of the 3,000 industrial chemical plants in the United States have fewer than 50 workers. Almost half of the industry's employees, however, are concentrated in large plants with more than 500 workers.

Chemical plants are usually close to customers or near the sources of raw material. Many plants that produce chemicals from petroleum, for example, are near the oil and gas fields of Texas and Louisiana. Although industrial chemcial workers are employed in almost every State, a large proportion of employment is concentrated in Texas, Tennessee, New Jersey, South Carolina, Virginia, Louisiana, and Ohio.

Occupations in the Industry

Workers with many different skills and levels of education work in the industrial chemical industry. Research and development (R&D) scientists, engineers, and technicians develop products and design equipment and production processes. Administrators, professionals, and clerical workers handle financial and business matters, keep records, and advertise and sell chemical products. Other employees are in processing, maintenance, and other plant jobs.

Scientific and Technical Occupations. The industrial chemical industry is one of the Nation's major employers of scientific and technical workers; almost one-fourth of its employees are scientists, engineers, or technicians.

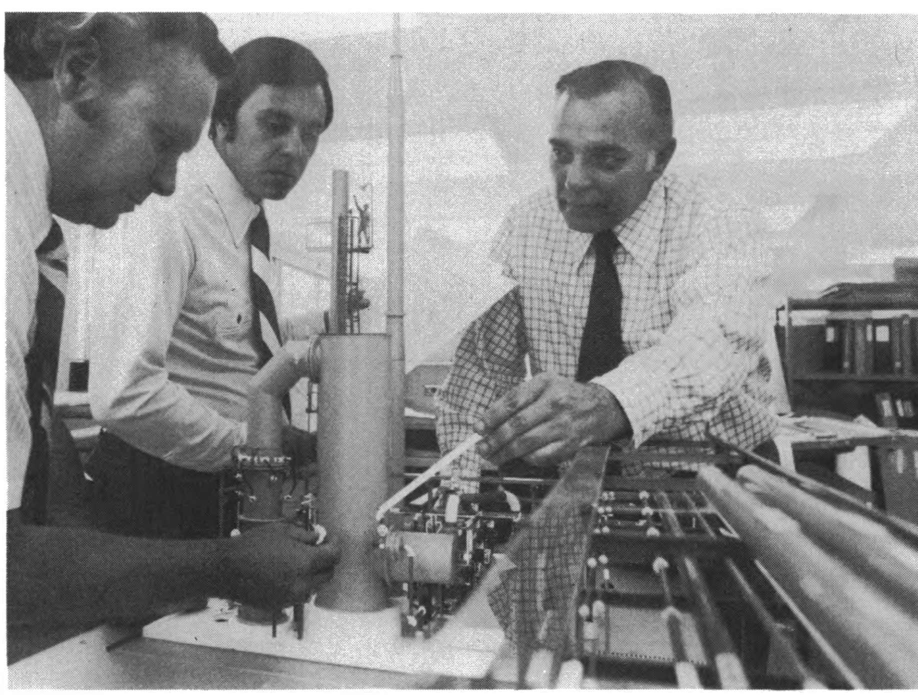
Chemists are the largest group of scientists in the industry. Most work in research and development studying the properties of chemicals to find new and improved products and production methods. Their efforts have led to the discovery of plastics, synthetic fibers and many other items.

Some chemists manage production operations in chemical plants or analyze and test chemical samples to ensure the quality of the final product. Others sell chemical products and provide technical advice to their customers.

Engineers are another important group of industrial chemical professionals. Using their knowledge of both chemistry and engineering, chemical engineers convert laboratory processes into large-scale production methods. They design chemical plants and processing equipment and sometimes supervise their construction. Chemical engineers also manage production operations in chemical plants, work in sales, and provide technical service to customers.

Mechanical engineers design power and heating equipment. They also work with chemical engineers to design processing equipment and supervise its installation, operation, and maintenance. Electrical engineers design electric and electronic instruments and control devices and facilities for generating and distributing electric power.

Many technical workers assist scientists and engineers. Laboratory technicians conduct tests and record the results in charts, graphs, and reports that are used by chemists and chemical engineers. Those in entry-level jobs do simple, routine tests while senior technicians perform complicated analyses. Drafters provide engineers with specifica-



Design engineers, drafter, and model builder examine model of new chemical plant layout.

tions and detailed drawings of chemical equipment.

Plant Occupations. About half of all industrial chemical workers operate or maintain equipment or do other plant jobs.

Skilled *chemical operators* (D.O.T. 558.-585-014 and 559.382-018) and their helpers are the largest group of plantworkers. They set dials, valves, and other controls on automatic equipment to ensure that the right temperature, pressure, and amounts of materials are used. As chemicals are processed, operators read instruments that measure pressure, flow of materials, and other conditions. They also use instruments to test chemicals or send chemical samples to the testing laboratory. Operators keep records of instrument readings and test results and report equipment breakdowns. Chemical operators sometimes are called filterers, mixers, or other titles, depending on the kinds of equipment they operate.

To keep production processes running smoothly, instruments must give accurate measurements and equipment must withstand corrosion, damaging chemicals, high temperatures, and pressure. Many skilled maintenance workers are needed to keep this equipment in good condition. Pipefitters and boilermakers lay out, install, and repair pipes, vats, and pressure tanks; maintenance machinists make and repair metal parts for machinery; electricians maintain and repair wiring, motors, and other electrical equipment; and instrument repairers install and service instruments and control devices. In some chemical plants, one worker may do several of these jobs. Plant workers also are needed to drive trucks; keep inventory of stock and tools; load and unload trucks, ships, and railroad cars; keep the plant and office clean; and do many other kinds of work.

Administrative, Clerical, and Related Occupations. About one-fifth of all industrial chemical workers hold an administrative, clerical, or other nonscientific white-collar job. High-level managers who often are trained in chemistry or chemical engineering decide what products to manufacture, where to build plants, and how to handle the company's finances. Executives depend on specialized workers including accountants, sales representatives, lawyers, industrial and public relations workers, market researchers, computer programmers, and personnel and advertising workers. Many secretaries, typists, payroll and shipping clerks, and other clerical employees work in offices and plants. (Individual statements elsewhere in the *Handbook* give detailed discussions of many scientific, technical, maintenance, and other occupations found in the industrial chemical industry as well as in other industries.)

Working Conditions

Because chemical plants usually operate around the clock—three shifts a day, 7 days a week—processing workers often work the second or third shift, generally for extra pay. Shift assignments are usually rotated, so an individual may work days one week and nights the next. Maintenance workers usually work only the day shift.

Most industrial chemical jobs, except those for laborers or material handlers, are not strenuous. Equipment operators are on their feet most of the time. Some workers must climb stairs or ladders to considerable heights, or work outdoors in all kinds of weather. Workers may be exposed to dust, disagreeable odors, or high temperatures, although many plants have ventilating or air-conditioning systems.

Many chemicals are dangerous to touch or breathe and prolonged exposure can cause cancer or other serious illnesses. As hazardous substances are identified and government regulations instituted, worker exposure will be brought to safe levels. Overall, the industrial chemical industry has a better-than-average occupational illness and injury rate. Protective clothing, helmets, eyeglasses, showers, eye baths near hazardous work stations, and other safety measures help prevent serious injuries.

Training, Other Qualifications, and Advancement

Jobs in the industrial chemical industry require from a few days of on-the-job training to many years of preparation. Some plant workers can learn their jobs in a day or two. Scientists, engineers, technicians, and chemical operators, on the other hand, spend several years learning their skills.

Industrial chemical firms generally hire and train inexperienced high school graduates for processing jobs. Equipment operators and other processing workers often start out in a labor pool where they are assigned jobs such as filling barrels or moving materials. Workers may be transferred from the labor pool to fill vacancies in one of the processing departments. Training for processing occupations is done almost entirely on the job under the supervision of an experienced worker. Workers move to jobs requiring greater skills as they gain experience and openings occur. Thus, a worker may advance from laborer to chemical operator helper, and then to chemical operator. Skilled processing workers rarely are recruited from other companies.

Although many maintenance workers start as helpers and pick up their skills from experienced workers, apprenticeship is the best way to learn a maintenance trade. Apprenticeship programs usually last 3 or 4 years and consist mainly of shop training in their particular jobs. Instrument repairers sometimes attend training programs offered by instrument manufacturers. Maintenance workers and trainees are encouraged to take job-related courses at local vocational or technical schools. Their employers may pay part or all of the tuition.

Technicians qualify for their jobs in many ways. Graduates of technical institutes, junior colleges, or vocational technical schools have the best opportunities. Companies also hire students who have completed part of the requirements for a college degree, especially if they have studied mathematics, science, or engineering. High school graduates with courses in chemistry can qualify through on-the-job training and experience. Many technicians receive additional technical school or undergraduate training through company tuition-refund programs.

Laboratory technicians usually start as trainees or assistants, and drafters begin as copyists or tracers. As they gain experience and show ability to work without close supervision, these technicians advance from routine work to more difficult and responsible jobs.

Engineers and scientists, in most cases, must have a least a bachelor's degree in engineering, chemistry, or a related science. Most research jobs, however, require advanced degrees or specialized experience. Many scientists and engineers attend graduate courses at company expense.

Some firms have formal training programs for newly hired scientists and engineers. Before they are assigned to a particular job, these employees work briefly in various departments to learn about the company's overall operation. In other firms, junior scientists and engineers are assigned immediately to a specific job.

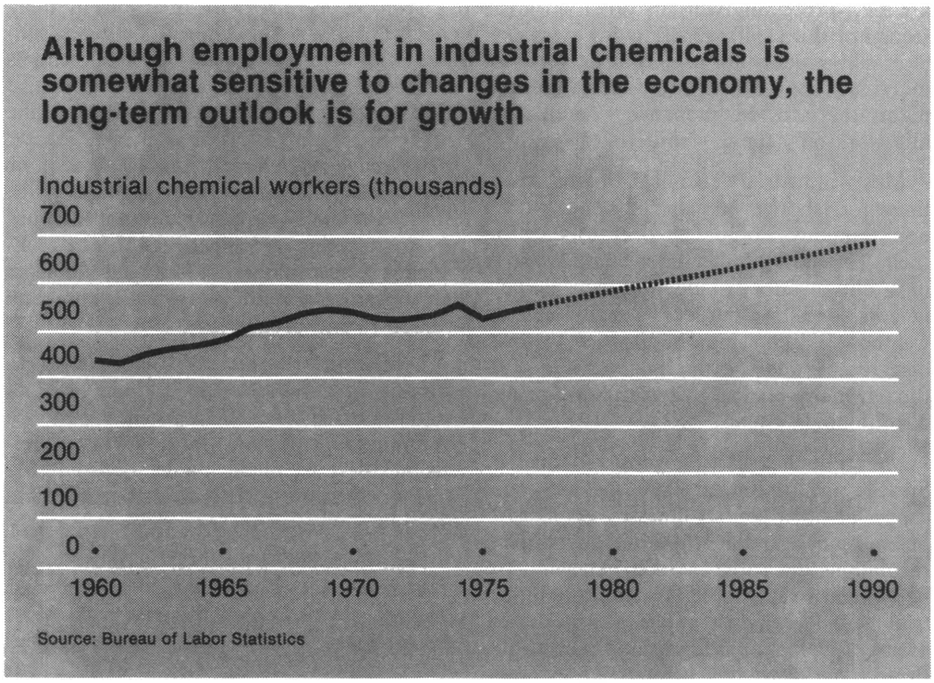
Chemists and engineers as well as people with college degrees in business administration, accounting, economics, statistics, marketing, or industrial relations often advance to administrative jobs. Some companies have advanced training programs for new administrative employees. Many companies prefer persons with a technical background in chemistry or engineering for sales positions, while other companies prefer to train college graduates who have good potential sales ability.

Secretaries, bookkeepers, and other clerical workers generally have had commerical courses in high school or business school.

Employment Outlook

Employment in the industrial chemical industry is expected to grow more slowly than the average for all industries through the 1980's. Most job openings will occur from the need to replace experienced workers who retire, die, or transfer to other industries.

Continued emphasis on research and development is expected to stimulate growth in the industrial chemical industry, which has far outstripped most other major industries in the development of new products. Some of these products, such as plastics and synthetic fibers, not only have created new markets but also have competed successfully in markets previously dominated by woods, metals, and natural textiles. Chemical products are ex-



pected to continue to make advances in these markets. However, higher production costs as firms pay more for petroleum and natural gas will result in higher prices for chemical products and lower growth rats for industrial chemicals. Costs will also increase due to the expenditures needed to meet air and water quality standards and higher health standards for worker exposure to potentially unhealthy chemicals.

Employment is expected to grow at a slower rate than production because of labor-saving technological developments and the greater use of automatic processing and control equipment. Although more administrative and technical workers will be needed to handle the increasingly complex production processes, most openings will be for production workers since they are the largest group of employees.

Table 1. Average hourly earnings in selected occupations in the industrial chemical industry, 1978

Occupation	Hourly rate range
Pipefitters	$6.13–$8.35
Instrument repairer or mechanic	7.90– 8.32
Laboratory technician	7.74– 8.15
Boilermaker or sheet-metal worker	6.13– 8.15
Chemical operator	6.10– 8.15

SOURCE: Bureau of Labor Statistics.

Earnings

Production workers in the industrial chemical industry have relatively high earnings. In 1978 they averaged $7.48 an hour, compared with $6.07 an hour for production workers in all manufacturing industries.

National wage data are not available for individual occupations in the industrial chemicals industry. However, 1978 hourly wages specified in a few union-management contracts are shown below.

Many production workers in the industrial chemical industry belong to labor unions, including the International Chemical Workers Union; Oil, Chemical and Atomic Workers International Union; and the United Steelworkers of America.

Sources of Additional Information

Further information on careers in the industry may be obtained from employment offices of industrial chemical companies, locals of the unions mentioned above, and from:

American Chemical Society, 1155 16th St. NW., Washington, D.C. 20036.

Chemical Manufacturers Association, 1825 Connecticut Ave. NW., Washington, D.C. 20009.

Oil, Chemical and Atomic Workers International Union, P.O. Box 2812, Denver, Colo. 80201.

Occupations in the Iron and Steel Industry

Steel is the backbone of any industrialized economy. Few products in daily use are not made from steel or processed by machinery made of steel. For example, steel sheets are made into automobile bodies, appliances, and furniture; steel bars are used to make parts for machinery and to reinforce concrete in building and highway construction; steel plates become parts of ships, bridges, railroad cars, and storage tanks; strip steel is used to make pots and pans, razor blades, and toys.

To satisfy the country's need for steel, the iron and steel industry employed about 554,000 persons in 1978. Employees work in a broad range of jobs that require a wide variety of skills; many of these jobs are found only in iron and steelmaking.

Characteristics of the Industry

The iron and steel industry, as discussed in this chapter, consists of the firms that operate blast furnaces, steel furnaces, and finishing mills. Blast furnaces make iron from iron ore, coke, and limestone. Steel furnaces refine the iron and scrap steel into steel. Primary rolling mills and continuous casting operations shape the steel into semifinished products called blooms, billets, and slabs. Other rolling mills shape these into steel sheets, bars, plates, strips, pipe, and various other finished products.

The types of operations performed in the more than 900 steel plants in the United States vary throughout the industry. Fully integrated steel plants, which are so large they may cover several square miles, contain blast furnaces, steel furnaces, and rolling mills. These plants perform all the operations necessary to convert processed iron ore into finished steel products. Other plants only perform finishing operations, such as making steel wire and pipe from billets.

The number of people employed in the plants of the iron and steel industry also varies greatly. Individual plants typically employ a large number of workers because the production of iron and steel products is a monumental task. It requires the handling and use of thousands of tons of raw materials, and involves enormous facilities and equipment, such as blast furnaces that may be 12 stories high and rolling mills that may be several city blocks long. About 65 percent of the industry's employees work in plants that have more than 2,500 employees; fully integrated plants may have more than 10,000. Many plants, however, have fewer than 100 employees.

Iron and steel plants are located mainly in the northeastern part of the United States near the abundant iron deposits of the Great Lakes area and the nearby coal deposits. About 7 out of 10 of the industry's workers are employed in five States— Pennsylvania, Ohio, Indiana, Illinois, and New York. Nearly 3 out of 10 are employed in Pennsylvania alone. The largest steel- producing plants are located in Indiana Harbor and Gary, Ind.; Sparrows Point, Md. (near Baltimore); Chicago; and Pittsburgh.

Occupations in the Industry

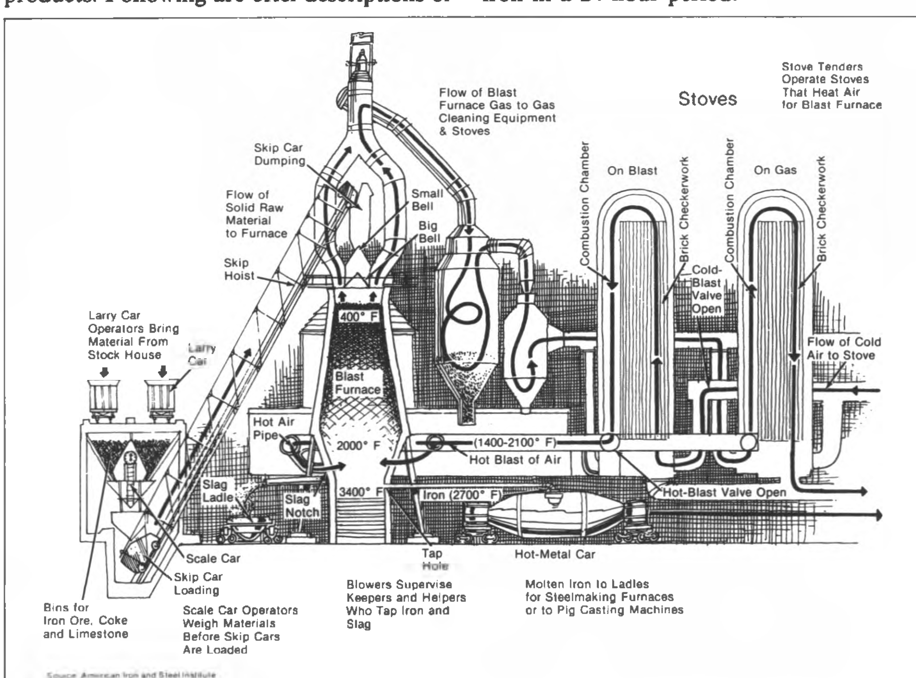
Workers in the iron and steel industry hold more than 2,000 different types of jobs. About 80 percent of all workers are directly engaged in moving raw materials and steel products about the plants, making iron and steel products, and maintaining the vast amount of machinery used in the industry. In addition, other workers are needed to do clerical, sales, professional, technical, administrative, and supervisory work.

Processing Occupations. The majority of the workers in the industry are employed in the many processing operations involved in converting iron ore into steel and then into semifinished and finished steel products. Because of the extensive use of automated control equipment in making steel from iron ore, most processing jobs are found in the rolling mills and finishing departments where the steel is shaped into semifinished and finished products. Following are brief descriptions of the major iron and steel making and finishing operations and some of the occupations connected with them.

Blast furnaces. The blast furnace, a large steel cylinder lined with heat-resistant (refractory) brick, is used to separate the iron from other elements in the iron ore. A mixture of ore, coke, and limestone (called a "charge") is fed into the top of the furnace. As this material works its way down through the furnace, hot air blown into the bottom from giant stoves causes the coke to burn at a high temperature. At this high temperature, a chemical reaction takes place between the coke and the iron ore, freeing the iron from other elements in the ore.

The iron, which now is a liquid, trickles down through the burning coke and collects in a pool 4 to 5 feet deep at the bottom of the furnace. As the liquid iron passes through the coke, the intense heat causes another chemical reaction between the limestone, the burned-out coke, and any other materials to form a waste product called "slag." The slag also trickles down through the coke and floats on top of the heavier iron. In a typical furnace, liquid iron is removed from the furnace every 3 or 4 hours; slag may be removed more frequently.

A blast furnace operates continuously, 24 hours a day, 7 days a week, unless it is shut down for repairs or for other reasons. A single furnace may produce up to 10,000 tons of iron in a 24-hour period.



Source: American Iron and Steel Institute

The raw materials used in blast furnaces are transferred from storage areas on railroad cars, moving on elevated tracks to the furnace. The cars are positioned over an open grate, and raw materials are dumped through the grate and into a large funnel-shaped bin called a hopper. *Skip operators* (D.O.T. 921.-683-062) drive other railroad cars on tracks in tunnels underneath the hoppers. Positioning their car under one of these bins, they fill it with raw material, weigh the loaded car, and then dump the material into skip cars where the ore, limestone, or coke is automatically carried up a steep ramp to the top of the blast furnace and dumped. Scale car operators must keep records of what they put in the furnace. In blast furnace operations without automatic controls, a skip car operator uses electric and pneumatic controls to operate the cars.

Stove tenders (D.O.T. 512.382-014) operate the gas-fired stoves that heat air for the blast furnace, and observe controls that show the temperature of the air inside the stove. When air reaches the correct temperature, the tender opens valves on the stove that allow the heated air to pass to the furnaces. Stove tenders also keep the stove flues clean of carbon and dirt.

Blowers (D.O.T. 519.132-010) oversee the operation of one or more blast furnaces and are responsible for the quantity and quality of the iron produced. They coordinate the addition of raw materials by stockhouse workers with the operation of the furnace and supervise *keepers* (D.O.T. 502.664-010) and their *helpers* (D.O.T. 502.687-010) in removing (tapping) the liquid iron and slag from the furnace. If the iron is not forming correctly in the furnace, blowers may have the stove tenders change the temperature and flow of air into the furnace.

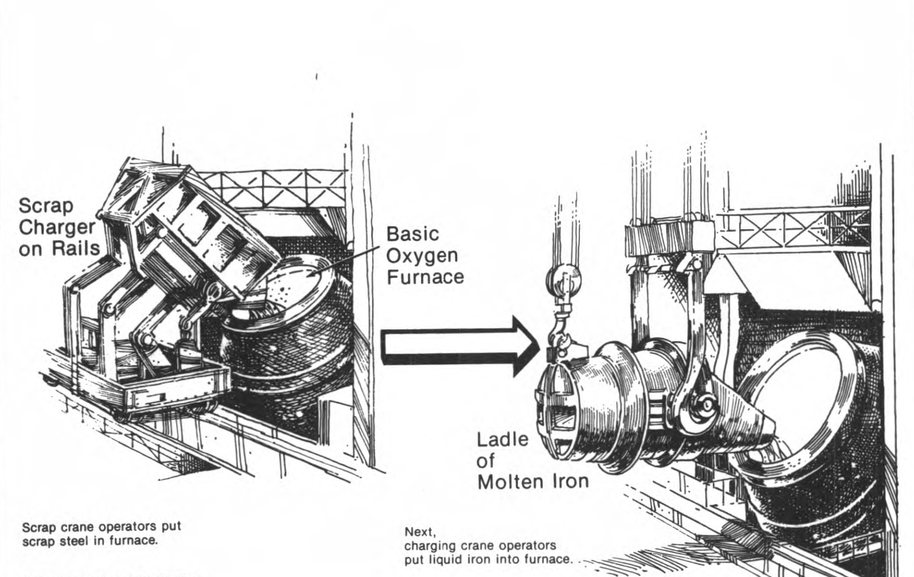
When the blower has determined that the iron is ready to be removed, the keeper and a helper use power drills, air hoses, or small explosive charges to remove the clay that is plugging a taphole above the liquid iron, allowing the slag to flow down a sand-lined channel into huge containers called ladles, which have been positioned under the channel by crane operators. Helpers open gates to divert the slag into other ladles when the first one is filled. After removing the slag, the keeper removes the clay from a lower taphole that allows the iron to flow down another channel into special railroad tank cars called "hot metal cars."

After the slag and iron have been removed, the keeper uses a "mud gun" to shoot clay into the tapholes. The keeper and helpers use tongs to remove solidified iron and slag from the channels and shovels to line the channels with special heat-resistant sand.

Some of the iron taken from the blast furnace is made into finished products such as automobile engine blocks and plumbing pipes. Most of it, however, is used to make steel. Because steel is stronger than iron and can be hammered and bent without breaking, it can be used for many more products.

Steel furnaces. Steel is made by heating iron or scrap steel to remove some of the carbon and other impurities and adding alloying chemical agents such as silicon and manganese. By varying the amount of carbon and chemical agents contained in the final product, thousands of different types of steel can be made—each with specified properties that are suited for a particular product. For example, stainless steel is rust-resistant and is used in products which need that quality, such as razor blades.

Steel is made in three types of furnaces: Basic oxygen, open hearth, and electric. More than 60 percent of all domestic steel is made in basic oxygen furnaces (BOF's) and about 15 percent in open hearth furnaces. Both produce similar kinds of steel, but BOF's do the job faster have replaced many open hearths in recent years. Although for many years electric furnaces were used mainly to produce high quality steels, such as stainless and tool steel, they now produce large quantities of regular steel and account for about 25 percent of total U.S. steel output.



Scrap crane operators put scrap steel in furnace.

Next, charging crane operators put liquid iron into furnace.

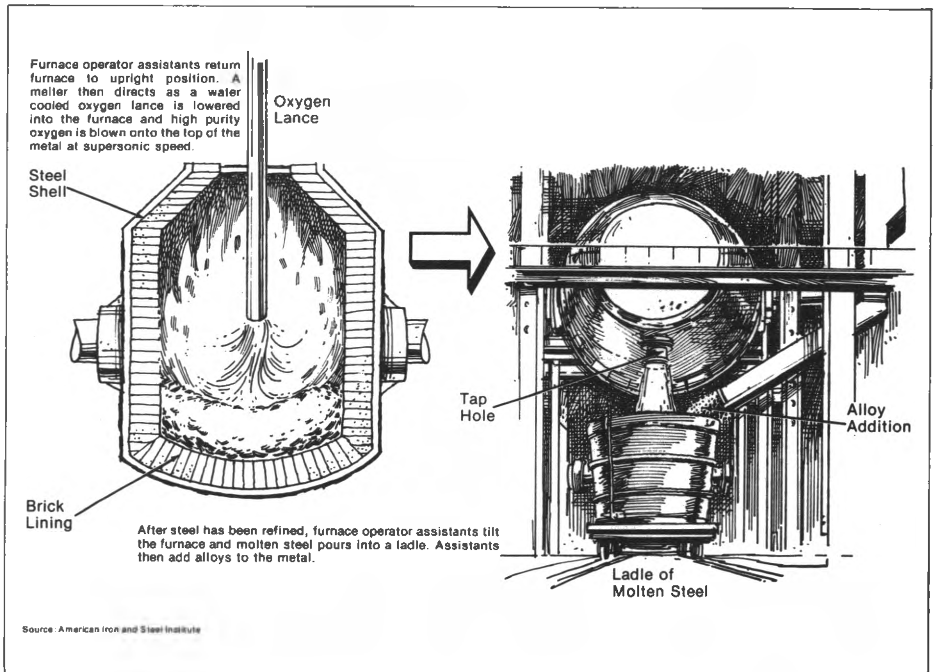
Source: American Iron and Steel Institute

Although the steelmaking procedure varies with the type of furnace used, the jobs associated with the various processes are similar. Since basic oxygen furnaces account for most of the U.S. steel, the jobs connected with them will be used as an illustration.

A *melter* (D.O.T. 512.132-010) supervises workers at a steel furnace. Melters receive information on the characteristics of the raw materials they will be using and the type and quality of steel they are expected to produce. The melter makes the steel according to the desired specifications by varying the proportions of iron, scrap steel, and lime in the furnace, and by adding small amounts of other materials such as manganese, silicon, copper, or chrome. The melter directs the workers who load furnaces with these raw materials and supervises the taking of a sample of liquid steel that is tested to insure the steel has the desired qualities. The melter must coordinate the loading and melting of the raw materials with the steel molding or casting operation to avoid delays in production.

A basic oxygen furnace is a giant, pear-shaped steel container lined with heat-resistant brick. The furnace can be tilted from side to side to receive raw materials and discharge steel and slag. The *furnace operator* (D.O.T. 512.362-018), under the direction of the melter, controls the operation of the furnace. To begin the operation, the furnace operator's first assistant uses controls to tilt the furnace to receive a load or "charge" of steel scrap and molten iron. A *scrap crane operator* (D.O.T. 921.663-010) adds scrap steel and is followed by a *charging crane operator* (D.O.T. 921.663-042) who adds the liquid iron made by the blast furnace. After the assistant rights the furnace, the furnace operator, who works in a control room overlooking the furnace, uses levers and buttons to lower the oxygen lance, a pipe that blows oxygen into the furnace at supersonic speeds. The furnace operator also controls the addition of lime, which combines with impurities in the iron to form slag, and the addition of any chemical agents that are required to give the steel the desired properties. If the chemical reactions in the furnace become too violent, the furnace may overheat, causing slag and iron to splash out the top. The furnace operator must pay close attention to conditions in the furnace, regulate the oxygen flow, and, if the furnace does overheat, take the necessary steps to cool it.

By observing the various instruments in the control room, the furnace operator knows when the steel has almost the correct composition. The first assistant then tilts the furnace while the second assistant and help-



Furnace operator assistants return furnace to upright position. A melter then directs as a water cooled oxygen lance is lowered into the furnace and high purity oxygen is blown onto the top of the metal at supersonic speed.

After steel has been refined, furnace operator assistants tilt the furnace and molten steel pours into a ladle. Assistants then add alloys to the metal.

Source: American Iron and Steel Institute

ers, working from behind a heat shield, use a long-handled spoon to take a sample. The sample is sent up to the lab where chemists determine how close the steel is to the product desired. Based on this information, the furnace operator determines how much longer and at what temperature the furnace should operate. When the furnace operator has determined that the steel has the specified qualities, the first assistant tilts the furnace towards a waiting ladle. The steel flows through a taphole in the side of the furnace and into the ladle. The second assistant and helpers may add chemical agents to the ladle while the steel is poured. By continually tilting the furnace at a steeper angle, the slagis kept above the taphole and prevented from flowing into the ladle. Eventually, the slag is poured through the taphole into the slag pot. The assistants and helpers then use handtools to clean out the taphole and furnace lip.

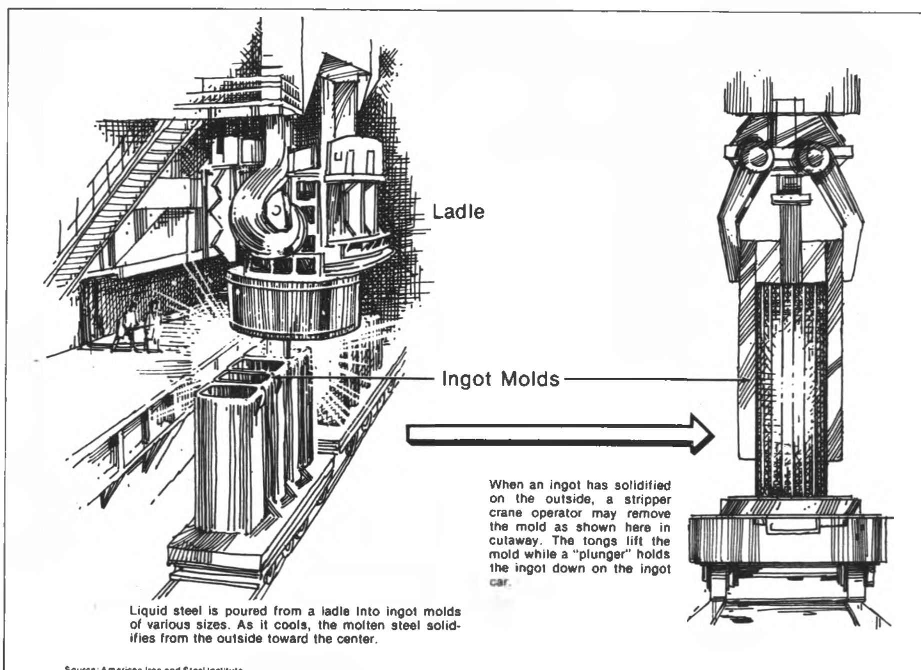
The liquid steel usually is solidified into large blocks called "ingots." A *hot-metal crane operator* (D.O.T. 921.663-010) controls an overhead crane which picks up the ladle of liquid steel and moves it over a long row of iron ingot molds resting on railroad flatcars (ingot buggies). The *steel pourer* (D.O.T. 502.664-014) operates a stopper at the bottom of the ladle to let the steel flow into these molds. The steel pourer also examines the molds to see that they are clean and smooth and directs a helper in taking a sample of the steel for chemical analysis. As soon as the steel has solidified sufficiently, an *ingot stripper* (D.O.T. 921.663-042) operates an overhead crane, which removes the molds from the ingots. The steel now is ready to be shaped into semifinished and finished products.

Rolling and finishing. The three principal methods of shaping steel are rolling, casting, and forging. (Forged steel usually is made in forging shops. Occupations in those shops are described elsewhere in the *Handbook*.) About 90 percent of the steel processed in steel mills is shaped by rolling. In this method, heated steel ingots are squeezed into longer and flatter shapes between two massive cylinders or "rolls." Before ingots of steel are rolled, they are heated to the temperature specified by plant metallurgists. The heating is done in large furnaces called "soaking pits" located in the plant floor. A *soaking pit crane operator* (D.O.T. 921.663-010) maneuvers an overhead crane to lift the ingots from small railcars and place them in the soaking pit. A *heater* (D.O.T. 613.362-010) and *helper* (D.O.T. 613.685-014) control the soaking pit operation. They adjust controls, which regulate the flow of air and fuel to the burners, to maintain the correct temperature in each pit, and by watching dials, they determine when the ingot is uniformly heated to the required temperature.

When the ingots are needed in the mill, the crane operator places them on an ingot buggy, which carries them to the first rolling mill, sometimes called a "primary" mill. Here, the ingots are rolled into smaller, more easily handled semifinished products called blooms, billets, and slabs. Blooms generally are between 6 and 12 inches wide and 6 and 12 inches thick. Billets, which are rolled from blooms, have a smaller cross section and are longer than blooms. Slabs are much wider and thinner than blooms.

Rolling ingots into blooms and slabs are similar operations; in fact, some rolling mills can do both. In the mill, the ingot moves along on a roller conveyer to a machine that resembles a giant clothes wringer. A "two-high" rolling mill has two rolls that revolve in opposite directions. The rolls grip the approaching red hot ingot and pull it between them, squeezing it thinner and longer. When the ingot has made one such pass, the rolls are reversed, and the ingot is fed back through them. Throughout the rolling operation, the ingot periodically is turned 90 degrees by mechanical devices called "manipulators," and passed between the rolls again so that all sides are rolled. This operation is repeated until the ingot is reduced to a slab or bloom of the desired size. It is then ready to be cut to specified lengths.

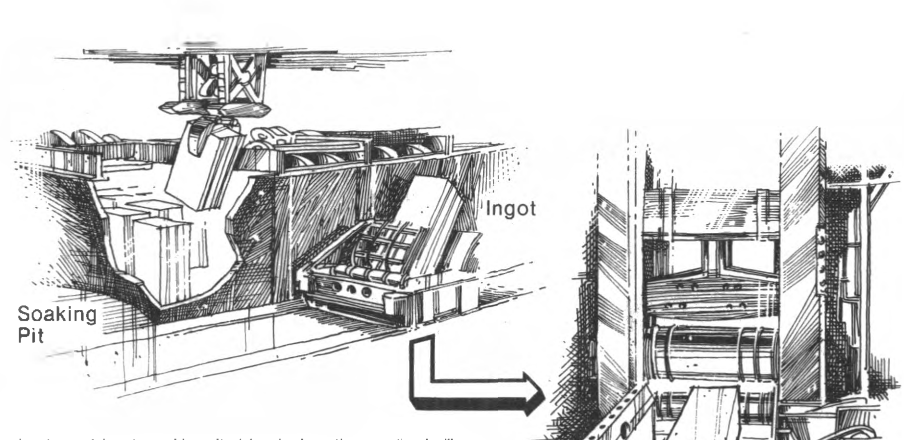
A *roller* (D.O.T. 613.362-014), the worker in charge of the mill, works in a glass-enclosed control booth, located above or beside the conveyor line. This employee's duties, which appear to consist principally of moving levers and pushing buttons, look relatively simple. However, the quality of the product and the speed with which the ingot is rolled depend upon the roller's skill. The roller regulates the opening between the rolls after each pass. If the opening is set too wide,



When an ingot has solidified on the outside, a stripper crane operator may remove the mold as shown here in cutaway. The tongs lift the mold while a "plunger" holds the ingot down on the ingot car.

Liquid steel is poured from a ladle into ingot molds of various sizes. As it cools, the molten steel solidifies from the outside toward the center.

Source: American Iron and Steel Institute



Ingots are taken to soaking pits (above) where they are "soaked" until they are of uniform temperature throughout. As each ingot is required at the roughing mill (right) soaking pit crane operators take it from the soaking pit to the huge facility. The almost-square end section of the steel emerging from the rolls at the right identifies it as a bloom. Another kind of semifinished steel is wider than it is high and is called a slab.

Source: American Iron and Steel Institute

more passes will be needed to get the required shape, and production will be slowed. If the opening is too narrow, the rolls or gears may be damaged. Long experience and a knowledge of steel characteristics are required for a worker to become a roller. A *manipulator operator* (D.O.T. 613.682-010) sits in the booth beside the roller and operates controls that correctly position the ingot on the roller conveyor before each pass.

Upon leaving the rolling mill, the red-hot slab, billet, or bloom moves along a conveyer to a place where a *shear operator* (D.O.T. 615.482-034) controls a heavy hydraulic shear that cuts the steel into desired lengths.

In a rolling mill that has automatic controls, a rolling mill attendant is given a card that has been punched with a series of holes, which represent coded directions on how the ingot is to be rolled. The attendant inserts the card into a card "reader" and presses a button to start the automatic rolling sequence. When this process is used, the roller's job is shifted from operating the controls to directing and coordinating the rolling process.

Of increasing use in shaping steel into slabs, blooms, and billets is the continuous casting process, which eliminates the necessity of producing large ingots that must be reheated and put through the primary mill. In one type of continuous casting, a ladle of liquid steel, a water-cooled mold of the desired product shape (for example, a bloom), and a cooling chamber are set above the plant floor. A series of rolls descend from the cooling chamber to the floor. Liquid steel is poured into the mold, cools, and solidifies along the bottom and lower sides of the mold. Passing down through the chamber, the steel is further cooled by a water spray. The rolls control the molded steel's descent, support its weight, and straighten it as it moves toward the plant floor. The molded steel is cut to the desired lengths as it emerges from the rolls. Continuous casting requires fewer workers than the pouring and rolling of ingots.

After the steel is rolled or cast into primary shapes, most of it is put through finishing operations. Slabs, for example, can be reduced and shaped into sheets, and billets can be made into bars, rods, and pipe.

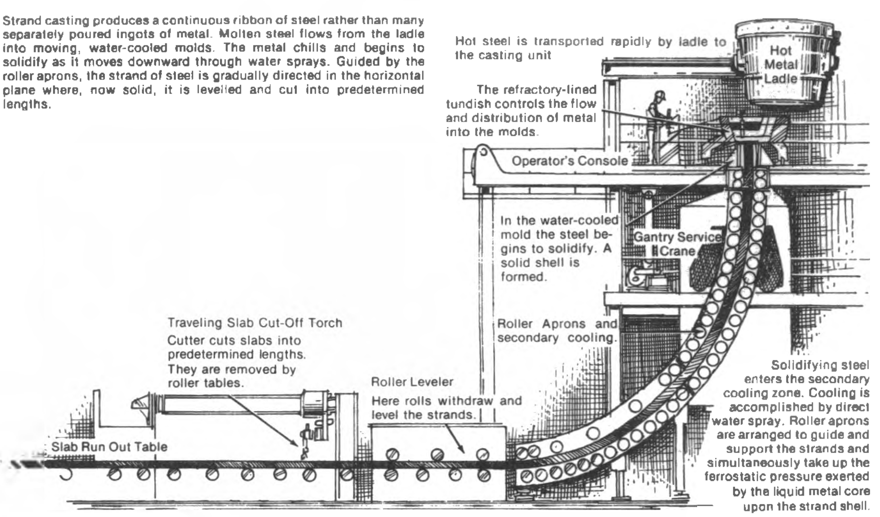
Steel sheet is the most important finished product made by the iron and steel industry. To make sheets, a slab is heated in a furnace similar to the soaking pits described earlier and run through a hot strip mill. The hot strip mill is a continuous series of pairs of rolls, similar to the two at the primary mill. As the slab moves through each pair of rolls, it becomes thinner and longer; edge guides control its width. After passing through the last pair of rolls, the sheet is wound into a coil. If the customer prefers a thinner sheet or an improved surface, the product may be cold rolled in another mill.

Having obtained information on the characteristics of the sheet desired, the roller at the hot strip mill refers to a printed guide to determine the necessary gauge between each pair of rolls, and the speed at which the slab should travel. Working in a pulpit, the roller uses controls to set the gauge on the last series of rolls, while the *speed operator* (D.O.T. 613.362-022) works controls that adjust the speed of the rolls and conveyor. Unless problems develop, the jobs of these two workers are repetitive. However, if the sheet should begin to buckle between rolls, due to the steel's composition or temperature, these two employees must readjust the gauge and speed of the rolls in an attempt to avoid damage to the sheet.

Under the direction of the roller, a *rougher* (D.O.T. 613.362-018) and assistant use handtools to adjust the gauge and edge guides for the first series of rolls (called the roughing mill). A *rougher operator* (D.O.T. 613.662-014), following the rougher's instructions, signals the furnace crew for additional slabs and operates controls to position the slab on the conveyor and guide it into the rolls.

Other important steel mill products include various types of wire and pipe made from billets. To make drawn wire, the billet is rolled into a long, thin, round product called a rod. A *wire drawer* (D.O.T. 614.-382-010) operates equipment that pulls the steel rod through a die which has a tapered hole, one end of which is smaller than the rod. As the rod passes through the hole, it is made thinner and longer and becomes wire. The wire drawer positions the rod in the die, sets the speed for drawing the rod through the die, lubricates the rod, and checks the wire for scratches and defects.

Strand casting produces a continuous ribbon of steel rather than many separately poured ingots of metal. Molten steel flows from the ladle into moving, water-cooled molds. The metal chills and begins to solidify as it moves downward through water sprays. Guided by the roller aprons, the strand of steel is gradually directed in the horizontal plane where, now solid, it is levelled and cut into predetermined lengths.



Source: American Iron and Steel Institute

A *piercing-mill operator* (D.O.T. 613.685-018) controls machinery that makes seamless pipe. The operator moves levers that drop the hot billet from a conveyer into a trough and pass it between two barrel-shaped rolls that spin the billet and force an end of it against a sharp plug or "mandrel." The mandrel smooths the inside wall of the billet and makes the diameter of the hole uniform. The operator uses controls to remove the mandrel and drop the billet onto a conveyor for further processing.

Maintenance, Transportation, and Plant Service Occupations. Large numbers of workers are required in steel plants to support processing activities. Some maintain and repair machinery and equipment, while others operate the equipment that provides power, steam, and water.

Machinists and machine tool operators make and repair metal parts for production equipment. Diemakers use machine tools to form dies, such as those used to make wire. *Roll builders* (D.O.T. 801.564-010) use lathes, grinders, and other machine tools to refinish the steel rolls used in the rolling mills.

Millwrights overhaul machinery and repair and replace defective parts. Electricians install wiring and fixtures and hook up electrically operated equipment. Electrical repairers (motor inspectors) keep wiring, motors, switches, and other electrical equipment in good operating condition.

Electronic repairers install and maintain the increasing number of electronic devices and systems used in steel manufacturing plants. Typically, this equipment includes communication systems such as closed-circuit television; electronic computing and data recording systems; and measuring, processing, and control devices such as X-ray measuring or inspection equipment.

Bricklayers repair and rebuild the brickwork in furnaces, soaking pits, ladles, and coke ovens, as well as mill buildings and offices. Pipefitters lay out, install, and repair piping that is used to carry the large amounts of liquids and gases used in steelmaking. Boilermakers test, repair, and rebuild heating units, storage tanks, stationary boilers, and condensers. Locomotive engineers and other traincrew members operate trains that transport materials and products in the vast yards of iron and steel plants. Other skilled workers operate the various boilers, turbines, and switchboards in factory powerplants.

Other types of maintenance and service workers include carpenters, oilers, painters, instrument repairers, scale mechanics, welders, loaders, riggers, janitors, and guards. Many laborers are employed to load and unload materials and do a variety of cleanup jobs.

Administrative, Clerical, and Technical Occupations. Professional, administrative, clerical, and sales workers constitute about one-fifth of the industry's total employment. Of these, the majority are clerical workers, such as secretaries, stenographers, typists, accounting clerks, and general office clerks.

Engineers, scientists, and technicians make up a substantial proportion of the industry's white-collar employment. Several thousand of these workers perform research and development work to improve existing iron and steel products and processes, and to develop new ones.

Among the technical specialists employed in steelmaking are mechanical engineers, whose principal work is the design, construction, and operation of mill machinery and material handling equipment. Metallurgists and metallurgical engineers work in laboratories and production departments where they have the important task of specifying, controlling, and testing the quality of the steel during its manufacture. Civil engineers are engaged in the layout, construction, and maintenance of steel plants, and the equipment used for heat, light, and transportation. Electrical engineers design, lay out, and supervise the operation of electrical facilities that provide power for steel mill operation. Chemists analyze the chemical properties of steel and raw materials in laboratories. Laboratory technicians do routine testing and assist chemists and engineers. Drafters prepare working plans and detailed drawings required in plant construction and maintenance.

Among the employees in administrative, managerial, and supervisory occupations are office managers, labor relations and personnel managers, purchasing agents, plant managers, and industrial engineers. Working with these personnel are several thousand professional workers, including accountants, nurses, lawyers, economists, statisticians, and mathematicians. The industry also employs several thousand sales workers.

(Detailed discussions of professional, technical, mechanical, and other occupations found in the iron and steel industry as well as in many other industries are given elsewhere in the *Handbook*.)

Covered with protective clothing, a worker takes a sample of molten iron.

Working Conditions

Working conditions vary by job. Work in almost all professional and clerical jobs and many maintenance jobs is done in comfortable surroundings. Workers near the blast and steel furnaces and in the rolling mills, however, are subject to extreme heat and noise. For example, when raw materials such as scrap steel are loaded into a steel furnace a thunderous roar occurs. The temperature in the building which surrounds the blast furnace remains extremely high even in the middle of the winter. Many methods have been developed to reduce job discomfort. The use of remote control, for example, enables some employees, such as furnace operators, to work outside the immediate vicinity of processing operations. In other instances, the cabs in which the workers sit while operating mechanical equipment, such as cranes, may be air-conditioned and sound insulated. Because certain processes are continuous, many employees are on night shifts or work on weekends.

Training, Other Qualifications, and Advancement

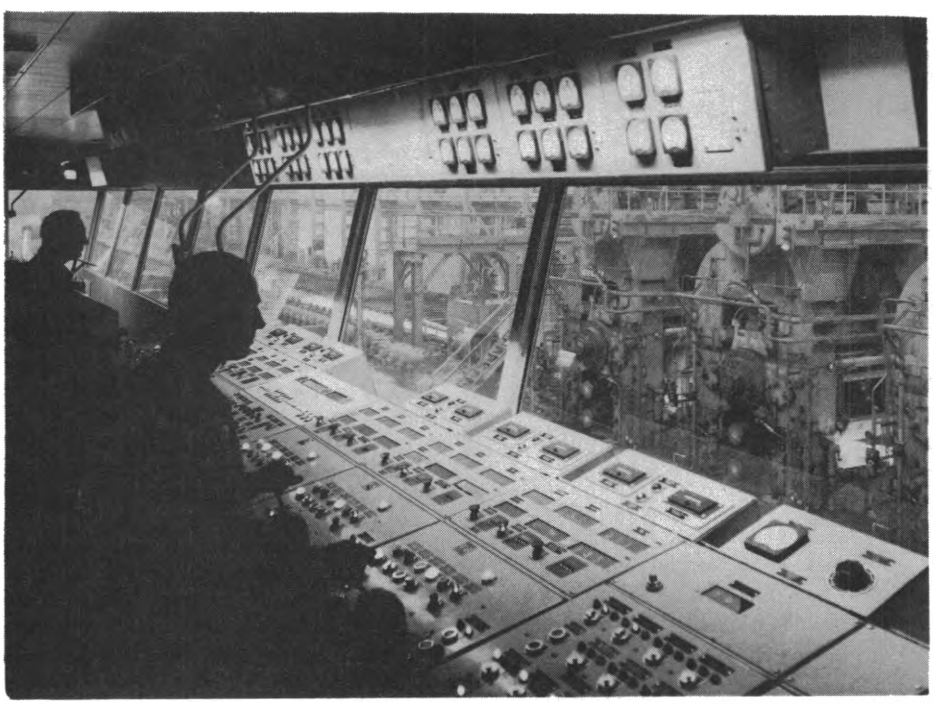
New workers in processing operations usually are hired as unskilled laborers. Openings in higher rated jobs usually are filled by promoting workers from lower grade jobs. Length of service with the company is the major factor considered when selecting workers for promotion. Promotions to first level supervisory positions, such as blower

Worker removes "scales" from a steel ingot.

and melter, differ among companies. Some firms determine these promotions solely on seniority while others also consider ability to do the job.

Training for processing occupations is done almost entirely on the job. Workers move to operations requiring progressively greater skill as they acquire experience. A crane operator, for example, first is taught how to operate relatively simple cranes, and then advances through several steps to cranes much more difficult to run, such as the hot-metal crane.

Workers in the various operating units usually advance along fairly well-defined lines of promotion within their departments. For example, to become a blast furnace blower, a worker generally starts as a laborer, advancing to second helper, first helper, keeper, and possibly blower. At a basic oxygen furnace, a worker may begin by doing general cleanup work and then advance to furnace hand, second assistant, first assistant, furnace operator, and possibly to melter. A possible line of advancement for a roller in a finishing mill might be assistant rougher, rougher pulpit operator, rougher, speed operator, and finish roller. Workers can be trained for skilled jobs, such as blower, melter, and roller, which are among the highest rated steelmaking jobs, in a minimum of 4 or 5 years, but they may have to wait much longer before openings occur.



From an enclosed booth, workers control the machinery in a rolling mill.

To help them advance in their work, many employees take part-time courses in subjects such as chemistry, physics, metallurgy, and management. Steel companies sometimes provide this training—often within the plant. Other workers take evening courses in high schools, trade schools, or universities, or enroll in correspondence courses.

Apprenticeship is the best way to learn a maintenance trade. Apprenticeship programs usually last 3 or 4 years and consist mainly of shop training in various aspects of the particular jobs. In addition, classroom instruction in related technical subjects usually is given, either in the plant, in local vocational schools, or through correspondence schools.

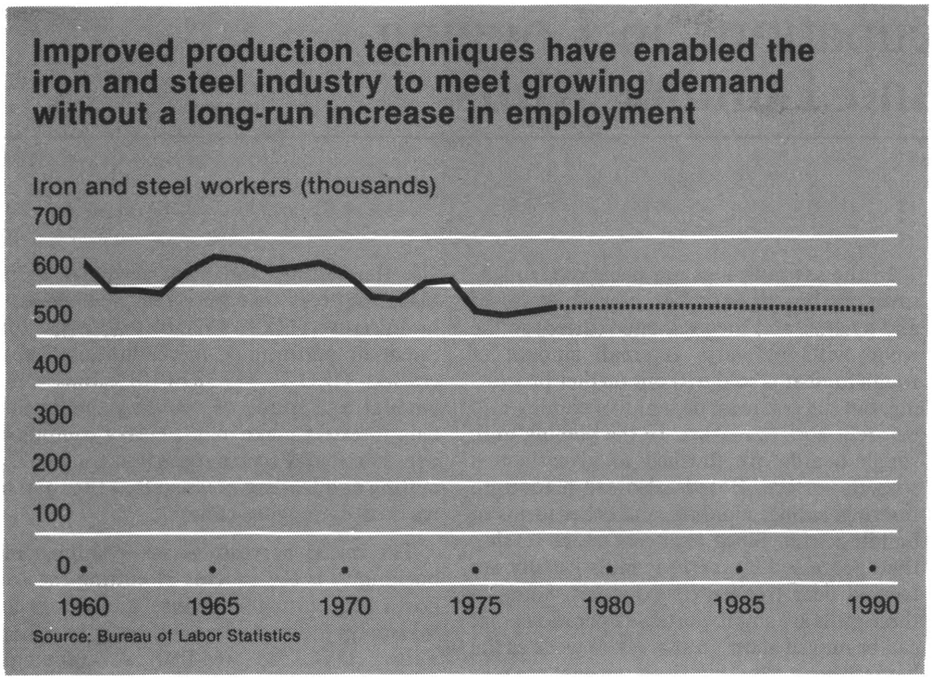
Steelmaking companies have different qualifications for apprentice applicants. Generally, employers require applicants to have the equivalent of a high school or vocational school education. In most cases, the minimum age for applicants is 18. Some companies give aptitude and other types of tests to applicants to determine their suitability for the trades. Apprentices generally are chosen from among qualified workers already employed in the plant.

The minimum requirement for many administrative, engineering, and scientific jobs usually is a bachelor's degree with an appropriate major. Practically all the larger companies have formal training programs for college-trained workers and recruit these workers directly from college campuses. In some of these programs, trainees work for brief periods in various operating and maintenance divisions to get a broad picture of steelmaking operations before they are assigned to a particular department. In other companies, the newly hired professional worker is assigned directly to a specific research, operating, maintenance, administrative, or sales unit. Engineering graduates frequently are hired for sales work and many of the executives in the industry have engineering backgrounds. Engineering graduates, as well as graduates of business administration and liberal arts colleges, are employed in sales, accounting, and labor-management relations, as well as in managerial positions.

Completion of a business course in high school, junior college, or business school is preferred for entry into most of the clerical occupations. Clerical jobs requiring special knowledge of the steel industry generally are filled by promoting personnel already employed in the industry.

Employment Outlook

Employment in the iron and steel industry is not expected to change significantly through the 1980's. Nevertheless, many workers will be hired to replace those who retire, die, or leave their jobs for other reasons. The total number hired may fluctuate from year to year because the industry is sen-



sitive to changes in business conditions, defense needs, and imports.

Production of iron and steel is expected to increase as population and business growth create a demand for more automobiles, household appliances, industrial machinery, and other products that require large amounts of these metals. Because of labor-saving technology, however, employment is not expected to keep pace with increases in production. Giant blast furnaces are being built that make more iron per worker than the smaller furnaces they are replacing. Some blast furnaces now have conveyor systems that automatically weigh and transfer raw materials from the storage areas to the furnace. Such systems will eliminate stockhouse jobs such as the scale car operator. Open hearth furnaces will continue to be replaced with more efficient basic oxygen furnaces, increasing the amount of steel produced per worker. Older primary rolling mills will be replaced by continuous casters, which use fewer employees to produce slabs, billets, and blooms. Greater use of computers to control plant equipment, as in hot finishing mills, and to process business records also will increase productivity.

Employment trends will differ among occupations. The number of job opportunities for engineers, metallurgists, laboratory technicians, and other technical workers will increase as the industry's research and development programs expand. Employment of computer systems analysts and programmers also will increase because computers will perform more of the work in the steelmaking operations. Some maintenance workers, such as electronic repairers, will be needed in greater numbers to maintain the increasingly complex machinery used by the steel mills. Employment of other maintenance workers—for example, bricklayers and carpenters, who work extensively on open hearth furnaces—will decline because they work on equipment that is being replaced. Employment in processing occupations is expected to decline slightly as more efficient plant machinery and equipment are introduced.

Earnings

Earnings of production workers in iron and steelmaking are among the highest in manufacturing. In 1978, they averaged $9.41 an hour, while workers in manufacturing as a whole averaged $6.17. To show how earnings vary by occupation and department, wage rates for employees in some of the principal occupations are presented in the table below. However, most steelworkers are paid on an incentive basis—the more they produce the more they earn—and often earn more than the table indicates.

Most production workers in the iron and steel industry are members of the United Steelworkers of America. Agreements between steel companies and the union include some of the most liberal fringe benefits in industry. Most workers receive paid vacation ranging from 1 to 5 weeks, depending on length of service. A worker in the top 50 percent of a seniority list receives a 13-week vacation every 5 years; the remaining workers receive 3 extra weeks of vacation once in a 5-year period. Workers may retire on company-paid pensions after 30 years of service, regardless of age. Employees having 2 years or more of service are eligible to receive supplemental unemployment benefits for up to 52 weeks. Other benefits include health and life insurance, supplemental jury-duty pay, and education and scholarship assistance. Professional and managerial personnel receive similar benefits.

Sources of Additional Information

For additional information about careers in the iron and steel industry, contact:

American Iron and Steel Institute, 1000 16th St. NW., Washington, D.C. 20036.

United Steelworkers of America, Five Gateway Center, Pittsburgh, Pa. 15222.

Table 1. Average hourly earnings in selected occupations in the basic iron and steel industry, 1978

Occupation	Hourly rate[1]
Blast furnaces:	
Keeper	$8.48
Larry or scale car operator	8.14
Basic oxygen furnaces:	
Furnace operator	9.51
Second assistant (second helper)	8.60
Bloom, slab and billet mills:	
Roller	9.97
Soaking pit crane operator	8.60
Continuous hot-strip mills:	
Roller	10.54
Rougher	8.71
Maintenance:	
Bricklayer	8.83
Millwright	8.71

[1]Excludes overtime and incentive pay

SOURCE: United Steelworkers of America.

Occupations in Logging and Lumber Mills

Nature and Location of the Industry

The logging and lumber mill industry offers a variety of careers for people who enjoy outdoor work. Logging camps and sawmills provide many job opportunities, especially in the South and the Pacific Northwest, the Nation's major timber-producing regions.

In 1978, about 85,000 wage and salary workers were employed in logging—harvesting trees and removing them from forests. A much larger number—about 235,000—worked in sawmills and planing mills where logs are converted into lumber. In addition, there were about 75,000 self-employed workers, most of them in logging.

This chapter deals with activities and jobs involved in cutting and removing timber from forests and in processing logs into rough and finished lumber. It excludes the manufacture of paper, plywood, veneer, and other wood products such as furniture and boxes. Occupations in paper manufacturing are discussed in a separate section of the *Handbook*.

Lumber production has entailed the same basic steps for many years. A stand of timber is harvested in the forest, moved to a central location or "landing" accessible to transportation, and then carried by truck or rail to a mill for processing. Logging crews typically consist of from 5 to 15 workers. Several crews, each working at a different location, may be needed to supply logs for a single mill. The crew moves through the forest as one area after another is harvested. Years ago, these workers lived in camps close to the cutting site. With better roads and transportation, almost all can now live at home and commute to work.

In the sawmill, logs are debarked, rough-sawn into boards or timbers of various widths and lengths, and then seasoned (dried) so the wood will not warp. A small amount of rough lumber is sold without further processing, but the rest must be sent to a planing mill before it goes to market. In the planing mill, rough boards are finished to give them a smooth surface. Boards also are made into flooring, siding, molding, and other forms of building trim. Since logs cost more to ship than processed lumber, sawmills usually are located near tree-harvesting areas. Some of these mills are small, portable operations that can be moved about from week to week as the harvest progresses, but the large ones are permanent. Planing mills may be part of sawmill operations or may be separate facilities miles away. Many sawmills and planing mills employ fewer than 20 workers, but some have more than 100.

Although some logging and lumber mill workers are employed in nearly every State, seven States account for about half of the industry's employment: Oregon, Washington, California, Alabama, North Carolina, Arkansas, Texas, Mississippi, and Georgia.

Occupations in the Industry

Harvesting, moving, and processing trees require the coordinated effort of many different types of highly specialized workers. These workers are described in the following sections on occupations in logging and occupations in lumber mills.

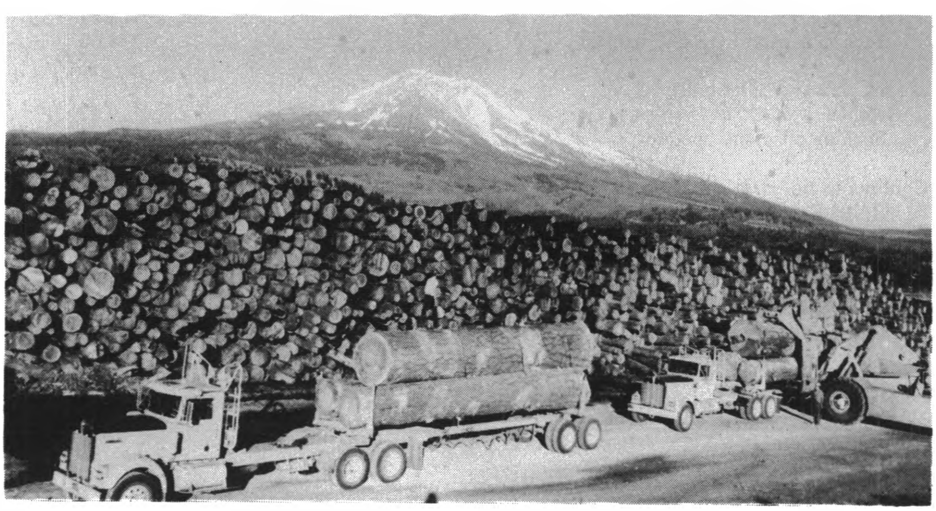
Logging. Before a stand of timber is harvested, a *forester* (D.O.T. 040.061-034) selects and marks which trees to cut. Foresters also map the cutting areas, plan and supervise the cutting, and plant seedlings to replace the trees that were removed. *Forestry technicians* (D.O.T. 452.364-010) assist foresters in performing these duties. *Timber cruisers* (D.O.T. 459.387-010) estimate the amount and grade of standing timber and help foresters make maps. Heavy equipment operators build access roads and trails to the cutting and loading areas so that they can be reached by logging crews.

The initial harvesting task—"falling and bucking"—is the process of cutting the tree down and cutting (bucking) it into logs for maximum product value and easier handling. *Fallers* (D.O.T. 454.384-010), working singly or in pairs, use powersaws to cut down large trees marked by the forester. Expert fallers can usually drop a tree in the exact spot where they want it, without injuring other trees. As soon as the tree is down, *buckers* (D.O.T. 454.684-010) saw the limbs off and saw the trunk into logs. Sometimes, small trees are felled with tree harvesters, which are machines mounted on a tractor and operated by a *tree-shear operator* (D.O.T. 454.-683-010).

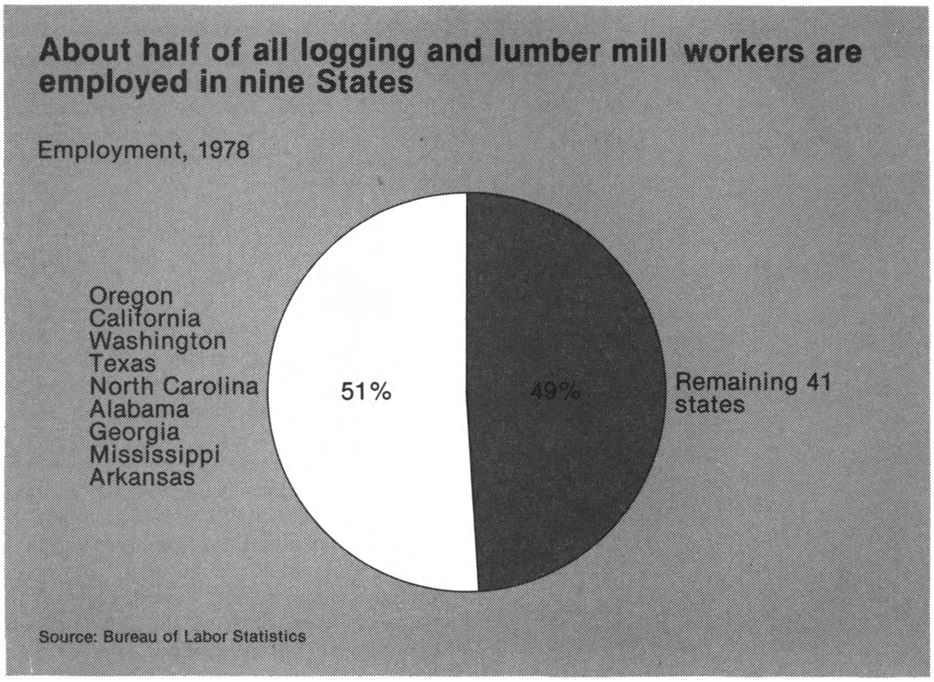
The next task—"skidding"—is a method of removing logs from the cutting area. A choker (steel cable) is noosed around the log by *choke setters* (D.O.T. 921.687-014) and then attached to a tractor, which drags or "skids" the log to the landing. A *rigging slinger* (D.O.T. 921.364-010) supervises and assists choke setters and tractor drivers.

Sometimes, other methods of removal are necessary or desired. In rough terrain in the West, where logs must be moved up or down steep slopes or across ravines, the "highlead" method is used instead of skidding. This method is somewhat like a fishing rod and reel. Steel cables run from a diesel-powered winch (reel) through pulleys at the top of a large steel tower (rod) and down to the cutting area, which may be hundreds of feet away from the tower. Choker setters noose the end of the cable around a log and a *yarder engineer* (D.O.T. 921.663-066) operates the winch to pull the log into the landing. Other methods include the use of heavy-duty helicopters and balloons that lift logs weighing several tons and carry them to the loading sites. The major advantages of these methods are that forest obstacles may be avoided more easily and environmental damage caused by dragging logs across the land is reduced.

After logs reach the landing, they are loaded on a truck trailer and hauled to a mill. A *loader engineer* (D.O.T. 921.683-058) operates a machine that picks up logs and places them on the trailer. A *second loader*



More than 12 billion cubic feet of wood are harvested each year in the United States.



(D.O.T. 921.687-022) directs the positioning of logs on the trailer. Although trucks usually are used, logs are sometimes carried by railroad cars.

Lumber Mills. At the sawmill, incoming logs are stacked on the ground (cold decking) or dumped into a pond to await cutting. Water storage protects the logs from splitting, insect damage, and fire. Cold decking, on the other hand, permits greater storage volume per acre, and some trees, such as oak, must be stored this way because they will sink in water. *Log scalers* (D.O.T. 455.487-010) measure logs and look for defects, such as knots and splits, to estimate the amount and quality of lumber available. *Pond workers* (D.O.T. 921.686-022) sort the logs so that all of one kind or size go into the mill together.

A *bull-chain operator* (D.O.T. 921.685-014) controls a conveyor that pulls logs up a chute into the sawmill. A *barker operator* (D.O.T 663.682-010) operates machinery to remove bark and foreign matter that could damage saws. One kind of machine has rough metal bars or knives that rub or chip the bark away. Another kind tears it off with the high pressure force of water. The removed bark may be processed into garden mulch or burned to produce heat and steam for the sawmill.

As a log enters the sawing area, a *deck worker* (D.O.T. 921.685-014) rolls it onto a platform called a "carriage," and a *block setter* (D.O.T. 667.686-014) alines the log and locks it into position. The carriage, which moves back and forth on rails, carries the log into the teeth of a large bandsaw; each time the log passes the saw a board is sliced off. This operation is controlled by a *head sawyer* (D.O.T. 667.662-010), who is one of the most experienced workers in the mill. The quality and quantity of usable lumber obtained from logs depend largely on the head sawyer's skill and knowledge.

After leaving the carriage, the lumber moves to an edger saw, consisting of two or more circular blades. Operated by a *pony edger* (D.O.T. 667.682-050), the edging machinery cuts the lumber to the desired width. For example, the production run may be cutting boards to a 4-inch width. Next, a *trimmer sawyer* (D.O.T. 667.482-022), using a series of circular cross-cut saws, cuts the lumber to various lengths, such as 8, 10, or 12 feet.

When all sawing is completed, a conveyor system moves the rough lumber into a sorting shed, where *graders* (D.O.T. 455.367-010) examine each board and determine its grade according to set standards of quality and value. After grading, *sorters* (D.O.T. 921.-685-054) pull and stack the lumber according to type, grade, and size.

At this stage, the lumber is still green and must be seasoned so that it will not shrink or warp. It may be stacked outdoors where the sun and wind will remove excess moisture. More frequently, however, it is placed in a specially heated building (dry kiln). *Dry-kiln operators* (D.O.T. 563.382-010) control temperature, humidity, and ventilation in kilns.

Some seasoned lumber is ready for use without further processing. Most of the lumber, however, must pass through a planing mill before being shipped to market. In this mill, the rough dried lumber is run through a set of rotating knives controlled by a *planer operator* (D.O.T. 665.482-018). Some knife heads produce smooth surfaces, while others tongue-and-groove the boards for flooring or paneling. Similarly, a wide variety of molding or other building trim may be cut. The dressed or finished lumber is usually graded again before storage by a *planer mill grader* (D.O.T. 669.587-010). The milling process is now ended and the lumber is ready for shipment.

In addition to those already described, workers in many other occupations requiring a broad range of training and skill are needed in the logging and milling processes. Maintenance mechanics install and repair saws and related machinery. Saw filers sharpen and repair saws, and electricians maintain and repair wiring, motors, and other electrical equipment. Increasingly, people with a background in electronics are being hired to maintain the growing amount of electronically controlled or operated equipment. Truckdrivers transport logs to the mills and deliver the finished lumber products to wholesalers.

Many workers are employed in clerical, sales, and administrative occupations. For example, many companies employ office managers, purchasing agents, personnel managers, sales workers, office clerks, stenographers and typists, bookkeepers, and business machine operators. Also, the industry employs professional and technical workers, such as civil and industrial engineers, drafters and surveyors, and accountants. (Detailed discussions of professional, technical, and mechanical occupations, found not only in logging and milling but in other industries as well, appear elsewhere in the *Handbook* in statments covering individual occupations.)

Working Conditions

Logging and lumber mill workers often must do their jobs under unpleasant working conditions. Most logging jobs are outdoors and the weather often is very hot and humid or extremely cold. The forest may be wet and muddy, with many annoying insects during the summer. Sometimes, working time and pay may be lost because of heavy rain or snow or extreme temperatures. Although usually sheltered, sawmills and planing mills may be noisy and dusty, and uncomfortably warm during the summer. Moreover, work at logging sites and in mills is more hazardous than in most manufacturing plants. For many persons, however, the opportunity to work and live in forest regions away from crowded cities more than offsets these disadvantages.

Training, Other Qualifications, and Advancement

Most loggers and millhands get their first jobs without previous training. Employers prefer high school graduates, but applicants who have less education frequently are hired. Entry level jobs usually can be learned in a few weeks by observing and helping experienced workers.

A beginning logger may start by helping choker setters or buckers. After gaining logging experience and basic skills, workers may advance to higher paying positions as vacancies occur. Those who have an aptitude for operating machinery may become a yarder engineer, or a tractor operator. Others may be interested in the highly skilled faller or bucker jobs.

In the mill, the beginner often is assigned


The logging and lumber mill industry offers a variety of careers for people who enjoy outdoor work.

to a labor pool to do odd jobs, such as sorting and stacking lumber. Millhands may be trained to operate various machines such as the edger saw or a band saw. Other mill workers may be able to pursue careers in lumber sales and marketing, or be trained for research jobs.

Mechanics, electricians, and others who repair and maintain the industry's equipment are trained on the job under the guidance of supervisors and experienced workers. In some companies, this training is supplemented by classroom instruction. Maintenance trainees frequently are selected from workers already employed in mills or logging crews. Many firms, however, will hire inexperienced people who have mechanical aptitude. Generally, it takes a trainee 3 to 4 years to become skilled in one of the maintenance jobs.

Workers who have leadership ability and years of experience can advance to supervisory positions in mills and logging crews. Many of the smaller logging companies and sawmills are owned by people who began their careers as loggers or millhands.

Loggers and millhands must be in good physical condition. Although modern equipment has reduced some of the heavy labor, stamina and agility are still important qualifications, particularly for loggers. Because of the danger involved in operating and working around heavy machinery, workers should be alert and well coordinated.

A bachelor's degree usually is the minimum educational requirement for forester, engineer, accountant, and other professional occupations. Completion of commercial courses in high school or business school usually is adequate for entry into clerical occupations, such as secretary, typist, and bookkeeper.

Employment Outlook

Employment in logging and lumber mills is expected to decline through the 1980's despite anticipated increases in lumber production to keep up with the Nation's population and industrial growth. Laborsaving machinery will make it possible to harvest more timber and process more lumber with fewer employees. Nevertheless, many workers will be needed each year to replace those who retire, die, or leave the industry for other reasons. The number of job openings may fluctuate from year to year, however, because the demand for lumber is sensitive to changes in construction activity.

Employment in logging camps and mills will decline over the long run as more modern equipment and techniques are adopted. A tree harvester, for example, which has a scissor-like pair of blades, can cut down a tree in one-quarter the time it takes with a saw. As more harvesters come into use, fewer logging workers will be required. Sawmills and planing mills may reduce employment requirements by installing new machinery and improving plant layouts. In the kiln area, for example, a stacking machine operated by two or three people can replace six who stack by hand.

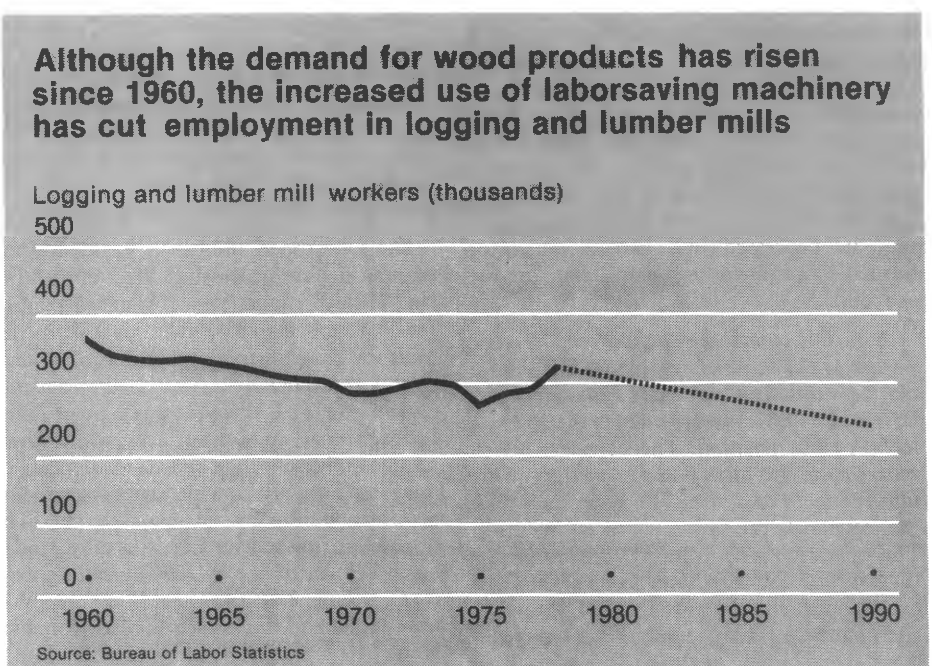
Although employment in the industry as a whole is declining, certain occupations will grow. Additional mechanics, for example, will be needed to maintain the growing stock of logging equipment, trucks, and mill machinery. More foresters and forestry technicians will find jobs in this industry as forest replanting and conservation programs receive greater attention. Engineers will be in greater demand as the industry's production methods become more complex. As in the past, however, most of the industry's job openings will be for logging and mill workers; because they make up a very large proportion of the industry's total employment, replacement needs are high.

Summer jobs sometimes are available for high school students 17 years of age or older. These jobs are unskilled and include such tasks as working on a survey crew, helping haul logs to landings, clearing brush, and fighting forest fires.

Earnings

In 1978, production workers in sawmills and planing mills averaged $5.79 an hour. In comparison, production workers in manufacturing industries as a whole averaged $6.17 an hour.

Wage rates in logging, sawmills, and planing mills vary considerably by occupation and geographic area. Workers in dif-



ferent regions of the United States often earn vastly different hourly wages for doing the same job. Average hourly rates for selected occupations in Western logging camps and sawmills in 1978 are shown in the accompanying tabulation. Workers in the South earned considerably less than those in the West.

Table 1. Average hourly earnings in selected logging and lumber mill occupations in the Pacific Northwest, 1978

Occupation	Hourly rate
Deck worker	$ 7.535
Pond worker	7.305
Sorter	7.60
Trimmer	8.06
Choker setter	7.665
Pony edger	7.815
Truckdriver	7.88
Grader	8.09
Lumber stacker	7.075
Planer operator	8.755
Rigging slinger	7.905
Yarder engineer	8.955
Head-saw operator, circular saw	9.68
Head-saw operator, band saw	10.22
Falller and bucker	10.635

SOURCE: Timber Operators Council.

The major unions in this industry are the International Woodworkers of America (AFL-CIO) and the Lumber Production and Industrial Workers, an affiliate of the United Brotherhood of Carpenters and Joiners of America (AFL-CIO). On the West Coast, a large proportion of the industry's production workers are covered by union-management contracts. In the South, on the other hand, relatively few are covered.

Sources of Additional Information

For further information about job opportunities and working conditions, contact:

International Woodworkers of America, 1622 N. Lombard St., Portland, Oreg. 97217.

Wood Industry Careers, National Forest Products Association, 1619 Mass. Ave. NW., Washington, D.C. 20036.

Motor Vehicle and Equipment Manufacturing Occupations

At the beginning of this century, motor vehicle manufacturing was a virtually unknown industry. Today, by a number of measures, the industry is one of the most important in the Nation.

One measure of an industry's role in the economy is the importance of the products it makes. The products of motor vehicle manufacturing, cars, trucks, and buses, are a vital part of our transportation system. Heavy trucks are used in industries such as mining and construction to haul raw materials and heavy equipment, and by other industries to carry a wide variety of goods from one part of the country to another. Small trucks carry bread, mail, building materials, and hundreds of other items for short distances. Buses are used for both local and transcontinental transportation, as well as for shipping some goods. Passenger cars provide people with mobility, both for work and recreation.

Another measure of an industry's economic importance is the number of people it employs. In 1978, about 977,000 persons worked in motor vehicle manufacturing. The industry employed more workers than any other single manufacturing industry and about 1 out of every 100 workers in the Nation's labor force.

Still another indicator is the number of jobs an industry creates in other sectors of the economy. In this respect, motor vehicle manufacturing is important for two reasons. First, it is a major consumer of steel, rubber, plastics, plate glass, and other basic materials needed to produce motor vehicles. As a result, numerous employment opportunities are created in the industries that produce these materials. Second, a number of industries employing large numbers of workers have been created because of motor vehicles. Some of these industries are motor vehicle repair shops, automobile dealerships, gas stations, highway construction, and truck and bus transportation facilities.

As in other large industries, the workers in motor vehicle manufacturing have widely different levels and types of education and training. Job requirements vary from a college degree for engineers and other professional and technical workers to a few hours of on-the-job training for some assemblers, material handlers, and custodians.

Nature and Location of the Industry

The automobile industry is able to produce millions of vehicles because of mass production of standardized parts and assembly line manufacturing. Parts plants make thousands of interchangeable parts that are put together by workers at assembly plants to build complete vehicles. New cars are driven off the assembly line at the rate of about one a minute.

Workers in this industry are employed both by major manufacturers of vehicles and by firms that supply parts to the major assemblers.

The industry has over 3,000 plants, ranging from small parts plants with only a few workers to huge assembly plants that employ thousands. About 85 percent of the industry's employees work in plants with 500 workers or more.

The majority of the industry's employees work in the Great Lakes region, including Michigan, Ohio, Indiana, Illinois, Wisconsin, and western New York. The single largest concentration of industry employees is found in the Detroit, Michigan, metropolitan area. While motor vehicle manufacturing takes place in nearly every other State, most of the remaining workers are found in California, Pennsylvania, Kentucky, Tennessee, Georgia, and Texas.

How Automobiles are Made

There are three stages in making an automobile: Designing, engineering, and testing; production of parts and subassemblies; and final assembly. Although the rest of this statement discusses only passenger cars, the information also applies to trucks, buses, and other motor vehicles.

Designing, Engineering, and Testing. About 2 to 3 years of designing, engineering, and testing precede the actual production of a new model.

First, managers decide what type of car to produce—a sports car, compact, luxury car, or station wagon. This decision is based on research on consumer desires, market conditions, and economic forecasts. After basic specifications for the car's size and cost are determined, design of the car's body and interior is assigned to industrial designers. From the sketches and drawings, skilled modelmakers make scale and full-size clay and fiberglass models of the car that are used to refine the styling, to evaluate safety features, and finally, to make master dies for producing the car. Engineers and drafters, often with the assistance of computer personnel, design the car's engine, transmission, suspension, and other mechanical and electrical parts. Scientists, including physicists, chemists, metallurgists, mathematicians, and others, work with other design team members to develop new parts, stronger and lighter metal alloys, new ways to use plastic and fiberglass, and thousands of other improvements in automobile design.

Each new design and improvement must meet safety and pollution control standards, as well as pass cost, fuel economy, and performance tests. Newly designed cars are thoroughly tested in the laboratory and on special test tracks that can duplicate almost every driving condition. Engines are run thousands of miles to test their durability. Safety features are tested in the laboratory and in actual crashes. Components that fail are redesigned before the car is produced.

Production of Parts. Once the car's final design has been agreed upon and the decision to go ahead with production has been made, the thousands of parts that are needed to mass-produce complete vehicles must be manufactured. Parts are made using a number of different methods and a variety of materials, including steel, copper, aluminum, glass, rubber, plastic, and fabric.

Even metal parts are made by a number of different methods. The metalworking process used to make each part is determined by a number of factors, including the size of the part, the amount of stress to which the part will be subjected, and the degree of precision required. Bulky parts, such as engine blocks, are made using the casting process. Another process, called forging, is used for axles, crankshafts, and other parts that must withstand great amounts of stress. Body panels are made by a process called metal stamping in which huge pressesstamp sheet metal into the shape of the desired part. Other parts, such as alternators and carburetor parts, are machined to exact dimensions. These metalworking processes are explained more fully under plant occupations.

A variety of manufacturing processes are used for the windows, trim, and interior. Plastic and glass parts are molded and cut, seat cushions are sewn, and many parts are painted.

Throughout production, many inspections and tests are made to insure that the assembled car will meet quality and safety standards.

Final Assembly. After many months of designing, testing, and producing parts, the car is ready for assembly. As the car's chassis is carried along the assembly line, specific tasks are performed at fixed stations. These tasks are usually done by assembly workers but some of the simpler tasks are done by "industrial robots," programed machines that perform certain operations automatically. Axles are attached; the engine and transmission are mounted; body panels are welded together, painted, and joined to the chassis; and instrument panels and seats are installed. Near the end of the line, hubcaps, mirrors, and other finishing touches are added. Gasoline is pumped into the fuel tank, headlights and wheels are aligned, and the car is inspected and driven off the line. The whole final assembly process may take as little as 90 minutes.

Assembling hundreds of cars a day requires expert timing and coordination. Parts and subassemblies are delivered according to production schedules arranged months in advance in order that they may be fed without interruption to workers from storage areas along the assembly line. Workers at each assembly station receive instructions for the color and special equipment for each car that passes along the line. This allows cars of different colors and types to follow each other on the assembly line. Throughout the assembly process, inspections are made to assure that each car is being put together correctly.

Occupations in the Industry

The automobile industry employs workers in hundreds of occupations. Production workers, such as assemblers, inspectors, welders, blue-collar worker supervisors, and machinists, make up over three-fourths of all employees.

Some of the major occupations are described briefly below. Detailed discussions of many of the professional, technical, craft, and plant jobs may be found elsewhere in the *Handbook*.

Professional and Technical Occupations. The modern automobile is the product of the research, design, and development work of thousands of engineers, scientists, drafters, and other professional and technical workers.

Most engineers in the automobile industry are mechanical, electrical, or industrial engineers. Mechanical engineers design improvements for engines, transmissions, and other working parts. Electrical engineers design the car's electrical system, especially the ignition system and accessories. Industrial engineers concentrate on plant layout, work standards, scheduling, and other production problems. The industry also employs metallurgical, civil, chemical, and ceramic engineers.

Most of the industry's mathematicians, statisticians, physicists, chemists, and other physical scientists work on research and development projects, such as finding ways to reduce fuel consumption and air pollution and studying the behavior of metals under certain conditions. Mathematicians and statisticians design quality control systems and work with research scientists and engineers. Some scientists supervise technical phases of production. Metallurgists, for example, supervise melting and heating operations in the casting and forging departments.

Drafters and industrial designers work closely with engineers in the design of each part of the car. Engineering technicians, laboratory assistants, and thousands of other technicians also assist engineers and scientists.

Administrative, Clerical, and Related Occupations. Managers decide what kind of vehicles to produce, what prices to charge, where to build plants, and whether to manufacture or buy certain parts. They are assisted by lawyers, market analysts, economists, statisticians, industrial relations experts, and other professionals, who may also supervise plant or office staffs. Purchasing agents, personnel managers, and other administrative workers direct special phases of the company's business.

Secretaries, bookkeepers, shipping clerks, keypunch and business machine operators, typists, and other clerical employees work in the industry's plants and offices.

Plant Occupations. About three-fourths of the automobile industry's employees work in the plant. Most of these workers are engaged directly in the production process making parts or working on the assembly line. Other plant workers such as industrial machinery repairers, maintenance electricians, and stationary engineers help support the production process by servicing and repairing machinery and equipment.

Foundry Occupations. Engine blocks and many other parts are "cast" or molded from melted metal. Patternmakers, coremakers, and machine molders make sand molds that have a hollow space inside in the shape of the part they are making. Workers called melters and pourers melt the metal in electric furnaces, or cupolas, and pour it into the mold. After the metal cools and hardens into the shape of the part, shakeout workers remove the casting from the mold.

Forging Occupations. Forging produces metal that is exceptionally strong; thus the forging process is used to make parts such as crankshafts and axles that must withstand heavy wear. Before metal can be shaped using this process, it must be heated in very hot furnaces called forges. After the metal is glowing hot, it is placed between two metal dies, which together form the shape of the desired part. Then, with tremendous force, these dies are brought together by hammers or presses that squeeze the metal into the desired shape. After the metal has been shaped, other workers remove rough edges and excess metal and perform other finishing operations such as heat treating and polishing.

Machining and other Metalworking Occupations. Most rough cast, forged, and some stamped parts must be machined to exact dimensions before they can be used. Engine cylinders, for example, must be bored out to precise dimensions that could not be achieved using the casting process alone. Machine tool operators, representing one of the industry's largest metalworking occupations, run machine tools that cut or grind away excess metal from rough parts. Most operators use only one kind of machine tool and have job titles related to the type of machine tool they operate, such as lathe operator or milling machine operator.

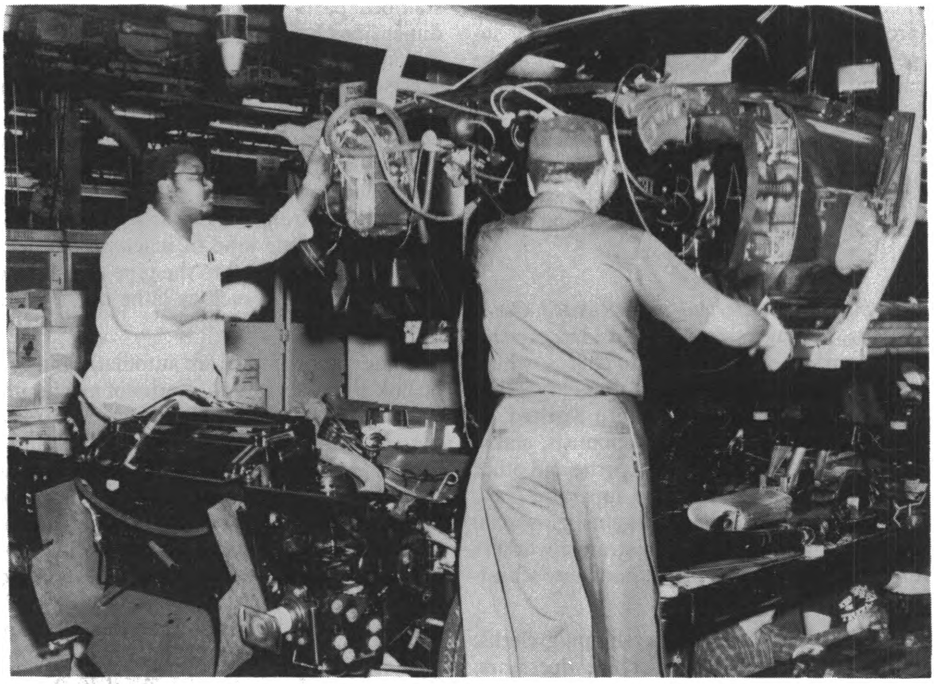
Some machine tools are automatic and can be linked together to do a series of machining operations. A rough engine block, for example, can be moved through hundreds of automatic drilling, cutting, and grinding operations with little or no manual labor. Some of the inspection also is automatic. Operators of those machines are required only to monitor a control panel to spot interruptions and breakdowns. Other types of machine tools need more highly skilled operators who can change or adjust cutting edges, determine proper feed speeds for the metal to be machined, and check the accuracy of machined parts.

Assembly Occupations. The largest group of workers in the automobile industry are the *assemblers* (D.O.T. 806.684-010). They put together small parts to make subassemblies and put subassemblies together to build a complete vehicle. On assembly lines, each assembler has a specific job to do as the vehicle passes a work station. For example, one worker mounts a tire and the next worker tightens the nuts with a power wrench. Most assembly jobs are repetitive and require limited skills. However, they do require good coordination, and may be strenuous.

Finishing Occupations. "Finishing" includes painting, polishing, upholstering, and other operations that protect the car's surface and add to the car's comfort and appearance. *Electroplaters* (D.O.T. 500.380-010) coat bumpers, grills, hubcaps, and trim with chrome. *Metal finishers* (D.O.T.705.684-034) file and polish rough metal surfaces in preparation for painting. *Sprayers* (D.O.T. 741.684-026) apply primers and paint with power spray guns. *Polishers* (D.O.T. 705.-684-058) polish finished surfaces by hand or with a power buffing wheel.

Several different kinds of workers are involved in making the car's upholstery. Working from a pattern, *upholstery cutters* (D.O.T. 781.684-014) cut fabric or leather with hand or electric shears. *Sewing machine operators* (D.O.T. 787.682-046) sew the pieces together into seat covers or headliners. *Cushion builders* (D.O.T. 780.684-050) fasten springs, padding, and foam rubber to the seats and other upholstered areas and install the covers.

Inspection Occupations. (D.O.T. 612.261-.-010; 619.261-010; 806.261-010, .281-010, .281-042, .281-050, .283-010, .364-010, .382-



Each assembler performs a specific job as the vehicle passes a work station.

010,. 382-014, .384-014, .384-018, .684-134, .687-014, and .687-018). Throughout the manufacture and assembly of a new car, inspectors check certain parts for defects. They inspect raw materials, examine parts during manufacturing, check the quality and uniformity of subassemblies, and test drive the new car. Inspectors need various skills, depending on the part of the process they inspect. Some inspectors must be able to read blueprints and specifications to determine the required dimensions for the parts they check. They then use micrometers and other precision measuring instruments to insure that the parts meet specifications. Other inspectors use testing instruments, such as dynamometers, to be sure that engines are working properly.

Other Plant Occupations. Many other workers help keep the plant operating smoothly by delivering materials and parts, repairing equipment, and cleaning and guarding the plant.

Keeping the assembly line running smoothly requires an elaborate materials handling and delivery system. First, *material handlers* (D.O.T. 929.687-030) load and unload raw materials and parts from trucks, ships, and railroad cars. Large and heavy materials—for example, heavy machinery or raw steel—are then moved about the plant by *overhead crane operators* (D.O.T. 921.663-010), while other parts and materials are moved by *power truck operators* (D.O.T. 921.683-050). *Checkers* (D.O.T. 222.387-058), *stock chasers* (D.O.T. 221.167-014), and *stock clerks* (D.O.T. 222.387-058) receive and distribute materials and keep records of shipments to make sure parts and tools are delivered to the assembly line at the right time.

A large staff of workers set up the plant's equipment and keep it in good condition. Maintenance mechanics and electricians service and repair complex mechanical hydraulic, electrical, and electronic equipment. Millwrights move and install heavy machinery. Plumbers and pipefitters lay out, install, and repair piping, valves, pumps, and compressors. Carpenters, stationary engineers, and sheet-metal workers also work in automobile plants.

The industry also employs many protective service workers to keep plants secure and many custodial workers to keep them clean. Most of the protective service workers are guards, while janitors and porters make up a large portion of the custodial work force in the industry.

Working Conditions

Although some workers in motor vehicle plants are subject to heat, dust, smoke, and fumes, improvements in ventilation and noise control systems have helped to eliminate these conditions. Strict safety rules have lessened the number of industrial accidents. Currently, the number of occupational injuries in this industry is about the same as the average for all manufacturing industries.

The standard workweek is 40 hours, but there may be considerable overtime work during periods of high demand for motor vehicles, and short workweeks and layoffs during periods of low demand.

Training, Other Qualifications, and Advancement

Engineers and scientists must have a least a bachelor's degree with an appropriate major. Advanced degrees or specialized experience sometimes are required for research and development jobs. About a dozen colleges offer undergraduate or graduate courses in automotive engineering, and many companies have training programs in automotive specialties for engineers and scientists. Most companies also offer grants, loans, or tuition refund plans to their employees for advanced study. Engineers and scientists may become supervisors of research or production units, and sometimes enter administrative or executive positions.

Most automotive designers usually have bachelor's degrees in industrial design, architecture or a related field. They should have a background in practical application, such as model building, as well as in design theory and techniques.

Most engineering technicians, laboratory assistants, drafters, and other technicians in the automobile industry are graduates of technical institutes or junior colleges. Others are trained on the job, at company schools, or at company expense at local technical schools or junior colleges. Technicians sometimes advance to engineering jobs through experience and study toward an engineering degree.

Although a college education is not always required, administrative jobs usually are filled by people with degrees in business administration, engineering, marketing, accounting, industrial relations, and similar fields. Some companies offer advanced training in these specialties.

For most production-line jobs, the industry seeks people who can do routine work at a steady pace. Most assembly jobs can be learned in a few hours, and the less skilled machine operating jobs can be learned in a few weeks. Plant workers should be in good health and have good coordination and ability to do mechanical work.

Tool-and-die makers, patternmakers, electricians, and some other craft workers in the automobile industry need at least 4 years of training. Although many persons learn their skills by working with experienced craft workers, apprenticeship training is the best way to learn a skilled trade. Automobile manufacturers, working with labor unions, offer apprenticeships in many crafts.

Applicants for apprenticeship usually must be high school, trade, or vocational school graduates, or have equivalent training. Training should include mathematics, science, mechanical drawing, and shop courses. Apprentices must pass physical examinations, mechanical aptitude tests, and other qualifying tests.

Apprenticeship includes both classroom and on-the-job instruction. For most craft jobs, apprentices must complete 8,000 hours of on-the-job instruction, although some may receive credit for experience in the Armed Forces, another apprentice training program, or other skilled trades. Shop math, blueprint reading, shop theory, and special subjects such as electronics and hydraulics are studied in the classroom. In the shop, apprentices learn the techniques of their trade and how to use tools and machinery.

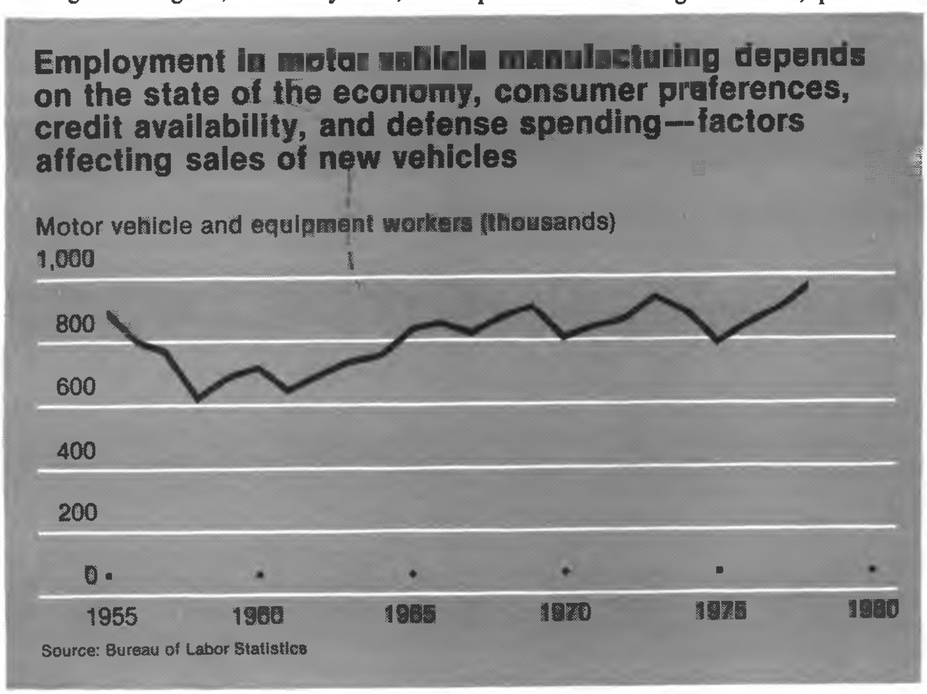
Supervisors usually are selected from workers already employed in the firm, especially if they have completed an apprenticeship and have considerable experience. Manufacturers usually have special training programs for newly promoted supervisors that provide instruction in the various aspects of their new job.

Employment Outlook

Employment in the automobile industry is expected to increase about as fast as the average for all industries through the 1980's. Production should increase as population and income continue to rise. In addition to job openings due to increased production, thousands of workers will be hired annually to replace those who retire, die, or transfer to other industries. The total number hired will fluctuate from year to year because the industry is sensitive to changes in general business conditions, consumer preferences, availability of credit, and defense activity. Employment, however, will not keep pace with output as laborsaving technology increases worker productivity.

The growing use of computers in design, engineering, and production operations should increase employment opportunities for programers and other computer personnel, but will limit employment growth in many clerical occupations. More engineers, scientists, technicians, and other professionals will be employed to meet the industry's research and development needs, especially to design new engines, exhaust systems, and safety equipment. The use of computers will increase the need for systems analysts and programers, but will limit growth in many clerical occupations.

The employment outlook for skilled workers in the industry varies by occupation. Little employment growth is expected for machinists and tool-and-die makers, for example, as more efficient metalworking processess are introduced. Some skilled occupations will grow, including electricians, millwrights, pipefitters, and machine repairers. Automation of the assembly line is expected to continue, but, because many assembly operations are difficult to automate, the demand for assemblers should still increase.



Earnings

Production workers in the motor vehicle manufacturing industry are among the highest paid in manufacturing. In 1978 they averaged $8.51 an hour, compared to $6.17 an hour for production workers in all manufacturing industries.

Besides wages and salaries, automobile workers receive a wide range of fringe benefits. They are paid 1 1/2 times their normal wage for working more than 8 hours a day or 40 hours a week, or for working on Saturday. They receive premiums for working late shifts, and double the normal wage for Sundays and holidays. Most workers get paid vacations (or payment instead of vacations) and 12 paid holidays a year. Most companies provide annual wage increases, plus automatic increases when the cost of living rises. Life, accident, and health insurance are provided also.

A great majority of the industry's workers are covered by company-paid retirement plans. Retirement pay varies with the length of service. Many plans provide for retirement at age 55, or after 30 years of service regardless of age.

Most wage workers and some salaried employees receive supplemental unemployment benefit plans, paid for entirely by their employers. These plans provide pay during layoffs and also provide short-workweek benefits when workers are required to work less than a full week. During layoff, provisions are included for life, accident, and health insurance; survivor income benefits; relocation allowances; and separation payments for those laid off 12 continuous months or more.

Most production maintenance workers in assembly plants, and a majority in parts plants, belong to the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America. In some parts plants, the International Union, Allied Industrial Workers of America is the bargaining agent. Other workers belong to the International Association of Machinists and Aerospace Workers; the Pattern Maker's League of North America; the International Molders' and Allied Workers' Union of North America; the Metal Polishers Buffers, Platers, and Helpers International Union; the International Union, United Plant Guard Workers of America (Ind.); the International Brotherhood of Electrical Workers; the International Union of Electrical, Radio, and Machine Workers; and the International Die Sinkers' Conference (Ind.).

Sources of Additional Information

Information on employment and training opportunities in the automobile industry can be obtained from local offices of the State employment service; employment offices of automobile firms; locals of the unions listed above; and from:

International Union, United Automobile, Aerospace and Agricultural Implement Workers of America, 8000 East Jefferson Ave., Detroit, Mich. 48214.

Motor Vehicle Manufacturers Association of the U.S., Inc., 320 New Center Building, Detroit, Mich. 48202.

Information on careers in automotive engineering and a list of schools offering automotive engineering courses are available from:

Society of Automotive Engineers, 2 Pennsylvania Plaza, New York, N.Y. 10001.

Occupations in the Nuclear Energy Field

Nature of the Industry

Nuclear energy is a source of heat and radiation that can be used for peaceful as well as military purposes. Although peaceful applications have been expanding rapidly in recent years, they are still in the early stages of development. Continuing research and development programs will be needed during the next several decades to find newer, safer, and more efficient ways of utilizing this energy.

Many kinds of research and industrial activities are required for the production and use of nuclear energy. These processes include the exploration, mining, milling, and refining of uranium-bearing ores; the production of nuclear fuels; the manufacture of nuclear reactors, reactor components, and nuclear instruments; the production of special materials for use in reactors; the design, engineering, and construction of nuclear facilities; the operation and maintenance of nuclear reactors; the disposal of radioisotopes; the production of nuclear weapons; and research and development work.

These activities take place in various types of facilities. Some work, such as mining and milling, manufacturing heat transfer equipment, and constructing facilities, differs little from similar work in other fields. Other activities, however, such as producing fuels needed to run reactors, are unique to the nuclear energy field.

Although there are several processes for producing nuclear energy, the most common method used today is the fission process. It involves splitting uranium or plutonium nuclei by neutron bombardment. When neutrons emitted from this fission process bombard other nuclei, further fission takes place and, under proper conditions, results in a "chain" reaction which releases energy that is converted into power. This energy can be controlled for commercial use.

Controlled fission is the essential feature of a nuclear reactor. The reactor is like a furnace and needs fuel to operate. The principal source material for reactor fuel is uranium 235. Uranium in its natural state contains less than 1- percent readily fissionable material, U-235. Although natural uranium sometimes is used as reactor fuel, a more concentrated and enriched fuel can be produced by increasing the proportion of the U-235 isotope through a process called gaseous diffusion. The rate of fission and energy produced in a nuclear reactor usually is controlled by inserting special neutron-absorbing rods into the fuel chamber or "core."

When nuclear energy is used commercially for power, the heat generated must be converted to electricity by conventional power equipment. The major difference between nuclear and conventional thermal electric power stations is that the steam to drive turbines comes from a nuclear reactor rather than from conventional power sources. (See accompanying chart.)

Because of the potential hazards of nuclear radiation, special radiation-resistant materials are used in reactors, and extensive safety measures are taken to protect personnel.

Steam produced by reactors now generates electricity for many communities. These reactors have become competitive with systems that use fossil fuels (such as coal and oil). In early 1979, there were 72 nuclear reactors in commercial operation. About 134 plants were either in the planning stage or were being constructed. Dual-purpose nuclear power desalting plants, which would provide at the same time a new source of fresh water and electric power, are being studied.

Nuclear reactors also power submarines and surface vessels. By eliminating refueling, nuclear propulsion extends the range and mobility of our naval forces.

Another significant application of nuclear energy is the use of radioisotopes. Radioisotopes emit radiation that special instruments, such as thickness gauges, can detect and are valuable research tools in environmental studies, agriculture, medicine, and industry.

The Federal Government supports about half of the basic nuclear energy activities, although private support has been increasing. The U.S. Department of Energy (DOE) directs the Federal Government's nuclear energy research program, and the Nuclear Regulatory Commission (NRC) controls the use of nuclear materials by private organizations. The operation of DOE-owned facilities, including laboratories, uranium processing plants, nuclear reactors, and weapons manufacturing plants, is contracted to private corporations. Most of these operations involve research into the expansion of medical and industrial applications of nuclear energy and the advancement of reactor technologies for generating electricity. Production of nuclear materials for civilian needs is also done in some of these facilities.

Privately owned facilities do all types of nuclear energy work except the development and production of military weapons and certain nuclear fuel-processing operations. Some research is carried out independently by colleges and universities and by nonprofit organizations.

Occupations in the Nuclear Energy Field

In 1978, about 350,000 people worked in nuclear energy activities. Most were employed in the design and engineering of nuclear facilities and in the development and manufacture of nuclear weapons and nuclear reactors and their components. Many persons also were involved in research and development of nuclear energy. Most nuclear energy workers are scientists, engineers, technicians, and craft workers, mainly because much of the work is still in the research and development phase. Office personnel in administrative and clerical jobs represent another large group. Most of the remainder are operatives and service workers involved in production operations, plant protection, and services.

Although many engineers working in the nuclear energy field are trained in nuclear technology, engineers trained in other branches also are employed. Mechanical engineers are the largest single group, but many electrical, electronic, chemical, civil, and metallurgical engineers also work in this field. Many of these engineers do research and development work; others design nuclear reactors, nuclear instruments, and other equipment.

Research laboratories and other organizations that do nuclear energy work employ scientists in basic and applied nuclear research. Most are physicists and chemists, but mathematicians, biologists, and metallurgists also do nuclear energy research.

Large numbers of engineering and science technicians, drafters, and radiation monitors assist the engineers and scientists in conducting research and in designing and testing equipment.

Many craft workers build equipment for experimental and pilot work and maintain the complex equipment and machinery. Many maintenance mechanics and all-round machinists work in most nuclear energy activities, as do electricians, plumbers, pipefitters, and other craft workers and chemical-process operators.

Activities in the Nuclear Energy Field

The following sections briefly describe some major nuclear energy activities and the associated workers.

Uranium Exploration and Mining. The 19,000 people employed in uranium exploration and mining in 1978 had jobs similar to those in mining of other metallic ores. Most work in the Colorado Plateau area of the Far West, in New Mexico, Wyoming, Utah, Colorado, and Arizona. A relatively small number of mines account for the bulk of production and employment. Most workers in uranium mines are in production jobs. Among them are miners and drillers in underground mines and truckdrivers, bulldozer operators, and machine loaders at open pit mines. Mining engineers and geologists also work in uranium exploration and mining.

Uranium Ore Milling. In uranium mills, metallurgical and chemical processes are used to extract uranium from mined ore. Uranium mills, located primarily in the Colorado Plateau, employed about 2,100 workers in 1978. These mills employ skilled machinery repairers, millwrights, pipefitters, carpenters, electricians, chemical-process operators, and some scientists and engineers.

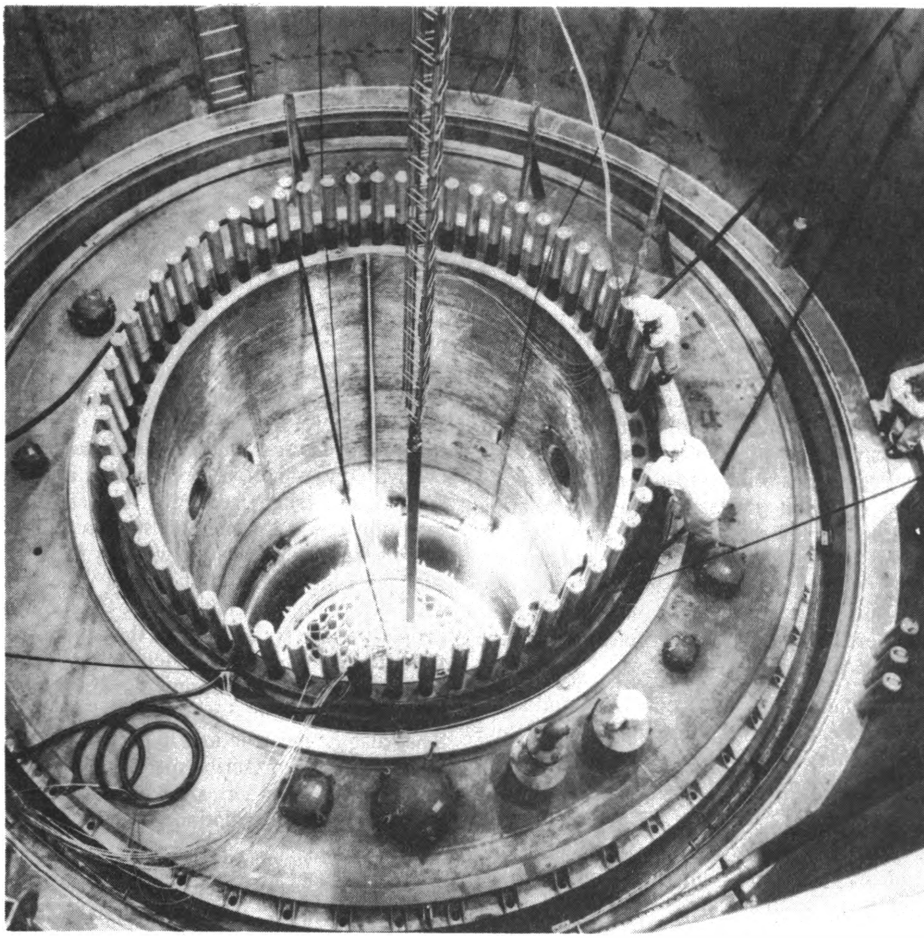
Uranium Refining and Enriching. Milled uranium is chemically processed to remove impurities and is then converted to metal or intermediate chemical products for reactor fuel preparation. Conventional chemical and metallurgical processes are used, but they must meet more exacting standards than in most other industries. The output of refining plants may be further processed to obtain enriched uranium.

Activity in this segment of the nuclear energy field is centered in Ohio, Tennessee, Kentucky, and Illinois. In 1978, uranium refining and enriching plants employed about 14,200 workers.

Maintenance craft workers, particularly in the highly automated uranium enriching plants, constitute a large proportion of skilled workers in this area. Many chemical-process operators also are employed. One-fourth of the engineers and scientists are chemical engineers and chemists.

Reactor Manufacturing. About 35,000 people were employed in the design and manufacture of nuclear reactors and reactor parts in 1978. Reactor manufacturers do extensive development work on reactors and auxiliary equipment and generally build most of the intricate components, such as fuel elements, control rods, and reactor cores.

Two out of five employees in firms that design and manufacture reactors are scientists, engineers, and technicians. Engineers alone represent one-fifth of the employment. Most are mechanical engineers and engineers who specialize in reactor technology. Assisting these engineers and scientists are many drafters and engineering technicians. Reactor manufacturers employ skilled workers, mostly all-round machinists, in experimental, production, and maintenance work. Nuclear reactor operators also are employed to operate experimental and test reactors.



Fuel being lowered into nuclear reactor.

Reactor Operation and Maintenance. About 17,500 workers operated and maintained nuclear reactors in 1978. Nuclear power stations employ reactor operators; mechanical, electrical, and electronic engineers; instrument and electronic technicians; and radiation monitors. Machinery and instrument repairers, electricians, and pipefitters maintain and repair the reactors.

Research and Development Facilities. A number of research and development laboratories are operated for DOE by universities and industrial concerns. These facilities are major centers for basic and applied nuclear research in engineering, in physical and life sciences, and in the development of nuclear reactors and other nuclear equipment. More than half of the 27,000 workers employed in DOE research and development facilities are engineers, scientists, and supporting technicians.

Although most nuclear energy research is done in DOE research and development facilities, about 3,100 persons conducted research in privately owned laboratories of educational institutions, other nonprofit institutions, and industrial concerns in 1978.

Production of Nuclear Weapons and Other Defense Materials. Establishments producing nuclear weapons, weapon components, and other defense materials employed about 31,000 persons in 1978. Among the large number of scientists and engineers employed at these facilities are physicists, chemists, and mechanical, electrical, and electronic engineers. Many engineering and physical science technicians, drafters, and radiation monitors assist scientists and engineers.

Construction of Nuclear Facilities. In 1978, about 66,000 persons worked on the construction of nuclear facilities—most were craft workers, such as pipe- and steamfitters, electricians, carpenters, and ironworkers. Operating engineers and boilermakers also were required in nuclear construction.

Other Nuclear Energy Activities. About 4,000 workers produced special materials such as beryllium, zirconium, and hafnium for use in reactors in 1978. About 8,500 workers were employed in companies that made reactor control instruments and radiation detection and monitoring devices. Large numbers of engineers and technicians are employed in these industries.

About 5,800 people were involved in the design, construction, or operation of particle accelerators used in nuclear research. Particle accelerators enable scientists to study the structure and properties of elementary particles in the nucleus of an atom.

Other workers process and package radioisotopes, produce radiography units and radiation gauges, and package and dispose of radioactive waste.

Government Employment. In 1978, the Department of Energy (DOE) employed about 5,500 workers who were involved in nuclear energy activities. The Nuclear Regulatory Commission (NRC) employed about 3,100 persons. Since DOE and NRC are primarily administrative and regulatory agencies, nearly 9 out of 10 employees are in administrative, professional, or clerical jobs. Several thousand employees are engaged in nuclear energy work in other Federal agencies and in regulatory activities and radiological health programs of State and local governments.

Unique Nuclear Energy Occupations. Most of the occupations discussed in the preceding sections are similar to those found in other industrial activities, even though they may have job titles unique to the nuclear energy field (such as nuclear engineer, radiation chemist, and nuclear physicist) and require some specialized knowledge of nuclear energy. (A detailed discussion of the duties, training, and employment outlook for most of these occupations appears elsewhere in the *Handbook*.)

The health-physics occupations and some other occupations that are unique to the nuclear energy field and require specialized training are discussed briefly in the following sections.

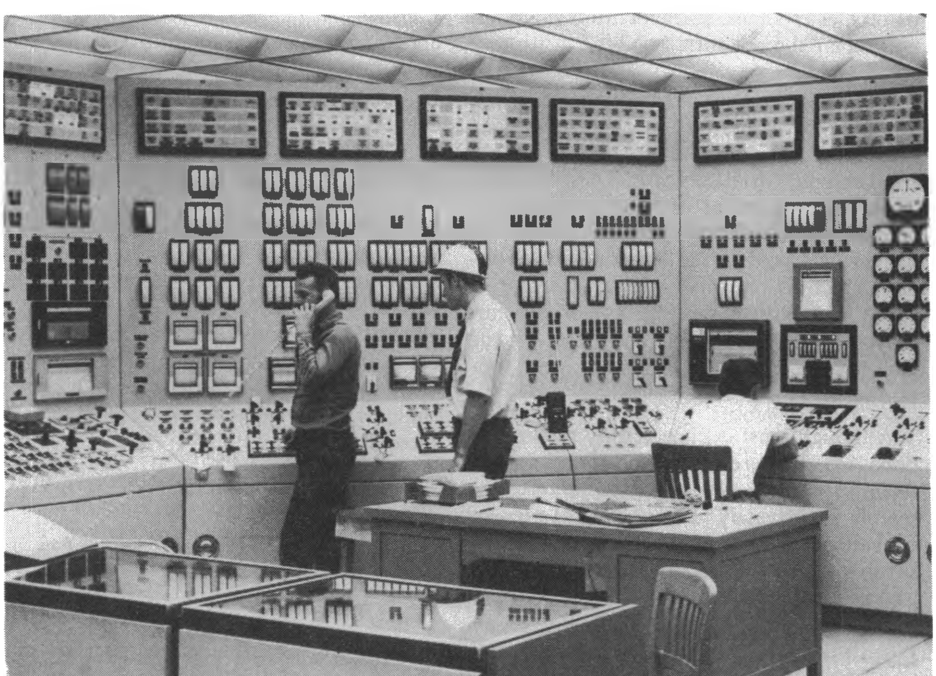
Health physicists (sometimes called radiation or radiological physicists or chemists) detect radiation and apply safety standards to control exposure to it. In 1978, about 1,000 health physicists were employed in radiation protection work, research, or teaching.

Health physicists are responsible for planning and organizing radiological health programs at nuclear energy facilities. They establish inspection standards and determine procedures for protecting employees and eliminating radiological hazards. Some supervise the inspection of work areas with potential radiation hazards and prepare instructions covering safe work procedures.

Health physicists also plan and supervise training programs dealing with radiation hazards and advise on methods of dealing with them. In some cases, they work on research projects dealing with the effects of human exposure to radiation and may develop procedures for using radioactive materials.

Radiation monitors (also called health-physics technicians) generally work under the supervision of health physicists. About 2,500 radiation monitors were employed in 1978. They use special instruments to monitor work areas and equipment to detect radioactive contamination. Soil, water, and air samples are taken frequently to determine radiation levels. Monitors also may collect and test radiation detectors worn by workers, such as film badges and pocket detection chambers, to ensure that they are functioning properly. Monitors calculate the amount of time that personnel may safely work in contaminated areas, considering maximum radiation exposure limits and the radiation level. They also give instructions in radiation safety procedures and prescribe special clothing requirements and other safety precautions for workers entering radiation zones.

Nuclear reactor operators perform work in nuclear power stations similar to that of boiler operators in conventional power plants; however, the controls they operate are different. They also help to load and unload nuclear fuels used in reactors. Those who work with research and test reactors check reactor control panels and adjust the controls to maintain specified operating conditions within the reactor. Workers who direct others in operating reactor controls are called senior operators.



A section of a control room at a nuclear power plant.

About 2,700 people worked as nuclear reactor operators in 1978.

Accelerator operators set up, maintain, and coordinate the operation of particle accelerators. They adjust machine controls to accelerate electrically charged particles, based on instructions from the scientists in charge of the experiment, and set up target materials that are to be bombarded by the particles.

Radiographers take radiographs to check the condition of metal castings, welds, and other objects by exposing them to a source of radioactivity such as X-rays or gamma rays. They select the proper type of radiation source and film and use standard mathematical formulas to determine exposure distance and time. After processing the radioactive film, the radiographer is able to discover cracks and weaknesses in the object radiographed so that it may be repaired.

Hot-cell technicians operate remote-controlled equipment to test radioactive materials that are placed in hot cells—rooms enclosed with radiation shielding materials such as lead and concrete. By controlling "slave manipulators" (mechanical devices that act as a pair of arms and hands) from outside the cell and observing their actions through the cell window, they perform standard chemical and metallurgical operations with radioactive materials. Hot-cell technicians also enter the cell wearing protective clothing to set up experiments or to decontaminate the cell and equipment. This classification is divided into several groups. *Decontamination workers* use radiation-detection instruments to locate plant areas and materials that have been exposed to radiation and decontaminate them with special equipment, detergents, and chemicals. They also verify the effectiveness of the process. *Waste-treatment operators* operate heat exchange units, pumps, compressors, and other such equipment to decontaminate and dispose of radioactive wastes. *Waste-disposal workers* seal contaminated wastes in concrete containers and transport the containers to be buried underground.

Radioisotope-production operators use remote control manipulators and other equipment to prepare radioisotopes for shipping and to perform chemical analyses to ensure that radioisotopes conform to specifications.

Working Conditions

Working conditions for most workers in the nuclear energy field generally are similar to those in other industries, except for radiation safety precautions. For instance, all uranium mines are equipped with mechanical ventilation systems that reduce the concentration of radioactive radon gas—a substance that may cause lung injury if inhaled over a number of years. Efforts to eliminate this hazard are continuing. Manufacturing facilities, power plants, and research laboratories are generally well lighted and well ventilated. Only a small proportion of employees in the nuclear energy field actually work in areas where direct radiation dangers exist. Even in these areas, shielding, automatic alarm systems, and other devices and clothing give ample protection to the workers.

Extensive safeguards and operating practices protect the health and safety of workers. The NRC regulates the possession and use of radioactive materials and inspects nuclear facilities to insure compliance with health and safety requirements. Constant efforts are being made to provide better safety standards and regulations.

Training and Other Qualifications

Training and education requirements and advancement opportunities for most workers in the nuclear energy field are similar to those in comparable jobs in other industries. These are discussed elsewhere in the *Handbook* under the specific occupations. However, additional specialized training is required for many workers because the field requires exacting work standards in both its research and production activities, and because it has unique health and safety problems.

Many engineers and scientists in the nuclear energy field have advanced training, particularly those doing research, development, and design work. Some employers require a Ph. D. degree. In some jobs, an advanced degree is not required, but it often increases one's advancement opportunities.

The specialized knowledge of nuclear energy essential for most of these scientific and engineering positions can be obtained at a college or university or through on-the-job experience. Many colleges and universities provide training in nuclear energy. Most persons planning to work in the nuclear energy field as scientists and engineers choose to major in a specific nuclear discipline, although a degree in a traditional engineering or science curriculum often is sufficient to begin work in the field. Some colleges and universities award graduate degrees in nuclear engineering or nuclear science. Others offer some graduate courses in these fields, but award degrees only in the traditional engineering or scientific fields.

Health physicists should have at least a bachelor's degree in physics, chemistry, or engineering, and a year or more of graduate work in health physics. A Ph. D. degree often is required for teaching and research.

Skill requirements for craft workers in the nuclear energy field are higher than in most industries because of the precision required to insure efficient operation and maintenance of complex equipment and machinery. For example, pipefitters may have to fit pipe to tolerances of less than one ten-thousandth of an inch and work with pipe made from rare and costly metals. Welding also must meet higher reliability standards than in most fields. These craft workers generally obtain the required additional specialized skills through apprenticeship training programs of employers and unions.

High school graduates who have taken science courses can qualify for on-the-job training as radiation workers, accelerator operators, radiographers, hot-cell technicians, decontamination workers, radioisotope-production operators, and radioactive waste disposal workers.

Nuclear power reactor operators need a basic understanding of reactor theory and a working knowledge of reactor controls. Most operator trainees are high school graduates. Some receive specialized training, through technical schools or training programs in the military service. Many trainees are selected from conventional power plant personnel who have experience operating boilers, turbines, or electrical machinery. Workers operating nuclear reactor controls must be licensed by the Nuclear Regulatory Commission. To qualify for a license, the trainees must pass an operating and a written test given by the NRC, along with a medical examination. The preparation for NRC licensing generally lasts at least 1 year. Licenses must be renewed every 2 years, however, due to rapid technological change. Consequently, continual training is necessary. Additional preparation beyond the operator's license is needed for a senior operator's license, which authorizes the holder to supervise a nuclear control room.

All employees who work in the vicinity of radiation hazards are given on-the-job training in the nature of radiation and the procedures to follow in case of its accidental release.

Individuals who handle classified data (restricted for reasons of national security) or who work on classified projects in the nuclear energy field must pass a security clearance.

The Department of Energy, at its contractor-operated facilities, supports on-the-job and specialized training programs to help prepare scientists, engineers, technicians, and other workers for the nuclear energy field.

Additional educational and training opportunities are offered in cooperative programs arranged by DOE laboratories with colleges and universities. Temporary employment at these laboratories is available to faculty members and students. Many undergraduate and graduate engineering students work at laboratories and other DOE facilities on a rotation basis, and many graduate students do their thesis work at DOE laboratories.

Government contractors often provide employees with training at their own plants or at nearby colleges and universities.

Employment Outlook

Employment in the nuclear energy field is likely to grow faster than the average for all industries through the 1980's. However, much public concern exists regarding the safety and environmental effects of the use of nuclear power. Continued controversy in this area could result in a slower rate of industrial growth than initially anticipated.

Expansion of nuclear generating capacity and continued increases in research and development expenditures should account for most of the growth in the field. Besides the job openings created by employment growth, many openings will occur as workers retire, die, or transfer to other occupations or industries.

The number of nuclear power plants operating in 1990 is expected to be more than double the number in 1978. This anticipated growth will require large increases in the number of workers in the design, construction, operation, and maintenance of these plants. In design, many more engineers and drafters will be required. Construction needs will call for large numbers of craft workers and laborers. Many more nuclear reactor operators and maintenance personnel will be needed to bring these plants into operation and keep them running efficiently.

Expansion will require substantial employment increases in the sectors involved in mining and milling uranium ore, processing reactor fuel, and producing special materials for reactors. Also, because of concern about the possible health hazards of nuclear radiation, increasing numbers of persons involved in reactor and personnel safety, such as health physicists and radiation monitors, should be needed.

Employment associated with research and development also is expected to increase, though not as fast as in the areas directly affected by nuclear construction. An increasing number of scientists, engineers, and technicians will study methods to improve the efficiency of the nuclear generation of electricity, peaceful uses for nuclear explosives, and the possible biomedical applications of nuclear science.

Earnings

Hourly earnings of production workers employed by contractors at DOE laboratories and other installations averaged $7.37 in 1978, compared with $5.90 for those in all manufacturing industries.

Scientists and engineers employed at DOE installations averaged $24,900 a year in 1978. Clerical personnel earned an average of $5.74 an hour while technicians averaged about $7.54 an hour. (Earnings data for many of the occupations found in the nuclear energy field are included in the statements on these occupations elsewhere in the *Handbook*.

Most hourly paid plant workers belong to unions that represent their particular craft or industry.

Sources of Additional Information

Information about research programs in the nuclear energy field is available from:

U.S. Department of Energy, Office of the Assistant Secretary of Energy Technology, 100 Independence Ave. SW., Washington, D.C. 20545.

For information about licensing and safety requirements, contact:

U.S. Nuclear Regulatory Commission, 1717 H St. NW., Washington, D.C. 20555.

Office Machine and Computer Manufacturing Occupations

Nature and Location of the Industry

During the last decade, employment in the office machine and computer industry grew much faster than employment in manufacturing as a whole, largely as a result of rapid expansion in the production of computers. For many years, the industry's chief products were typewriters, adding machines, calculators, and other conventional office machines. Today, however, plants that make computers and related equipment account for about three-fourths of the industry's production.

In 1978, the office machine and computer manufacturing industry employed just over 350,000 workers in approximately 1,050 plants. About 3 out of every 4 of them worked in plants that produced computer equipment, the remainder worked in plants that produced conventional office machines, scales, and other weighing devices.

Computer equipment manufacturing plants produce general-purpose computers, computers used for special applications, such as space exploration and missile guidance, and related equipment,such as machines that read magnetic numbers on bank checks. In addition to computers and related equipment, plants may furnish "software" (computer programs and operating systems that control the operation of the computer). Thousands of people, whose employment is not included in this chapter, are employed outside manufacturing plants by firms that specialize in software, rent or lease computers, and provide related services.

Nearly half the people employed in factories producing conventional office machines and scales produced desk calculators; cash registers; coin and ticket counters; and adding, accounting, and voting machines. The rest produced typewriters, industrial and household scales, and miscellaneous office machines, including items as diverse as postage meters and dictating machines.

Large plants account for most of the employment in office machine and computer manufacturing. About 65 percent of the industry's employees work in plants that have 1,000 or more employees; several computer plants have more than 5,000 employees.

Six of every ten persons employed in computer manufacturing work in California, New York, and Minnesota, and the following States employ most of the remainder: Massachusetts, Pennsylvania, Colorado, Florida, Texas, Arizona, and North Carolina. In New York, the lower Hudson River Valley area has many important computer manufacturing centers: Poughkeepsie, East Fish Kill, and Kingston. Large manufacturing plants also are located in Utica, N.Y., and in the Boston, Mass., and Philadelphia, Pa., areas. The leading center in the Midwest is Minneapolis-St. Paul. The Los Angeles and San Diego industrial areas are the most important computer manufacturing centers in the West, followed by Phoenix, Ariz.; and San Jose, Calif.

Most of the conventional business machine manufacturing employment is located in eight States: Ohio, Kentucky, New York, Michigan, California, Illinois, New Jersey, and Connecticut. Some of the important manufacturing centers are: Dayton, Toledo, and Euclid, Ohio; the New York-Northeastern New Jersey industrial area; Hartford and Stamford, Conn.; Chicago, Ill.; Detroit, Mich.; and Lexington, Ky.

Occupations in the Industry

A variety of occupations, requiring a broad range of training and skills, are found in plants that make office machines and computers. More than half of the industry's workers are in white-collar jobs (engineering, scientific, technical, administrative, sales, and clerical); the others are in plant jobs (assembly, inspection, maintenance, transportation, and service). White-collar workers represent a significantly larger proportion of total employment in the computer industry than in most other manufacturing industries because of the highly complex nature of computer manufacturing.

Some of the key occupations in the office machine and computer industry are described briefly in the following section. (Detailed discussions of professional, technical, and other occupations found in this industry, as well as in many others, are presented elsewhere in the *Handbook*, in sections covering individual occupations.)

Engineering and Scientific Occupations. Nearly 1 of every 10 workers in the office machine and computer industry is an engineer or scientist. Most of them work at computer plants.

The largest group of engineers work with electricity or electronics. Most are engaged in research and development, although many work in production. The industry also employs large numbers of mechanical and industrial engineers. Some mechanical engineers are engaged in product development and tool and equipment design. Others are concerned with the maintenance, layout, and operation of plant equipment. Industrial engineers determine the most effective means of using the basic factors of production—labor, machines, and materials.

Chemists make up the largest group of scientists in this industry. Their work is primarily in chemical processing of printed circuits used in computers. Mathematicians, another large group, work on complex mathematical problems important in designing computers. Physicists, employed in research and development, work on items such as miniaturized components and circuits. Statisticians work in fields such as quality control and production scheduling.

The industry also employs systems analysts and computer programmers, many of whom have scientific or engineering backgrounds. Systems analysts primarily devise new information processing techniques and improve existing techniques. Programmers design and test computer programs. Some analysts and programmers specialize in scientific and engineering problems, while others process accounting, inventory, sales, and other business data. Some may assist sales personnel in determining data processing needs of customers.

Technical Occupations. More than 1 of every 20 workers in the industry is a technician. Most specialize in electronics and assist engineers and scientists in research and development, testing and inspecting electronic components, and doing complex assembly work. Some electronics technicians specialize in repairing computers. Chemical control technicians prepare solutions used in the etching of circuit boards. Photographic technicians set up cameras and other equipment used in the tracing process to create copper etchings on circuit boards. Drafters prepare drawings from sketches or specifications furnished by engineers. Engineering aides assist engineers by making calculations, sketches, and drawings, and conducting performance tests on components.

Administrative and Sales Occupations. About 1 of every 13 workers is an administrator; including top executives, who manage companies and determine policy decisions, and middle managers, who direct departments such as advertising and industrial relations. Other administrative employees include accountants, lawyers, and market researchers.

Sales personnel hold about 1 of every 25 jobs in the industry. Those who sell conventional office machines usually work on their own. Computer sales personnel, on the other hand, are assisted by a host of technical experts, such as engineers and systems analysts.

Because computers are complex and expensive, computer sales representatives may have to spend several months to complete a sale.

Clerical Occupations. Nearly 1 of every 6 workers in the industry is in a clerical job. Included in this group are secretaries, clerk typists, file clerks, bookkeepers, and business machine operators, and keypunch and computer operators.

Plant Occupations. Nearly half of this industry's employees are plant (blue-collar) workers. Most plant workers are engaged directly in making computers and office machines. They include assemblers, inspectors or testers, machinists, machine tool operators, and their supervisors. Truckdrivers, material handlers, power truck operators, guards, and janitors move materials and perform custodial duties; plumbers, pipefitters, electricians, carpenters, and other workers maintain production machinery and building facilities.

Assembly Occupations. (D.O.T. 706.381-010, -018; 726.684-018) Workers who assemble computers and office machines have many different skills and make up the largest group of plant workers.

Assemblers may put together small parts to make components or components to make subassemblies or the finished product. Much of their work is done by hand. Some assemblers do a single operation as components move down the assembly line. The assembly of typewriters, for example, is divided into many simple operations. Each assembler does one job as the typwriter passes the work station. Some assembly jobs are difficult and require great skill, while others are relatively simple. Skilled electronics assemblers, for example, use diagrams as guides to wire complex memory and logic panels for computers.

Machines are used for many assembly operations. Automatic wire-wrapping machines, for example, wire panels and plug-in-boards. Operators feed these machines and remove and inspect finished items.

Electronic technicians usually do the most difficult hand assembly work. In research laboratories, they put together experimental equipment. In plants, they put together complex items that require a knowledge of electronics theory.

Assemblers commonly use screwdrivers, pliers, snippers, and soldering irons, and they use special devices to position and hold parts during assembly. Some assemblers use precision equipment to weld connections in circuit assemblies.

Machining Occupations. Most office machine and computer manufacturing plants employ machining workers who operate power-driven machine tools to produce plastic and metal parts. Numerical control machine operators tend machines that have been programed to perform machining operations automatically. Toolmakers construct and repair equipment used to make and assemble parts. Diemakers specialize in metal forms (dies) used in punch and power presses that shape metal parts.

Inspection and Testing Operations. These operations begin when raw materials enter the plant and continue throughout the assembly process. Finished parts and products are tested and inspected thoroughly.

Some inspectors examine individual parts; others inspect components during subassembly; still others inspect completed office machines and computers. Many inspecting jobs require highly skilled workers. On the other hand, relatively unskilled people can run some automatic test equipment; these workers are called test-set operators or testing machine operators.

Job titles indicate the work many inspectors do. *Manufactured parts inspectors* (D.O.T. 706.381-022) use precision testing instruments to determine whether parts have been machined properly. *Type inspectors* (D.O.T. 706.687-026) use a magnifying glass to examine typewriter type for defects. *Electronic subassembly inspectors* (D.O.T. 726.-384-022) use microscopes, meters, and various measuring devices to examine circuits and other electronic subassemblies.

In plants that manufacture conventional office machines, final inspection is relatively simple. Inspectors operate the machines, look for defects, and refer malfunctioning machines to repairers. The final inspection or "debugging" of computers, on the other hand, is complex. Electronics technicians inspect new computers under the supervision of electronic engineers. They use complex equipment to run tests and detailed drawings and instructions to find causes of malfunctions.

Maintenance Occupations. Many maintenance workers with different types of training take care of the industry's production machinery and equipment. Skilled electricians are responsible for the maintenance of electrical equipment. Machine and equipment repairers make mechanical repairs. Maintenance machinists and welders build and repair equipment. Air-conditioning and refrigeration mechanics are employed to maintain equipment in plants that are air-conditioned and have special refrigerated and dust-free rooms. Painters, plumbers, pipefitters, carpenters, sheet-metal workers, and other building maintenance craft workers also are employed in this industry.

Other Plant Occupations. Many truckdrivers are employed to make deliveries to various parts of plants. Laborers load and unload

Inspection of components is just one of the many steps in computer and office machine manufacturing.

trucks and boxcars and do general cleanup work. Some other plant occupations are boiler operator, stationary engineer, guard, and janitor.

Working Conditions

The work environment in office machine and computer manufacturing plants is generally pleasant. Work stations usually are well lighted and clean, and fumes and high noise levels generally are not a problem. Also, because computers and other electronic products are very sensitive, work areas are kept free of dust. Many computer factories are relatively new and are located in suburban areas.

Some plant jobs are repetitious, but very few require great physical effort. Also, the work is safer than in most manufacturing industries.

Training, Other Qualifications, and Advancement

A bachelor's degree in engineering or one of the sciences is usually required for engineering and scientific jobs. For research and development work, applicants with advanced degrees generally are preferred. Some companies have training programs designed to give newly hired college graduates a broad picture of manufacturing operations before they are assigned to a particular department. Because of the highly technical nature of computers, many of the industry's executives have backgrounds in engineering or science.

Engineers and scientists, as well as persons with a degree in computer science, are employed as sales workers, programmers, and systems analysts. Business and liberal arts graduates are employed in accounting, personnel, and other administrative activities.

Technicians qualify for their jobs in a number of ways. Some obtain training in either public, private, or Armed Forces technical schools. Others have one or more years of scientific or engineering training but not a degree. Other technicians are promoted from lower grade jobs in the plant; some well-qualified technicians may advance to engineering jobs after completing courses in mathematics, engineering, and related subjects.

People who complete commercial courses in high school or business school are preferred in clerical jobs such as secretary or office machine operator. For computer operators, most firms prefer applicants who have some college or technical training in data processing. With additional training, some computer operators and clerical workers advance to programmer jobs.

In selecting workers for plant jobs, firms generally prefer high school or vocational school graduates who are then trained through on-the-job instruction and experience that varies from a few days to years. Some plants also conduct classroom training of short duration. Skilled craft workers, such as machinists and tool and die makers, may spend 3 to 4 years in learning their jobs, and some firms have formal apprenticeship programs, which include both on-the-job training and classroom instruction related to the particular craft. Frequently, openings for skilled jobs are filled by workers already in the plant.

Workers who have little or no previous experience or training are hired for less skilled inspection, assembly, and machining jobs. Applicants may have to pass aptitude tests and demonstrate ability for particular types of work. Most assembly and inspection jobs require good eyesight and color perception, manual dexterity, and patience.

Experienced plant workers have opportunities to advance to jobs with higher pay. Assemblers, for example, can become semiskilled inspectors, and eventually skilled inspectors. Machine tool operators can move to skilled machinist jobs. Craft workers and skilled inspectors can become technicians, after completing courses in company-operated schools, junior colleges, or technical schools. Supervisory jobs are open to experienced plant workers who have leadership ability.

Employment Outlook

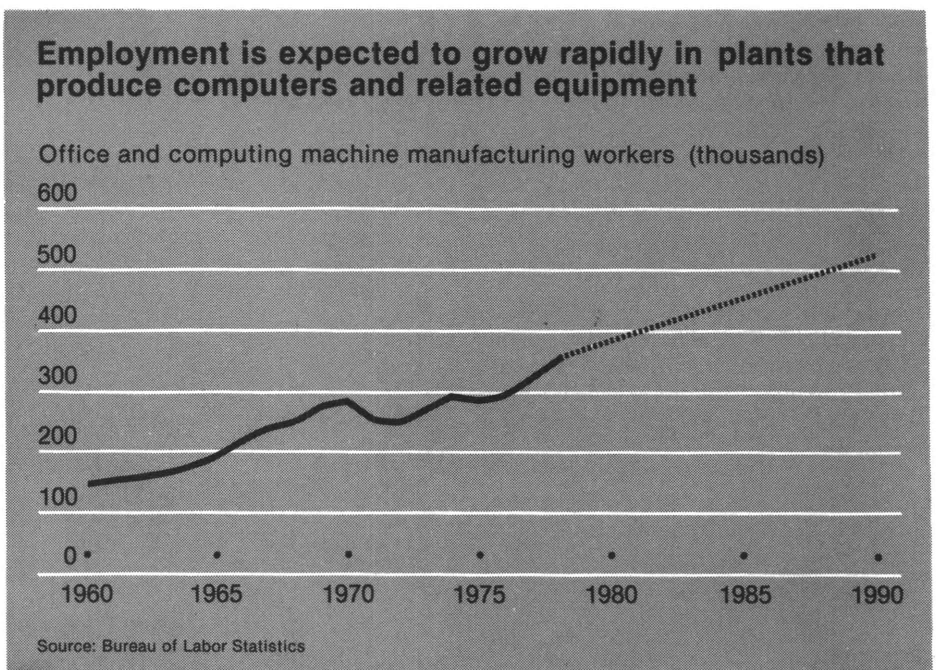
Employment in this industry is expected to increase faster than the average for all industries through the 1980's. This growth is projected to occur principally in plants that produce electronic computer equipment; little growth is foreseen among manufacturers of conventional office equipment. In addition, many openings will arise as experienced workers retire, die, or transfer to jobs in other industries.

The demand for computers and related equipment is expected to increase rapidly as computers are used to solve an increasing array of problems in business, industry, and government. Using computers to control the flow of automobile traffic, to aid physicians in diagnosing medical problems, and to help students learn more quickly are just a few of the new computer applications. In addition to demand generated by new applications, further price reductions will bring computer systems within reach of more and more small organizations. Growth in the number of computers will be accompanied by a need for additional computer-related equipment, as well as software designed to meet specific needs.

Although the demand for conventional office machines is expected to remain strong through the 1980's, employment in plants producing this equipment will grow slowly. Most job openings will result from the need to replace experienced workers who retire, die, or transfer to other industries. The demand for office equipment should continue to rise as business and government organizations grow and the volume of paperwork increases. However, technological improvements in production methods are expected to increase output per worker. For example, increasing mechanization of operations will tend to reduce labor requirements, particularly in the manufacture of mass-produced, products such as typewriters and calculators.

Employment is expected to grow faster for some occupations than for others. For example, the number of professional and administrative workers, particularly engineers, scientists, and technicians, is expected to increase more rapidly than the number of plant workers. Demand for these workers will be spurred by continued high levels of research and development expenditures to improve machine capabilities, design more efficient software, and develop new applications for computers.

Semiskilled workers, such as assemblers and inspectors, will continue to account for



most of the work force in production occupations, despite the growing use of automated and mechanized assembly line equipment.

Earnings

In 1978, plant workers in the office machine and computer industry had average earnings of $5.58 an hour. Wages in computer manufacturing plants were slightly lower than in the industry as a whole, averaging $5.57 an hour in 1978.

Some employees work night shifts and weekends because many plants operate around the clock. Employees working second or third shifts, or more than 8 hours a day or 40 hours a week, generally receive extra pay.

Paid vacations and holidays are almost universal in this industry. Most employees receive 1 to 4 weeks of vacation, depending on length of service. They also receive insurance and pension benefits at least partially financed by the employer. Employee stock purchase plans are available in many firms.

Many plant workers are covered by union contracts. The principal unions in this industry are the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the International Union of Electrical, Radio and Machine Workers; and the International Brotherhood of Electrical Workers.

Sources of Additional Information

For general information on jobs in the industry, write to:

American Federation of Information Processing Societies, Inc., 210 Summit Ave., Montvale, N.J. 07645.

Occupations in the Paper and Allied Products Industries

In 1978, the paper and allied products industry employed about 702,000 people to produce many different kinds of paper and paperboard products. The industry employs workers in occupations ranging from unskilled to higher specialized technical and professional jobs, many found only in the paper industry.

Nature and Location of the Industry

The paper industry is highly mechanized. Pulp, paper, and many finished paper products are manufactured by machines—some as long as a football field—in a series of nearly automatic operations that require very little handling of materials by workers. Manufacturing plants in the paper industry are engaged in one or more of three different operations: The production of pulp (the basic ingredient of paper) from wood, reused fibers, or other raw materials; the manufacture of paper or paperboard (thick paper) from pulp; or the conversion of rolls or sheets of paper or paperboard into finished products, such as tissue paper, envelopes, and boxes.

The largest group of employees in the industry—about 270,000 in 1978—work in mills that produce pulp, paper, or paperboard. The remainder are divided about equally between plants that make boxes and containers and plants that make napkins, towels, and a variety of other paper products.

About four-fifths of the industry's employees work in factories that employ 100 workers or more.

Workers in this industry are located throughout the country, although about half are employed in nine States: New York, Pennsylvania, Wisconsin, Illinois, Ohio, California, Massachusetts, New Jersey, and Indiana.

Occupations in the Industry

Employees in the paper industry work in a variety of occupations requiring a board range of training and skills. Many workers operate and control specialized papermaking, finishing, and converting machines. Some workers install and repair papermaking machinery. Others make deliveries or load and unload trucks, railroad cars, and ships.

The industry employs many workers in clerical, sales, and administrative occupations, such as purchasing agents, personnel managers, sales representatives, office clerks, stenographers, bookkeepers, and business machine operators. Also, because of the complex processes and equipment used, the industry employs professional and technical workers, including chemical and mechanical engineers, chemists, laboratory technicians, and pulp and paper testers. (Detailed discussions of professional, technical, and mechanical occupations, found not only in the paper industry but in other industries, are given elsewhere in the *Handbook*

Production Jobs. In 1978, more than three-fourths of all employees in the industry worked in production jobs. The simplified description of papermaking occupations and processes that follows applies to a plant which combined the production of pulp, paper, and finished paper products into one continuous operation. (See accompanying chart.)

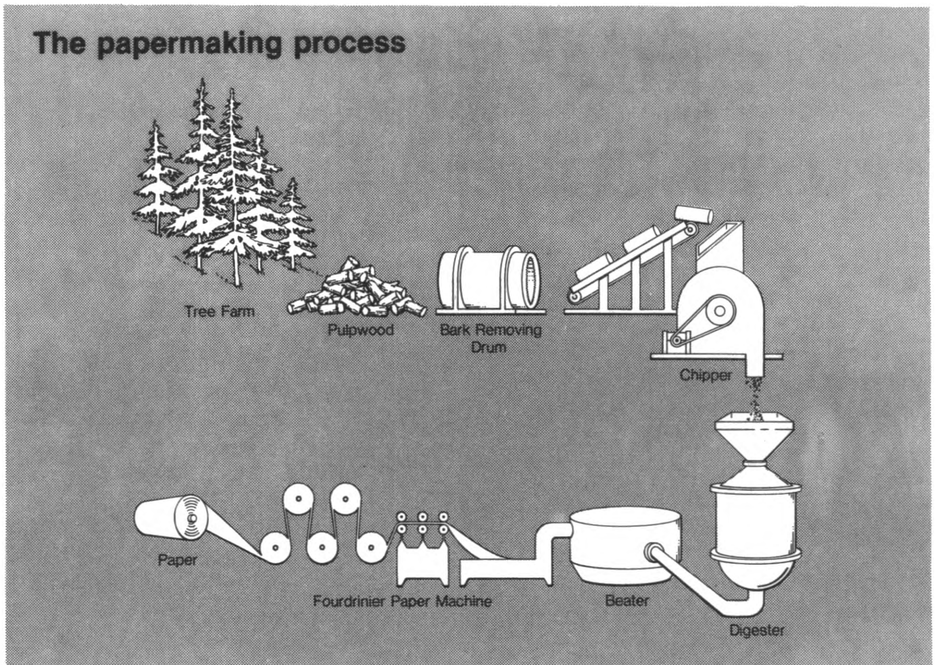
After trees are cut, loggers saw off the limbs and saw the trunk into logs. The logs are then transported to the pulp mill where the bark is removed. One machine used for this operation is a large revolving cyclinder known as a "drum barker." Logs are placed on a conveyor belt and fed into this machine by a semiskilled worker called a *barker operator* (D.O.T. 563.685-010). The machine cleans bark from the logs by tumbling them against each other and also against the rough inner surface of the drum. Next, pulp fibers in the logs are separated from other substances by a chemical or mechanical process, or both, depending on the type of wood used and the grade of paper desired.

In the mechanical process, pulpwood is held against a fast- revolving grindstone that separates the fibers. In the more commonly used chemcial process, pulpwood is carried on conveyor belts to a chipper machine operated by a *chipper* (D.O.T. 564.685-014). The machine cuts the pulpwood into chips about the size of a quarter.

In recent years, a larger number of mobile harvesters and chippers have been used to chip whole trees or logs at the original harvest site. This practice has reduced transportation costs and the amount of wood not utilized.

After the logs have been converted to wood chips, they are "cooked" with chemicals under high temperature and pressure in a "digester," a kettlelike vat several stories high. Digesters are operated by skilled workers called *digester operators* (D.O.T. 532.362-010), who determine the amount of chemicals to be used and the cooking temperature and pressure. They also direct the loading of the digester with wood chips and chemicals. Digester operators check an instrument panel to make certain that proper conditions are maintained. From the digester, pulp fibers are washed to remove chemicals, partically cooked chips, and other impurities. These fibers, called pulp, resemble wet, brown cotton.

Many modern plants today are making greater use of continuous digesters (equipment that produces pulp continuously rather than in separate batches). Continuous digest-



ers make it practical to use sawdust in pulpmaking, and eliminate the manual starting and stopping of each batch of pulp.

To prepare pulp for papermaking, it is mixed thoroughly with water and further refined in machines operated by skilled workers called *beater engineers* (D.O.T. 530.662-010). The kind of and amount of chemicals and dyes they use and the length of time they "beat" the solution determine the color and strength of the paper.

The pulp solution, now more than 99 percent water, is turned into paper or paperboard by machines that are among the largest in American industry. The machines are of two general types. One is the Fourdrinier machine, by far the most commonly used, the other is the cylinder machine used to make particular types of paper, such as building and container board. In the Fourdrinier, the pulp solution pours into a continuously moving and vibrating belt of fine wire screen. As water drains, millions of pulp fibers adhere to one another, forming a thin wet sheet of paper. After passing through presses that squeeze out more water, the newly formed paper enters the dryer section.

The quality of paper produced largely depends on the skills of *paper machine tenders* (D.O.T. 539.362-014), who control the "wet-end" of the papermaking machine to form paper of specified thickness, width, and physical strength. They check control-panel instruments to coordinate the flow of pulp and the speed of the machine. Paper machine operators also interpret laboratory test or, in some instances, visually check and feel the paper to determine whether it meets required specifications. Less skilled workers help to keep the pulp moving smothly through the machine.

Many modern papermaking machines use computers and advanced instrumentation to help the operator control the quality of paper. For example, beta-ray sensors measure the weight of paper and electromagnetic sensors measure the thickness. A computer compares these measurements with programmed specifications and adjusts the machine to eliminate any differences. Computers also have reduced manual control and increased monitoring functions for many operators. For example, the computer rather than the machine operator now sets production variables such as temperature, pressure, and flow rates.

Paper machine operators supervise *backtenders* (D.O.T. 534.662-010), who control the pressure and temperature of machinery that dries, finishes, and gives the paper the correct thickness. In addition to inspection for imperfections, backtenders make sure the paper is wound tightly and uniformly into rolls. They also adjust the machinery that cuts the rolls into smaller rolls and, with the help of assistants, may weigh and wrap the rolls for shipment.

Papermills that produce a fine grade of paper for books, magazines, or stationery usually have finishing departments. Most workers in these departments are either semiskilled or unskilled. One semiskilled worker, the *supercalender operator* (D.O.T. 534.682-038), aided by several helpers and by mechanical handling equipment, places huge rolls of paper onto a machine that gives the paper a smooth and glossy finish. The supercalender operator also inspects the finished paper to make sure that specifications have been met. Another semiskilled worker, the *paper sorter and counter* (D.O.T. 649.687-010), inspects for tears, dirt sports, and wrinkles; counts sheets of paper; and may fill customer orders.

In converting plants, machines operated by semiskilled or skilled workers convert paper and paperboard into envelopes, napkins, corrugated shipping containers, and other paper products. These occupations differ widely, depending largely on the product being manufactured. An example of a semiskilled worker is the *envelope machine operators* (D.O.T. 649.685-042), who feeds and tends an automatic machine that makes envelopes from either rolls of paper or prepared envelope blanks. One of the few skilled workers in a converting plant is the *printer-slotter operator* (D.O.T. 659.662-010) who controls a machine that cuts and creases, and prints designs or lettering on paperboard sheets. Thousands of workers print designs and lettering on bags, labels, wallpaper, and other paper products. Among these are compositors, who set type, and press operators who prepare and operate printing presses.

Maintenance Jobs. The paper industry employs many skilled maintenance workers to care for its complex machinery and electrical equipment. *Millwrights* install and repair machinery. They also take apart and reassemble machines which are moved about the plant. *Instrument repairers* install and service instruments that measure and control the flow of pulp, paper, water, steam, and chemical additives.

Other important maintenance employees include *electricians*, who repair wiring, motors, control panels, and switches; *maintenance machinists*, who make replacement parts for mechanical equipment; and *pipefitters*, who lay out, install, and repair pipes.

Stationary engineers are employed to operate and maintain powerplants, steam engines, boilers, air compressors, and turbines.

Professional and Technical Occupations. The complexity of pulp and paper manufacturing requires thousands of workers who have engineering, chemical, or other technical training. In 1978, the paper industry employed, approximately 12,000 scientists and engineers and 13,000 technicians.

Many chemists supervise the testing of pulp and paper for quality control. Others study the influence of various chemicals on pulp and paper. In addition, some chemists and engineers are employed as sales representatives, supervisors of plant workers, or as administrators in positions which require technical knowledge.

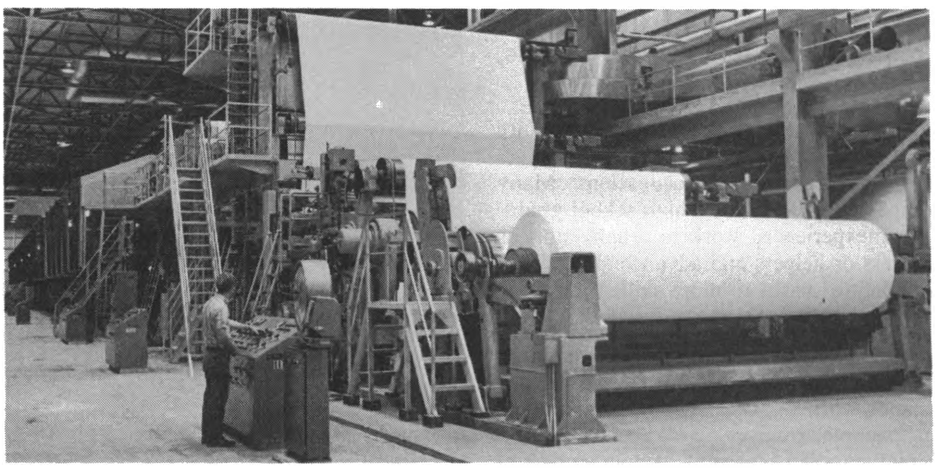
Chemical and *mechanical engineers* transform new pulp and papermaking techniques into practical production methods. Some chemical engineers supervise the production process. *Electrical engineers* supervise the operation of power-generating and distributing equipment and instruments.

Packaging engineers design containers and packages and supervise their production. A few box manufacturers also employ artists who develop lettering, designs, and colors for containers.

Foresters manage large areas of timberland and assist in the wood-buying operations of pulp and paper companies. They map forest areas, plan and supervise the harvesting, and seed or plant new trees to assure continuous production of timber.

Systems analysts and *computer programmers* are becoming increasingly important to this industry as more production controls are computerized. They also analyze and convert business and production problems to a form which the computer can solve.

During manufacturing, pulp and paper are tested frequently to determine whether size, weight, strength, color, and other properties meet standards. Machine operators do some



The paper industry is highly mechanized.

testing, but many mills employ *testing technicians*, also called laboratory technicians, pulp testers, and chemical analysts, to assist engineers and chemists in research and development activites.

Administrative, Clerical, and Related Occupations. The paper industry employs many administrative, clerical, and other office personnel. Executives plan and administer company policy. To work effectively, executives require informaton from a wide variety of personnel, including accountants, sales representatives, lawyers, and personnel in industrial relations, transportation, market research, and other activities. Bookkeepers, secretaries, shipping clerks, and other clerical workers keep records of personnel, payroll, inventories, sales, shipments, and plant maintenance.

Working Conditions

Workers in the paper and allied products industries averaged 43 hours a week in 1978, which is somewhat higher than the average for manufacturing industries as a whole. Most pulp and paper plants operate around the clock—three shifts a day, 7 days a week. Production workers can expect to work on evening or night shifts from time to time. Workers normally have year-round employment because paper production is not subject to seasonal variation.

Maintenance workers usually work the regular day shift. Multicraft maintenance mechanics generally earn about $1.50 an hour more than a single-craft mechanic.

Most pulp and papermaking jobs are not strenuous physically, even though some employees may work in hot, humid, and noisy areas. They also may be exposed to disagreeable odors from chemicals in the papermaking process. The rate of injury in this industry has been about the same as the rate for all manufacturing.

Employees of pulp, paper, and paperboard mills receive paid vacations which usually range from 1 to 6 weeks according to length of service. Workers also generally receive 10 to 12 paid holidays a year. Most paper companies have life and health insurance programs and retirement pension plans.

Training and Other Qualifications, and Advancement

Paper and pulp companies generally hire and train inexperienced workers for production and maintenance occupations. Many companies prefer to hire high school graduates. Inexperienced workers usually start as laborers or helpers and advance along fairly well-defined paths to more skilled jobs.

Some large plants have formal 3- to 4-year apprenticeship programs, including both on-the-job and classroom instruction, for maintenance workers. The machinist apprentice, for example, receives classroom instruction in mathematics, blueprint reading, and shop theory. Generally, an applicant is given a physical examinationa and mechanical aptitude tests.

Newer mills, have retrained many maintenance workers to become multicraft workers —skilled in four crafts. They are given 18 months to become competent in each craft, or a total of 4 1/2 years. For example, a pipefitter would learn the skills of a millwright, a machinist, and an electrician.

A bachelor's degree is usually the minimum educational requirement for scientists, engineers, foresters, and other professional occupations. For research work, persons having advanced degrees are preferred. Many engineers and chemists (called *process engineers* and *paper chemists*) have specialized training in paper technology. Many college students who major in papermaking work during the summer and upon graduation are hired permanently. Many associations, colleges, and companies offer scholarships in pulp and papermaking technology.

Some companies have formal training programs for engineering and science graduates who work temporarily in various departments to gain a broad knowledge of pulp and paper manufacturing before being assigned to a particular department. Other firms immediately assign junior chemists or engineers to a specific research, operation, or maintenance unit.

Generally, no specialized education is required for laboratory assistants, testing technicians, or other kinds of technicians. Some employers, however, prefer to hire technical institute or junior college graduates. Beginning technicians start in routine jobs and advance to positions of greater responsibility after they acquire experience and can work with minimum supervision.

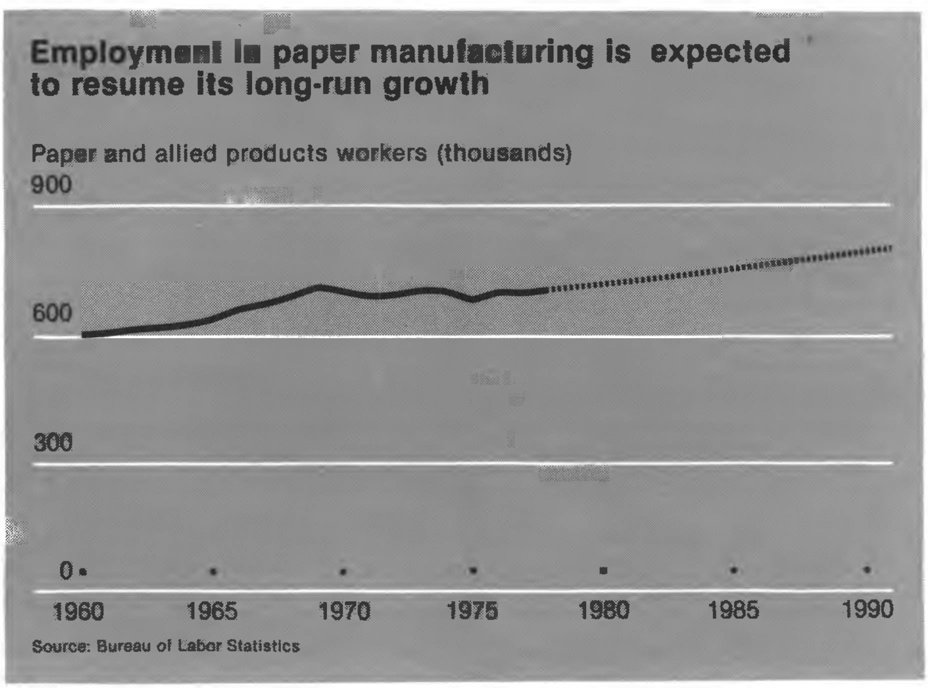
Administrative positions usually are filled by people who have college degrees in business administration, marketing, accounting, industrial relations, or other specialized business fields. A knowledge of paper technology is helpful for administrators and sales workers, especially sales representatives who give customers technical assistance. Most clerks, bookkeepers, stenographers, and typists have had commercial courses in high school or business school.

For most production workers, promotion generally is limited to more skilled jobs within a "work area," which may be a department, section, or an operation on one type of machine. For example, a person may start as a utility person and advance to backtender and finally to machine operator. These promotions may take years, depending on the availability of jobs. Experience gained within a work area usually is not transferable; unskilled or semiskilled workers who transfer to jobs outside their usual work area or to other plants usually must start in entry jobs.

Many plant supervisors are former production workers. Some companies promote qualified workers directly to supervisory positions, but others, require additonal training which often continues after the promotion—through conferences, special training sessions, and courses at universities or trade schools. Most firms provide financial assistance to employees who take courses at universities or trade schools.

Employment Outlook

Employment in the paper and allied products industry is expected to increase more slowly than the average for all industries through the 1980's. Although some new jobs will open up from growth, most openings will occur as workers retire, die, or leave their jobs for other reasons. The number of job openings may fluctuate from year to year, however, because the demand for paper and paper products is sensitive to changes in economic conditions.



Over the long run, as population and business activity increase and new uses for paper develop, employment will grow at slower rate than production because of the greater use of laborsaving machinery. Employment in plants that produce paper, pulp, and paperboard is expected to decline slightly but the number of workers in plants that make finished products such as napkins, envelopes, boxes, and wrapping paper should increase moderately.Plants that produce finished paper products are not as suited for laborsaving machinery as plants that produce pulp and unfinished paper products.

The number of engineers, scientists, technicians, and maintenance workers is expected to increase faster than other occupational groups in the industry. More scientific and technical personnel will be needed as research and development activities expand, and more maintenance workers will be required to service the more complex machinery. Employment of administrative and clerical workers also is expected to rise at a faster pace than total employment. On the other hand, the number of production workers may decline slightly as more laborsaving machinery is introduced. Nevertheless, replacement needs will create many job openings for production workers.

Earnings

Production workers in the paper industry had average earnings of $6.52 an hour in 1978. In the same year, production workers in private industry, except farming, averaged $5.97 an hour.

The following tabulation, based on information from a number of union-management contracts in the paper industry, illustrates the approximate range of hourly wage rates for selected production and maintenance occupations in 1978. Local rates within these ranges depend on geographic location, type and size of mill, kind of machines used, and other factors.

A majority of the production workers are members of trade unions. The largest union in the industry is the United Paperworkers International Union. Many other workers in the Western States are represented by the Association of Western Pulp and Paper Workers. Many printing workers belong to the International Printing and Graphic Communications Union. Some maintenance and craft workers belong to various craft unions.

Sources of Additional Information

Further information about job opportunities in this industry is available from local offices of the State employment service and from:

American Paper Institute, 260 Madison Ave., New York, N.Y. 10016.

Fibre Box Association, 5725 East River Rd., Chicago, Ill. 60631.

A list of schools offering courses on paper technology is available from:

American Paper Institute, 260 Madison Ave., New York, N.Y. 10016.

For information on job opportunities for paper and paper products sales repesentatives, write to:

National Paper Trade Association, Inc., 420 Lexington Ave., New York, N.Y. 10017.

Table 1. Average hourly earnings in selected production and maintenance occupations in the paper industry, 1978

Occupation	Hourly rate range
Production occupations:	
Paper machine operator	$7.40–$11.60
Backtender	6.56– 11.18
Head stock preparer (beater engineer)	6.68– 9.93
Digester operator (cook)	7.10– 9.16
Supercalendar operator	6.13– 9.16
Drum barker operator	6.09– 9.85
Chipper	6.58– 9.05
Maintenance occupations:	
Pipefitter	6.32– 9.42
Electrician	6.32– 9.42
Machinist	6.32– 9.42

SOURCE: Bureau of Labor Statistics.

Occupations in the Petroleum Refining Industry

The petroleum refining industry forms the link between crude oil production and the distribution and consumption of petroleum products. Products refined from crude oil supply the fuels and lubricants used for all modes of transportation, for heat in homes, factories, and other structures, and for fuel to generate electric power. In addition, basic petroleum compounds are used to manufacture hundreds of everyday products such as synthetic rubber, fertilizers, plastics, and fibers.

About 163,000 workers, representing a wide range of educational backgrounds and skills, were employed in the petroleum refining industry in 1978. These workers are involved in refining oil. Occupations in petroleum and natural gas production and processing are discussed in a separate section of the *Handbook*.

Nature and Location of the Industry

A modern refinery is a complicated plant made up of tanks and towers connected by a maze of pipes, pumps and valves. From the time crude oil enters the refinery to the shipment of finished products, the production flow is almost continuous. Operators use instruments including computers to measure and regulate the flow, volume, temperature, and pressure of liquids and gases going through the equipment. Manual handling of materials has been virtually eliminated.

Petroleum refining consists of heating crude oil as it flows through a series of pipes in a furnace. The heated crude oil is passed into the flash zone of a distillation tower where a portion of the oil is separated as vapor and moves up the the tower for futher "fractionation." The heaviest parts (for example, heavy fuel oils and asphalt) are drawn off along the bottom of the tower where temperatures are highest; lighter parts (jet fuel and diesel fuel) are drawn off along the middle of the tower; and the lightest (gasoline and gases) are taken off at the top where temperatures are lowest. Since this process does not produce a sufficient quantity of some products, such as gasoline, further processing by more complicated methods combines or modifies products obtained through fractionating to increase the yield of some products. Treating units remove water, sulfur compounds, and other impurities.

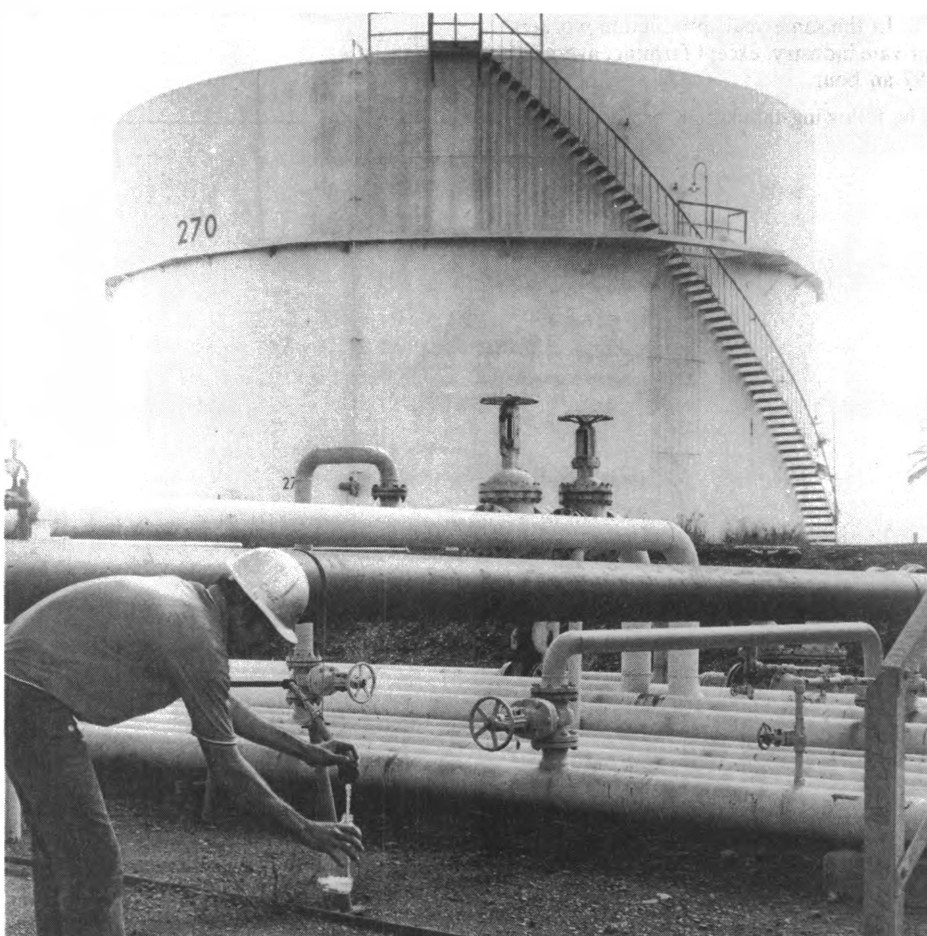
About 289 refineries were in operation in 1978. They ranged in size from plants with fewer than 10 employees to those with several thousand. Although many States have refineries, employment is concentrated in 10 States: Texas, California, Pennsylvania, Illinois, Louisiana, Oklahoma, Ohio, New York, New Jersey, and Indiana. Refineries usually are located near oilfields, industrial centers, or deepwater ports where tankers can dock.

Occupations in the Industry

About half of the workers in a refinery are involved in the operation (as opposed to maintenance) of the plant. A key worker in converting crude oil into usable products is the *refinery operator* (D.O.T. 549.260-010), or chief operator, who is responsible for one or more processing units. The refinery operator, aided by *refinery operator helpers* (D.O.T. 542.362-014), makes adjustments for changes in temperature, pressure, and oil flow. In modern refineries, operators monitor instruments on panels that show the entire operation of all processing units in the refinery. They also patrol units to check their operating condition.

Other plant workers may include *still-pump operators* (D.O.T. 549.362-010), *pumpers* (D.O.T. 549.360-010), and their *helpers* (D.O.T. 549.684-010), who maintain and operate pumps that control all production throughout the refinery; and *treaters* (D.O.T. 549.362-014), who operate equipment to remove impurities from gasoline, oil, and other products. In automated plants, computers may do the work of pumpers and treaters. Operators monitor the computers to spot potential problem areas, and may make routine checks of the refinery to make sure that valves are operating properly.

Many refineries employ large numbers of maintenance workers to repair, rebuild, replace, and clean equipment. In other plants, some maintenance work is contracted to companies outside the petroleum industry. Many maintenance workers are needed because high heat, pressure, and corrosion quickly wear out the complex refining equipment. Occupations involved in maintenance include skilled boilermakers, electricians,



A modern refinery is made up of tanks and towers connected by a maze of pipes and valves.

carpenters, instrument repairers, machinists, pipefitters, sheet-metal workers, and welders. There also are helpers and apprentices in these trades. Some skilled workers have a primary skill in one craft and also the ability to handle closely related crafts. For example, a pipefitter also may be a boilermaker and a welder. Maintenance workers who have such combined jobs are sometimes called refinery mechanics.

Plant workers who do not operate, monitor, or maintain equipment do many other tasks. Some drive delivery trucks; some load and unload materials on trucks, trains, or ships; and others keep stock and tool inventory records. The industry also employs service workers such as guards and janitors.

Almost 14 percent of the workers in petroleum refining are scientists, engineers, and technicians. Among these are chemists, chemical engineers, mechanical engineers, environmental engineers, laboratory technicians, and drafters. Chemists and laboratory technicians control the quality of petroleum products by making tests and analyses to determine chemical and physical properties. Some chemists and chemical engineers develop and improve products and processes. Laboratory technicians assist chemists in research projects or do routine testing and sample taking. Some engineers design chemical processing equipment and plant layout, and others supervise refining processes. Environmental engineers and technicians supervise and improve treatment and disposal of refinery waste waters and gases. Drafters prepare plans and drawings needed in refinery construction and maintenance.

Refining companies employ other kinds of white-collar workers. Among the professional workers needed to keep a refinery operating are managers, accountants, purchasing agents, lawyers, computer programmers, systems analysts, and personnel and training specialists. Typists, secretaries, bookkeepers, keypunch operators, and business machine operators provide clerical support. (Detailed discussions of these occupations are presented elsewhere in the *Handbook*.)

Working Conditions

Most refinery jobs require only moderate physical effort. A few workers, however, have to open and close heavy valves and climb stairs and ladders to considerable heights. Others may work in hot places or may be exposed to unpleasant odors.

The injury rate in the petroleum refining industry was slightly above the average for all of manufacturing in 1977, although the number of lost workdays was only about half the rate noted in other manufacturing industries.

Training, Other Qualifications, and Advancement

Employers prefer to hire applicants who are high school graduates. Aptitude testing and interviewing frequently are used in selecting applicants for plant jobs. Inexperienced plant workers usually begin as aides in a labor pool; they may move materials, pack cartons, fill barrels, or do maintenance work. They may be transferred either to the operating or maintenance department when a vacancy occurs.

Workers newly assigned to an operating department learn to operate equipment under the guidance of experienced operators. Formal training courses frequently are given in plant operation.

A supervisor trains inexperienced workers in maintenance skills. Some refineries give classroom instruction related to particular work. After 3 or 4 years, a person may advance from helper to skilled craft worker in one of the maintenance crafts. Some large refineries train workers in several crafts. For example, a qualified instrument repairer may be given electrician or machinist training.

For scientists and engineers, a bachelor's degree in an appropriate field usually is the minimum educational requirement. Advanced degrees are preferred for research work.

For most laboratory assistant jobs, 2-year technical school training is required. Laboratory assistants begin in routine jobs and advance to positions of greater responsibility as they acquire experience and learn to work without close supervision. Inexperienced drafters begin as copyists or tracers and can advance to more skilled drafting jobs.

Professional positions generally are filled by people who have college degrees in science and engineering, accounting, business, industrial relations, or other specialized fields. For positions as clerks, bookkeepers, secretaries, and typists, most refineries employ persons who have had commercial courses in high school or business school.

Employment Outlook

Although refinery output is expected to increase, employment in this industry is expected to show little change through the 1980's. Automated, computerized plants, increased refining capacity, and improved refining techniques should make it possible for the industry to increase production without increasing employment significantly. Nevertheless, thousands of job openings will result from the need to replace workers who retire, die, or transfer to other occupations.

Most jobs will be for operators, maintenance workers, administrative staff, and technicians. More maintenance workers, such as electricians, pipefitters, and instrument repairers, will be needed to take care of the increasing amount of automated equipment and complex control instruments.

Earnings

Refinery workers are among the highest paid employees in manufacturing. In 1978, production workers in petroleum refining averaged $9.32 an hour, compared with an average of $6.17 an hour for production workers in manufacturing industries as a whole.

Because petroleum is refined around the clock, operators may be assigned to any one of the three shifts, or rotated on various shifts. Some operators work weekends and get days off during the week. Employees usually receive additional pay for shift work. Most maintenance workers are on duty during the day.

Many refinery workers are union members and belong to the Oil, Chemical and Atomic Workers International Union. Some refinery workers are members of AFL-CIO craft unions or of various independent unions.

Sources of Additional Information

More information on job opportunities in the petroleum refining industry may be obtained from the personnel offices of individual oil companies. General information on jobs in the industry is available from:

National Petroleum Refiners Association, 1899 L St. NW., Suite 1000, Washington, D.C. 20036.

Occupations in the Printing and Publishing Industry

Printing is both an art and one of our chief means of communication. In 1978, the printing and publishing industry employed almost 1.1 million workers. In addition, thousands of printing workers were employed by government agencies and private firms that do their own printing, such as banks and insurance companies.

Nature and Location of the Industry

The industry includes the printing and publishing of newspapers, magazines, books, and advertising matter; the production of business forms, greeting cards, and gift wrappings; commercial or job printing; bookbinding; and typesetting, photoengraving, platemaking, and other printing services, primarily for printing establishments.

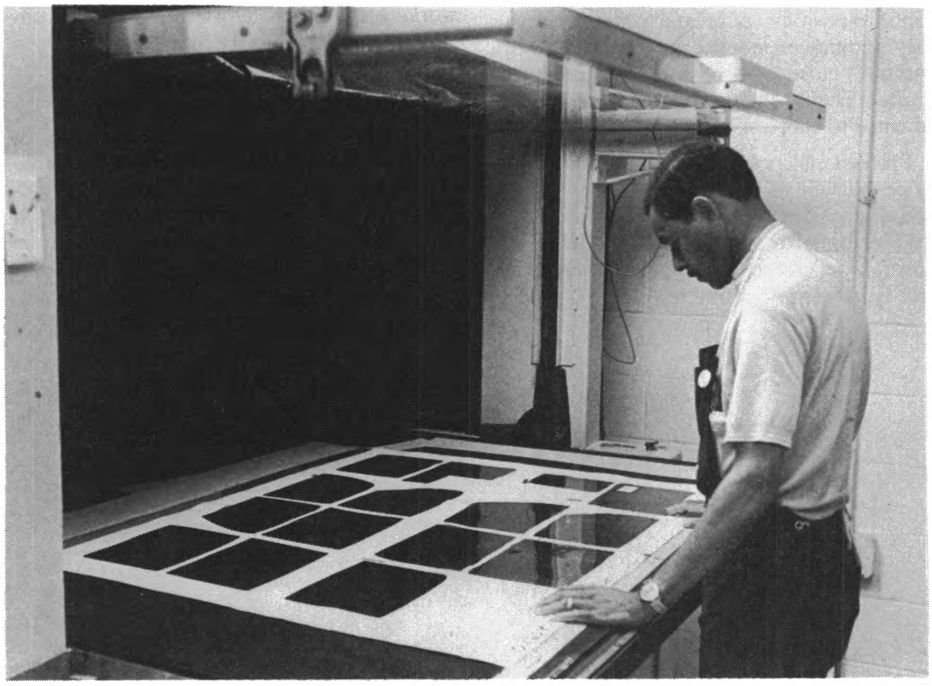
In 1978, the largest division in terms of employment was newspaper printing and publishing, with about 406,000 employees. Although some major newspapers have more than 2,000 employees, many have fewer than 20.

Commercial printing shops, the second largest division of the industry, employed about 380,000 workers. These shops produce a variety of materials, including advertising matter, business cards, calendars, catalogs, labels, maps, and pamphlets. They also print limited-run newspapers, books, and magazines. Many commercial shops have several hundred workers, but employment is concentrated in smaller shops.

Printing jobs are found throughout the country. Almost every town has at least one printing shop, frequently a small newspaper plant that also may do other printing. However, about one-half of the Nation's printing employees are in six States—New York, Illinois, California, Pennsylvania, Ohio, and New Jersey. Within these States, most printing activities are in or near manufacturing, commercial, or financial areas such as New York City, Chicago, Los Angeles, San Francisco-Oakland, Philadelphia, Cincinnati, and Newark. Other leading centers of printing are Boston, Detroit, Minneapolis-St. Paul, Washington, D.C., St. Louis, and Dayton. Employment in book and magazine printing is highly concentrated in these areas. A much larger proportion of newspaper employment, however, is found outside these centers because of the great number of small local newspapers.

Printing Methods

Printing is a means of transferring ink impressions of words and pictures to paper, metal, or other materials. A plate of metal, rubber, or plastic is prepared so that part of it can be covered with ink. The ink is then transferred to a sheet of paper or other material that is pressed against the plate.



Because of changing technology, employment of lithographers is growing rapidly.

In letterpress printing, the letters and images are raised from the rest of the printing plate. The printing surface is covered with ink and pressed directly against the paper to transfer the image onto the paper. In gravure printing, the image is etched into the surface of a cylinder. The whole surface is covered with ink and then wiped off; ink is left only in the sunken or etched areas. When paper is pressed against the surface, the ink is lifted out and appears on the paper. In lithography (offset printing), the printing plate surface is smooth, with both image and nonimage areas on the same level. Lithography is based on the principle that grease and water do not mix. The plate's non-image areas are dampened. A greasy printing ink is used that adheres to the image areas of the plate and not to the damp non-image areas. The inked image is transferred from the plate to a rubber blanket and then to the paper.

Screen printing is a method in which inks or other materials such as paint and varnish, are forced through a stencil mounted on a finely woven screen. The shape of the stencil openings determines the design to be printed. This process may be applied to a variety of surfaces such as paper, glass, metal, plastic, and textiles.

Printing Occupations

Production of printed materials requires workers in a wide variety of occupations. Printing craft workers represent a large segment of these employees. They usually specialize in one area of printing operations: Type composition, photography, platemaking, presswork, or binding. Their training generally is confined to only one of the basic printing methods—letterpress, lithography, or gravure. Some of the principal printing crafts are briefly described below. Detailed information on these crafts is presented in the section on printing occupations elsewhere in the *Handbook*.

The printing process begins in a composing room where manuscript copy is set in type, proofed, and checked for errors. Machine and handset type and other materials, such as photoengravings, are assembled there and prepared for the pressroom.

In 1978, almost 45 percent of all printing craft workers—181,000—were employed in composing room occupations. This group includes *linotype machine operators* (D.O.T. 650.582-010) who make type metal molds of letters, *make-up arrangers* (D.O.T. 973.381-026), who assemble type in shallow trays called "galleys" and make trial copy of this type; phototypesetters, who prepare negatives (films) of text used in offset printing and *proofreaders* (D.O.T. 209.387-030), who check the trial copy with the original copy for errors.

Electrotypers and stereotypers (D.O.T. 974.381-010 and 974.382-014) make duplicate pressplates of metal, rubber, and plastic for letterpress printing. These plates are made from the metal type forms prepared in the composing room. Electrotype is used mainly in book and magazine work. Stereotypes which is less durable, is used chiefly in newspaper work.

Photoengravers (D.O.T. 971.381-022 and 022) make metal printing plates of illustrations and other copy that cannot be set up in type. In letterpress photoengraving, the printing surfaces on these plates stand out in relief above the nonprinting spaces, as do the letters and the accompanying type. Similarly, gravure photoengravers, a specialized type of photoengravers, make gravure cylinders in which the image is etched below the surface for use in reproducing pictures and type.

The actual printing operation is performed in the pressroom. *Printing press operators* (D.O.T. 651.382-010 and 014, .482-010, and .682-010) prepare type forms and pressplates for final printing and tend the presses while they are in operation. Small commercial shops generally have small and relatively simple presses that often are fed paper by hand. At the other extreme are the enormous presses used by the larger newspaper, magazine, and book printing plants. They automatically print the paper and cut, assemble, and fold the pages. These machines are operated by crews of press operators assisted by less skilled workers.

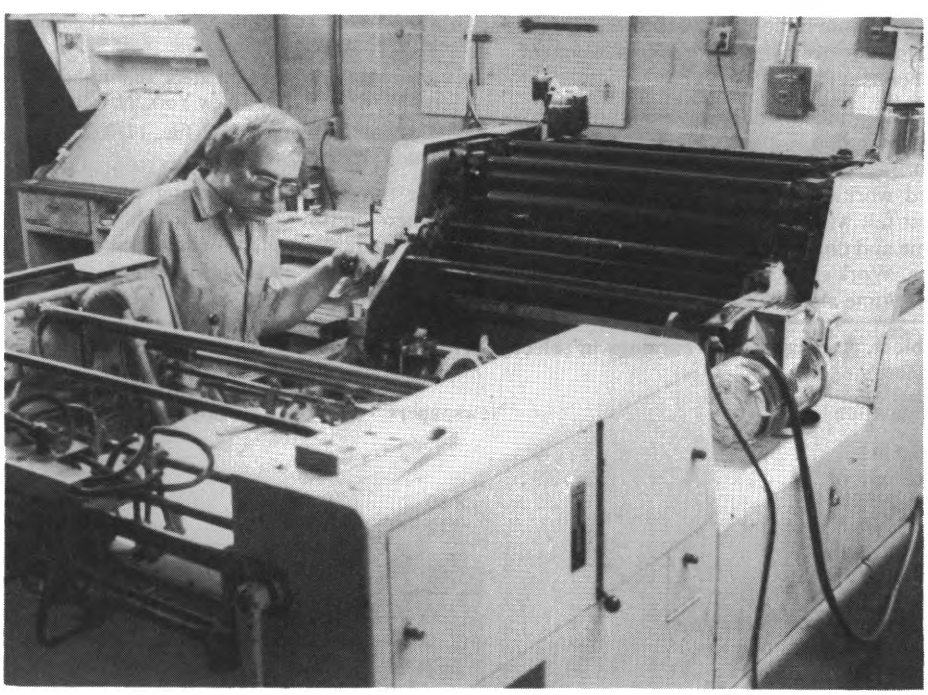
Lithography (offset printing) has grown to be the most widely used method of printing. Practically all items printed by other processes also can be produced by lithography. It is a process of photographing the matter to be printed, making a printing plate from the photograph, and pressing the inked plate against a rubber blanket which in turn presses it onto the paper. Several operations are involved in lithography, and each is performed by a specialized group of workers. The main group of lithographic workers are *camera operators* (D.O.T. 972.382-014), *strippers* (D.O.T. 971.381-050), and *platemakers* (D.O.T. 972.381-010).

Because of the increasingly complex and highly mechanized printing equipment in use today, technically trained people are needed in all areas of printing management and production. For example, an increasing number of production technicians are employed to see that the standards for each printing job are met.

Many printed items, such as books, magazines, pamphlets, and calendars, must be folded, sewed, stapled, or bound after they leave the printing shops. Much of this work is done by skilled bookbinders. In many binderies, however, a large portion of the work is done by less skilled bindery workers.

Besides printing craft workers, the industry employs people in a variety of other occupations. Many mailroom workers are employed in newspapers and magazine plants to address, bundle, and tie the printed matter for distribution. Modern mailroom processes are mechanized to a considerable extent. Mailers operate addressing, stamping, stacking, bundling, and typing machines. Many large printing firms employ mechanics and machinists to repair and adjust typesetting machines, printing presses, and other equipment.

Printing firms employ a great many people as executives, sales representatives, accountants, engineers, computer programers, stenographers, clerks, and laborers. Newspapers and other publishers employ a considerable number of reporters, editors, and photographers. These occupations are discussed elsewhere in the *Handbook*.



On small printing presses, adjustments are made by the operator.

Training and Other Qualifications

Most printing craft workers (union or nonunion) learn their trades through established apprenticeship programs. A substantial number of people, however, learn these trades by working as helpers or through a combination of work experience and schooling.

Most printing unions, in conjunction with management, have established guidelines for apprenticeship programs for the various printing crafts. Many nonunion printing firms have established apprenticeship programs with the help of local printing associations and the employer organization Printing Industries of America. Apprentices often are chosen from among people already employed in various unskilled jobs in printing plants.

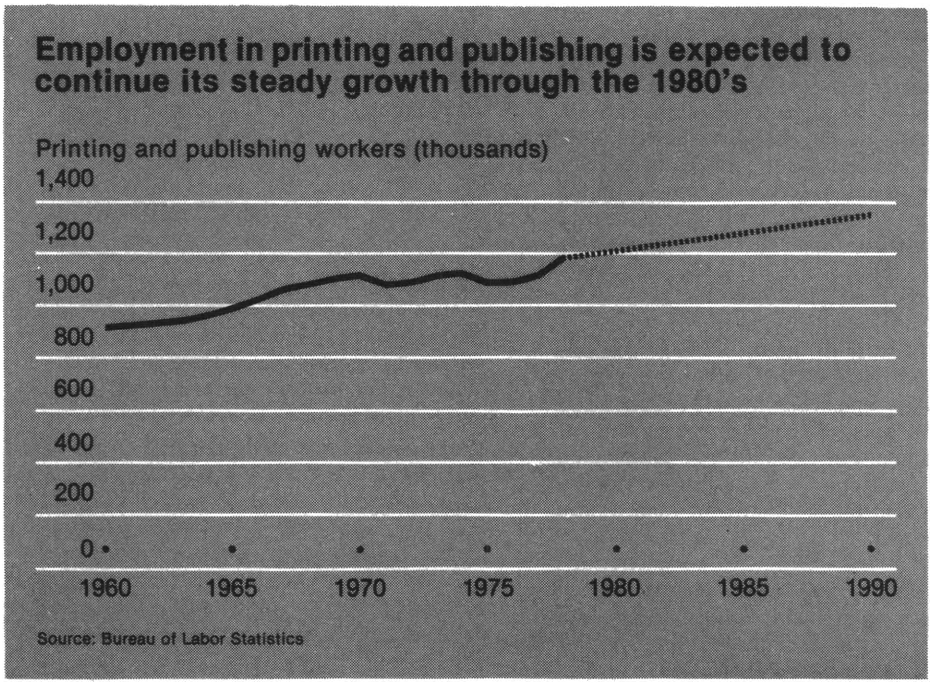
Printing apprenticeships usually last from 4 to 6 years, depending on the occupation and shop or area practices. The apprenticeship programs cover all phases of a particular trade and generally include classroom or correspondence study in related technical subjects, as well as on-the-job training. Apprenticeship applicants generally must be at least 18 years of age and pass an aptitude test and a physical examination. Applicants who qualify may be put on a waiting list, if there are no immediate apprenticeship job openings.

Most employers prefer applicants to have a high school education or its equivalent. A thorough knowledge of spelling, punctuation, the fundamentals of grammar, and basic mathematics is essential in many of the printing trades. A knowledge of the basic principles of chemistry, electronics, and physics is becoming increasingly important because of the growing use of photomechanical and electronic processes in printing.

Most printing crafts require people with good eyesight, about average physical strength, and a high degree of manual dexterity. Alertness, patience, and the ability to work with others also are necessary. The ability to distinguish colors is important in areas of printing where color is used. An artistic sense also is an asset since the finished product should be pleasing in balance and design.

About 4,000 schools—high schools, vocational schools, technical institutes, and colleges—offer courses in printing technology. These courses may help a person to be selected for apprenticeship or other job openings in the printing and publishing industry.

Administrative jobs usually are filled by upgrading experienced people. Many owners and production managers of printing firms have come from the ranks of printing craft workers. In recent years, however, more



firms are filling administrative positions with people who have college degrees in business administration, marketing, accounting, industrial relations, or other specialized business fields. Most firms hire clerks, bookkeepers, stenographers, and typists who have completed commercial courses in high school or business school.

Some computer programmers in the printing industry have technical school training; others learn their skills on the job. Also, many compositors and typesetters are being taught computer programming skills, and the International Typographic Union has established a training center for this purpose.

Employment Outlook

Employment in the printing and publishing industry is expected to grow about as fast as the average for all industries through the 1980's. Most job openings will occur from the need to replace experienced workers who retire, die, or transfer to other industries.

The volume of printed materials is expected to increase rapidly because of population growth, the increasingly high literacy level of the population, and the trend to greater use of printed materials for information, packaging, and various industrial and commercial purposes. Employment will grow at a slower rate than the volume of printing, however, because of laborsaving technological changes in printing methods.

Employment is expected to increase at different rates for the different occupations in the industry. Employment of technical, maintenance, and clerical workers will increase at a faster pace than total employment. The number of lithographic craft workers, is expected to increase because of the growing use of lithography. On the other hand, since lithography does not require photoengraving, employment of photoengravers is expected to decline. The trend to computerization of typesetting operations will reduce the need for some machine operators in composing rooms and create a demand for more computer typesetters. More mechanics will be hired to maintain the industry's increasingly complex machinery.

Earnings

Earnings of production workers in the printing and publishing industry are among the highest in manufacturing. In 1978, they averaged $6.47 an hour, while those in manufacturing industries as a whole averaged $6.17.

The accompanying tabulation shows average estimated union minimum hourly rates for selected printing occupations in 1978 based on a survey of 69 large cities. These are the minimum basic rates for daywork, and do not include overtime, other special payments, or bonuses.

Most printing craft workers who are covered by union contracts work fewer than 40 hours a week. Some contracts specify a standard workweek of less than 35 hours, but most fall within a 35 to 37-1/2 hour range. Time and one-half generally is paid for overtime. Work on Sundays and holidays is paid for at time and one-half or double-time rates in most commercial printing firms. In newspaper plants, however, the workweek often includes Sundays. Time and one-half or double time is paid for these days only when they are not part of the employee's regular shift. Night-shift workers generally receive pay differentials above the standard day rates.

The starting wage rates of apprentices generally are from 40 to 50 percent of the basic rate for skilled workers in the shop. Wages are increased periodically, usually every 6 months, until the apprentice reaches the skilled rate.

The frequency of injuries in the printing industry is somewhat lower than the average for all manufacturing industries.

About 35 percent of all printing trades workers are members of unions. Among these unions are the Graphic Arts International Union, the International Printing and Graphic Communciations Union, the International Typographical Union, and the International Mailers Union.

Sources of Additional Information

Details about employment opportunities and apprenticeships may be obtained from local employers such as newspapers and printing shops, local offices of the unions mentioned above, or the local office of State employment services. Some State employment service offices screen applicants and give aptitude tests.

For general information on the industry, write to:

American Newspaper Publishers Association, The Newspaper Center, P.O. Box 17407, Dulles International Airport, Washington, D.C. 20041.

Amercan Photoplatemakers Association, 556 West 167 St., South Holland, Ill. 60473

Graphic Arts Technical Foundation, 4615 Forbes Ave., Pittsburgh, Pa. 15213.

Gravure Technical Institue, 60 E. 42 St., New York, N.Y. 10020.

National Association of Printers and Lithographers , 570 Seventh Ave., New York, N.Y. 10018.

Printing Industries of America, Inc., 1730 Lynn St. Arlington, Va. 22209.

(See the section on printing occupations elsewhere in the *Handbook* for names of labor organizations and trade associations that can provide more information on specific printing trades.)

Table 1. Average hourly earnings in selected printing occupations, 1978

Occupation	Minimum hourly rate	
	Newspapers	Book and job shops
Bookbinder	—	$8.55
Compositor:		
Hand	8.80	9.62
Machine operator	9.12	9.36
Electrotyper	—	8.14
Photoengraver	9.68	10.33
Press operator	8.77	—
Press (cylinder) operator	—	8.72
Press (platen) operator	—	7.64
Stereotyper	8.84	9.17

SOURCE: Bureau of Labor Statistics.

Occupations in the Textile Mill Products Industry

Two hundred years ago no cloth was manufactured in the United States. Most had to be imported from England. Indeed, the textile industry was so important to England's prosperity that neither diagrams of the machinery nor the mechanics who operated it were allowed to leave Britain. In 1789, however, an English textile mechanic named Samuel Slater disguised himself as a farmer and sailed to the United States. He carried the details of the machinery where no official could find them—in his head. A few years later he opened a spinning mill in Pawtucket, R.I. Today, the spinning jennies Slater built stand silent, a show for tourists. But the industry that began in Pawtucket now includes 6,600 mills and factories and provides jobs for almost 1 million people.

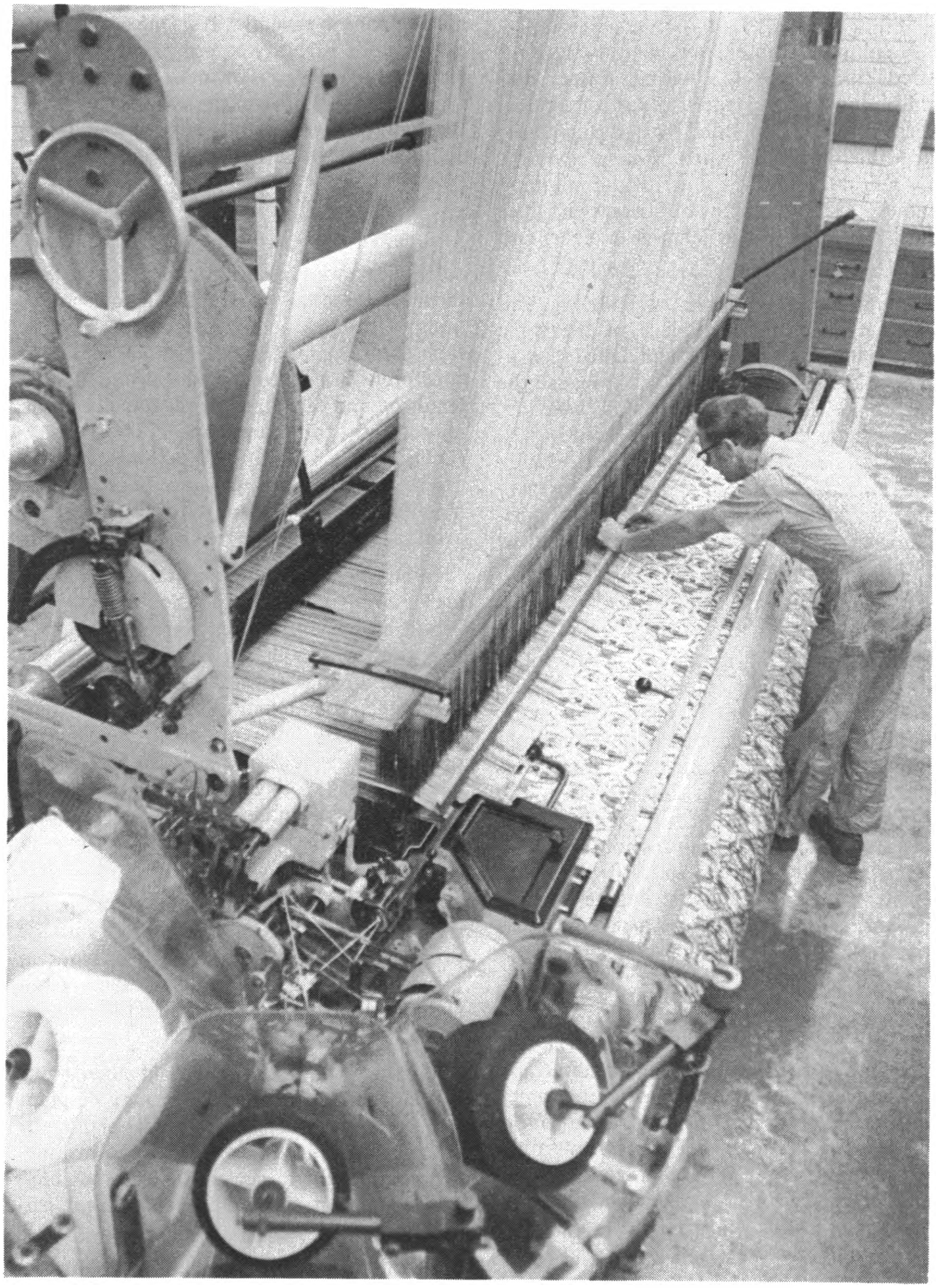
Nature and Location of the Industry

Almost one-half of all employees in the industry work in mills that weave or knit fabrics for clothing or household furnishings. About two-fifths work in mills that color or put patterns on cloth, or that manufacture carpets and other products such as thread, lace, and cord for tires. Most of the remainder produce knit goods for use in stockings and underwear. About 9 out of 10 textile workers are employed in plants having 100 workers or more.

Textile plants are found in almost every State, but they are concentrated in a broad arc stretching from New England through the southeastern United States into Texas. New England—where the industry was born—led the rest of the country in the number of textile mills until the early part of this century, when the Southeast became dominant. This shift occurred because the Southeast enjoys several economic advantages, such as lower labor costs, cheaper steam and electric power, and greater accessibility to cotton. Today, the Northeast employs more people than any other region in manufacturing narrow fabrics such as lace, ribbon, and fabric tape; in weaving and finishing wool; and in producing miscellaneous textile goods. The South leads the rest of the country in every other sector of this industry. Three states—North Carolina, South Carolina, and Georgia—employ over half of all textile workers.

Occupations in the Industry

The raw materials of textile manufacturing must pass through many hands before becoming finished fabrics. As a result, most employees are directly involved in production, either working with their hands or operating machinery.



The raw materials of textile manufacturing must pass through many hands before becoming finished fabrics.

In the past, cotton was the basic raw material for the industry. Today, consumers demand fabrics that are durable and require minimal care, while textile manufacturers continually seek cleaner raw materials. Accordingly, synthetic fibers, such as nylon or polyester, have replaced cotton as the leading raw material because they are easier for the consumer to care for and easier for the manufacturer to work with. Regardless of the raw material, however, all textiles are produced by spinning fiber into yarn, weaving or knitting yarn into fabric, and dyeing and finishing the fabric.

First, fibers must be prepared for spinning. To clean and align them, they are combed and carded. Very short fibers are removed, and all fibers are drawn into a form strong enough to withstand the twisting process of spinning. Textile workers, called *opener tenders* (D.O.T. 680.685-070), *picker tenders* (D.O.T. 680.685-074), *card tenders* (D.O.T. 680.685-018), *drawing frame tenders* (D.O.T. 680.685-034), and *roving tenders* (D.O.T. 680.685-098), operate the machinery that prepares the fiber. They start, stop, and clean the machines. While patrolling the aisles between groups of machines, they also repair broken fiber ends and feed fiber into the machines.

A spinning frame draws and twists prepared fiber through rotating rollers and winds it on conical structures called bobbins. These machines, operated by frame spinners, turn the fiber into yarn. *Frame spinners* (D.O.T. 682.685-010) run rows of spinning frames, position bobbins of fibers, twist fiber ends, repair breaks in lengths of fiber, and clean the machines.

Spinning and weaving or spinning and knitting generally take place in the same plant. However, weaving and knitting usually are done in different plants because the machinery is quite different. For weaving, *loom winder tenders* (D.O.T. 681.685-062), *warper tenders* (D.O.T. 681.685-018), *slasher tenders* (D.O.T. 582.562-010) and *warp tying machine tenders* (D.O.T. 683.685-034) position yarn on their respective machines, draw or thread the yarn into place, tie yarn ends, observe the machines to detect malfunctions, and remove the prepared yarn.

In one room, fabric may be produced on 2,000 looms which interlace—weave—the yarn. *Weavers* (D.O.T 683.682-038),who constitute about 10 percent of all textile machine operatives, operate and monitor as many as 200 looms at a time to detect and remove defects. They also repair breaks in yarn, fix minor loom malfunctions, and call *loom fixers* (D.O.T. 683.260-018) for major repairs. Loom fixers adjust and repair machines. Each fixer works with several weavers.

Although most textiles are woven, knitted cloth claims a larger share of the market each year. A *knitting machine operator* (D.O.T. 685.665-014) tending several machines at a time places knit yarn on a machine which intermeshes yarn loops to produce fabric. The operator starts the machines, feeds in the yarn, observes the knitting process for malfunctions, ties broken yarn ends, and notifies *knitting machine fixers* (D.O.T. 689.280-014) about any breakdowns. Knitting machine fixers and loom fixers do similar work, but on different machines.

The most highly skilled workers in a knitting mill are *knitter mechanics* (D.O.T. 685.-360-010), who arrange metal pattern plates in the form of chains and place the chains in the knitting machines. Chains control the operation of the machines. Thus, these mechanics provide the means by which textile designs become knitted fabrics.

The woven or knitted fabric is ready to be dyed and finished either by mills that also weave or knit the fabric, or by independent businesses. *Dyers* (D.O.T. 582.131-014) develop dye formulas for a desired color and supervise the dyeing. *Dye weighers* (D.O.T. 550.684-014) mix the dyes and chemicals used in dyeing. *Dye range operators* (D.O.T. 582.582-010) run the machines that dye and dry the cloth.

Manufacturers print textiles in thousands of different colors and designs to appeal to a variety of consumer preferences. Printing may be done in several ways. One of the newest methods is rotary screen printing, a system in which a porous cylinder (screen) holds the print design. Dye in the cylinder is forced through the screen and leaves the print as the cylinder rolls over the cloth.

However, before the fabric can receive a print, the design must be created, and *colorists* (D.O.T. 022.161-014) must develop the colors for printing. *Screen printing artists* then use these colors to make color separations of designs on transparent paper. For each color, *screen makers* (D.O.T. 971.381-046) prepare a screen which they treat with emulsion and expose photographically to the appropriate transparency. *Screen printers* (D.O.T. 979.684-030) mount the screens on the rotary screen printing machines, fill the machines with dyes, and tend them as they print.

In addition to dyeing and printing, finishing often involves treating the fabric to prevent excessive shrinkage, to strengthen it, or to provide a silky luster. Each step offers job opportunities for textile machine operatives and general maintenance workers. Important to the industry but not directly involved in production are several other occupations, including textile designers, textile engineers, and textile technicians, which usually require special talents and 2 to 4 years of education after high schoool.

Textile designers create the patterns, or designs, that are woven or knitted into or printed on fabrics. Most designers work in New York City, the location of designing and styling departments of most textile companies.

Textile engineers usually hold supervisory or managerial positions. They may be plant managers who supervise entire plants, or plant engineers, responsible for the heating, air conditioning, electrical, material handling, or other systems in textile establishments.

Textile technicians translate fiber properties into useful end products. They may develop new fiber processing techniques in research; measure major characteristics of raw textiles in quality control and production; or sell or service customers in customer sales and service. Many technicians work in the dyeing and finishing areas of textile plants.

In addition to occupations unique to the manufacture of textiles, many others are found in the industry: Managers of plants and departments; personnel specialists; bookkeepers, accountants, and computer programers; a wide assortment of clerical workers, including secretaries, computer console operators, and shipping and receiving clerks; janitors, guards, and food service workers; mechanics and repairers; and laborers, including freight and material handlers who use mechanical devices to lift and move heavy loads to various textile machines.

Working Conditions

The accident rate for the industry is slightly higher than the average for all manufacturing industries. Workers in some plants, particularly older ones, must contend with high noise levels, high humidity, and poor lighting. Also, the lint-laden air found in some plants may cause respiratory problems after many years of exposure. Federal safety and health regulations should improve the lint and noise conditions.

Training, Other Qualifications, and Advancement

Most workers in the textile industry are in machine operative occupations that can be learned on the job. Other occupations require additional training and special skills. Professional training is required for a small proportion of jobs.

Training for most production jobs is provided on the job and lasts from a few weeks to a few months, depending on the complexity of the work. Methods of instruction vary, but usually an employee starts out by assisting an experienced worker. Some mills set aside a section of the plant where full-time instructors—often former machine operators—show new workers how to operate the machines. Persons from outside the textile plant sometimes provide instruction. For example, manufacturers might explain the operation of new equipment or State educational coordinators might organize and conduct training programs at the request of the company.

Good coordination, good eyesight, and manual dexterity are important requirements for production jobs in this highly mechanized industry. Although most textile employers prefer that production workers have a high school education, they often do not require it.

Only a small percentage of workers in this industry are trained through apprenticeship programs. However, there are such programs, ranging in length from 2 to 4 years, for dyers, weavers, loom fixers, electricians, and some other occupations. Persons interested in these programs should contact a textile employer or a local State employment service office.

Some production workers become instructors and train new employees. Others may advance to supervisory or management positions after having shown interest and ability at jobs of increasing responsibility. Most textile companies have training programs to help an employee advance in skilled occupations; many pay all or part of the tuition for courses taken at private and public schools and colleges.

Textile designers and textile technicians need training at a technical institute, a technically oriented junior college, or a 4-year textile college. Talent, demonstrated in high school courses in art, drawing, and design, indicates a potential for success in the textile design field, although competition for jobs may be stiff. Textile designers need a vivid and fertile imagination, a feeling for color and design, sensitivity to consumers' desires, and the ability to visualize the effect of designs on cloth. Qualifications of a good textile technician include manual dexterity, the ability to communicate orally and in writing, and patience with details. High school courses in algebra, geometry, chemistry, physics, and English are good preparation for textile technician jobs. Advancement for a textile technician often means promotion to a supervisory position such as department head or blue-collar worker supervisor in the company's production division.

The majority of those in textile management have graduated from 4-year colleges. Textile manufacturers are particularly interested in persons with degrees in engineering and business-related subjects although the industry employs graduates with degrees in various fields, including liberal arts and business. Also, graduates of textile colleges or those who majored in textile curriculums often have a head start on advancement to management positions. Textile curriculums include studies in various aspects of the industry, such as textile engineering, chemistry, or management. Most of the ten colleges which offer 4-year undergraduate degrees in textiles are located in the Northeast and Southeast. High school courses in mathematics and the physical sciences are good preparation for pursuing degrees in textile engineering or chemistry; courses in business and economics provide a good basis for textile management.

Many college graduates begin careers in the textile industry as management trainees. Training programs may extend over several months and are usually designed to expose a new employee to all facets of the company—its organization, policies, manufacturing processes, and merchandising techniques. Programs include classroom instruction, plant site visits, and management internships in various departments of a company. Many then move into manufacturing supervisory jobs and to positions of increasing responsibility.

Upper level management positions in textile companies include plant engineer and plant manager. College graduates with degrees in engineering eventually may become engineers for an entire plant. Those who become plant managers must be able to lead and motivate people and frequently have degrees in textile engineering or textile management.

Employment Outlook

Textile industry employment is expected to grow about as fast as the average for all industries through the 1980's. Many more job openings will result from persons leaving the industry because of death, retirement, or for other reasons than from growth of the industry. The demand for textile employees, particularly plant workers, will be greatest in the Southeast.

Most workers in the textile industry are in machine operative occupations that can be learned on the job.

Textile output is expected to expand over the next decade in response to demand from the apparel and home furnishings industries which is spurred by growth in population and incomes. An anticipated increase in the variety of textile products also should contribute to growth. In addition, although competition from imports has lessened the demand for domestic products of some sectors of this industry, trade agreements limiting imports may weaken this competition.

Textile employment is expected to grow more slowly than the industry's output, however, since laborsaving machinery and the use of synthetic fibers increase worker productivity. Numerous improvements in machines and production processes will continue to reduce demand for workers in yarn manufacture and weaving. Also, in the coming decade management will use computers increasingly to help control the production process.

Although technologically advanced machinery will limit the increase in machinery operators, the demand for professional and managerial personnel will grow. Craft workers, such as knitter machine mechanics and dyers, will become more essential as textile machinery increases in complexity. New technologies, such as computer processing and electronic instrumentation, will require more textile technicians and computer specialists. The industry's demand for college graduates in textile engineering and textile management also will grow. Federal Government safety and health regulations as well as scientific research and development will continue to stimulate demand for chemists and mechanical, electrical, and industrial engineers.

Earnings

Average hourly earnings of production workers in the textile industry in 1978 were below the average for production workers in all manufacturing industries—$4.29 versus $5.69.

In 1978, production workers' average wages ranged from $3.74 an hour in women's hosiery mills to $4.78 an hour in synthetics finishing plants. Also, wages varied by geographic area.

Although some textile production workers are paid according to incentive plans—i.e., according to how much they produce—about 3 out of every 4 are paid time rates. Workers usually paid under incentive wage plans include drawing-frame tenders, spooler tenders, and weavers.

Production workers average nearly 40 hours a week, about the same as production workers in all manufacturing. Most textile mills operate three 8-hour shifts. Those who work the 3d, or late, shift usually receive a shift differential.

Textile production has few seasonal influences. When there is a lack of work due to a recession or for some other reason, the textile industry usually reduces operations by 1 or 2 days a week instead of laying off workers.

Employees in both unionized and nonunionized plants usually receive paid holidays and vacations, retirement plans, hospitalization insurance, and sick pay. Labor-management agreements in unionized plants include provisions for arbitration of grievances and protection of workers from the unfavorable effects of technological change such as layoffs and undesirable changes in work assignments.

About one-fifth of all textile workers are members of labor unions, compared with about one half of all manufacturing workers. The major textile unions are the Amalgamated Clothing and Textile Workers Union (ACTWU) and the United Textile Workers of America (UTWA).

Sources of Additional Information

Information on vocational education for occupations in the textile industry is available from the Division of Vocational Education of the Department of Education in each State.

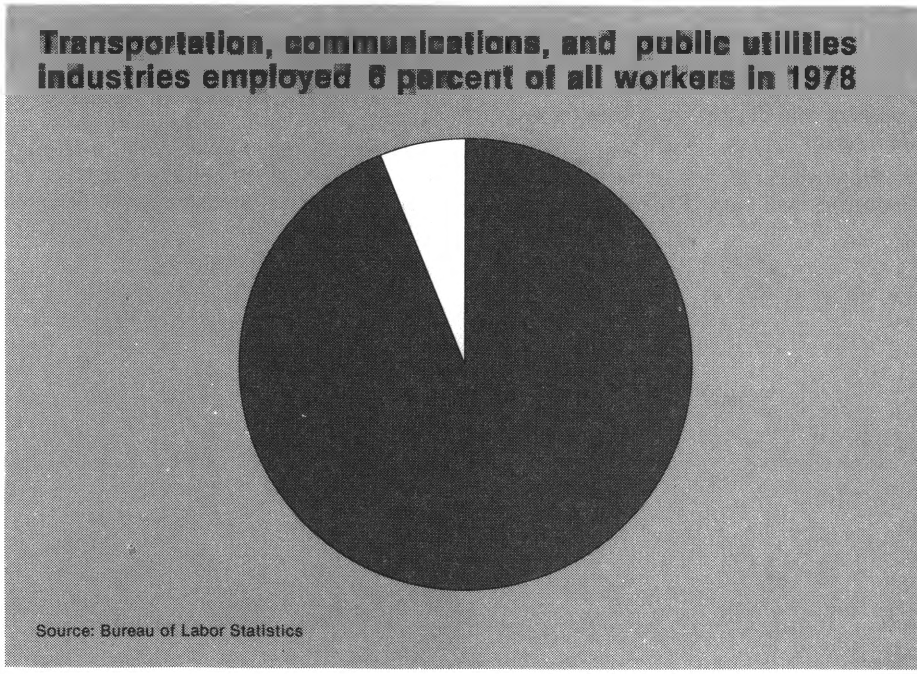
For information on educational requirements and occupational descriptions, write to:

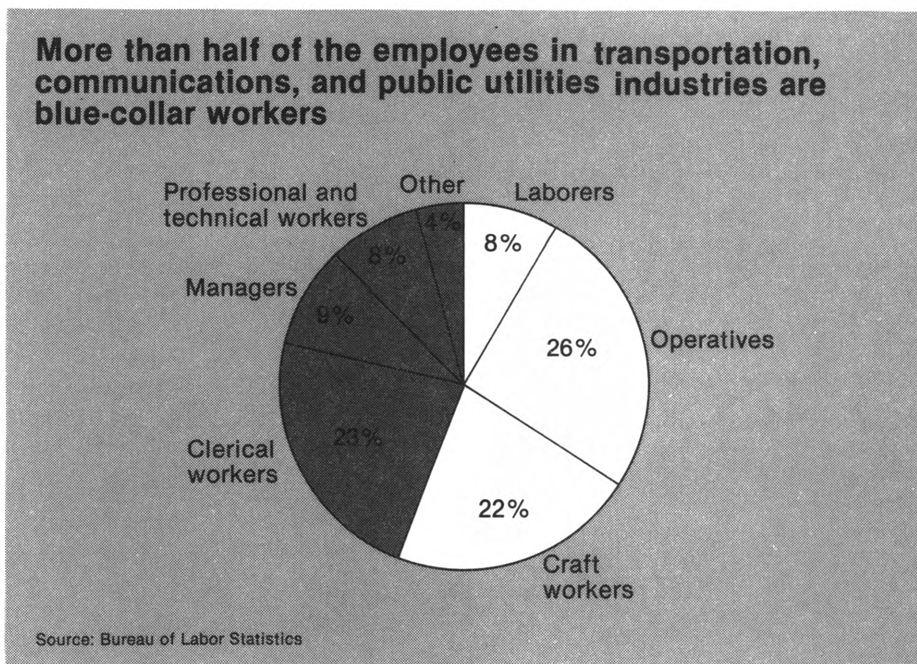
American Textile Manufacturers Institute, Communications Division , Suite 300, 1101 Connecticut Avenue, NW., Washington, D.C. 20036.

United Textile Workers of America, 420 Common St., Lawrence, Mass. 01840.

For information regarding specific jobs in your area, contact the local office of the State employment service.

TRANSPORTATION, COMMUNICATIONS, AND PUBLIC UTILITIES





Transportation, communications and public utility firms are commonly grouped together because they provide a public service and are owned or regulated by public agencies. The type of regulation varies from industry to industry, but in general the goals have been to ensure fair prices and to see that the public interest is served.

In 1978, over 5.9 million people worked in this group of industries, over 800,000 in Federal, State, and local governments. The largest industry was motor freight transportation and warehousing (including local and long-distance trucking), which employed almost 1.5 million workers. Close behind were the communications industry and electric, gas, and sanitary services, both with over 1.2 million workers. Other industries in this sector employing a significant number of workers were local and interurban transit (including taxicabs), with 570,000 employees; the railroads, with 550,000; air transportation, with 420,000; and water transportation, with 230,000.

As shown in the accompanying chart, blue-collar workers (craft workers, operatives, and laborers) accounted for almost three-fifths of total employment in these industries in 1978. The remaining two-fifths were white-collar workers (professional, managerial, clerical, and sales). However, the occupational pattern differed among the various industries.

In transportation, operatives constitute the largest group of workers, over two and one-half times as large as the next largest occupational group. Among the operatives are the thousands of bus and taxi drivers who provide public transportation. But over half of the total number of drivers are local and long-distance truckdrivers who move goods throughout the country. Other operatives include railroad brake operators and sailors. The transportation industries also employ many craft workers, such as the railroad shop workers who repair locomotives, and airplane mechanics. Also needed are numerous clerical employees, such as reservation and ticket clerks, yard clerks, and secretaries.

The communications industries employ many clerical workers to help provide vital public services such as telephone service, newspapers, and television. Secretaries, bookkeepers, stenographers, and payroll clerks keep records and prepare statistical reports. These workers, for example, ensure that customers are billed correctly for telephone and telegraph services. Also included are switchboard operators and messengers. The communications industries also employ entertainers, writers, interpreters, and other professionals. Many craft workers are employed to install, maintain, and repair the equipment used in the telephone industry and in radio and television studios.

Electric, gas, and water utilities, as well as sanitary services need a large number of craft workers to provide prompt and efficient service to consumers. In the electric power industry, for example, these employees install powerlines and run cables underground. They also repair all equipment, including the machinery in the powerplants and the meters in customers' homes. The need to record the use of these utilities and to bill customers promptly accounts for the large number of clerical employees that also are found in this industry group.

Employment in the transportation, communications, and public utility industry is expected to increase more slowly than the average for all industries through the 1980's. In addition to openings resulting from growth, many thousands of jobs will be available each year because of the need to replace workers who die, retire, or transfer to other industries.

Employment growth in the transportation industries will vary. Rising population and income as well as business expansion will stimulate growth in air transportation at a faster than average rate. Average growth is expected in some local passenger transportation (subways and local buses). On the other hand, employment in trucking is expected to grow at a slower than average rate while employment in interurban transit and taxicab service is expected to remain about the same. The long-run decline in railroad employment is expected to continue, but at a descreasing rate.

Employment in communications is expected to grow at about the same rate as the average for all industries through the 1980's. Although demand for the services provided by the communications industries will increase rapidly, advances in technology are expected to limit employment growth in some occupations, particularly in telephone communication. Computers and other electronic equipment are expected to be applied increasingly to work previously done by wage earners. For example, when long-distance phone calls are dialed directly, the length of the call and billing information can be recorded automatically. This reduces the need for telephone operators.

Employment in electric and gas utilities also will be affected strongly by advancing technology, so that while the demand for these utilities will increase greatly, the number of workers will grow at about the average rate. Most of the employment increase will be for scientific, engineering, and other technical workers as research accelerates in the development of more efficient ways of using energy.

The chapters that follow cover major industries in the transportation, communications, and public utility fields. More detailed information about particular occupations in these fields appears elsewhere in the *Handbook*.

Civil Aviation

The rapid development of air transportation has increased the mobility of the population and has created many thousands of job opportunities in the civil aviation industry. In 1978, almost 485,000 people were employed in a variety of interesting and responsible occupations in this industry.

Nature and Location of the Industry

Many different organizations and activities are involved in civil aviation. The most familiar are airlines that provide transportation for passengers and cargo. Airlines account for four times as much intercity passenger travel as buses and railroads combined. Other commercial transportation is provided by air taxi companies that use small planes to provide passenger and cargo service, often to and from small airports not serviced by the airlines.

The civil aviation industry includes other kinds of flying activities. For example, many businesses transport executives in company planes. Some firms and individuals use their own planes for crop dusting, inspecting pipelines, and other activities. The government-licensed shops that repair and inspect smaller airplanes also are included in the industry.

The Federal Aviation Administration (FAA) and the Civil Aeronautics Board (CAB)—both part of the Federal Government— regulate the civil aviation industy. The FAA develops air safety regulations, coordinates flights, operates ground navigation equipment, and licenses some personnel, including pilots and aircraft mechanics. The CAB makes policy on airline rates and routes.

In 1978, about 330,000 employees worked for the airlines. Most of the remaining civil aviation employees worked for air taxi companies, for firms that use airplanes to transport executives, and for firms that rent, service, or repair aircraft. The rest worked for the Federal Government; in 1978, the FAA employed about 58,000 people, the CAB fewer than 1,000.

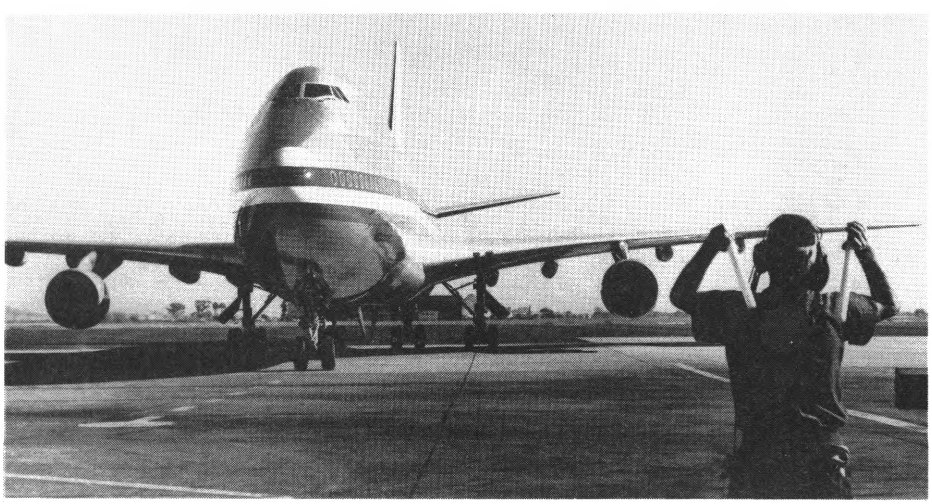
About half of all airline employees work at airports near New York, Miami, Los Angeles, San Francisco, Chicago, Atlanta, and Dallas, the cities where major airlines are based. Others work at airports scattered throughout the country. A substantial number of FAA employees work in Oklahoma City. Many of the rest, as well as most employees of the CAB, work in Washington, D.C. Most other civil aviation employees work at airports near large cities.

Occupations in the Industry

Over three-quarters of all civil aviation employees work in ground occupations. Many of these are maintenance personnel such as mechanics who service, inspect, and repair planes; aircraft cleaners who wash the planes' exteriors; and cabin-service agents who clean the interiors. Other employees deal with the public. Reservation and ticket agents arrange transportation for passengers while cargo agents take orders from shippers and arrange for transportation of their goods.

Some employees direct the flights. Dispatchers plan flights for airline crews, analyzing weather conditions and determining fuel requirements and weight maximums. They authorize flights if conditions are safe and if Federal and company regulations are met. Flight service specialists work for the FAA. Before flights, they assist pilots, especially those not employed by airlines, by suggesting routes and altitudes and providing them with information on their flight path, such as terrain and weather peculiarities. Air traffic controllers, who also work for the FAA, observe planes on radar and give pilots instructions which keep planes separated. Other groundworkers include freight handlers, and clerical, administrative, and professional personnel.

Flight crewmembers make up the remaining one-quarter of civil aviation employment. They include the pilots who fly the planes and the flight attendants who assist passengers. Detailed discussions of most of the principal occupations in civil aviation are presented elsewhere in the *Handbook* in the section on air transportation occupations.


In 1978, almost 485,000 people were employed in the civil aviation industry.

Working Conditions

Working conditions vary widely, depending on the occupation. While most employees work in fairly comfortable surroundings—such as offices, terminals, or airplanes—mechanics and others servicing aircraft are subject to noise, dirt, and grease, and sometimes work outside in bad weather.

Because airlines operate flights at all hours of the day and night, personnel in some occupations often have odd hours or work schedules. Flight and ground personnel may have to work at night, on weekends, or holidays. Flight personnel also may be away from their home bases about one-third of the time or more. When they are away from home, the airlines provide hotel accommodations. Ground personnel usually work a 5-day, 40-hour week. They generally receive extra pay for overtime work or an equal amount of time off.

Training, Other Qualifications, and Advancement

Jobs are available to persons with a wide variety of training and backgrounds. Some jobs require previous training and may require certificates from the FAA; others can be learned on the job.

Pilots must have a commercial pilot's license from the FAA when they begin work. Many also have an air transport license. They must have an instrument license to fly when the weather is bad. As a rule, new airline pilots begin as flight engineers and must have a flight engineer's license.

Interested persons may obtain pilot training from military or civilian flying schools. Physical requirements are strict. With or without glasses, pilots must have 20/20 vision, good hearing, and no physical handicaps that prevent quick reactions. In addition, airlines generally require 2 years of college and prefer college graduates. Ad-

Reservation agents work in large, centrally located offices.

vancement for pilots usually is limited to better flying jobs.

Applicants for flight attendant jobs must be in excellent health, and those who have some college and have experience in dealing with the public are preferred. Applicants are trained for their jobs at company schools. Advancement opportunities are limited, although some attendants become customer service directors, instructors, or recruiting representatives.

When hiring airplane mechanics, employers prefer graduates of airplane mechanic trade schools who are in good physical condition. Most mechanics remain in the maintenance field, but they may advance to head mechanic, inspector, and, in a few cases, to supervisory and executive positions. Some jobs require aircraft mechanics to be certified by the FAA.

New reservation and passenger agents are trained by the company. A good speaking voice and a pleasant personality are necessary because these workers deal directly with the public. A high school education is required.

Air traffic controllers and flight service specialists work for the FAA and are selected through the competitive Federal Civil Service System. Applicants must pass a rigid physical examination and a written test. The FAA trains new workers on the job and at the FAA Academy. Controllers and specialists can advance to supervisory positions and to higher management jobs in air traffic control.

Completion of commercial courses in high school or business school usually is adequate for entry into general clerical occupations such as secretary or typist. However, additional on-the-job training is needed for specialized clerical occupations such as bookkeeper.

Administrative and sales positions usually are filled by college graduates who have majored in business administration, marketing, accounting, industrial relations, or transportation. Some companies have management training programs for college graduates in which trainees work for brief periods in various departments to get a broad picture of air transportation operations before they are assigned to a particular department.

Employment Outlook

The total number of workers in civil aviation occupations is expected to increase faster than the average for all occupations through the 1980's. Besides the job openings that will be created by employment growth, many openings will arise as experienced workers retire, die, or transfer to other fields of work. Job opportunities may vary from year to year, however, because the demand for air travel fluctuates with ups and downs in the economy.

Airline employment is expected to increase as passenger and cargo traffic grows in response to increases in population, income, and business activity. Employment in other civil aviation activities is expected to rise as more aircraft are purchased for business, agricultural, and recreational purposes.

Earnings

Airline employees earned an average of $24,000 a year in 1978, over twice the average for all nonsupervisory workers in private industry, except farming. Among the major occupations, salaries ranged from $950 a month for new reservation agents to $9,000 a month for experienced airline captains. As an additional benefit, airline employees and their immediate families are entitled to reduced-fare transportation with their own and most other airlines.

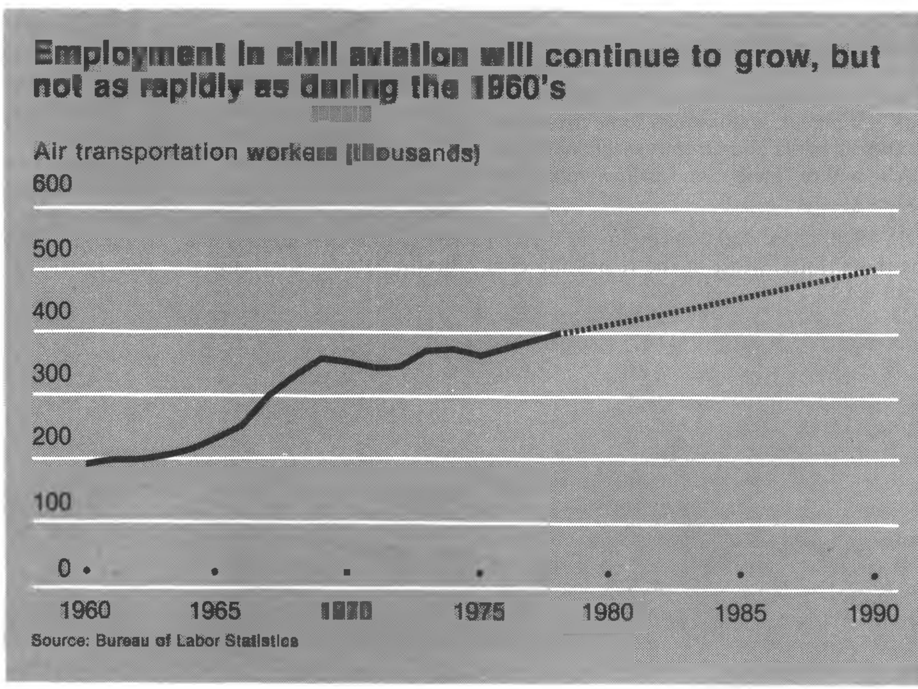
Sources of Additional Information

For information about job opportunities in a particular airline, write to the personnel manager of the company. Addresses of companies are available from:

Air Transport Association of America, 1709 New York Ave. NW., Washington, D.C. 20006.

For information about FAA-approved schools that offer training for airplane mechanics, pilots, or other technical occupations in aviation, write to:

Community and Consumer Liaison Division, Office of Public Affairs, APA-400, Federal Aviation Administration, Washington, D.C. 20591.



Occupations in the Electric Power Industry

Electricity has become so much a part of our daily lives that most of us take it for granted. Bringing electricity into our homes and places of work and recreation is not as simple as turning on a switch. There are several hundred thousand employees working in the electric power industry to make it possible.

Nature and Location of the Industry

The delivery of electricity to users at the instant they need it is the task of the electric utility systems. Since electricity cannot be stored efficiently but must be used as it is produced, an electric utility system must have sufficient capacity to meet peak consumer needs at any time.

An electric utility system includes powerplants that generate electric power, substations that increase or decrease the voltage of the power, and vast networks of transmission and distribution lines. Electric utilities range from large systems serving broad regional areas to small power companies serving individual communities. Most electric utilities are investor owned (private) or owned by cooperatives; others are owned by cities, counties, and public utility districts, as well as by the Federal Government. While some utilities generate, transmit, and distribute only electricity, others distribute both electricity and gas. This statement is concerned with employment relating only to the production and distribution of electric power.

Producing and distributing large quantities of electrical energy involves many processes and activities. The accompanying chart shows how electric energy is generated, and how it travels from the generating station to users.

The first step in providing electrical energy occurs in a generating station or plant, where huge generators convert mechanical energy into electricity. Electricity is produced primarily in steam-powered generating plants that use coal, gas, oil, or nuclear energy for fuel. In addition, a considerable amount of electricity is produced in hydroelectric generating stations that use water power to operate the turbines. Still other generators, primarily for use in standby or peak load service, are powered by diesel engines or gas turbines.

After electricity is generated, it passes through transformers where the voltage is increased so that the electricity may travel long distances without excessive loss of power. Next the electricity passes onto transmission lines that carry it from the generating plant to substations, where the voltage is decreased and passed on to the distribution networks serving individual customers. Transmission lines tie together the generating stations of a single system and also the power facilities of several systems. In this way, power can be interchanged among several utility systems to meet varying demands.

In 1978, 582,000 people worked in the electric power industry. Most of them, 499,000, worked in investor-owned utilities and cooperatives, and 80,100 worked in Federal and municipal government utilities. A few large manufacturing establishments which produce electric power for their own use also employ electric power workers.

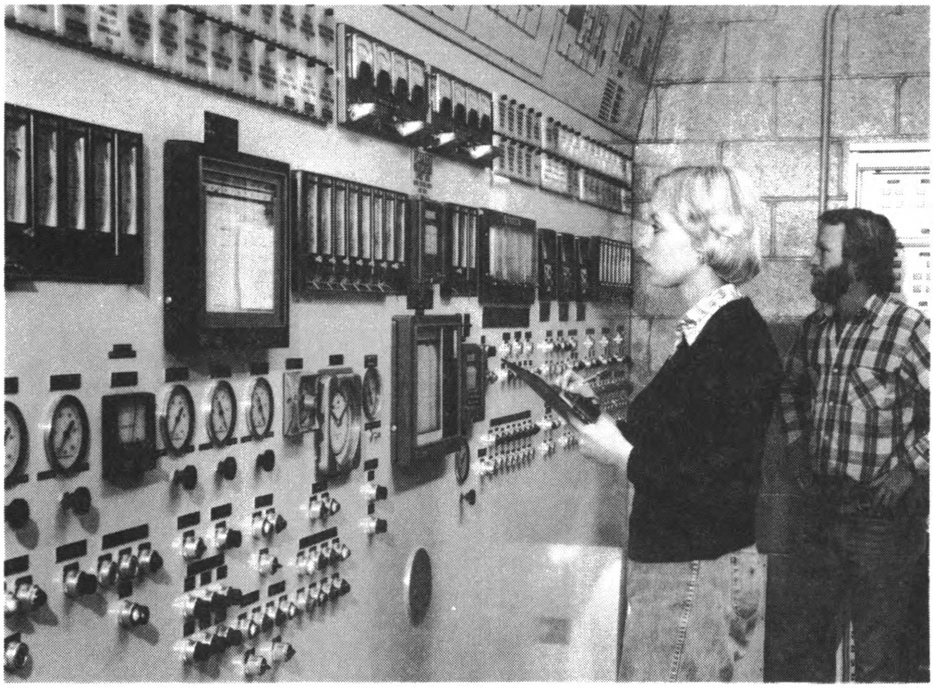
Since electricity reaches almost every locality, jobs in this industry are found throughout the country. Although hydroelectric power projects have created jobs in relatively isolated areas, most utility jobs still are found in heavily populated urban areas.

Occupations in the Industry

Many different types of workers are required in the electric power industry. About 40 percent of the industry's employees work in occupations related to the generation, transmission, and distribution of electricity, and in customer service occupations. (These occupations are discussed in detail later in this section.) The industry also employs large numbers of workers in engineering, scientific, administrative, sales, clerical, and maintenance occupations. A brief discussion of these occupations is given below. Further information can be found in statements covering individual occupations elsewhere in the *Handbook*.

Engineering and Scientific Occupations. Engineers plan generating plant construction and additions, interconnections of complex power systems, and installations of new transmission and distribution systems and equipment. They supervise construction, develop improved operating methods, and test the efficiency of the many types of electrical equipment. In planning modern power systems, engineers help select plant sites, types of fuel, and types of plants. Engineers also help industrial and commercial customers make the best use of electric power. For example, they may demonstrate how to modernize a chemical manufacturing plant or how to remodel a store or hotel, suggesting changes that would use electricity more effectively.

Administrative and Clerical Occupations. Because of the enormous amount of recordkeeping required, electric utilities employ many administrative and clerical personnel. Large numbers of stenographers, typists,



About 40 percent of the industry's employees are directly involved in the generation, transmission, and distribution of electricity.

bookkeepers, office machine operators, file clerks, accounting and auditing clerks, and cashiers are employed. These workers keep records of the services rendered by the company, make up bills for customers, and prepare a variety of statements and statistical reports. An increasing amount of this work in the larger offices now is being performed by computers. This generally results in more clerical work being done either by fewer or by the same number of employees. The use of this equipment also creates a need for programmers and computer operators. Administrative employees include accountants, personnel officers, purchasing agents, and lawyers.

Maintenance Occupations. A considerable number of workers test, maintain, and repair equipment. The duties of these skilled craft workers are similar to those of maintenance workers in other industries. It may be necessary to replace a switch or transformer, for example, or a weak section in a boiler may have to be repaired. Among the more important skilled workers are electricians, instrument repairers, industrial machinery repairers, machinists, pipefitters, welders, and boilermakers.

Working Conditions

Because of the dangers of electrocution and other hazards, electric utilities and unions have made intensive efforts to enforce safe working practices. This has resulted in an injury rate lower than in most manufacturing industries. However, some occupations, especially those in linecrews, are more subject to accidents than others.

Employment Outlook

Employment in the electric power industry is expected to increase more slowly than the average for all industries through the 1980's. The greater use of electric power in industrial processes, growth of commercial centers such as shopping malls, and population growth all will contribute to some increased demand for electricity. However, due to the growing use of automatic controls, employment will not increase as fast as electric power production.

Trends in growth will differ from one occupation to another in the industry. The need for scientific, engineering, and technical employees is expected to increase, stimulated by the development and construction of new power generating facilities, research into more efficient energy usage to combat shortages and higher prices of fossil fuels, and efforts to control pollution.

In many other occupations in this industry, only slight increases in employment are expected. Larger, more efficient powerplants will limit growth of employment of powerplant employees. The increased use of electronic data processing equipment for billing and recordkeeping will restrict growth in some clerical jobs. In occupations that will experience little or no growth, most jobs openings will result from the need to replace workers who die, retire, or leave the electric power industry for other reasons.

People hired by electric power companies are likely to have relatively secure jobs. Even during downturns in the economy, these companies seldom lay off employees.

Earnings

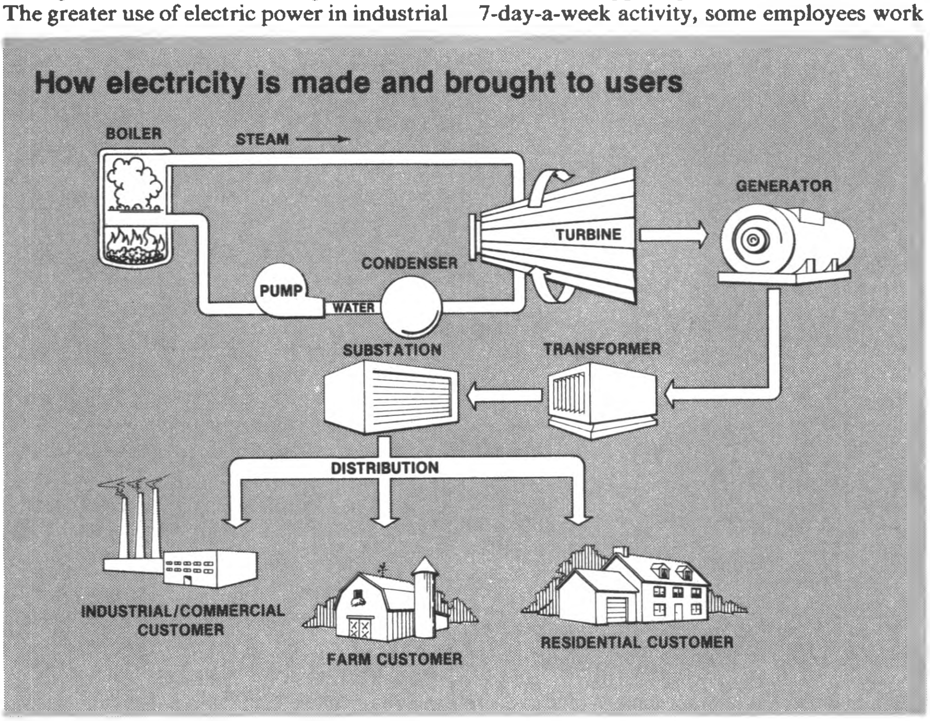
Earnings in the electric utility industry are relatively high. In 1978, nonsupervisory employees in private electric power companies averaged $7.70 an hour, compared with the average of $5.69 an hour for all nonsupervisory workers in private industry, except farming.

Because supplying electricity is a 24-hour, 7-day-a-week activity, some employees work evenings, nights, and weekends, usually on rotating shifts. Most union contracts with electric utilities provide a higher rate of pay for evening and nightwork than the basic day rate.

Overtime work often is required, especially during emergencies such as floods, hurricanes, or storms. During an "emergency callout," which is a short-notice request to report for work during nonscheduled hours, the worker generally is guaranteed a minimum of 3 or 4 hours' pay at 1 1/2 times the basic hourly rate. Travel time to and from the job is counted as worktime.

In addition to these provisions that affect pay, electric utilities provide other employee benefits. Generally, annual vacations are granted to workers according to length of service. A typical contract or employee benefit program provides for a 1- week vacation for 6 months to 1 year of service, 2 weeks for 1 to 7 years, and 3 weeks for 8 to 18 years. Many contracts and programs provide for 4 weeks after 18 years, 5 weeks after 25 years, and 6 weeks after 30 years. The number of paid holidays ranges from 9 to 14 a year. Nearly all companies have benefit plans for their employees. A typical program provides life, hospitalization, and surgical insurance and paid sick leave. Retirement pension plans supplement Federal social security payments and generally are paid for in full or in part by the employer.

Many nonsupervisory electric utility workers in production, transmission, and distribution departments are union members. The bargaining representative for most of these workers is either the International Brotherhood of Electrical Workers or the Utility Workers' Union of America. Independent unions represent some utility workers.



Sources of Additional Information

Information about jobs in the electric power industry is available from local electric utility companies, industry trade associations, or the local offices of unions that represent electric utility workers. Additional information also may be obtained from:

Edison Electric Institute, 1111 19th St. NW., Washington, D.C. 20036.

International Brotherhood of Electrical Workers, 1125 15th St. NW., Washington, D.C. 20005.

Utility Workers' Union of America, 815 16th St. NW., Washington, D.C. 20006.

Powerplant Occupations

Nature of the Work

Powerplants employ many different types of workers to produce electricity. All equipment in the plants must be kept in good running order; thus the machinery must be regularly cleaned and serviced, and all operations carefully checked and controlled. Maintenance personnel, including electrical, instrument, and mechanical repairers, inspect and repair this equipment. For example, an instrument repairer may notice that a gauge connected to a turbine does not register properly. The repairer may disassemble the gauge, locate the specific problem, and replace a part if necessary.

Other powerplant workers include helpers and cleaners, and the custodial staff, including janitors and guards. In steam generating plants using coal for fuel, coal handlers also are employed. In hydroelectric plants, gate tenders open and close the headgates that control the flow of water to turbines. Supervision of powerplant operations is handled by chief engineers called operations supervisors, and by their assistants, watch engineers (also called shift supervisors).

Operators are the key workers in a powerplant. They include four basic classes of workers—switchboard, boiler, turbine, and auxiliary equipment operators. Their job is to observe and regulate the various kinds of powerplant equipment keep records of all operations to make certain that equipment functions efficiently and detect any trouble. In this way, operators ensure that power production will not be interrupted.

Following orders of load dispatchers, operators regulate the flow of electricity onto various powerlines according to the changing needs of customers.

Switchboard operators (D.O.T 952.362-014,-018,-022) control the amount of electric power flowing from generators to outgoing powerlines by watching instrument panels and by operating switchboards. Switches control the movement of electric current through the generating station circuits and onto the transmission lines. Instruments mounted on panelboards show the power demand on the station at any instant, the powerload on each line leaving the station, the amount of current being produced by each generator, and the voltage.

The operators use switches to distribute the power demands among the generators, to combine the current from two or more generators, and to regulate the flow of the electricity onto various powerlines according to the changing needs of consumers. When power requirements change, they order generators started or stopped and, at the proper time, connect them to the power circuits in the station or disconnect them. In doing this, they follow telephone orders from the load dispatcher who directs the flow of current throughout the system.

Switchboard operators and their assistants also check their instruments frequently to see that electricity is moving through and out of the powerplant properly, and that correct voltage is being maintained. Among their other duties, they keep records of all switching operations and of load conditions on generators, lines, and transformers. They obtain this information by making regular meter readings.

Boiler operators (D.O.T. 950.382-010)—employed only in steam-powered generating plants—are responsible for maintaining the proper steam pressure needed to turn the turbines. They note and regulate the fuel, air, and water supply used in the boilers by means of control valves, meters, and other instruments which are mounted on panel boards. The size of the generating unit determines the number of boilers used; a boiler operator may be responsible for operating one or several boilers.

Turbine operators (D.O.T. 952.137-022 and .362-042) control the turbines that drive the generators. In small plants, they also may operate auxiliary equipment or a switchboard. Since modern steam turbines and generators operate at extremely high speeds, pressures, and temperatures, the operator must give close attention to the pressure gauges, thermometers, and other instruments showing the operations of the turbo-generator unit. Turbine operators record the information shown by these instruments and check the oil pressure at bearings, the speed of the turbines, and the circulation and amount of cooling water in the condensers that change the steam back into water. They also are responsible for starting and shutting down the turbines and generators, as directed by the switchboard operator in the control room. Other workers, such as helpers and junior operators, assist the turbine operators.

Auxiliary equipment operators (D.O.T. 952.362-010) check and record the readings of instruments that indicate the operating condition of pumps, fans, blowers, condensers, evaporators, water conditioners, compressors, and coal pulverizers. Precise operation of this machinery is necessary for the proper functioning of boilers and turbines. For example, after steam goes through the turbines, it enters the condensers. Here the steam becomes water. This operation of the condensers provides some of the force that drives the turbines. Since auxiliary equipment may occasionally break down, these operators must be able to detect trouble quickly and, sometimes, make minor repairs. In small plants which do not employ auxiliary equipment operators, these duties are performed by turbine operators.

In most powerplants constructed in recent years—including nuclear—the operation of boilers, turbines, auxiliary equipment, and the switching required for balancing generator output has been centralized in a single control room. From here, central *control room operators* (D.O.T. 952.382-018) or powerplant operators regulate all the generating equipment, which in older plants requires specialists such as boiler and turbine operators. Control room operators have several assistants who patrol the plant and check the equipment. When equipment is not operating properly, operators report problems to the plant superintendent or a watch engineer.

Watch engineers or shift supervisors (D.O.T. 950.131-014) oversee the workers in the powerplant who operate and maintain the boilers, turbines, generators, transformers, switchboards, and other machinery and equipment. Watch engineers are supervised by a chief engineer or a plant superintendent who is in charge of the entire plant. In small plants, the watch engineer also may be the general plant supervisor.

Generally, a nuclear-powered plant requires about the same kind and number of employees as a steam-generating plant powered by coal. However, nuclear plants employ a few additional employees such as health and safety specialists.

Working Conditions

A powerplant is typically well lighted and ventilated, clean, and orderly, but there is some noise from the equipment.

Switchboard operators in the control room often sit at the panel boards, but boiler and turbine operators are almost constantly on their feet. The work of powerplant operators generally is not physically strenuous, particularly in the new powerplants. Many generating stations operate 24 hours a day, 7 days a week, some powerplant employees must work nights and weekends, usually on rotating shifts.

Training, Other Qualifications, and Advancement

New powerplant workers generally begin at the bottom of the ladder—usually on cleanup jobs. Such work gives beginners an opportunity to become familiar with the equipment and operations of a powerplant. They advance to the more responsible job of helper as openings occur. Formal apprenticeships in these jobs are uncommon. Applicants generally are required to have a high school or vocational school education.

It takes from 1 to 3 years to become qualified as an auxiliary equipment operator and from 4 to 8 years to become a boiler operator, turbine operator, or switchboard operator. A person learning to be an auxiliary equipment operator progresses from helper to junior operator to operator. A boiler operator generally spends from 2 to 6 months as a laborer before being promoted to the job of helper. Depending on openings and the worker's aptitude, the helper may advance to junior boiler operator and eventually to boiler operator, or transfer to the maintenance department and work up to boiler repairer. Turbine operators advance from the ranks of auxiliary equipment operators.

Where a utility system has a number of generating plants of different size, operators usually first get experience in the smaller stations and then are promoted to jobs in the larger stations as vacancies occur. Thus, how rapidly a worker advances also may depend on the availability of openings. If these are few, it may take longer to obtain a particular job than just to learn it.

In many States and large cities, employees who operate equipment in powerplants must be licensed by local or State agencies. These licensing requirements vary from place to place.

Some powerplant workers employed in nuclear-powered electric plants must have special training in addition to the knowledge and skills required for conventional steam-generated electric power. All control room operators, assistant control room operators, and some operators of high pressure auxiliary equipment in nuclear powerplants must be licensed by the Nuclear Regulatory Commission.

New workers in the switchboard operators section begin as helpers, advance to junior operators, and then to switchboard operators. Some utility companies promote substation operators to switchboard operating jobs. The duties of both classes of operators have much in common. Switchboard operators can advance to work in the load dispatcher's office.

Watch engineers are selected from among experienced powerplant operators. At least 5 to 10 years of experience as a first-class operator usually are required to qualify for a watch engineer's job.

Employment Outlook

Employment of powerplant operators is expected to increase more slowly than the average for all occupations through the 1980's, even though the production of electrical energy will increase at a rapid rate. Although some new jobs will become available, most job openings will occur because of the need to replace workers who retire, die, or leave the industry for other work. People hired by electric power companies are likely to have relatively secure jobs. Even during downturns in the economy, these companies seldom lay off employees.

Because of the increased demand for electric power, it will be necessary to build and operate many new generating stations. The use of larger and more efficient equipment, however, will result in a great increase in capacity and production without a corresponding increase in the number of powerplant operators. For example, it takes only one turbine operator to control a turbo-generator regardless of the generator's size. Also, automatic equipment makes it possible to control several boilers from a central control room.

Table 1. Average hourly earnings in powerplant occupations, 1978

Occupation	Hourly rate
Watch engineer	$9.32
Control room operator	8.88
Switchboard operator, Class A	8.13
Boiler operator	8.00
Turbine operator	7.80
Switchboard operator, Class B	7.56
Auxiliary equipment operator	6.08

SOURCE: International Brotherhood of Electrical Workers.

Earnings

The earnings of powerplant workers vary by occupation and locality. The following tabulation shows estimated average hourly earnings for selected powerplant occupations in privately owned utilities in 1978.

Sources of Additional Information

For information concerning licensing of powerplant employees, contact State and local occupational licensing agencies in your area.

Transmission and Distribution Occupations

Nature of the Work

The transmission and distribution phase of the utility system links the electric power produced in generating plants to individual customers according to their needs. The principal workers involved in these activities are those who control the flow of electricity—load dispatchers and substation operators—and employees who construct and maintain powerlines—line installers and repairers, cable splicers, troubleshooters, ground helpers, and laborers.

Load dispatchers (D.O.T. 952.167-014), also called system operators or power dispatchers, control the flow of electricity throughout the area served by the utility. They operate the plant equipment used to generate electricity and direct its flow. The load dispatcher's source of information for the entire transmission system is the pilot board. This board, which dominates the load dispatcher's room, is a complete map of the utility's transmission system. It enables the dispatcher to determine, at a glance, the existing conditions at any point in the system. Often lights are connected to the pilot board, which show the positions of switches that control generating equipment and transmission circuits, as well as high-voltage connections with substations and large industrial customers. The board also may have meters and several recording instruments that make a graphic record of operations for future analysis and study.

Because it takes some time to change the level of electricity being produced, the load dispatcher must anticipate power demands so that the system will be prepared to meet them. Power demands on utility systems may change from hour to hour. A sudden afternoon rainstorm, for example, may cause a million lights to be switched on in a matter of minutes. Dispatchers telephone instructions to the switchboard operators at the generating plants and the substations, telling them when to start or stop additional boilers and generators so that power production will be in balance with power needs.

Dispatchers also direct the handling of any emergency situation, such as transformer or transmission line failure, and route current around the affected area. They also may be in charge of connecting their utility system with other systems and directing transfers of current between systems as the need arises.

Substation operators (D.O.T. 952.362-026) generally are responsible for the operation of the step-up or step-down substations. A step-up substation usually is located adjacent to the powerplant to raise the voltage of the electricity so it can travel long distances. A step-down substation, at the other end of the transmission line, reduces power voltage before it is sent out to the customer. Under orders from the load dispatcher, these operators use a switchboard to direct the flow of current out of the station. Ammeters, voltmeters, and other types of instruments register the amount of electric power flowing through each line. The flow of electricity from the incoming to the outgoing lines is controlled by circuit breakers. The substation operators, using switchboard levers that control the circuit breakers, connect or break the flow of current. In some substations, where alternating current is changed to direct current to meet the needs of special users, the operator controls converters which perform the change.

In addition to switching duties, substation operators check the operating condition of all equipment to make sure that it is working properly. They supervise the activities of the other substation employees on the same shift. In smaller substations, the operator may be the only employee.

Some utilities employ a mobile operator who drives from one automatic station to another, inspecting powerlines, operating controls, and assisting customers' electricians in large commercial or government installations.

Line installers and repairers (D.O.T. 821.-261-014 and .361-018 and -026) make up the largest single occupation in the industry. They construct and maintain the network of powerlines that carries electricity from generating plants to consumers.

Installers bolt crossarms to transmission poles and then bolt or clamp insulators in place on the crossarms. Next, they raise wires and cables and attach them to the insulators. Other equipment, such as lightning arrestors, transformers, and switches, also must be attached to the poles. Any routine maintenance and replacements necessary are performed by line installers and repairers.

When wires, cables, or poles break, it means an emergency call for a linecrew. Line repairers splice or replace broken wires and cables and replace broken insulators or other damaged equipment. Most installers and repairers now work from "bucket" trucks with pneumatic lifts that take them to the top of the pole at the touch of a lever.

In some power companies, linecrew employees specialize in particular types of work. Those in one crew may work on new construction only; others may do only repair work.

Trouble shooters (D.O.T. 821.261-026,) are experienced line installers and repairers who are assigned to special crews that handle emergency calls. They move from one job to another, as ordered by a central service office that receives reports of line trouble. Often troubleshooters receive their orders by direct radio communications with the central service office.

To do this job well, these workers must have a thorough knowledge of the company's transmission and distribution network. Upon reaching the location of the break, they first find and report the source of trouble, and then attempt to restore service by making the necessary repairs. For example, depending on the nature and extent of the problem, troubleshooters may have to install new fuses or cut down live wires. They must be familiar with all the circuits and switching points so that they can safely disconnect live circuits when lines break down.

Ground helpers (D.O.T. 821.684-014), also called tower erector helpers, assist in constructing, repairing, and maintaining the transmission and distribution lines. For example, they dig pole holes, and then help the line installers and repairers to raise the poles while positioning them into the holes.

Cable splicers (D.O.T. 829.361-010) supervise the installation of insulated cables on utility poles and towers, as well as those buried underground and those carried in underground conduits. When cables are installed, these workers direct the laying of the conduit and the pulling of the cable through it. The cables are joined at connecting points in the transmission and distribution systems. At each connection—or break in the system—insulation is wrapped around the wiring and the cable is sealed with lead sheathing. Most of the physical work in placing new cables or replacing old ones is done by laborers.

Cable splicers spend most of their time repairing and maintaining cables and changing the layout of the cable systems. They must know the arrangement of the wiring systems, where the circuits are connected, and where they lead to and come from. When making repairs, they must make sure that the continuity of each line is maintained from the substation to the customer's premises. Cable splicers also periodically check insulation on cables to make sure it is in good condition.

Working Conditions

Load dispatchers and substation operators generally work indoors in pleasant surroundings. Line installers and repairers, troubleshooters, and ground helpers work outdoors and, in emergencies, may work in all kinds of weather. Cable splicers do most of their work beneath city streets—often in cramped quarters. Safety standards developed over the years by utility companies, with the cooperation of labor unions, have greatly reduced the hazards of these jobs. Workers stringing high-voltage lines, for example, protect themselves by wearing rubber gloves. Also, barricades and specific warning signs usually are posted where workers lay conduits or run wires underground.

Training, Other Qualifications, and Advancement

Load dispatchers are selected from experienced switchboard operators and from operators of large substations. Usually, 7 to 10 years of experience as a senior switchboard or substation operator are required for promotion to load dispatcher. To qualify for this job, an applicant must have thorough knowledge of the entire utility system. Substation operators generally begin as assistant or junior operators. Advancement to the job of operator in a large substation requires from 3 to 7 years of on-the-job training.

About 4 years of on-the-job training are needed to qualify as a skilled line installer and repairer. New workers usually begin training as ground helpers, and assist the line installers and repairers. For example, they may help set poles in place or pass tools and equipment. Some companies have formal apprenticeship programs for line employees. Apprenticeship programs combine on-the-job training with classroom instruction in blueprint reading, elementary electrical theory, electrical codes, and methods of transmitting electrical energy. After about 6 months, apprentices begin to do simple linework under close supervision, and progress to more difficult work as they gain experience. A line installer and repairer may advance to troubleshooter after several years of experience.

Candidates for linework should be strong and in good physical condition for the strenuous work of climbing poles and lifting lines and equipment. They also must have steady nerves and good balance to work at the top of the poles and to avoid the hazards of live wires and falls.

Most cable splicers get their training on the job, usually taking about 4 years to become fully qualified. Workers begin as helpers and then are promoted to assistant or junior splicers. In these jobs, they are assigned more difficult tasks as their knowledge of the work increases.

Employment Outlook

Several thousand job opportunities are expected to be available in transmission and distribution occupations through the 1980's. Most of these will occur because of the need to replace experienced workers who retire, die, or transfer to other fields of work. Workers hired by electric power companies are likely to have relatively secure jobs. Even during downturns in the economy, these companies seldom lay off employees.

Some increase in the employment of transmission and distribution workers is expected, although trends will differ among the various occupations in this category. In spite of the need to construct and maintain a rapidly growing number of transmission and distribution lines, the number of line installers and repairers and troubleshooters is expected to increase only slightly because of the use of more mechanized equipment. A limited increase in the number of cable splicers is expected because of the growing use of underground lines in suburban areas. The need for regular substation operators, however, will be reduced substantially, since the introduction of improved and more automatic equipment makes it possible to operate more substations by remote control.

Earnings

Wages for transmission and distribution workers vary by occupation and geographic location. The following tabulation shows estimated average hourly earnings for major transmission and distribution occupations in privately owned utilities in 1978.

Table 1. Average hourly earnings in transmission and distribution occupations, 1978

Occupation	Hourly rate
Trouble shooter	$9.84
Load dispatcher	9.01
Line installer and repairer	8.57
Substation operator	7.68
Ground helper	7.55

SOURCE: International Brotherhood of Electrical Workers.

Customer Service Occupations

Nature of the Work

Workers in customer service occupations include people who read, install, test, and repair meters so that the utility company can accurately charge customers for their consumption of electric power. Also included are workers who represent the utility company in rural areas, and appliance repairers who work in company-operated shops, fixing customers' electrical equipment.

Electric meter repairers (D.O.T. 729.281-014) are the most skilled workers in this group. Their main duties are to maintain and repair meters, although they also may install and test meters. Some of these workers specialize in repairing simpler types of meters, such as those in homes. Others can handle all kinds of meters, including the more complicated ones used in industrial plants where large quantities of electric power are consumed. Often, some of the large systems require specialists, such as *meter installers* (D.O.T. 821.361-014 and .684-010) who put in and take out meters, and *meter testers* (D.O.T. 821.381-010).

Meter readers (D.O.T. 209.567-010) go to customers' premises to check the meters that register the amount of electric energy used. They record the amount used during the current billing period and watch for, and report, any tampering with meters.

District representatives usually serve as company agents in outlying districts that are too small to justify more specialized workers and in localities where the utility company does not have an office. They collect overdue bills; make minor repairs; and read, connect, and disconnect meters. They receive service complaints and reports of line trouble from customers, and send them to a central office.

Appliance repairers are discussed in a separate statement elsewhere in the *Handbook*.

Working Conditions

Electric meter repairers may work both outdoors and in. Outdoors, they may be exposed to bad weather as they install, test, maintain, and repair meters for houses, factories, and stores. Indoors, they work in well lighted shops using sophisticated equipment to test and adjust meters. Meter readers are on their feet much of the time, walking in all kinds of weather to customers' premises.

Training, Other Qualifications, and Advancement

Meter repairers begin their jobs as helpers in the meter testing and repair departments. Persons entering this field should have a basic knowledge of electricity. About 4 years of on-the-job training are required to become thoroughly familiar with all types of repairs. Some companies have formal apprenticeship programs in which the trainee progresses according to a specific plan.

Inexperienced workers can qualify as meter readers after a few weeks of training which is acquired on the job by accompanying experienced meter readers on the rounds.

The duties of district representatives also are learned on the job. An important qualification for this occupation is the ability to deal tactfully with the public in handling service complaints and collecting overdue bills.

Employment Outlook

Employment in customer service occupations is expected to show little change through the 1980's. The need for meter readers will be limited because of the trend toward less frequent readings. Moreover, automatic meter reading may become more common, and new meters will require less maintenance. However, some job openings for meter repairers and meter readers will occur each year because of the need to replace workers who retire, die, or transfer to other fields of work. People hired by electric power companies are likely to have relatively secure jobs. Even during downturns in the economy, these companies seldom lay off employees.

Earnings

The earnings of customer service workers vary according to the type of job they have and the section of the country in which they work. The following tabulation shows estimated average hourly earnings for major customer service jobs in privately owned utilities in 1978.

Table 1. Average hourly earnings in customer service occupations, 1978

Occupation	Hourly rate
District representative	$8.75
Meter repairer, Class A	7.80
Meter repairer, Class B	6.91
Meter reader	6.21

SOURCE: International Brotherhood of Electrical Workers

Meter readers go to customers' homes to record electricity used.

Occupations in Radio and Television Broadcasting

Nature and Location of the Industry

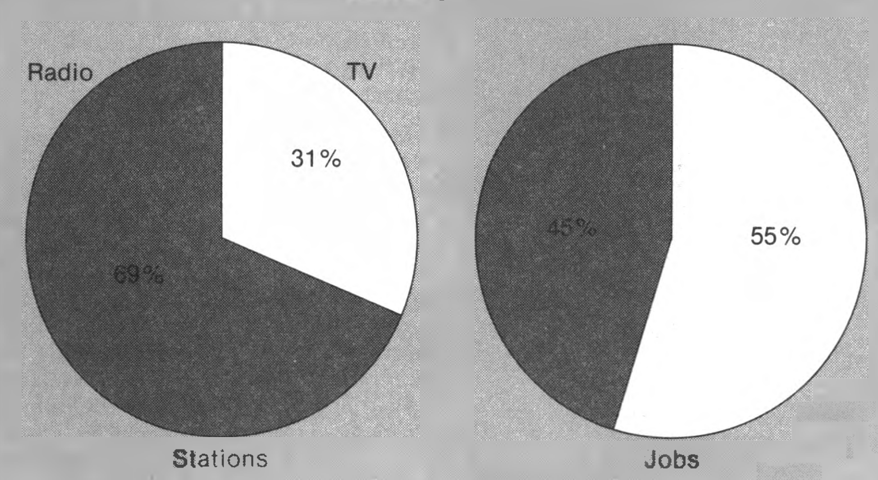
The glamour and excitement of radio and television make broadcasting careers attractive to many people. In 1978, over 200,000 persons were employed in broadcasting; more than one-half were in television, and the rest were in radio. Over four-fifths of all employees worked full time while nearly one-fifth worked part time. In addition, several thousand freelance professionals, mostly writers, performers, musicians, and athletes, worked on a contract basis for stations, networks, and other producers. Several thousand other employees worked for independent producers in activities closely related to broadcasting, such as the preparation of filmed and taped programs and commercials.

Commercial broadcasting. In 1978, about 7,650 commercial radio stations and about 730 commercial television stations were in operation in the United States. Commercial radio broadcasting stations, most of which are small, independent businesses, account for about two-fifths of total industry employment. The smallest radio stations employ only four or five people while radio stations in large cities may have 100 employees or more. Commercial radio stations are served by seven nationwide networks and a large number of regional networks. Stations can affiliate with networks by agreeing to broadcast their programs on a regular basis. The seven national radio networks employed approximately 900 workers in 1977.

Commercial television stations account for about one-third of total industry employment and, on the average, are much larger than commercial radio stations. While commercial television stations in small towns may employ as few as 25 people, stations in major metropolitan areas may employ several hundred, and most employ at least 50 people.

Most television stations depend on one of three national television networks for programs that would be too expensive for individual stations to originate—for example, sports events or newscasts of national and international significance. These networks, in turn, can offer national coverage to sponsors. Two hundred stations across the country may carry a network television show. In 1977, the three national networks employed over 14,000 workers. Most network programs originate in New York City or Los Angeles.

Public broadcasting. There were about 1,000 noncommercial radio stations and about 260 educational television stations in 1978. These stations are operated principally by educational agencies such as State commissions, local boards of education, colleges and universities, and special community public television organizations. Educational stations employ less than one-tenth of all workers in the industry; most work in television. As in the case of commercial broadcasting, television stations, on the average, are much larger than radio stations.



Although television accounted for only 31 percent of all broadcast stations and cable systems, it provided 55 percent of all broadcast jobs

Source: Federal Communications Commission

Cable television. About 3,000 cable TV systems employed almost one-fifth of all workers in the industry in 1978. These systems served nearly 9,000 communities in the United States.

Occupations in the Industry

Broadcasting stations offer a variety of interesting jobs throughout the country. Opportunities for entry jobs, however, are best at stations in small communities. The highest paying jobs, of course, are in large cities, particularly those with national network stations.

Nearly one-half of all employees in the broadcasting industry hold professional or technical jobs, such as announcers, anchor and news persons, writers, or broadcast technicians. Clerical and sales workers make up about one-fourth and managerial personnel, an additional one-fourth. Other employees include craft workers such as electricians, carpenters, and radio and television repairers; operatives such as photographic process workers and truckdrivers; service workers such as janitors and guards; and laborers such as freight and material handlers.

Jobs vary greatly between small and large stations. In small stations, the station manager, who frequently is the owner, may act as sales manager, or perhaps as program director, announcer, and copywriter. Announcers in small stations may do their own writing, operate the studio control board, and do sales work. The engineering staff in a small radio station may consist of only one full-time broadcast technician assisted by workers from the other departments. In large radio and television stations, jobs are more specialized. Traditionally, radio and television stations maintain four major departments: Programming, engineering, sales, and general administration. An increasing number of stations have created a separate department for news; elsewhere, news personnel work in the programming department. The kinds of jobs found in each of the four departments are described in the following paragraphs.

Programming Department. Staff members produce daily and weekly shows, assign personnel to cover special events, and provide general program services such as sound effects and lighting. From time to time, freelance performers, writers, singers, and other entertainers are hired for specific broadcasts, for a series of broadcasts, or for special assignments.

The size of a station's programming department depends on the extent to which its broadcasts are live, recorded, or received from a network. In a small station, a few people make commercial announcements, read news and sports summaries, select and play recordings, and introduce network programs. In a large station, on the other hand, the program staff may consist of a large number of people in a wide variety of specialized jobs.

Program directors (D.O.T. 184.167-030) are responsible for the overall program schedules of large stations. They arrange for a combination of programs that will appeal to the audience and at the same time meet the needs of advertisers.

Continuity directors (D.O.T. 132.037-010) are responsible for the writing and editing of scripts. They may be assisted by *continuity writers* (D.O.T. 131.087-010), who prepare announcers' books ("copy") that contain each program's script and commercials along with their sequence and length.

Radio and television directors (D.O.T. 159.067-014; .167-014) plan and supervise individual programs or series of programs. They coordinate the shows, select artists and studio personnel, schedule and conduct rehearsals, and direct on-the-air shows. They may be assisted by *associate directors* or *program assistants* (D.O.T. 962.167-014), who work out detailed schedules and plans, arrange for distribution of scripts and changes in scripts to the cast, and help direct on-the-air shows. They may arrange for props, makeup service, artwork, and film slides, and assist in timing. They also transmit cues from directors to performers.

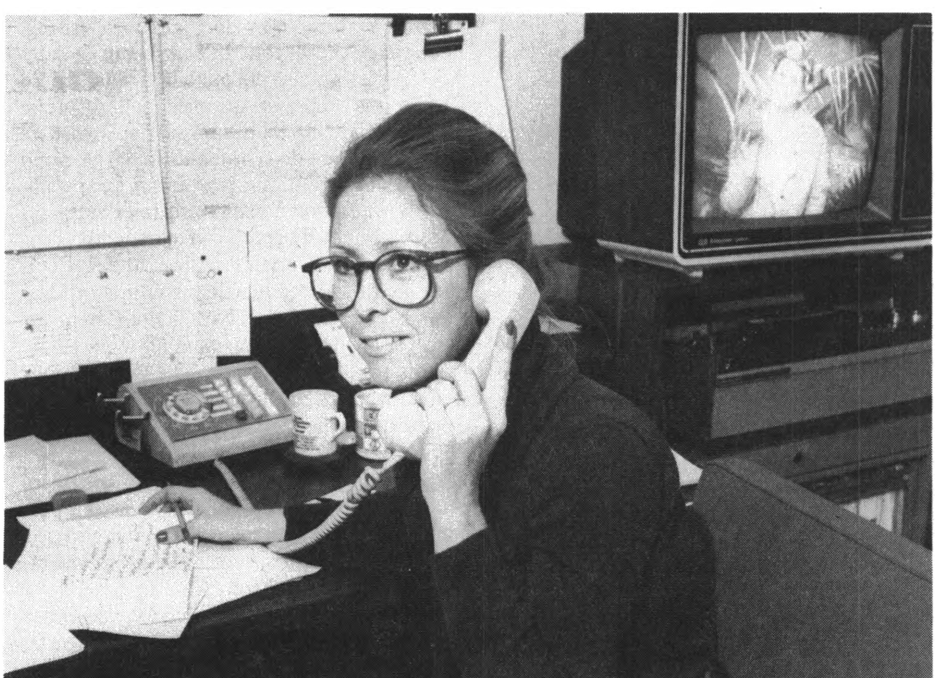
Public service directors (D.O.T. 184.117-010) plan, schedule, and coordinate programs in fields such as education, religion, and civic and government affairs. They contact member network stations to promote public service programs on a national scale.

In large stations, directors may work under the supervision of a *producer* (D.O.T. 159.117-010), who selects scripts, controls finances, and handles other production problems. In small stations, these functions are combined in the job of *producer-director*.

Announcers probably are the best known workers in the broadcast industry. Announcers introduce programs, guests, and musical selections and deliver most of the live commercial messages. In small stations, they also may operate the control board, sell time, and write commercial and news copy. The work of radio and television announcers is discussed in detail elsewhere in the *Handbook*.

Music is an important part of radio programming. Small and large stations use recordings and transcriptions to provide musical programs and background music for other shows. Large stations, which have extensive music collections, sometimes employ *music librarians* (D.O.T. 100.367-022) to maintain their music files and answer requests for a particular selection. The networks employ specialized personnel to plan and arrange for music. *Musical directors* (D.O.T. 152.047-018) select, arrange, and direct music for programs following general instructions from program directors. They select musicians for live broadcasts and direct them during rehearsals and broadcasts. Musicians are generally hired on a freelance basis.

News gathering and reporting are key aspects of radio and television programming. *News directors* (D.O.T. 184.167-014) plan and supervise all news and special events coverage. *News reporters* (D.O.T. 131.267-018) gather and analyze information about newsworthy events for broadcast on radio or television programs. They may specialize in a particular field, such as economics, health, or foreign affairs, and often report special news events from the scene. *News writers* (D.O.T. 131.267-014) select and write copy for *newscasters* (D.O.T. 131.267-010) to read on the air. In many stations, these jobs are combined.



Organizing educational programs is the most challenging part of this public service director's job.

Stations that originate live television shows must have staff members who help directors stage the programs. *Art directors* (D.O.T. 142.031-010) select locations and settings and coordinate the setting up of scenery and props to convey the desired visual impressions. They are assisted by *set decorators* (D.O.T. 142.061-042), who select furniture, draperies, pictures, lamps, rugs, and other props, and *scenic arts supervisors* (D.O.T. 149.031-010), who create layouts of scenery and backdrops. *Property handlers* (D.O.T. 962.687-022) set up props and do other chores. *Makeup artists* (D.O.T. 333.-071-010) prepare personnel for broadcasts by applying cosmetics. *Sound effects technicians* (D.O.T. 962.281-014) operate special equipment to simulate sounds, such as gunfire or rain.

Almost all commercial television programming is recorded either on film or video tape. Broadcast technicians make video tape recordings on electronic equipment that permits instantaneous playback of a performance. Video tape is used to record live shows and to prerecord programs for future broadcasts. Many stations employ specialized staff members to take care of film or video tape. *Film editors* (D.O.T. 962.264-010) edit and prepare all film and video tape for on-the-air presentation. They screen all films received, cut and splice films to insert commercials, and trim film segments so that the film is the appropriate length and produces the desired effect. *Film or tape librarians* (D.O.T. 222.-367-026) catalog and maintain files of film and video tape.

Engineering Department. Technicians position microphones, adjust levels of sound, keep transmitters operating properly, and move and adjust lights and television cameras to produce clear, well-composed pictures. They also install, maintain, and repair the many types of electrical and electronic equipment required for these operations.

Most stations employ *chief engineers* (D.O.T. 003.167-030 and -034), who are responsible for all engineering matters, including supervision of technicians. In small stations, they also may work at the control board and repair and maintain equipment. Large stations have engineers who specialize in fields such as sound recording, maintenance, and lighting. Networks employ a few *electrical-design engineers* (D.O.T. 003.061-018) to design and develop new electronic apparatus to meet special problems. *Broadcast technicians* have many jobs. They control the operation of the transmitter to keep the level and frequency of broadcast within legal requirements. They also set up, operate, and maintain equipment in the studio and in locations where remote broadcasts are to be made. More detailed information about the work of broadcast technicians appears elsewhere in the *Handbook*.

Sales Department. *Sales representatives* (D.O.T. 259.357-018 and -022), the largest group of workers in this department, sell advertising time to sponsors, advertising agencies, and other buyers. Those working in the cable television industry contact homeowners, apartment managers, and others to sell community television antennas and cable service. Sales representatives must have a thorough knowledge of the station's operations and programming. The job also requires that they be knowledgeable about the audience—including, for example, size and characteristics, number of radio and television sets in use, income levels, and consumption patterns. Sales representatives in large stations often work closely with sponsors and advertising agencies. Many television stations sell a substantial part of their time, particularly to national advertisers, through independent advertising agencies.

Large stations generally have several workers who spend all of their time handling sales. They are supervised by the sales manager, who may handle a few of the largest accounts personally. If the station is large enough, researchers may be employed to collect and analyze statistics and other market information on the community served. In small stations, sales responsibilities often are handled by part-time sales personnel or announcers during hours they are not on the air.

General Administration. *Station managers* (D.O.T. 184.117-062) coordinate the activities of the programming, engineering, and sales departments. In a very small station, the owner and a bookkeeper may handle all the recordkeeping, accounting, purchasing, hiring, and other routine office work. If the size of the station warrants it, the business staff may include business managers, accountants, lawyers, personnel workers, public relations workers, and others. They are assisted by office workers, such as secretaries, typists, bookkeepers, clerks, and messengers.

Working Conditions

Workers in this industry generally function in clean, comfortable surroundings. Since electronic equipment must be operated at cool temperatures, radio and television studios usually are air-conditioned. Broadcasts outside the studio, however, may require personnel to work under less favorable conditions. For example, workers may be subjected to noisy, crowded conditions in sporting arenas or convention halls or may have to appear at the scene of a fire or riot. Major networks sometimes send news teams to foreign countries to report on wars, political revolutions, coronations, international sports, and other events.

Programming and engineering workers are much more likely to experience varied or erratic working conditions than are sales and administrative workers, whose office jobs seldom require exceptionally long or irregular hours. Programming and engineering workers, however, often work long hours under great pressure in order to meet broadcast deadlines.

While the industry is reputed for its high-pressure, even frantic atmosphere, the work is not hazardous, as a rule. The rate of occupational illness and injury in broadcasting is much lower than the average for all industries. Indeed, for many people, the glamour and excitement more than compensate for the frequently demanding nature of the job.

Training, Other Qualifications, and Advancement

A high school diploma is sufficient for many entry level jobs in broadcasting. For an increasing number of jobs, however, technical training or a college degree is preferred. Entry level jobs in the engineering department, for example, require some technical training in electronics. A college education provides a good background for many jobs in the programming, sales, and business end of broadcasting. While a major in almost any field is acceptable, many stations prefer candidates with a background in the liberal arts. Some technical schools offer courses in broadcasting, and many colleges and universities offer 2- or 4-year degree programs in broadcasting, mass communications, telecommunications, speech, and journalism.

While employers closely examine the educational qualifications of applicants, experience remains the key to success in this highly competitive industry. Students at all levels of training are well advised to take advantage of any opportunities to gain experience through internships or part-time work in a commercial or noncommercial station. In fact, many college and university radio stations are entirely staffed by student volunteers. One can acquire a feel for the working conditions and the range of jobs in a radio or television station and make valuable contacts. In some cases, such experience leads directly to permanent employment in the industry.

Education beyond high school almost always is an asset in terms of career potential and advancement. A high school graduate may start working for a radio station in a clerical or sales job, for example, but opportunities to progress to the management ranks are likely to be much greater with a college degree. In the programming area, proficiency in announcing may be enough to land a job, but advancement usually requires a strong educational background in addition to administrative skills.

Television programming for networks and large independent stations generally requires some experience in broadcasting in addition to a college degree.

Some people get their start in broadcasting as clerks, typists, property handlers, or assistants. Jobs such as these do not ordinarily require specialized training or experience. They do, however, provide workers with the chance to advance to more responsible jobs as they gain knowledge and experience. A few people get started in broadcasting with temporary jobs in the summer when regular workers go on vacation and broadcast schedules of daylight-hours stations are increased.

Technical training in electronics is required for entry jobs in engineering departments. Programs in electronics are offered by trade schools and technical institutes, and

Programming and engineering workers often are under great pressure to meet broadcast deadlines.

also by junior and community colleges. High school courses in electronics, mathematics, and physics often are helpful to people who plan to pursue careers as broadcast technicians.

Some technical schools give courses especially designed to prepare the student for the series of written examinations required for the Federal Communication Commission's (FCC) first class radiotelephone operator license. The tests cover the theory, construction, and operation of transmission and receiving equipment; the characteristics of electromagnetic waves; and U.S. and international regulations governing broadcasting. The first class license is required by law for anyone who operates transmitters in televison stations. In radio stations, those who maintain, repair, or adjust transmitters need the first class license; those involved in the most routine operation of transmitters need only a restricted radiotelephone operator permit, for which no examination is required. Industry experts stress the importance of a first class license, particularly for technicians who wish to progress to the top ranks in broadcast engineering. In most areas, holders of a first class license are at an advantage in finding employment as a broadcast technician.

Small radio stations with only a few employees sometimes prefer to have as many staff members as possible who are legally qualified to operate their transmitters. Because of this, nontechnicians, especially announcers, have a better chance of getting a job in radio if they have a restricted permit, or better yet, a first class license.

Entry jobs as announcers in small stations usually do not require specific training or experience, but applicants should have a pleasant voice and an excellent command of the language, and be able to project an attractive or dramatic personality. Courses in speech, English, social science, drama, and electronics are helpful to persons seeking careers as announcers. In addition, college campus radio experience, summer and part-time employment at local stations, and a good knowledge of the commercial industry are all highly regarded as backgrounds for this occupation, as they are for other occupations in this industry.

Qualifications for administrative and sales jobs in broadcasting are similar to those required by other employers; a business course of study in high school or a college degree in business or management is good preparation for such jobs. Large stations often seek persons who have advanced training in accounting or business administration and who exhibit strong managerial potential.

Most beginners start out in small broadcasting stations at low salaries. These stations offer opportunities to learn the different phases of broadcasting because they generally use personnel in combination jobs. For example, an announcer may perform some of the duties of a broadcast technician. After years of experience, workers may qualify for jobs in large stations in major metropolitan areas.

People in the engineering department tend to remain in this area of work, where thorough knowledge of electronics is essential. Program employees usually remain in programming work, although they occasionally transfer to or from the sales and business departments. Transfers are most common between sales and general administrative departments because of their close working relationship; in fact, in small stations, they often are merged into one. Although transfers of experienced workers between departments are limited to the extent noted, these distinctions are less important in beginning and top level jobs. At the higher levels, a station executive may be drawn from top level personnel of any department. Many executives, however, have backgrounds in sales and financial administration.

Many radio and television station managers consider training in a private trade or technical school helpful for people interested in careers in the broadcasting industry. However, before enrolling in any broadcasting school, whether public or private, prospective students should contact employers, broadcasting trade organizations, and the Better Business Bureau in their area to determine the school's performance in producing suitably trained candidates.

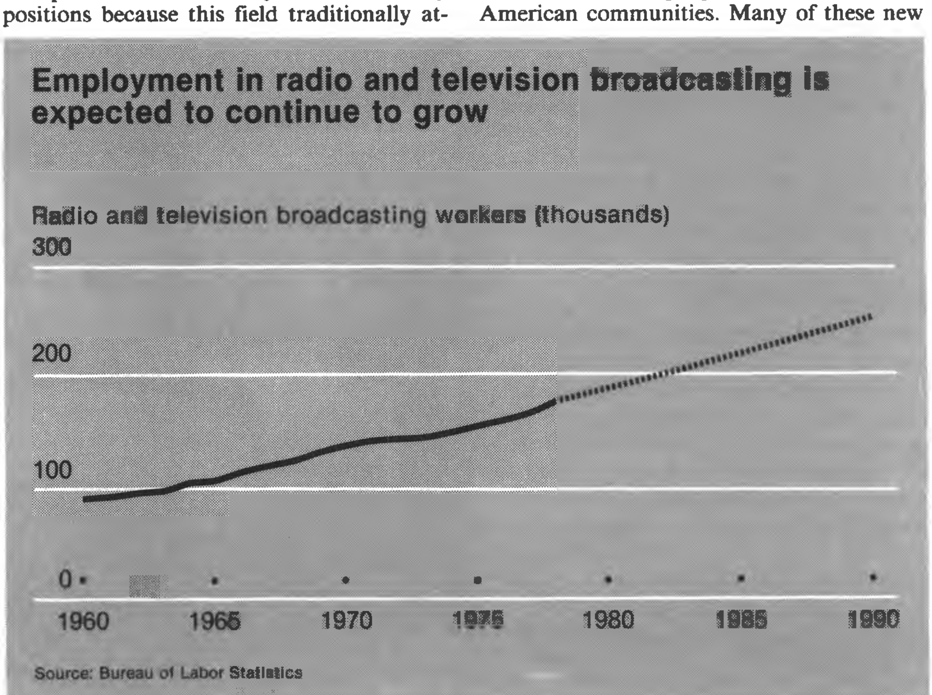
Employment Outlook

Employment in the broadcasting industry is expected to grow faster than the average for all industries through the 1980's. Besides the job openings from growth, many openings will result from the need to replace experienced workers who retire, die, or leave the industry for other reasons. Competition will be very keen for entry positions because this field traditionally attracts large numbers of jobseekers. Most entry positions are likely to be available in small stations as stations in major metropolitan areas such as New York City and Los Angeles generally seek highly experienced personnel. The value of work experience in this industry cannot be overemphasized. Students who gain experience through internships or part-time work should have the best job prospects.

The Federal Communications Commission, through its standards and policies, determines the number of new stations that are allowed to go on the air. The demand for additional broadcasting in small communities may lead to the emergence of new stations there. However, because advertising expenditures are the source of revenue for commercial broadcasters, such stations are concentrated in major metropolitan areas. The number of noncommercial stations is expected to increase as government and private funding continues to expand.

Technological developments, however, are likely to limit employment growth in some broadcasting occupations. For example, automatic programming equipment that permits radio stations to provide virtually unattended programming may reduce the demand for announcers. In addition, the increased use of remotely controlled transmitters may limit growth in engineering and technician jobs.

Cable television (CATV) has emerged as a powerful new force in communications. By using cables instead of airwaves, CATV can offer customers a larger selection of stations plus many additional programs produced specifically for cable television. Additional job opportunities for professional, technical, maintenance, and other workers will be created as CATV systems increasingly originate and transmit programs to thousands of American communities. Many of these new



jobs will be in small cities where most CATV systems are located to improve television reception in rural areas.

Earnings

In 1978, earnings of nonsupervisory broadcasting workers averaged $6.56 an hour, compared to an average of $5.69 an hour for nonsupervisory workers in all private industry, except farming. Salaries vary widely among occupations and locations in the broadcasting industry. In addition to top broadcasting executives, experienced sales personnel are among the most highly paid workers in this industry. Employees in large cities generally earn much more than those in the same kinds of jobs in small towns. Salaries tend to be higher in large stations than in small ones, and higher in television than in radio.

Most full-time broadcasting employees have a scheduled 40-hour workweek; employees in many small stations work a considerable amount of overtime. Sales and administrative employees generally work in the daytime hours common to most office jobs. However, program and engineering employees must work shifts which may include evenings, nights, weekends, and holidays.

Several unions operate in the broadcasting field. They are most active in the network centers and large stations in metropolitan areas. The National Association of Broadcast Employees and Technicians and the International Brotherhood of Electrical Workers both organize all kinds of broadcasting workers, although most of their members are technicians. The International Alliance of Theatrical Stage Employees and Moving Picture Machine Operators organizes various crafts, such as stagehands, sound and lighting technicians, wardrobe attendants, makeup artists, and camera operators. Many announcers and entertainers are members of the American Federation of Television and Radio Artists. The Directors Guild of America, Inc., (Ind.) organizes program directors, program assistants, and stage managers. The Screen Actors Guild, Inc., represents the majority of entertainers who appear on films made for television.

Sources of Additional Information

Booklets entitled *Careers in Radio* and *Careers in Television* are available from:

National Association of Broadcasters, 1771 N St. NW., Washington, D.C. 20036.

For information about colleges and universities that offer programs or course work in broadcasting, contact:

Broadcast Education Association, National Association of Broadcasters, 1771 N St. NW., Washington, D.C. 20036.

For more information on employment and trends in public radio and television broadcasting, write to:

Corporation for Public Broadcasting, 1111 16th St. NW., Washington, D.C. 20036.

For additional information on FCC licensure and employment in the various segments of the radio and television broadcasting industry, contact:

Federal Communications Commission, Policy Analysis Branch, 1919 M St. NW., Washington, D.C. 20554.

Occupations in the Railroad Industry

Trains are one of the most efficient methods of transporting large amounts of freight over distances exceeding several hundred miles. Locomotives can pull thousands of tons of cargo using fewer employees and far less fuel than trucks and airplanes. In 1978, the railroads hauled 1.4 billion tons of freight and carried 281 million passengers as well.

With 550,000 workers in 1978, the railroads were one of the Nation's largest employers. Railroad workers operate trains, build and repair equipment and facilities, provide services to customers, and collect and account for revenue. In most nonprofessional jobs, seniority systems prevail—workers start at the bottom and work their way up.

Nature and Location of the Industry

The railroad industry is made up of "line-haul" railroad companies that transport freight and passengers, and switching and terminal companies that provide line-haul railroads with services at some large stations and yards.

About 95 percent of all railroad employees work for line-haul companies that handle about 99 percent of the industry's business. The remainder work for switching and terminal companies. Most railroad revenue and employment come from freight. Passenger service has declined substantially in the past 30 years because the railroads have not been able to compete with the speed of the airlines or the convenience of private automobiles.

Railroad workers are employed in every State except Hawaii. Large numbers work at terminal points where railroads have central offices, yards, and maintenance and repair shops. Chicago, the hub of the Nation's railroad network, has more railroad employees than any other area, but many employees also work in the major railroad operations centered near New York, Los Angeles, Philadelphia, Minneapolis, Pittsburgh, and Detroit.

Occupations in the Industry

Railroad workers can be divided into four main groups: Operating employees; station and office workers; equipment maintenance workers; and property maintenance workers.

Operating employees make up almost one-third of all railroad workers. This group includes locomotive engineers, conductors, and brake operators. Whether on the road or at terminals and railroad yards, they work together as traincrews. Also included are switchtenders who help conductors and brake operators by throwing track switches in railroad yards and hostlers who fuel, check, and deliver locomotives from the engine house to the crew.

Trains are one of the most efficient methods of transporting large amounts of freight over long distances.

Another one-third of all railroad workers are *station and office employees* who direct train movements and handle the railroads' business affairs. Professionals such as managers, accountants, statisticians, and systems analysts do administrative and planning work. Clerks keep records, prepare statistics, and handle business transactions such as collecting bills and adjusting claims. Agents manage the business affairs of railroad stations. Telegraphers and telephoners pass on instructions to traincrews and help agents with clerical work.

More than one-fifth of all railroad employees are *equipment maintenance workers*, who service and repair locomotives and cars. This group includes car repairers, machinists, electrical workers, sheet-metal workers, boilermakers, and blacksmiths.

Property maintenance workers, who make up about one-fifth of all railroad employees, build and repair tracks, tunnels, signals, and other railroad property. Track workers repair tracks and roadbeds. Bridge and building workers construct and repair bridges, tunnels, and other structures along the right-of-way. Signal workers install and service the railroads' vast network of signals, including highway-crossing protection devices.

The accompanying chart shows the distribution of railroad employment among these four occupational groups in 1978. Detailed information about some occupations within these groups is given elsewhere in the *Handbook*.

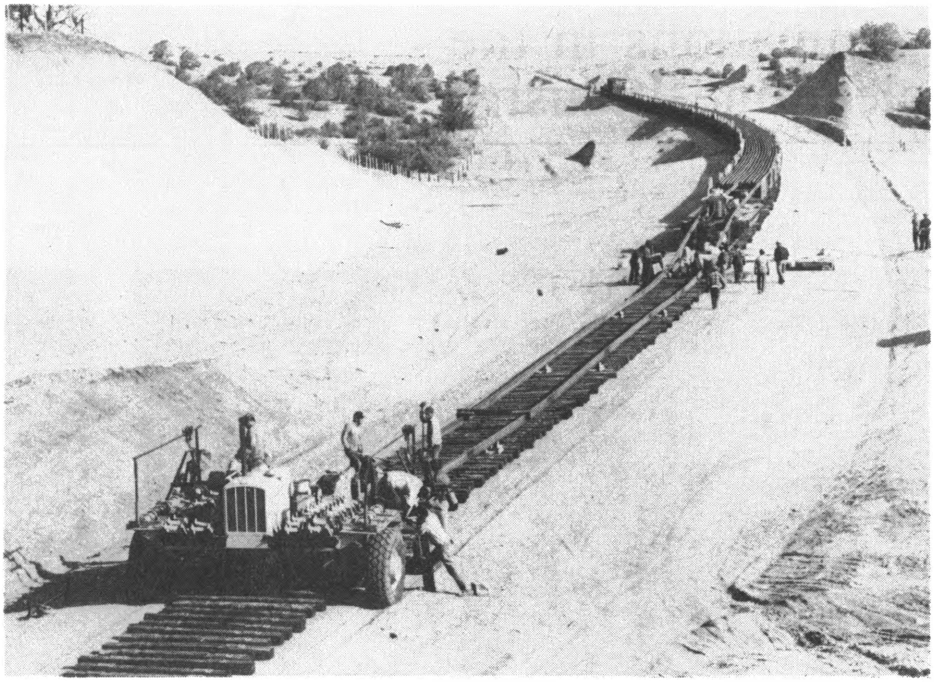
Working Conditions

Working conditions vary by occupation. Professionals, station agents, and most clerks work in an office environment. But other employees, such as brake operators, track workers, and signal installers, have strenuous, outdoor jobs.

Trains run 24 hours a day, 7 days a week. So while many railroad employees work a scheduled 40-hour week, operating, yard, and train control employees as well as those maintaining operating equipment may work nights, weekends, and holidays. New employees who are assigned to the "extra board" may be called to duty on short notice at any time. Bridge and building workers, signal installers, and track workers may work away from home for days at a time.

Training, Other Qualifications, and Advancement

Most beginning railroad workers are trained on the job by experienced employees.



Track workers repair tracks and roadbeds.

Training for some office and maintenance jobs is available in high schools and vocational schools. Universities and technical schools offer courses in accounting, engineering, traffic management, transportation, and other subjects that are valuable to professional and technical workers.

New employees in some occupations, especially in operating service jobs such as locomotive engineer, start as extra board workers. They substitute for regular workers who are on vacation, ill, or absent for other reasons. They also may be called when railroad traffic increases temporarily or seasonally.

Extra board workers with enough seniority move to regular assignments as they become available. The length of time a new worker spends on the extra board varies according to the number of available openings. Some workers do not receive regular assignments for many years.

Beginners in shop trades usually are high school graduates with no previous experience, although some shop laborers and helpers are promoted to the trades. Shopworkers serve 3- to 4-year apprenticeships, depending on their previous work experience.

Most applicants for railroad jobs must pass physical examinations. Those interested in traincrew jobs need excellent hearing and eyesight. Color-blind persons are not hired as locomotive engineers or brake operators or for any other jobs that involve interpreting railroad signals.

Railroad workers are promoted on the basis of seniority and ability. Job openings are posted on bulletin boards and workers may bid for them; the worker who is highest on the seniority list usually gets the job. To qualify for promotion, however, workers may have to pass written, oral, and practical tests. Advancement in train and engine jobs is along established lines. All conductors, for example, are chosen from qualified brake operators.

Besides determining advancement, seniority also gives workers some choice of working conditions. A telegrapher, for instance, may have to work several years on the night shift at out-of-the-way locations before finally getting a day shift assignment near home.

Employment Outlook

The long-run decline in railroad employment is expected to continue through the 1980's, but at a decreasing rate. Nevertheless, thousands of job opportunities will develop each year as the industry replaces some experienced workers who retire, die, or transfer to other fields of work.

Despite an expected increase in freight traffic, railroad employment will decline as technical innovations increase worker productivity. For example, as more yards install automatic classification systems, fewer yard workers will be needed to assemble and disassemble trains. The installation of wayside scanners, which identify cars electronically, will reduce the need for clerical workers.

Most people in passenger service may eventually work for AMTRAK, the National Railroad Passenger Corporation, created in 1971 to revive train passenger service.

Earnings

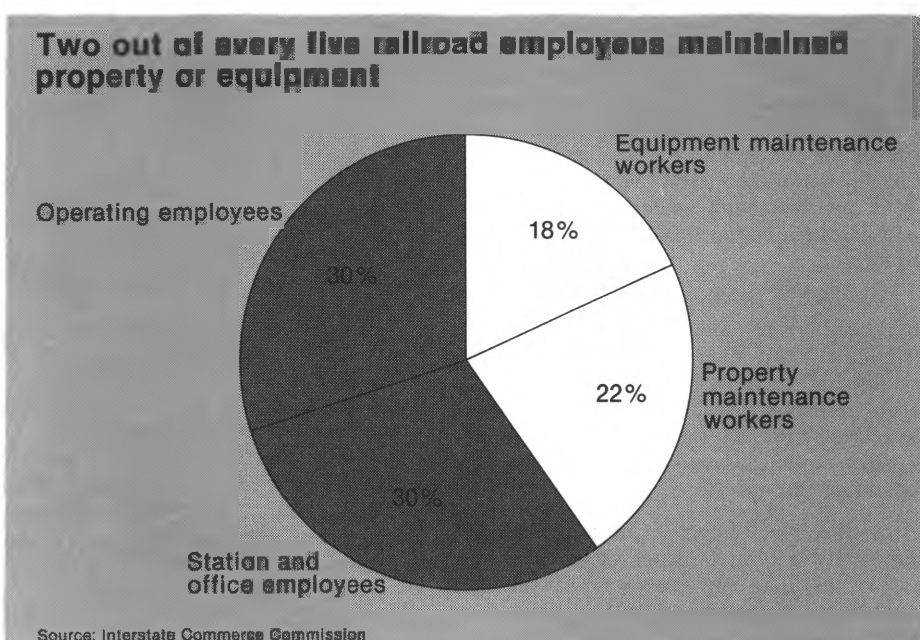
Nonsupervisory railroad employees averaged \$7.87 an hour in 1978, about two-fifths higher than the average for all nonsupervisory workers in private industry, except farming. Earnings of railroad workers vary widely, however, depending on the occupation. For example, in 1978 average hourly earnings for locomotive engineers in passenger service were \$13.84; for freight service brake operators, \$8.82; for railway clerks, \$7.47; and for track gang members, \$6.58. Regional wage differences are much less in railroading than in many other industries because of nationally negotiated labor contracts.

Most railroad employees work a 5-day, 40-hour week and receive premium pay for overtime. However, operating employees often work nights, weekends, and holidays.

Sources of Additional Information

Additional information about occupations in the railroad industry may be obtained from local railroad offices. For general information about the industry, write to:

Association of American Railroads, American Railroads Building, 1920 L St. NW., Washington, D.C. 20036.



Occupations in the Telephone Industry

Just about everyone has a telephone. Many households have two or more, and large businesses and organizations have hundreds. Some people have telephones in their cars and on their boats. A few even carry portable telephones like briefcases. There also are thousands of public telephones on street corners and in airports, restaurants, and stores. Altogether, more than 169 million telephones were in use in the United States in 1978, and people made over half a billon local and long-distance calls every day.

To provide all this service, telephone companies employed approximately 985,000 persons in 1978. Most worked in telephone craft occupations, in clerical occupations, or as telephone operators.

The telephone industry offers steady, year-round employment in jobs requiring a variety of skills and training. Most require a high school education; some can be learned on the job. Many require particular skills that may take several years of experience, in addition to the initial period of training.

Telephone jobs are found in almost every community, but most telephone employees work in cities that have large concentrations of industrial and business establishments. The nerve center of every local telephone system is the central office that contains the switching equipment through which one telephone may be connected with any other telephone. When a call is made, the signals travel from the caller's telephone through wires and cables to the cable vault in the central office. Here thousands of pairs of wires, including a pair for the caller's telephone, fan out to a distributing frame where each pair is attached to switching equipment. As the number is dialed, electromechanical and electronic switching equipment make the connection automatically, and, in seconds, the caller hears the telephone ringing. Only in a few remaining switchboards and in unusual situations does an operator make the connection.

Because some customers make and receive more calls than a single telephone line can handle, a system somewhat similar to a miniature central office may be installed on the customer's premises. This system is the private branch exchange (PBX), usually found in office buildings, hotels, department stores, and other business firms.

Another type of service for businesses is called CENTREX, in which incoming calls can be dialed to any extension without an operator's assistance, and outgoing and interoffice calls can be dialed by the extension users. This equipment can be located either on telephone company premises or on the customer's premises. CENTREX has replaced PBX in popularity among business and industrial users that handle a very large volume of calls. However, PBX is still more popular with smaller users.

The telephone industry offers steady, year-round employment in jobs requiring a variety of skills and training.

Other communications services provided by telephone companies include conference equipment installed at a PBX to permit conversations among several telephone users simultaneously; mobile radio-telephones in automobiles, boats, airplanes, and trains; and telephones equipped to answer calls automatically and to give and take messages by recordings.

Besides providing telephones and switching equipment, telephone companies build and maintain most of the vast network of cables and radio-relay systems for communications services, including those that join the thousands of broadcasting stations around the country. These services are leased to networks and their affiliated stations. Telephone companies also lease data and private wire services to business and government offices.

The Bell System owns slightly more than 4 out of 5 of the Nation's telephones. Approximately 1,500 independent telephone companies own the remainder. General Telephone and Electronics Corp., United Telecommunications, Inc., and Continental Telephone Corp., service about 2 out of every 3 telephones owned by independent companies.

Telephone Occupations

Although the telephone industry requires workers in many different occupations, telephone craft workers and operators make up more than one-half of all workers. (See accompanying chart.)

Telephone craft workers install, repair, and maintain telephones, cables, switching equipment, and message accounting systems. These workers can be grouped by the type of work they perform. Construction workers place, splice, and maintain telephone wires and cables; installers and repairers place, maintain, and repair telephones and private branch exchanges (PBX) in homes and offices and other places of business; and central office craft workers test, maintain, and repair equipment in central offices.

Operators make telephone connections; assist customers in specialized services, such as reverse-charge calls; and provide information. Detailed discussions of telephone craft occupations and telephone and PBX operators are presented elsewhere in the *Handbook*.

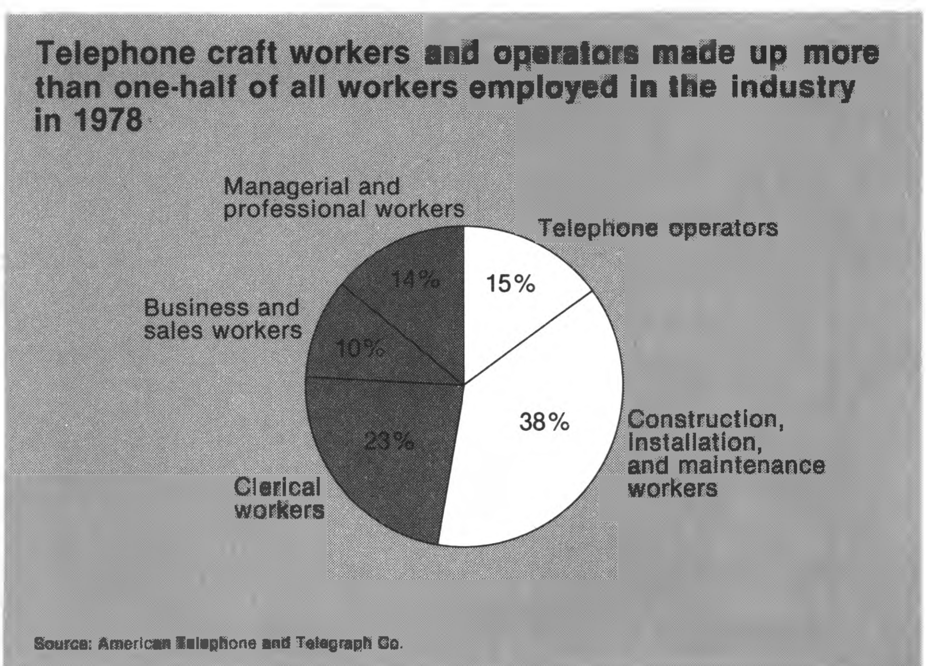
More than one-fifth of all telephone industry employees are clerical workers. They include stenographers, typists, bookkeepers, office machine and computer operators, keypunch operators, cashiers, receptionists, file clerks, accounting and auditing clerks, and payroll clerks. Clerical workers keep records of services, make up and send bills to customers, and prepare statistical and other reports.

About one-tenth of the industry's employees are professional workers. Many of these are scientific and technical personnel such as engineers and drafters. Engineers plan cable and microwave routes, central office and PBX equipment installations, new buildings, and the expansion of existing structures, and solve other engineering problems.

Some engineers also engage in research and development of new equipment, and persons with engineering backgrounds often advance to fill top managerial and administrative positions. Other professional and technical workers are accountants, personnel and labor relations workers, public relations specialists and publicity writers, computer systems analysts, computer programers, and lawyers.

About 1 in every 10 of the industry's employees is a business or sales representative. These employees sell new communications services and directory advertising and handle requests for installing or discontinuing telephone service.

About 3 percent of the industry's workers maintain buildings, offices, and warehouses; operate and service motor vehicles; and do other maintenance jobs in offices and plants. Skilled maintenance workers include stationary engineers, carpenters, painters, electricians, and plumbers. Other workers employed by the telephone industry are janitors, porters, and guards.



Employment Outlook

Telephone industry employment is expected to increase more slowly than the average for all industries through the 1980's. Some new jobs will be created in response to increased demand for telephone services, and tens of thousands of openings will arise each year as workers retire, die, or leave for other reasons.

Employment will grow primarily because higher incomes and a larger and more mobile population will increase the use of telephone service. Greater demand for transmission of computer-processed data and other information via telephone company lines also will stimulate employment growth. Laborsaving innovations, however, will keep employment from growing as rapidly as telephone service.

Employment of telephone operators is expected to decline. As the number of telephone companies charging customers for directory assistance calls increases, more people will dial numbers directly and use telephone directories to locate needed numbers, thus reducing the need for operators. Also, improved switching equipment will allow more calls to be connected without an operator's assistance, and more advanced billing systems will automatically relay billing information to computerized files that are used in preparing customer's billing statements. Technological innovations will restrict employment growth in some skilled crafts. For example, mechanical improvements, such as pole-lifting equipment and earth-boring tools, have limited the employment of line installers by increasing their efficiency.

New technology, however, is expected to increase the demand for engineering and technical personnel, especially electrical and electronic engineers and technicians, computer programers, and systems analysts. Employment in administrative and sales occupations will rise as telephone business increases.

Earnings and Working Conditions

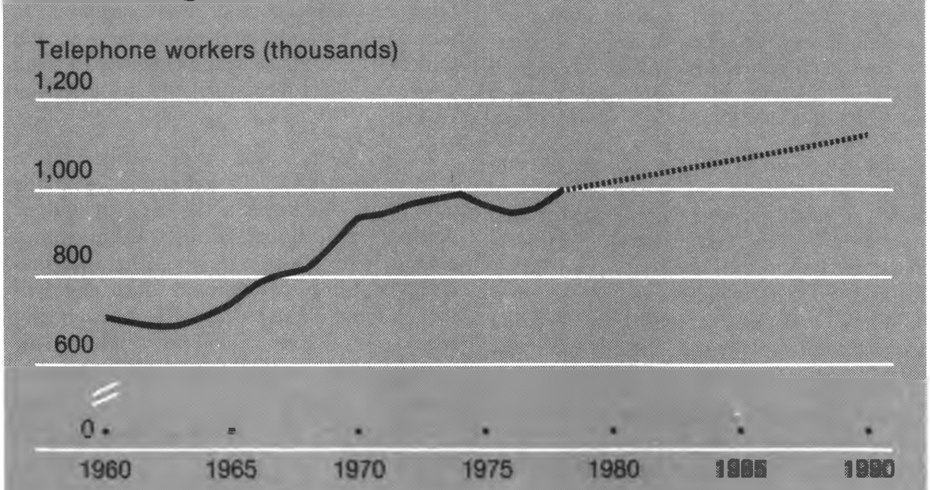
In 1978, nonsupervisory telephone employees averaged $7.50 an hour compared with $5.69 for nonsupervisory workers in all private industries, except farming.

In late 1978, basic rates ranged from an average of $4.31 an hour for telephone operator trainees to $13.35 for professional and semiprofessional workers other than drafters.

A telephone employee usually starts at the minimum wage for the particular job. Advancement from the starting rate to the maximum rate generally takes 5 years, but operators and clerical employees of some companies may reach the maximum in 4 years.

More than two-thirds of the workers in the industry, mainly telephone operators and craft and clerical workers, are members of labor unions. The two principal unions are the Communications Workers of America and the International Brotherhood of Electrical Workers, but many other employees

Although employment in the telephone industry is sensitive to economic conditions, growth is expected in the long run



Source: Bureau of Labor Statistics

are members of the independent unions that form the Telecommunications International Union.

Union contracts govern wage rates, wage increases, and the time required to advance from one step to the next for most telephone workers. Contracts also call for extra pay for work beyond the normal 8 hours a day, or 5 days a week, and for all Sunday and holiday work. Most contracts provide a pay differential for night work.

Overtime sometimes is required, especially during emergencies, such as floods or hurricanes. During an "emergency call-out," which is a short-notice request to report for work during nonscheduled hours, workers are guaranteed a minimum period of pay at the basic hourly rate. Some contracts count travel time between jobs as worktime.

Paid vacations are granted according to length of service. Usually, contracts provide for a 1-week vacation beginning with 6 months of service; 2 weeks for 1 to 7 years; 3 weeks for 8 to 14 years; 4 weeks for 15 to 24 years; and 5 weeks for 25 years and over. Depending on locality, holidays range from 9 to 11 days a year. Most telephone workers are covered by paid sick leave and group insurance plans, which usually provide sickness, accident, and death benefits and retirement and disability pensions.

The telephone industry has one of the best safety records in American industry. The number of disabling injuries has been well below the average.

Sources of Additional Information

More details about employment opportunities are available from the telephone company in your community or local offices of the unions that represent telephone workers. If no local union is listed in the telephone directory, write to:

Telecommunications International Union, P.O. Box 5462, Hamden, Conn. 06518.

United States Independent Telephone Associaton, 1801 K St. NW., Suite 1201, Washington, D.C. 20006.

Occupations in the Trucking Industry

In 1978, the trucking industry employed over 1.3 million workers—more than the rival rail, air, and pipeline transportation industries combined. It offers many opportunities to persons not planning to attend college, since nearly 90 percent of its employees are freight handlers, drivers, truck maintenance personnel, or clerical workers—occupations which only require a high school education.

Nature and Location of the Industry

The trucking industry is made up of companies that sell transportation and storage services. Although some trucking companies serve only a single city and its suburbs, and others carry goods only between distant cities, most large trucking firms provide both local and long-distance service. Some firms haul only one type of product and therefore use only one type of truck. For example, they may carry steel rods on flat trailers or grain in open-top vans. Trucking companies may operate either as contract carriers hauling commodities of one or a few shippers exclusively or as common carriers offering transportation services to businesses in general.

Trucking companies vary widely in size. While a few employ several thousand workers, many others are owner-operated, with the owner doing the driving.

Trucking industry employees work in cities and towns of all sizes and are distributed much the same as the Nation's population.

Occupations in the Industry

About four-fifths of all trucking industry employees are blue-collar workers. Most are truckdrivers, but the industry also employs a large number of material handlers, mechanics, washers and lubricators, and supervisors. Most white-collar employees are clerical workers, such as secretaries and rate clerks, and administrative personnel, such as terminal managers and accountants. The duties of some of these occupations are described briefly in the following sections.

Truckdriving Occupations. More than half of the industry's employees, about 620,000 workers, are drivers. *Long-distance truckdrivers* spend their working hours driving large trucks or tractor-trailers between freight terminals in cities that may be hundreds of miles apart. Some load and unload their trucks, but the usual practice is to have other employees do this work. *Local truckdrivers* operate trucks over short distances, usually within one city and its suburbs. They pick up goods from, and deliver goods to, trucking terminals, businesses, and homes in the area.

Clerical Occupations. About 13 percent of the industry's employees are clerical workers. Although many have general clerical jobs, such as secretary or clerk-typist, which are common to all industries, others have specialized jobs. For example, *dispatchers* (D.O.T. 249.167-014) coordinate the movement of trucks and freight into and out of terminals, make up loads for specific destinations, assign drivers and develop delivery schedules, handle customers' requests for pickup of freight, and provide information on deliveries. *Claims adjusters* (D.O.T. 241.367-014) handle claims for freight lost or damaged during transit. *Manifest clerks* (D.O.T. 214.362-014) prepare forms that list details of freight shipments. *Parts-order clerks* (D.O.T. 249.367-058) supply mechanics with replacement parts for trucks; they also take care of most of the clerical duties needed to maintain a truck repair shop.

Administrative and Related Occupations. Administrators make up about 7 percent of the industry's employees. Top executives manage companies and make policy decisions while middle managers supervise the operation of individual departments, terminals, or warehouses. Larger companies employ accountants to maintain financial records and lawyers to provide legal advice. Some firms also employ sales representatives to solicit freight business.

Material Handling Occupations. About 7 percent of the industry's employees load and unload trucks at warehouses. Much of this work is done by *material handlers* (D.O.T. 929.687-030) working in groups of three of four under the direction of a dock supervisor or gang leader. Material handlers load and unload freight using handtrucks, conveyors, and other devices. Heavy or bulky items are moved by *power truck operators* (D.O.T. 921.683-050) and *crane operators* (D.O.T. 921.663-010). Gang leaders determine the order in which items will be loaded, so that the cargo is balanced and items to be unloaded first are near the truck's door. *Truckdrivers' helpers* (D.O.T. 905.687-010) travel with drivers to unload and pick up freight. Occasionally, helpers may do relief driving.

Truck Maintenance Occupations. About 5 percent of the employees maintain the trucks. *Truck mechanics* (D.O.T. 620.261-010) keep trucks and trailers in good running condition. Much time is spent on preventive maintenance to assure safe operation, to check wear and damage to parts, and to reduce breakdowns. When breakdowns do occur, these workers determine the cause and make the necessary repairs. *Truck mechanic helpers* (D.O.T. 620.684-014) and apprentices assist experienced mechanics in inspection and repair work. *Truck lubricators* and *washers* (D.O.T. 915.687-018 and 919.687-014) clean, lubricate, and refuel trucks, change tires, and do other routine maintenance.

Detailed discussions of administrative, clerical, mechanical, truckdriving, and other occupations found in the trucking industry as well as in many other industries are presented elsewhere in the *Handbook*.

Working Conditions

Working conditions vary greatly among occupations in the industry. For truckdriv-

Many truckdrivers start out as dock workers, loading and unloading freight.

ers, maneuvering large trucks in fast-moving traffic can cause tension, but more comfortable seating, power steering, and air-conditioned cabs have reduced physical strain. Long-distance drivers frequently work at night and may spend time away from home; local drivers usually work during the day. Material handlers and truckdrivers' helpers have strenuous jobs, although conveyor systems and other freight handling equipment have reduced some of the heavier lifting, making the work easier and safer. Truck mechanics and other maintenance personnel may have to work in awkward or cramped positions while servicing vehicles and frequently get dirty because of the grease and oil on the trucks. In addition, most maintenance shops are hot in summer and drafty in the winter, and mechanics occasionally must make repairs outdoors when a truck breaks down on the road.

Many large organizations operate around the clock and require some material handling and maintenance personnel to work evenings, nights, and weekends.

Training, Other Qualifications, and Advancement

Workers in blue-collar occupations usually are hired at the unskilled level, as material handlers, truckdrivers' helpers, lubricators, and washers. No formal training is required for these jobs, but many employers prefer high school graduates. Applicants must be in good physical condition. New employees work under the guidance of experienced workers and supervisors while learning their jobs; this usually takes no more than a few weeks. As vacancies occur, workers advance to more skilled blue-collar jobs, such as power truck operator and truckdriver. The ability to do the job and length of service with the firm are the primary qualifications for promotion. Material handlers who demonstrate supervisory ability can become gang leaders or dock supervisors.

Qualifications for truckdriving jobs vary and depend on individual employers, the type of truck, and other factors. In most States, drivers must have a chauffeur's license, which is a commercial driving permit obtained from State motor vehicle departments. The U.S. Department of Transportation establishes minimum qualifications for drivers who transport goods between States. They must be at least 21 years old, be able-bodied, have good hearing, and have at least 20/40 vision with or without glasses. However, many firms will not hire long-distance drivers under 25 years of age. Drivers also must be able to read, speak, and write English well enough to complete required reports. Drivers must have good driving records.

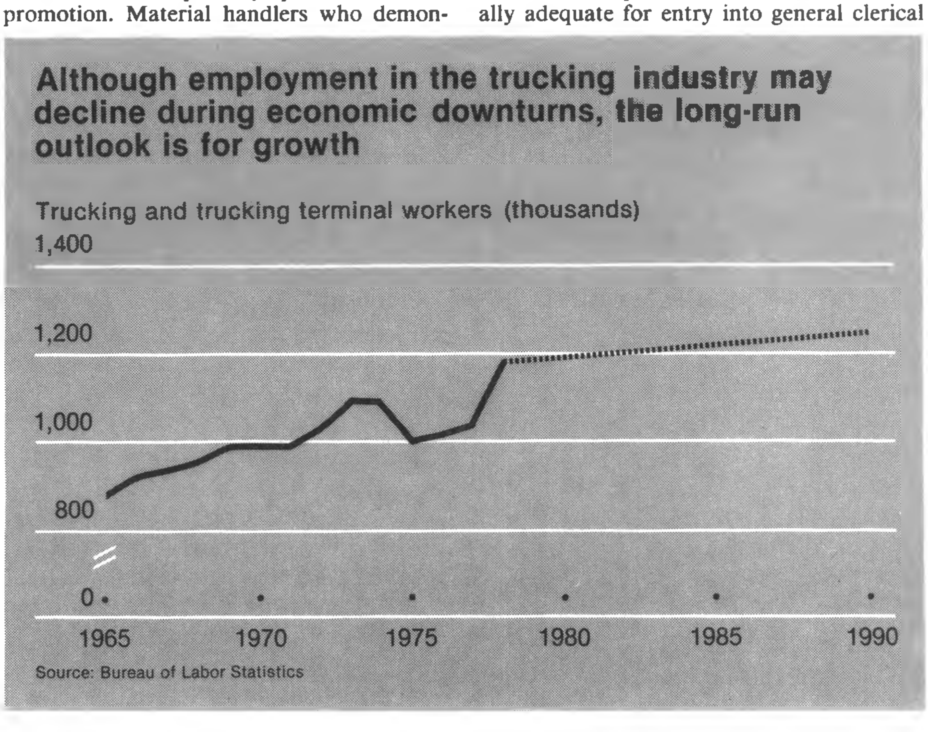
People interested in professional driving should take the driver-training courses offered by many high schools. A course in automotive mechanics also is helpful. Private truckdriving training schools offer another opportunity to prepare for a driving job; however, completion of such a course does not assure employment as a driver.

Most truck mechanics learn their skills informally on the job as helpers to experienced mechanics. Others complete formal apprenticeship programs that generally last 4 years and include on-the-job training and related classroom instruction. Unskilled workers, such as lubricators and washers, frequently are promoted to jobs as helpers and apprentices. However, many firms will hire inexperienced people, especially those who have completed courses in automotive mechanics, for helper or apprentice jobs.

Completion of commercial courses in high school or in a private business school is usually adequate for entry into general clerical occupations such as secretary or typist. Additional on-the-job training is needed for specialized clerical occupations such as claims adjuster.

Generally, no specialized education is needed for dispatcher jobs. Openings are filled by truckdrivers, claims adjusters, or other workers who know their company's operations and are familiar with State and Federal driving regulations. Candidates may improve their qualifications by taking college or technical school courses in transportation.

Administrative and sales positions frequently are filled by college graduates who have majored in business administration, marketing, accounting, industrial relations, or transportation. Some companies have management training programs for college graduates in which trainees work for brief periods in various departments to get a broad understanding of trucking operations before they are assigned to a particular department. High school graduates initially employed in entry level jobs may be promoted to administrative and sales positions.



Employment Outlook

Employment in the trucking industry is expected to grow more slowly than the average for all industries through the 1980's. In addition to the job openings created by employment growth, thousands more will arise as experienced workers retire, die, or transfer to other fields. The number of jobs may vary from year to year, however, because the amount of freight fluctuates with ups and downs in the economy.

Trucks carry virtually all freight for local distribution and a great deal of freight between distant cities. As the volume of freight increases with the Nation's economic growth, employment in the trucking industry will rise. Employment will not increase as fast as the demand for trucking services, however, because technological developments will increase output per worker. For example, more efficient freight-handling methods—such as conveyors and draglines to move freight in and out of terminals and warehouses—will increase the efficiency of material handlers. Larger trucks as well as more efficient packaging techniques also will allow truckdrivers to carry more cargo.

Earnings

In 1978, nonsupervisory workers in the trucking industry averaged $7.90 an hour, compared with $5.69 an hour for their counterparts in all private industry, except farming. Earnings are relatively high in the trucking industry, because highly paid drivers represent a large proportion of employment; many long-distance drivers earn more than $500 a week.

Most employees are paid an hourly rate or a weekly or monthly salary. However, truckdrivers on the longer runs generally are paid on a mileage basis while driving. For all other worktime, they are paid an hourly rate.

A large number of trucking industry employees are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind).

Sources of Additional Information

For general information about career opportunities in the trucking industry, write to:

American Trucking Associations, Inc., 1616 P St. NW., Washington, D.C. 20036.

Information about specific jobs may be available from the personnel departments of local companies or the local offices of your State employment service.

WHOLESALE AND RETAIL TRADE

Wholesaling and retailing are the final stages in the transfer of goods from producers to consumers. Wholesalers assemble goods in large lots for distribution to retail stores, industrial firms, and institutions such as schools and hospitals. Retailers sell goods directly to consumers in a variety of ways—in stores, by mail, or through door-to-door selling. A list of the items sold by wholesale and retail businesses would include almost every item produced by industry—automobiles, clothing, food, furniture, and countless others.

In 1978, about 19.4 million people (not counting an estimated 1.7 million who were self-employed persons or unpaid family workers) worked in wholesale and retail trade. The largest number—14.5 million or about three-fourths of them—were employed in retail trade. The majority held jobs in department stores, food stores, and restaurants and other eating places. About 4.9 million people worked in wholesale trade.

White-collar workers predominate in these industry divisions. As shown in the accompanying chart, sales workers make up more than one-fifth of total industry employment. Managerial workers constitute another one-fifth of the work force; included in this group are buyers, sales managers, and credit managers. Clerical workers make up over one-sixth of the work force; many hold jobs as cashiers, especially in supermarkets and other food stores. Other important clerical occupations in retail trade are secretaries, typists, office machine operators, bookkeepers, and accounting clerks. Large numbers of shipping and receiving clerks work in both wholesale and retail trade.

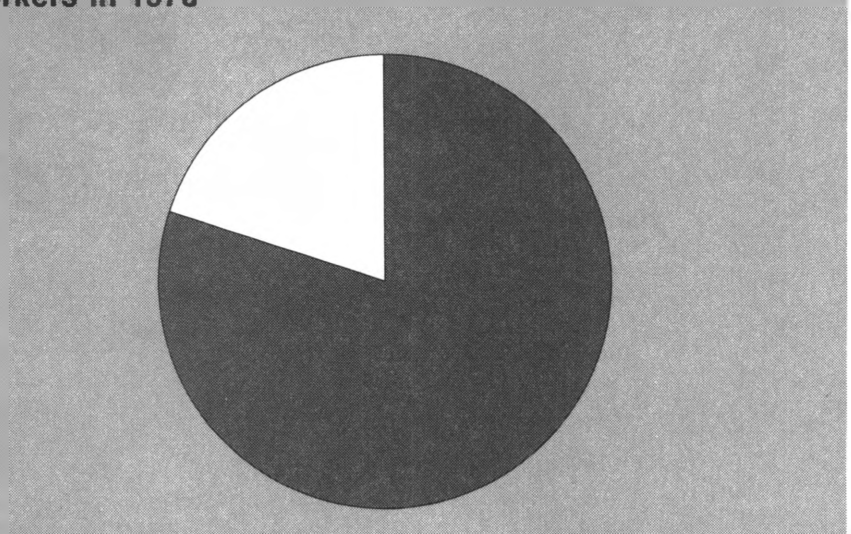
Blue-collar workers (craft workers, operatives, and laborers) constitute nearly one-fourth of the industry's jobholders. Many work as mechanics and repairers, gas station attendants, drivers and delivery workers, meatcutters, and material handlers. Most mechanics work for motor vehicle dealers and gasoline service stations. A large number of meatcutters work in wholesale grocery establishments and in supermarkets and other food stores.

Service workers, employed mostly in retail trade, constitute about 1 out of 6 workers in the industry. Food service workers, such as waitresses and cooks, make up by far the largest concentration of service workers. Other large groups of service workers are janitors, cleaners, and guards.

Employment in wholesale and retail trade is expected to increase about as fast as the average for all industries through the 1980's as sales rise in response to growth in population and income. Due to laborsaving innovations, employment will not grow as fast as sales. The use of computers for inventory control, reordering, customer billing, and other tasks will limit the need for additional clerical workers. Improved methods of handling and storing merchandise will limit the demand for laborers.

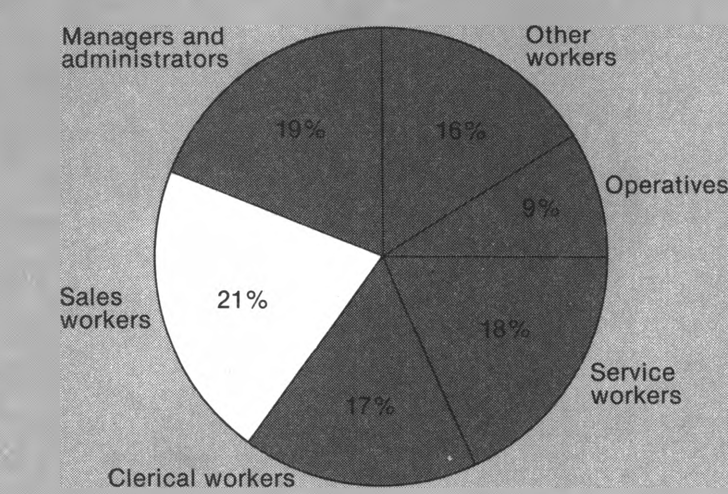
The statements that follow discuss job opportunities in restaurants and food stores. More detailed information about occupations that cut across many industries appears elsewhere in the *Handbook*.

Wholesale and retail trade employed 20 percent of all workers in 1978



Source: Bureau of Labor Statistics

Sales occupations account for only 1 out of every 5 workers in retail and wholesale trade



Source: Bureau of Labor Statistics

Occupations in the Restaurant Industry

Nature and Location of the Industry

In 1978, the restaurant industry was the third largest industry in the country, employing more than 4.2 million people in establishments ranging from coffee shops to luxurious restaurants. The type of food and service a restaurant offers varies with its size and location, as well as with the kind of customer it seeks to attract. Fast-food restaurants and cafeterias emphasize rapid service and low or moderate cost food items. Steak houses and pizza places consider the quality of their specialty most important. some restaurants cater to customers who wish to eat a leisurely meal in elegant surroundings and their menus often include unusual dishes or "specialties of the house."

While most restaurants today are small, with less than 10 paid employees, extensive chain operations are assuming a larger share of the restaurant market. These larger operations are either franchised or corporately owned, with central commissaries distributing food to individual restaurants, rather than the chef or owner of each restaurant buying products on a daily or weekly basis.

Restaurant jobs are found almost everywhere. Although employment is concentrated in the States with the largest populations and particularly in large cities, even very small communities have sandwich shops and roadside diners.

Occupations in the Industry

Nearly three-fourths of all restaurant employees prepare and serve food, and keep cooking and eating areas clean. Waiters and waitresses, and cooks and chefs make up the two largest groups of workers. Others are counter workers, who serve food in cafeterias and fast-food restaurants; bartenders, who mix and/or serve drinks; dining room attendants, who clear tables, carry soiled tableware back to the kitchen, and sometimes set tables; dishwashers, who wash dishes and help keep the kitchen clean; pantry workers, who prepare salads, sandwiches, and certain other dishes; and janitors and porters, who dispose of trash, sweep and mop floors, and keep the restaurant clean. Some of these workers operate mechanical equipment such as dishwashers, floor polishers, and vegetable slicers. (Detailed information on cooks and chefs, waiters and waitresses, bartenders, food counter workers, and dining room attendants and dishwashers is given elsewhere in the *Handbook*.)

Managers and proprietors embody another large share of the restaurant work force, representing more than one-seventh of the total. Many are owners and operators of small restaurants and, along with managing the business, cook and perform other duties. Some work as salaried employees and manage restaurants for others.

Some restaurants cater to customers who wish to eat a leisurely meal in pleasant surroundings.

All other restaurant workers combined account for about one-sixth of total industry employment. Most are clerical workers—cashiers, who receive payments and make change for customers; food checkers, who total the cost of items selected by cafeteria customers; hosts and hostesses, who greet guests and supervise services; and bookkeepers, typists, and other office workers. A few restaurants employ dietitians to plan menus, supervise food preparation, and enforce sanitary regulations. Restaurant chains and some large restaurants employ mechanics and other maintenance workers, accountants, advertising or public relations directors, personnel workers, and musicians and other entertainers.

Working Conditions

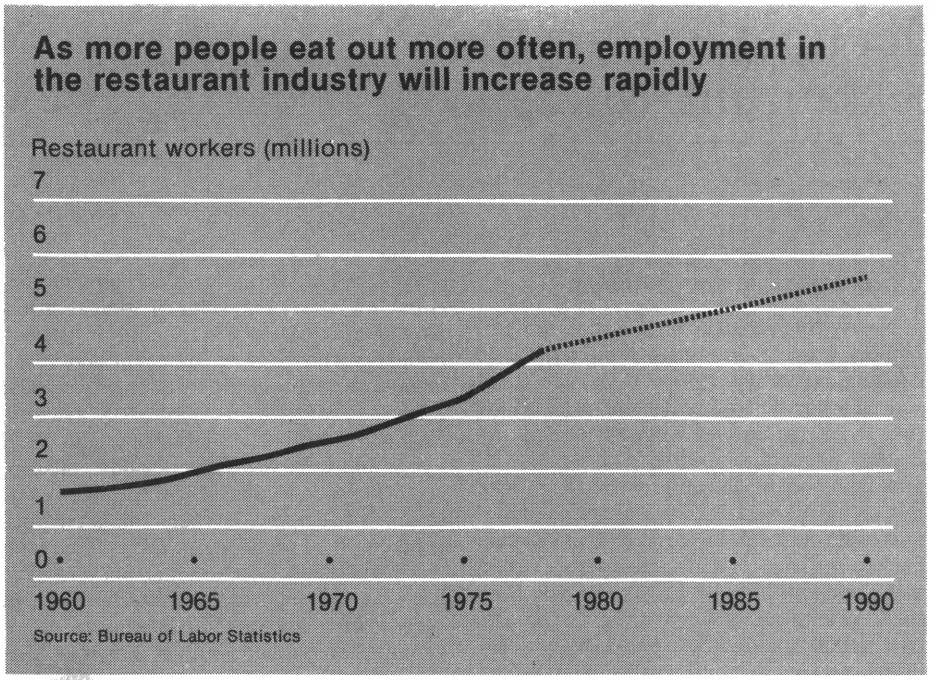
The schedule of full-time restaurant employees, working from 30 to 48 hours a week, often includes evenings, holidays, and weekends. Some must work split shifts, which means they are on duty for several hours during one meal, take some time off, and then return to work for the next busy period. Still other restaurant employees work rotating shifts, which change daily, weekly, or monthly.

Many restaurants have well-designed kitchens and dining room areas, and are furnished with up-to-date equipment and labor saving devices. Others might not be as well designed or equipped. In all restaurants, workers are expected to stand much of the time, lift heavy trays and pots, or work near hot ovens or steam tables. Work hazards include the possibility of burns; sprains from lifting heavy trays and other items; and slips and falls on wet floors.

Training, Other Qualifications, and Advancement

The skills and experience needed for restaurant work vary from one occupation to another. Some jobs require no special training or experience, while others require formal training or managerial experience. Requirements also vary from one restaurant to another; large restaurants usually have higher educational and experience standards than small restaurants.

Persons seeking employment in restaurants who do not have a high school education or previous experience usually begin as kitchen workers, dishwashers, or dining room attendants. Even though a high school education is not mandatory, some restaurants hire only high school graduates, and



some hire only experienced waiters and waitresses, cooks, and bartenders. Extensive training, apprenticeship, or years of experience are essential for chefs' positions.

Newly hired restaurant workers generally are trained on the job. Kitchen workers, for example, may be taught to operate a lettuce-shredder and to make salads. Waiters and waitresses are taught to set tables, take orders from customers, and serve food in a courteous and efficient manner. In many restaurants, new employees receive their training under the close supervision of an experienced employee or the manager. Large restaurants and some chain restaurant operations may have more formal programs that often include several days of training sessions for beginners. Some employers, such as fast-food restaurants, use instructional booklets and audio-visual aids to train new employees.

Many public and private high schools offer vocational courses for persons interested in restaurant training. Usually included are food preparation, catering, restaurant management, and other related subjects. Similar training programs are available for a variety of occupations through hotel and motel associations, restaurant associations, trade unions, technical schools, junior and community colleges, and 4-year colleges. Programs range in length from a few months to 2 years or more. The Armed Forces are another good source of training and experience in food service work.

When hiring food service workers, such as waiters and waitresses and cooks and chefs, employers look for applicants who have good health and physical stamina because the work is often rigorous. Because of the need to work closely with others and under considerable pressure, applicants should be able to remain calm under stress. In addition, a neat appearance and a pleasant manner are important for bartenders, waiters and waitresses, and other employees who meet the public. Advancement opportunities in restaurants vary among the occupations. They are best for cooks who may advance to chef, or supervisory or management positions, especially in hotels, clubs, or larger, more elegant restaurants. Experience as maitre d'hotel may lead to a position as director of food and beverage services in a large chain organization. For most other restaurant occupations, however, advancement within the operation is limited, principally because of the small size of most food service establishments. For some occupations, such as food counter workers in fast-food restaurants, advancement opportunities are passed up because most workers remain employed for only a short time.

Although many restaurant managers obtain their positions through hard work and advancement within a restaurant's staff, it is becoming increasingly important for restaurant managers to have formal training in hotel, restaurant, or institutional management. Graduates employed by hotels and restaurants usually go through a management training program before being given much supervisory and administrative responsibility. They often are hired as assistant managers or management trainees and subsequently advance to manager. From there it is possible, particularly in the large restaurant chains, to advance to a top management position. Those with access to the necessary capital may open their own eating places.

Employment Outlook

Employment in the restaurant industry is expected to increase faster than the average for all industries through the 1980's. In addition to the openings arising from employment growth, thousands of openings are expected each year due to turnover—the need to replace experienced employees who find other jobs or who retire, die, or stop working for other reasons. Turnover is particularly high among part-time workers, many of whom are students. As a result, there are plenty of jobs available in this industry for interested persons, including those with limited skills.

Most openings will be for waiters and waitresses and cooks—both because of their high replacement needs and because these workers make up a very large proportion of all restaurant employees. High school students make up a large percentage of the workers in fast-food restaurants. Employment opportunities also are expected to be favorable for food counter workers. The number of openings in clerical jobs, such as cashier, will be relatively small. A few openings will occur in specialized positions, such as food manager and dietitian.

Population growth, rising personal incomes, and more leisure time will contribute to a growing demand for restaurant services. Also, with the increasing number of women joining the work force, more and more families are finding dining out a welcome convenience. Fast-food and other chain restaurants are the fastest growing segment of this industry and are expected to need many more food service workers to serve their increasing number of customers. Rising worker productivity, however, will prevent employment from growing as rapidly as demand for restaurant services. Restaurants have become more efficient as fast-food service counters have become more popular, and as managers have centralized the purchase of food supplies, introduced self-service, and used precut meats and modern equipment. Many restaurants now use frozen entrees in individual portions, which require less time and skill to prepare than fresh foods.

Earnings

Earnings of restaurant workers depend on the location, size, type, and degree of unionization of the restaurant in which they work. Also, workers in the service areas receive tips in addition to their wages.

Table 1. Average hourly earnings in selected restaurant occupations, 1978

Occupation	Hourly rate range[1]
Chef	$3.68–$7.15
Bartender	3.34– 6.53
Cook	2.90– 6.36
Pantry worker	2.33– 4.97
Assistant cook	2.07– 4.97
Checker	1.99– 4.53
Kitchen helper	2.11– 4.50
Dishwasher	2.11– 4.28
Cashier	2.25– 4.13
Porter	2.11– 4.11
Food counter worker	1.70– 3.73
Waiter and waitress	1.31– 3.54
Dining room attendant	1.54– 3.53

[1]Excludes tips.

SOURCE: Bureau of Labor Statistics

In 1978, nonsupervisory workers in the restaurant industry averaged $3.21 an hour (excluding tips). Listed on the previous page is a range of hourly earnings for individual occupations based on data from union contracts covering eating and drinking places in several large cities.

Salaries of managerial workers differ widely because of differences in duties and responsibilities. Many people who had specialized training in restaurant management received starting salaries ranging from $11,500 to $13,500 annually in 1978. Managerial trainees without this background often started at lower salaries. Many experienced managers earned between $25,000 and $40,000 a year.

In addition to wages, restaurant employees usually get at least one free meal a day, and often are provided with uniforms. Waiters, waitresses, and bartenders also may receive tips.

The principal union in the restaurant industry is the Hotel and Restaurant Employees and Bartenders International Union (AFL-CIO). The proportion of workers covered by union contracts varies greatly from city to city.

Sources of Additional Information

For additional information about careers and training in the restaurant industry, write to:

National Institute for the Foodservice Industry, 20 North Wacker Dr., Suite 2620, Chicago, Ill. 60606.

American Hotel and Motel Association, 888 7th Ave., New York, N.Y. 10019.

Information on vocational education courses for restaurant work may be obtained from the local director of vocational education, the superintendent of schools in the local community, or the State director of vocational education in the department of education in the State capital.

Occupations in Retail Foodstores

Nature and Location of the Industry

Your local foodstore may be the place you visit to do your weekly grocery shopping, or the late-night mart where you go to pick up snacks when guests drop in unexpectedly. Or it could be one of the specialty stores where you go to buy such items as natural foods, baked goods, international delicacies, or dairy products. Each of these stores is a small part of a large industry—the retail foodstore industry—which employs about 2.3 million workers.

Jobs in foodstores vary, and workers range in education and training from high school dropouts to college-educated managerial and marketing professionals. Jobs in foodstores are especially attractive because employers often provide training and because the opportunities for promotion are good. The large number of opportunities for part-time employment may be of special interest to homemakers and students who do not want full-time jobs.

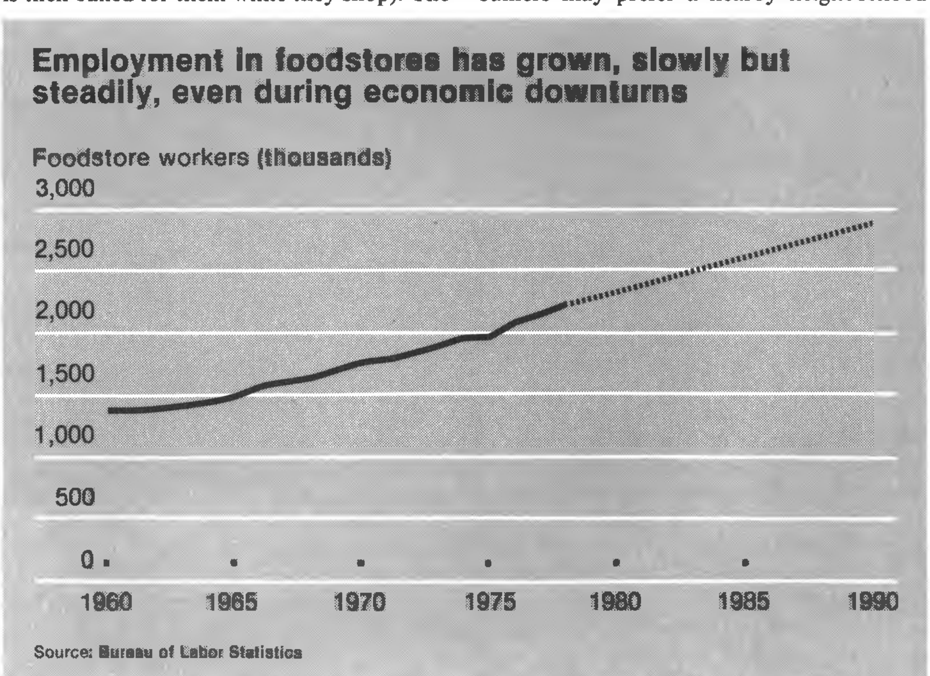
There are three basic types of foodstores: Supermarkets, which sell many items; small grocery stores, including convenience stores; and specialty foodstores, which emphasize a particular type of food or service.

In recent years, supermarkets have been expanding both in size and in the variety of items they offer for sale. In addition to traditional food items, many supermarkets now have large specialty food departments, delicatessen sections, and "bake-offs" (where customers can select prepared dough which is then baked for them while they shop). The range of nonfood items has been growing also, and often includes such merchandise as plants, automotive supplies, household goods, pharmaceutical products, alcoholic beverages, and even some clothing. Film processing, check cashing, money orders, and catering services are frequently offered.

Small neighborhood grocery stores are the most numerous of all foodstores. Besides a small selection of popular food items, they may feature "ethnic" foods. Usually, owners personally manage these stores and only employ additional help as needed. Few owners operate more than one store.

Convenience stores are a type of small grocery store that specializes in a rather limited selection of items that customers might want in a hurry. Although many items are priced higher than in supermarkets, customers are attracted by longer hours, fast service, and convenient location. As a result, supermarkets and small neighborhood grocery stores have lost some business to convenience stores in recent years.

Supermarkets and small grocery stores account for the overwhelming majority of establishments and employees in the industry. While a supermarket generally employs between 25 and 75 persons, the average number of paid employees in all retail foodstores is between 10 and 15. Because prices generally are lower than at any other type of foodstore, supermarkets attract customers who make many purchases. When only a loaf of bread or a quart of milk is needed, however, consumers may prefer a nearby neighborhood grocery store or a convenience store.



Specialty foodstores operate in much the same manner as small neighborhood grocery stores. However, they may feature only one type of food, such as dietetic or health food, bakery products, dairy products, or candy. Most are small and usually are operated by the owner and a few clerks. In recent years, as supermarkets have expanded their selection of goods and services, they have taken considerable business away from specialty stores.

Occupations in the Industry

About 40 percent of foodstore workers are either clerical employees—stock clerks, produce, dairy, frozen food, or grocery clerks, cashiers, and bookkeepers—or specialized department workers—meat cutters, meat wrappers, fruit and vegetable processors, and packers. Laborers, including stock and material handlers, order fillers, and warehouse selectors, make up about 25 percent of employment. Managers and administrators including buyers make up an additional 20 percent. The remaining 15 percent are accountants, personnel and labor relations workers, route drivers, truckdrivers, cleaning, food, and other service workers, sales workers, bakers, mechanics, and others. (Separate statements on many of these occupations appear elsewhere in the *Handbook*.)

Retail store managers (D.O.T. 185.167-046) coordinate store operations. They often plan work schedules, control advertising, ordering, pricing, and other aspects of merchandising, and always are concerned with customer relations. Other major responsibilities include store security, personnel matters, expense control, and planning possible competitive strategy.

Clerks (D.O.T. 290.477-018, 299.367-014) in supermarkets usually are called stock, grocery, or produce clerks. Stock clerks work in all parts of the store. They arrange food and other merchandise to create attractive displays. They help customers find what they want and perform general cleanup duties. In addition to marking prices on merchandise, they periodically take inventory and identify which items need to be replenished or reordered. Occasionally, they operate cash registers or bag groceries.

Grocery clerks keep the shelves in the grocery department filled with merchandise. For example, they may count the cans of soup on the shelves and in the stockroom and decide how much to reorder from the warehouse. Since storage space is limited, the order should include only as much as might be sold before another delivery from the warehouse will be made.

Produce clerks maintain the displays of fruits and vegetables. Because fruits and vegetables are perishable, clerks use special techniques to keep the stock attractive. Fruits and vegetables are rotated so that goods received in the store first are sold first. Lettuce and other greens are moistened and chilled to preserve crispness. In addition to caring for the displays, produce clerks help unload delivery trucks, keep the produce department clean, answer customers' questions, and weigh and package produce.

In large stores that have bakery and delicatessen departments, other clerks may work behind counters selling pastries, lunchmeats, salads, and other ready to eat items.

Meat cutters (D.O.T. 316.684-018) and *meat wrappers* (D.O.T. 920.587-018) order and prepare meats for sale. Since meat often is delivered to the store in large pieces, meat cutters use saws and knives to cut the large pieces into roasts, steaks, stew meats, and other meal-size portions. After the fat is cut away and bone chips are removed, the meat is placed in plastic trays ready to be wrapped.

Meat wrappers use a machine to wrap the package of meat in clear plastic. Then, the wrappers weigh the packages and attach labels the weighing machine has printed which identify the type of meat, weight, price per pound, and total price for each package.

At the checkout counter, cashiers ring up the price of each item on the cash register. Being aware of price changes on products is an important part of their job, since prices for produce and other items change frequently. In addition to ringing up prices, cashiers add sales tax, receive checks, money, food stamps and coupons, make change, and bag purchases. In some stores, cashiers use computerized checkout systems that automatically perform some of these functions. When not serving customers, cashiers clean counters and restock small convenience items, such as magazines or candy, displayed near the checkout counter.

Many supermarkets also employ *baggers* (D.O.T. 920.687-014) to bag groceries and carry them from the checkout counter to customers' cars. Cleaning and other service workers polish floors, clean windows, sanitize meat preparation rooms, and do other housekeeping jobs. The store manager observes the activities of each department, corrects problems as they arise, and is responsible for all activities and the store's success.

The central administrative offices of supermarket chains employ accountants, bookkeepers, buyers, personnel specialists, computer specialists, clerks, secretaries, and other office workers. Chainstores with their own distribution centers also employ many truckdrivers, stock clerks, and laborers in warehouses.

Working Conditions

Almost all foodstore employees must be able to stand for several hours at a time. Stock clerks must be capable of lifting cases of merchandise which weight up to 50 pounds, and meat cutters must be careful when handling knives and using machinery, such as electric saws. Because they frequently work in refrigerated rooms, meat cutters also must be able to tolerate low temperatures (35 to 50 degrees fahrenheit). The frequency and severity of injuries in retail foodstores have been somewhat higher than the average for all wholesale and retail trade.

Managers may work long hours, often staying after regular store hours to check work schedules, plan merchandising strategy, take inventory, or do paperwork. Successful store operation often depends on the manager's ability to delegate responsibility to assistants who run the store in his or her absence and to be responsive to customers' needs.

Training, Other Qualifications, and Advancement

In a large supermarket, a new employee often begins as a trainee in one of the following occupations: cashier; stock, grocery, or produce clerk; meat wrapper; or meat cutter. In some stores, however, new employees are trained as combination cashier-clerks.

When hiring trainees, employers look for high school graduates who are good at arithmetic. A neat appearance, an outgoing personality, and the ability to get along with people also are important. Cashiers, in particular, should be pleasant, courteous, quick, and accurate. Applicants who have less than a high school education may be hired if they qualify in other respects.

New workers learn their jobs mostly by helping and observing experienced employees. It may take a few years to qualify as a skilled meat cutter, but cashiers and produce clerks generally can learn their jobs in several months. Jobs as stock clerks and meat wrappers can be learned in even less time.

Before being assigned to a store, cashier trainees may attend a school operated by a supermarket chain. These short-term courses, which emphasize rapid and accurate operation of cash registers and computer assisted checkout systems, include instructions for treating customers courteously and for handling complaints. Trainees who pass the examination are assigned to a store to finish their training; those who fail may be hired for other jobs, such as stock clerk.

Some stores have meat cutter apprenticeship programs, which generally last 2 to 3 years, and include classroom instruction as well as on-the-job training.

Foodstores provide ambitious employees with excellent opportunities for advancement. In supermarkets, stock clerks frequently move up to better paying jobs as head clerks or grocery department managers. Produce clerks may advance to jobs as produce managers, produce buyers, or produce supervisors of several stores. Meat wrappers can learn to be cutters, and then advance to meat department managers. Cashiers and department managers may be promoted to front end managers, assistant managers and, eventually, managers of a supermarket. Advancement in small foodstores usually is limited, but employees may get all-round experience to start their own small businesses.

Many large firms have systematic training programs for manager trainees. Several years of experience generally are required before one becomes a store manager. Some attend a college or a training school or take special correspondence courses, often paid for by the company.

Some supermarket employees and managers advance to administrative jobs in their company's central offices. They may specialize in personnel, labor relations, buying, merchandising, advertising, consumer affairs, or research, or may become dairy, meat, delicatessen, produce, grocery, or nonfood specialists. Many of these jobs may require college training.

In cooperation with the Food Marketing Institute, Cornell University offers about 20 home study courses in management for food industry employees who wish to improve their chances for advancement. All employees are eligible to take these courses. Included are courses on food distribution, food warehousing and transportation, checkout management, store security, accounting, economics of food retailing, and others.

The National Association of Retail Grocers also offers several management workshops in cooperation with land grant universities.

Several universities offer bachelor's, master's, and doctoral programs in food distribution. These curriculums include special courses related to the retail foodstore industry in addition to general courses in management, marketing, finance, business, law, accounting, and economics. A number of other colleges, junior colleges, and technical institutes offer programs, courses, and workshops in this field. As the industry becomes more complex, firms may increasingly seek persons with formal training.

A person graduating from a food management curriculum with a bachelor's degree generally enters a store management trainee program or a sales position with a supplier. A graduate with an advanced degree generally enters a research or planning position with a firm.

Employment Outlook

Employment through the 1980's is expected to grow about as fast as the average for all industries. Large supermarkets and small convenience stores are expected to grow faster than other types of stores. In addition to new jobs created by growth, many openings will occur every year because of death, retirements, and other separations from the labor force. Relatively high turnover among nonmanagerial workers will continue to create many openings.

As population increases, more food will have to be distributed; this will increase foodstore sales and employment. However, employment is not expected to increase as rapidly as foodstore sales because technological innovations will increase employee productivity. For example, computer assisted checkout systems now are replacing mechanical registers in many stores, resulting in increased efficiency of operation. These systems consist of an optical or magnetic scanner that transmits the code number (Universal Product Code—UPC) of each purchase to a computer that is programed to record a description and the price of the item, add the tax, and print out a receipt. The computer can improve warehouse productivity by keeping track of the store's inventory and placing orders with the warehouse when needed. It also makes it easier for managers to keep track of the effects of various pricing strategies, and may help reduce losses due to cashier error. The development of scales for weighing and simultaneously marking meat and produce with UPC should encourage the adoption of the system.

Another innovation likely to affect future employment growth is the increased use of labor-saving methods of displaying merchandise. For example, the use of large bins or wire baskets of merchandise that can be moved into the display area on a forklift is reducing the need for shelf stocking in some stores.

Central cutting and packaging of meat and poultry have been in use for well over a decade, and are expected to continue to affect employment growth in the future.

Innovations or practices such as those mentioned above are expected to slow employment growth for many workers in the foodstore industry, including cashiers, clerks, meat cutters, meat wrappers, and material handlers. Overall, however, employment is expected to rise in response to an increasing population and the development of new communities.

Persons with college backgrounds in business administration, marketing, and related disciplines, and particularly graduates of food industry management curriculums, are expected to have the best opportunities for managerial, sales, research, planning, and other professional positons.

The outlook for part-time jobs as cashiers and stock clerks is very good. Large numbers of foodstore employees are students who are supplementing their income while attending school. After completing school, many leave for jobs in other industries. Other part-time employees also may work only for short periods. As a result, there are many part-time job opportunities that frequently can lead to full-time jobs.

Clerks arrange food to create an attractive display.

Earnings

Earnings of nonsupervisory workers in foodstores are among the highest in retail trade. In 1978, they averaged $5.24 an hour, compared with $4.19 an hour for nonsupervisory workers in retail stores as a whole.

Earnings vary considerably by occupation. Based on a 1977 Bureau of Labor Statistics survey of grocery stores, the top hourly union rates for full-time cashiers ranged from $3.72 to $7.64; for full-time grocery clerks, ranged from $3.72 to $7.73; for baggers, from $2.30 to $5.29, and for meat cutters,from $4.95 to $8.56.

In 1978, full-time experienced clerks and cashiers who were union members earned average hourly wages of $6.67. Union apprentice clerks and cashiers earned average hourly wages of $4.50.

Earnings tend to be highest in large stores in metropolitan areas; they are highest in the North Central region and the West and lowest in the South. Employees generally receive health insurance, annual and sick leave, pension benefits, and other benefits usually available to workers in other industries.

Based on limited information, management and sales trainees generally earned starting salaries of around $13,000 a year in 1978. Experienced managers may earn considerably more than this. As is the case with other retail foodstore employees, managerial salaries usually are highest in large stores in metropolitan areas. Research and planning positions generally pay considerably more than management or sales trainee jobs.

Many foodstore employees are union members. A large number of meat cutters, clerks, and other foodstore employees belong to the United Food and Commercial Workers International Union. Some are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.).

Sources of Additional Information

Details about employment opportunities are available from local foodstores and the local office of the State employment service. For additional information on some specific occupations in the industry, see separate statements elsewhere in the *Handbook*.

For additional information on careers in the retail foodstore industry, write to:

National Association of Retail Grocers of the United States, P.O. Box 17208, Washington, D.C. 20041.

FINANCE, INSURANCE, AND REAL ESTATE

Nearly every individual and organization uses the services provided by the finance, insurance, and real estate industries. Financial institutions such as banks, savings and loan companies, and consumer credit organizations offer services ranging from checking and savings accounts to handling stock and bond transactions. Insurance companies protect individuals and businesses against losses caused by fire, accident, sickness, and death. Real estate firms serve as agents in the sale or rental of buildings and property, and often manage large office and apartment buildings.

In 1978, more than 4.6 million persons worked in these fields. Finance alone employed over 2 million persons, another 1.6 million worked in the insurance industry, and the remainder, nearly 1 million, held jobs in real estate.

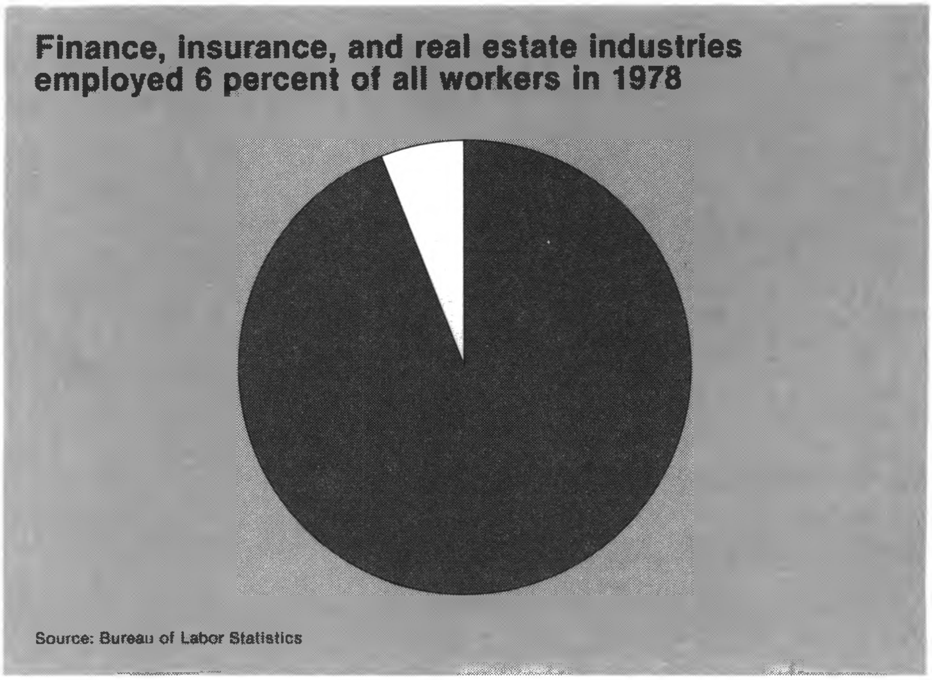
The overwhelming majority of these jobs are white collar. Clerical workers alone make up a large percentage of total employment. Although many types of clerical workers are unique to particular industries in this group, such as bank tellers in financial institutions and claim representatives in insurance companies, others, such as secretaries, typists, bookkeepers, and office machine operators are found in nearly all industries.

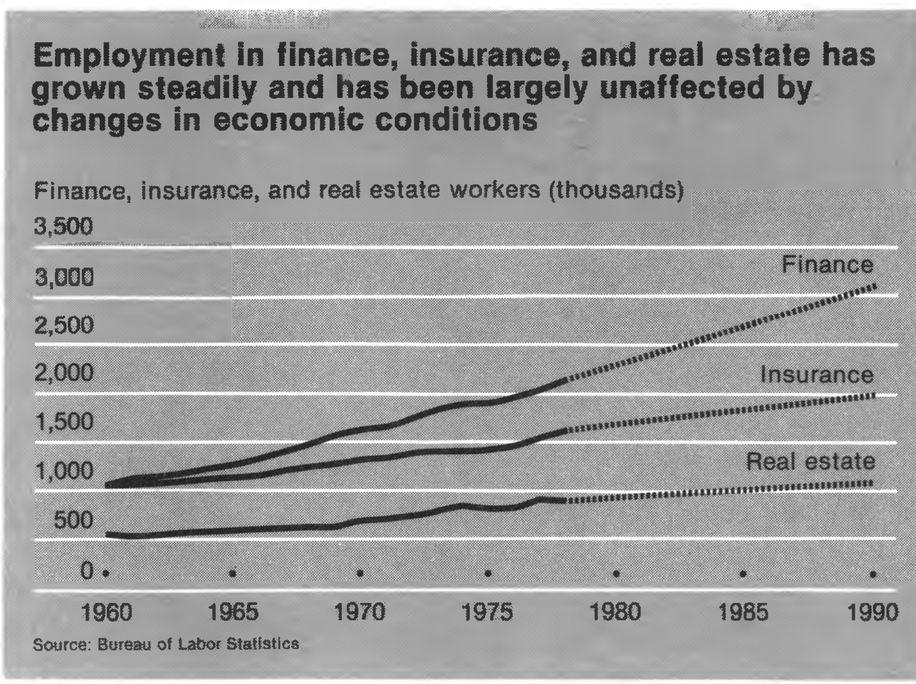
Finance, insurance, and real estate industries also employ large numbers of sales workers, mostly as insurance and real estate agents and brokers. A relatively small number of sales workers sell stocks and bonds.

Managers and officials, bank officers, and office managers, for example, make up yet another important part of employment, while professional and technical workers, such as accountants, lawyers, computer specialists, and financial analysts, account for a much smaller share.

Employment patterns differ somewhat, of course, among the finance, insurance, and real estate industries. Employment of sales workers, for example, differs greatly among the three industries. In real estate, they account for 40 percent of total employment or more than six times the average for the economy as a whole. Insurance companies employ a slightly lower, though still very large, share of sales workers. In finance, however, sales workers make up a much smaller part of total employment.

The situation for clerical occupations is the reverse of that for sales personnel. Clerical workers constitute a relatively small proportion of the work force in real estate compared





with about 50 percent in finance and insurance.

In all three industries professional and technical employees make up a very small share of the total, while the proportion of managers exceeds the average for the entire economy.

In the future, population, business activity, and personal incomes all are expected to rise and create a need to expand both the types of services offered and the number of establishments in these industries. The three industries are expected to grow at different rates, however, as shown in the accompanying chart.

Between 1978 and 1990, employment in

both finance and real estate is expected to grow faster than the average for all industries, while employment growth in insurance should be about as fast as the average. As the chart indicates, finance will grow about twice as fast as insurance, with real estate expanding at a more moderate pace.

Occupational growth rates also will vary, principally as a result of changes in technology or ways of doing business. For example, the increasing use of data processing should continue to lessen the demand for workers in routine clerical and recordkeeping functions but spur demand in computer occupations.

Occupations in the Banking Industry

Nature and Location of the Industry

Banks have been described as "department stores of finance" because they offer a variety of services ranging from individual checking accounts to letters of credit for financing world trade. Banks safeguard money and valuables; administer trusts and personal estates; and lend money to business, educational, religious, and other organizations. They lend money to individuals to purchase homes, automobiles, and household items, and to cover unexpected financial needs. Banks continually adapt their services to meet their customers' needs. In recent years, for example, they have offered revolving credit plans, charge cards, accounting and billing services, and money management counseling.

Banks employed approximately 1.4 million workers in 1978. Most bank employees work in very large commercial banks, which offer a wide variety of services. Others work in mutual savings banks, which offer more limited services—mainly savings deposit accounts, mortgage loans, safe-deposit rentals, trust management, money orders, travelers' checks, and passbook loans. Still others work in the 12 Federal Reserve Banks (or "bankers' banks") and their 24 branches as well as in foreign exchange firms, clearinghouse associations (where banks exchange checks and other credit papers), check cashing agencies, and other related organizations. In addition, nearly 725,000 people in 1978 performed similar work in savings and loan associations, credit unions, mortgage brokerage firms, and other nonbank credit agencies.

Most bank employees work in heavily populated States, such as New York, California, Illinois, Pennsylvania, and Texas. New York City, the financial capital of the Nation, has far more bank workers than any other city.

Occupations in the Industry

In 1978, commercial banks processed over 25 billion checks and handled an enormous amount of paperwork. Clerical workers account for nearly two-thirds of all bank employees. Many tellers or clerks process the thousands of deposit slips, checks, and other documents that banks handle daily. Banks also employ many secretaries, stenographers, typists, telephone operators, and receptionists.

Bank officers and managers constitute a large portion of employment in the banking industry. Approximately 1 out of 4 employees is an officer—a president, vice president, treasurer, comptroller, branch manager, loan officer, personnel officer, or other official. Professional and technical occupations, which make up a smaller segment of employment, include accountants, lawyers, labor relations workers, computer programmers and systems analysts, economists, and public relations specialists. Banks, like other institutions, also employ guards, elevator operators, and other service workers.

Three large occupational categories in banking—officers and managers, tellers, and clerks—are described in separate statements elsewhere in the *Handbook*.

Working Conditions

The workweek in banks is generally 40 hours or less; in some localities, a workweek of 35 hours is common. Tellers and some other employees may work at least one evening a week when banks remain open for business. Certain check processors and operators of computing equipment may work on evening shifts.

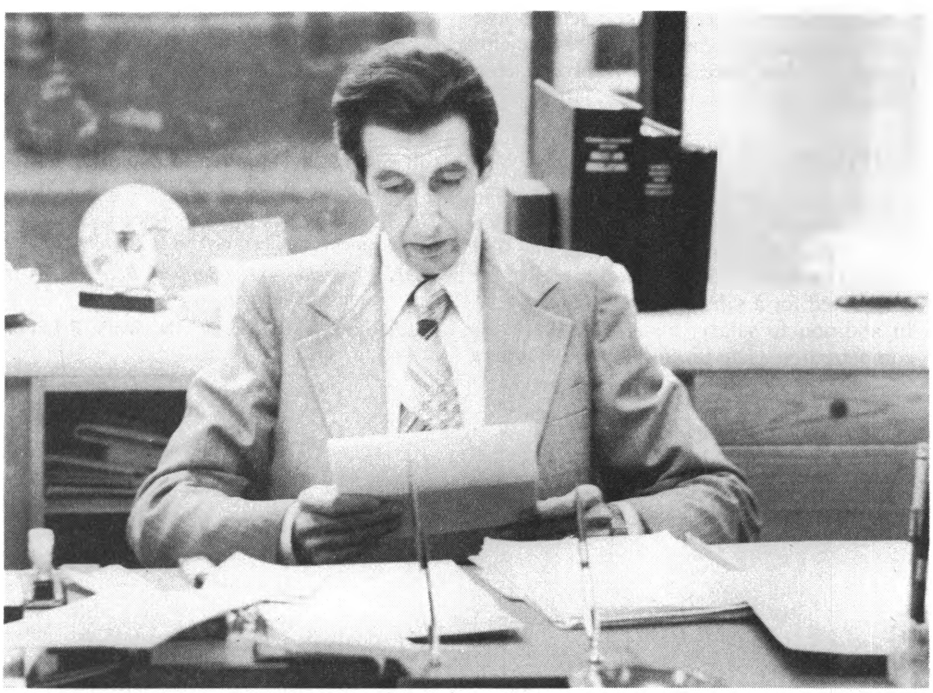
Training and Advancement

Professional and managerial bank workers usually have completed college; most tellers and clerks have finished high school; guards and building service personnel may have less than a high school education.

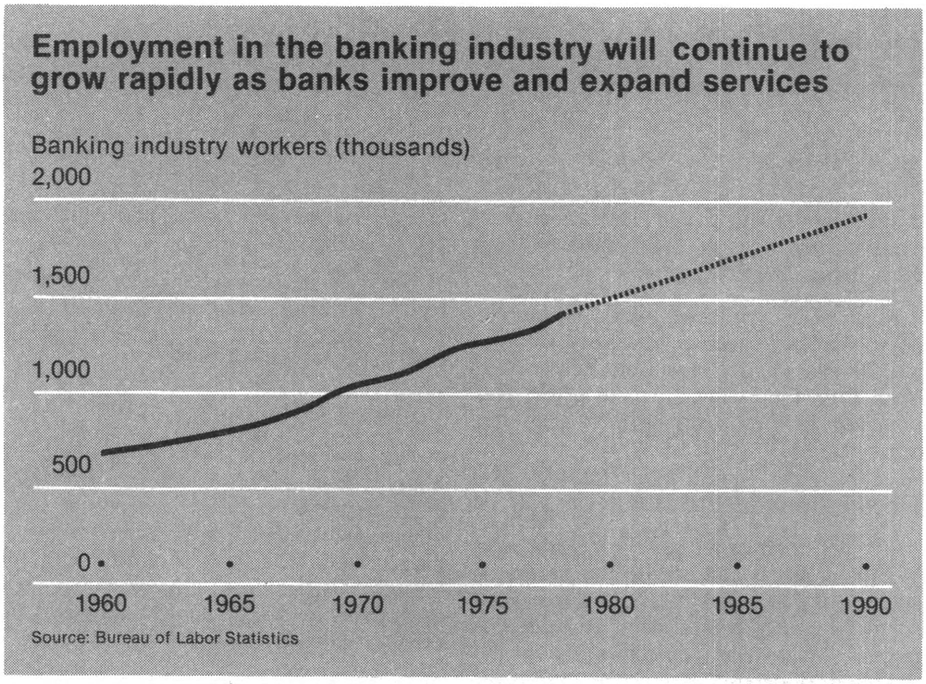
Most new employees receive some form of in-service bank training. Banks also provide other opportunities for workers to broaden their knowledge and skills. Many banks encourage employees to take courses at local colleges and universities. In addition, banking associations sponsor a number of programs, sometimes in cooperation with colleges and universities. The American Bankers Association (ABA) offers the most extensive national program for bank officers. Each of its dozen schools, located all over the country, deals with a different phase of banking. Those enrolled prepare extensively at home, then attend annual sessions of 1 or 2 weeks, and receive certificates after 1 to 3 years in areas such as commercial lending, installment credit, and international banking. ABA also sponsors annual seminars and conferences and provides textbooks and other educational materials. Many banks pay all or part of the costs for those who successfully complete courses.

Support personnel can prepare for better jobs through courses offered by the American Institute of Banking (AIB), an arm of the ABA. The institute, which has over 400 chapters in cities across the country and numerous study groups in small communities, also offers correspondence study and assists local banks in conducting cooperative training programs. The great majority of banks use AIB facilities; many banks use other training sources as well.

Banking employees should enjoy working with numbers and should be able to handle large amounts of money. They should present a good image to customers. Often bank



Bank officers must review a lot of correspondence.



officials are encouraged to participate in community activities.

Employment Outlook

Banks should continue to be a major source of job opportunities in office occupations. Banking employment is expected to rise faster than the average for all industries through the 1980's. New jobs resulting from expansion of banking activity as well as those that arise as employees retire, die, or stop working for other reasons, are expected to account for tens of thousands of openings each year. While a friend's referral may help an applicant get a foot in the door, especially in smaller establishments, most banks rely upon walk-in applicants as their single largest source of new personnel.

Most openings occur at the clerical level. High turnover among tellers should result in numerous job openings. Particularly strong demand is expected for secretaries and for office machine and computer operators.

Two kinds of opportunities exist for the college graduate: As trainees for officer or managerial positions, and as professional personnel such as accountants, auditors, statisticians, computer programmers, and system analysts.

A growth in bank facilities and a rise in population, sales, and incomes will result in more financial transactions. Jobs also will be created as banks continue to improve and expand services such as bank charge cards and the handling of accounts for retail stores. As banks bring these and other services to suburban areas, branch banks will grow in number and provide additional employment opportunities.

The continued conversion to electronic data processing may lessen demand for some bank workers, despite the expected increase in bank services. The effect of this development will vary by occupation, as indicated in the statements on specific banking occupations elsewhere in the *Handbook*.

Bank employees are less likely to be laid off during periods of low business activity than workers in many other fields. Even when a bank is sold or merged, workers seldom lose their jobs. Bank officials usually reduce employment, when necessary, by not replacing employees who leave.

Earnings

Salary practices in banks resemble those in many other industries. Most banks review a new employee's salary twice during the first year. Thereafter, employees generally are considered for a salary increase once a year. In addition to salary, many banks provide compensation as an incentive to outstanding performance, such as selling services or increasing deposits. The employee usually receives this compensation as an immediate or yearend bonus.

In addition to salaries, bank workers generally receive liberal fringe benefits. For example, most banks have some type of profit-sharing or bonus plan. Group plans that provide life insurance, hospitalization, surgical benefits, and retirement income are common. Sometimes free checking accounts or safe-deposit boxes also are provided. These fringe benefits, along with job stability, may compensate for the fact that banking salaries tend to be lower than those paid for comparable positions in other industries.

Sources of Additional Information

General information about banking occupations, training opportunities, and the banking industry itself is available from:

American Bankers Association, Bank Personnel Division, 1120 Connecticut Ave. NW., Washington, D.C. 20036.

National Association of Bank Women, Inc., National Office, 111 E. Wacker Dr., Chicago, Ill. 60601.

National Bankers Association, 499 S. Capitol St. SW., Suite 520, Washington, D.C. 20003.

For information about career opportunities as a bank examiner, contact:

Federal Deposit Insurance Corporation, Director of Personnel, 550 17th St. NW., Washington, D.C. 20429.

Information on careers with the Federal Reserve System is available from:

Board of Governors, The Federal Reserve System, Personnel Department, Washington, D.C. 20551, or from the personnel department of the Federal Reserve bank serving each geographic area.

State bankers' associations can furnish specific information about job opportunities. Writing directly to a particular bank to inquire about job openings also can produce favorable results. For the names and addresses of banks in a specific location as well as the names of their principal officers, consult one of the following directories, which are published twice each year:

The American Bank Directory (Norcross, McFadden Business Publications).

Bankers Directory—The Banker's Blue Book (Chicago, Rand McNally International).

Polk's World Bank Directory (Nashville, R.L. Polk & Co.).

Occupations in the Insurance Industry

The insurance industry offers many employment opportunities both for recent high school and college graduates and for experienced workers.

The 1,821 life and 2,800 property-liability (also called casualty) insurance companies do business in home and regional offices and also in thousands of sales offices throughout the country.

Nature of the Business

There are three major types of insurance: Life, property-liability, and health. Many insurance companies also offer mutual fund shares and variable annuities as additional investment choices for their customers. Some companies specialize in only one type of insurance; a growing number of large insurers now offer several lines.

Life insurance policies provide benefits to survivors upon the death of the insured. Some also provide policyholders with a steady income when they reach retirement age or if they become disabled; policies may be designed to help provide funds to educate children when they reach college age, or give extra financial protection while the children are young. Life insurance policies also may be used to protect business interests and to guarantee employee benefits. Property-liability insurance provides policyholders with protection against loss or damage to their property, and protects them from financial responsibility for injuries to others or damage to other people's property. It covers hazards such as fire, theft, and windstorm, as well as workers' compensation and other claims. Most life and property liability companies sell accident and health insurance, which helps policyholders pay medical expenses, and may furnish other benefits for an injury or illness.

An increasing number of insurance policies cover groups ranging from a few individuals to many thousands. These policies usually are issued to employers for the benefit of their employees. Most common are group life and health plans, although the number of group automobile and homeowner policies is growing rapidly. In 1978, group life insurance protected about 114 million persons; the number of policies was about 60 percent higher than 10 years earlier.

Insurance Workers

Almost 1.6 million people worked in the insurance business in 1978. The majority were in clerical and sales jobs. (See accompanying chart.) Nearly half of all insurance workers have clerical jobs; only the banking industry has a larger proportion of employees doing clerical work. In insurance, clerical workers keep records of premium payments, services, and benefits paid to policyholders. Most are secretaries, stenographers, typists, statistical clerks, office machine operators, or general office clerks. They do work similar to that of their counterparts in other businesses.

Other clerical workers have positions of greater responsibility that require extensive knowledge of some phase of insurance. They include *claim adjusters* (D.O.T. 241.217-010) and *claim examiners* (D.O.T. 241.267-018) who decide whether claims are covered by the policy, see that payment is made, and, when necessary, investigate the circumstances surrounding the claim. (See the statement on claim representatives elsewhere in the *Handbook.*)

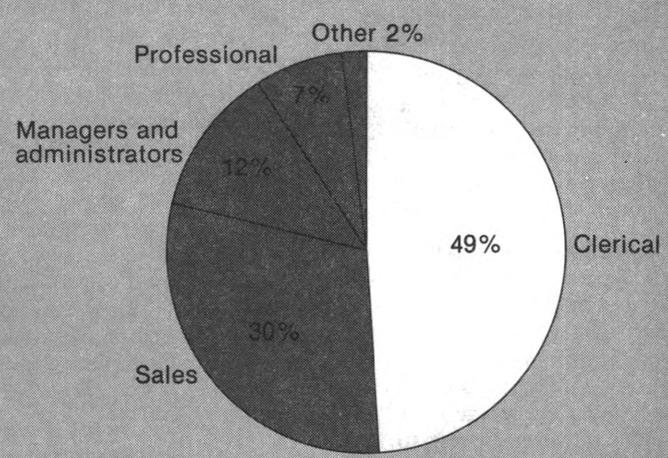
Nearly one-third of all insurance employees are sales workers—chiefly agents and brokers who sell policies to individuals and business firms. *Agents and brokers* (D.O.T. 250.257-010) usually find their own customers or "prospects," and see that each policy they sell meets the individual needs of the policyholder. (See the statement on insurance agents and brokers elsewhere in the *Handbook.*)

About one out of eight insurance workers has a managerial job. Managers of local sales offices often spend part of their time selling. Others, who work in home offices, are in charge of departments such as actuarial calculations, policy issuance, accounting, and investments.

Professionals, employed mainly at home offices, represent about 1 out of 15 insurance workers. These specialists, who work closely with insurance company managers, study insurance risks and coverage problems, analyze investment possibilities, prepare financial reports, and do other professional work. Among them is the *actuary* (D.O.T. 020.-167-010) whose job is unique to the insurance field. Actuaries make studies of the probability of an insured loss and determine premium rates. (See the statement on actuaries elsewhere in the *Handbook.*) Another specialist is the *underwriter* (D.O.T. 169.167-058), who evaluates insurance applications to determine the risk involved in issuing a policy. Underwriters decide whether to accept or reject the application; they also determine which premium rate should apply for each policy issued. (See the statement on underwriters elsewhere in the *Handbook*.)

Other professional employees do essentially the same work in insurance companies as in other businesses. Accountants, for example, analyze insurance company records and financial problems relating to premiums, investments, payments to policyholders, and other aspects of the business. Safety engineers, fire protection engineers, and industrial hygienists in casualty companies consult with industrial and commercial policyholders on matters concerning the health and safety of their employees. (See the statement on occupational safety and health workers elsewhere in the *Handbook.*) Lawyers interpret the regulations that apply to insurance company operations and handle the settlement of some insurance claims. Investment

About half of all insurance employees are clerical workers



Source: Bureau of Labor Statistics

Insurance companies are usually located in modern, attractive offices.

analysts evaluate real estate mortgages and new issues of bonds and other securities, analyze investments held by their companies, and recommend when to hold, buy, or sell. As more computers are installed to process insurance records, an increasing number of programers, systems analysts, and other data processing specialists are being employed. Most companies also employ public relations, sales promotion, and advertising specialists.

Insurance companies require the same kinds of custodial and maintenance work as other large organizations. About 1 out of 45 workers in the insurance business performs these duties.

Places of Employment

Insurance company home and regional offices generally are located near large urban centers. About one-half of all persons employed in these large offices work in seven States: New York, California, Illinois, Texas, Pennsylvania, Massachusetts, and Ohio. Insurance workers who deal directly with the public—sales personnel and claim adjusters—are located throughout the country. Almost all insurance agents and brokers work out of local company offices or independent agencies. Many claim adjusters work in independent firms located in small cities and towns throughout the country. Company operated drive-in claim centers are located in many medium-sized towns.

About half of all insurance employees work in life companies and agencies. Included in this group are some very large companies with thousands of employees; nearly one-third of life company workers are employed in firms of more than 1,000 people. Property-liability companies, although more numerous than life insurance companies, generally have fewer workers; fewer than one in five of those employed in casualty companies work in establishments of 1,000 or more. Most local agencies and sales offices are relatively small, regardless of the types of insurance handled. About 60 percent of these offices employed fewer than 20 persons.

Training, Other Qualifications, and Advancement

Insurance offers job opportunities for people with different educational backgrounds and talents. Some positions require specific college training; others can be filled by workers with limited academic training and few skills.

Graduation from high school or business school is enough training for most beginning clerical jobs. Courses in typing and business math are assets; the ability to operate office machines also is helpful. These and other special skills help beginners advance to more responsible jobs.

Jobs in engineering, accounting, and other professional fields generally require the same kinds of college training here as in other businesses. College-trained people also are preferred for managerial positions, many of which are filled by promotion from within.

In all work requiring contact with the public, employees should have a pleasant disposition and an outgoing personality. Those in frequent contact with policyholders should be able to inspire confidence in their ability to protect the customer's interests. Because insurance companies often encourage their managers and administrative employees to participate in community organizations, they should be people who enjoy working with others in a social situation.

Insurance workers have ample opportunity to continue their education. The Insurance Institute of America, for example, has home study courses for claim adjusters, claim examiners, underwriters, and sales workers. The American College of Life Underwriters, the National Association of Life Underwriters, and the Life Underwriter Training Council offer courses that stress the services agents provide to policyholders. Other courses, especially designed to help clerical employees better understand life insurance, relate to the organization and operation of both home and field offices. These are given by the Life Office Management Association, which also provides programs for the development of supervisors and managers.

Employment Outlook

Employment of insurance workers is expected to increase faster than the average for all occupations through the 1980's as the insurance industry continues to expand. In addition to new jobs that will become available, thousands of openings will occur as employees die, retire, or leave their jobs to seek other work.

The expected increase in employment will result mainly from a growing volume of insurance business. As a larger proportion of the population enters the age group normally associated with family formation, higher incomes, and greater consumer spending, insurance sales should expand. Sales of life insurance will rise as the growing number of young adults attempt to provide a secure future for their families. Property-liability insurance sales should expand as they buy homes, cars, and other items that require insurance protection. More business insurance will be needed as new plants are built, new equipment is installed, and more goods are shipped throughout the country and the world. Additional sales will be generated by a rising demand for relatively new services such as dental, prepaid legal, and kidnap insurance. Furthermore, the growing concern over the health and safety of industrial workers and consumers will spur demand for men and women to work in the areas of occupational safety and health, product liability, and workers' compensation.

Growth of insurance employment, however, is not expected to keep pace with the expanding volume of business for several reasons. Sales workers are expected to become more productive as more insurance is sold through group contracts and multiple-line policies (those that cover many different risks formerly covered in separate policies). Although the total number of clerical jobs probably will continue to rise, the increasing use of computers to do routine jobs will lessen the demand for many low-skilled clerical workers.

The insurance industry has always been a stable employer and most insurance workers have better prospects of regular employment than workers in many other industries. Business people usually regard property-liability insurance as a necessity, both during economic recession and in boom periods. Individuals who buy insurance try to provide as much basic financial protection as possible, even when their incomes decline.

Earnings

Earnings of nonsupervisory office workers in insurance companies averaged $195 a week in 1978, slightly below the average for all industries. There were slight differences in earnings depending upon the type of insurance company. For example, workers in companies specializing in accident and health insurance averaged about $190 a week, while employees in life companies earned about $194 and workers in casualty companies were paid average weekly salaries of about $197. Salary levels in different parts of the country also vary; earnings are generally lowest in southern cities and highest in northeastern and western metropolitan areas. Within a geographic region, salaries usually are higher in the larger companies.

Salary levels for clerical occupations vary widely. It is estimated that in 1978 the average weekly salary for file clerks was about $133; for typists about $141; for executive secretaries $247; and for experienced computer operators $267.

Starting salaries for professional workers are generally comparable to those for similar positions in other businesses. Specialists with graduate degrees or sevseral years' experience may receive considerably higher starting salaries. Unlike salaried professional workers, agents and brokers earn commissions on the policies they sell. (See the statement on insurance agents and brokers elsewhere in the *Handbook*.) Annual salaries for supervisors in life and property-liability companies ranged from $18,300 to $29,760. Salaries for executives in life insurance companies ranged between $37,000 and $67,000 a year in 1978, depending upon their area of specialization and level of responsibility.

Insurance company employees worked an average of 37 hours a week in 1978. Agents and brokers, who sometimes must extend their working hours to meet prospective clients, frequently worked longer hours. Most employees receive 8 to 12 paid holidays a year. Two-week paid vacations generally are granted after 1 year of service; in most companies, paid vacations are extended to 3 weeks after 5 years and, in some, to 4 weeks after 10 years. Practically all insurance companies provide employer-financed group life and retirement programs. Health insurance plans also are available but employers and employees share the cost.

Sources of Additional Information

General information on employment opportunities in the insurance business may be obtained from the personnel departments of major insurance companies or from insurance agencies in local communities.

Other information on careers in the insurance field is available from:

American Council of Life Insurance, 1850 K St. NW., Washington, D.C. 20006.

Insurance Information Institute, 110 William St., New York, N.Y. 10038.

Alliance of American Insurers, 1776 F St. NW., Suite 504, Washington, D.C. 20006.

National Association of Independent Insurers, Public Relations Department, 2600 River Rd., Des Plaines, Ill., 60018.

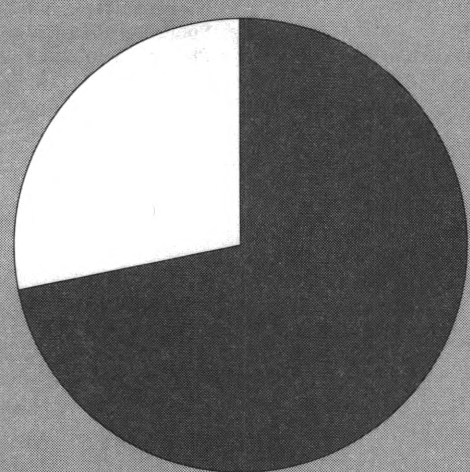
SERVICE AND MISCELLANEOUS INDUSTRIES

An increasing share of our national wealth is being spent for services as a result of greater emphasis on amenities such as health care, education, and recreation. In many ways, this trend reflects the country's goals of a better and fuller life for all its citizens.

In today's job market, the service industries are a major source of employment, for new workers as well as experienced ones. They offer job opportunites to people at all levels of skill, training, and education.

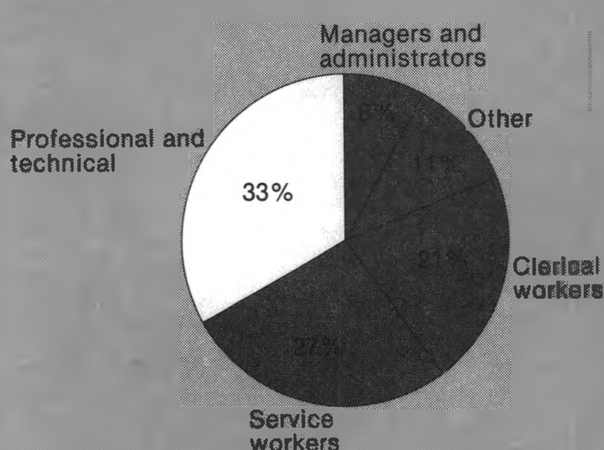
In 1978, more than 31 million people worked in service industries. One-half were wage and salary workers in private firms, including over 1.1 million private household workers; almost 13.5 million more were government employees (mainly in education and health); and about 2.5 million were self-employed.

Service industries employed 28 percent of all workers in 1978



Source: Bureau of Labor Statistics

Service industries employ the largest proportion of professional and technical workers of any major industry group



Source: Bureau of Labor Statistics

Educational services, including elementary and secondary schools and institutions of higher education, make up the largest sector of the service industry and account for about one-fourth of its work force. Medical services, including hospitals, offices of physicians, and other establishments that provide health services, constitute the next largest sector and account for about one-fifth of the workers. Other service industries employing many workers are hotels, laundries, beauty and barber shops, private households, business and repair services, welfare and religious organizations, and places of entertainment.

As shown in the accompanying chart, white-collar workers (professional, managerial, clerical, and sales workers) account for over three-fifths of the service industry's employment. The industry employs the highest proportion of professional, technical, and kindred workers of any major industry; these workers account for one-third of the industry's employment. By far the largest concentration of professional personnel is represented by teachers in educational services. Other major employers of professional workers are medical and health services—where doctors, dentists, and nurses constitute a large share of the work force. Many professionals are self-employed. Clerical workers account for about 1 out of 5 service industry employees. Most are stenographers, typists, secretaries, and office machine operators. Managers, officials, and proprietors, including health services administrators, make up less than one-tenth of the industry's employment.

Service workers represent over one-fourth of the industry's employment. Among the largest service occupations are private household workers, practical nurses, hospital attendants, janitors, waiters and waitresses, cooks, and protective service workers.

Blue-collar workers, mainly skilled craft workers and semiskilled operatives, constitute less than one-tenth of the industry's employment. Many craft workers are mechanics in automobile and other repair service industries, or maintenance workers in hotels, schools, and other establishments. Operatives work mainly in laundries, auto repair shops, and other types of repair businesses. Most of the relatively few laborers in this industry work in auto repair shops, on golf courses, and in bowling alleys.

Employment in the service industry is expected to increase faster than the average for all industries through the 1980's. The growth in the demand for services is expected to stem from population growth, expanding business activity, and rising personal incomes. Among the fastest growing segments of the industry will be hospitals, medical services, and computer software firms.

The importance of personal contact in many service activities tends to limit the effect of technological innovations on employment requirements. Although computers may slow the employment growth in some areas—for example, in bookkeeping—technological change is not expected to significantly limit the total demand for workers in the service industry.

The chapters that follow discuss job opportunities in the hotel and laundry and drycleaning industries. More detailed information about occupations important to other service industries, such health and education, appears elsewhere in the *Handbook*.

Occupations in the Hotel Industry

Hotels, motels, and resorts provide lodging to suit the needs of every traveler. Some motels offer inexpensive, basic services for those who simply want a comfortable place to sleep. Other motels and many hotels cater to persons who desire more luxurious surroundings and offer fine restaurants and personal service. In addition, resort hotels and motels provide many recreational facilities that may include swimming pools, golf courses, tennis courts, horseback riding, game rooms, and health spas.

This chapter gives an overview of jobs in hotels, motels, and resorts. Other chapters in the *Handbook* describe the work of hotel housekeepers, managers, front office clerks, and bellhops.

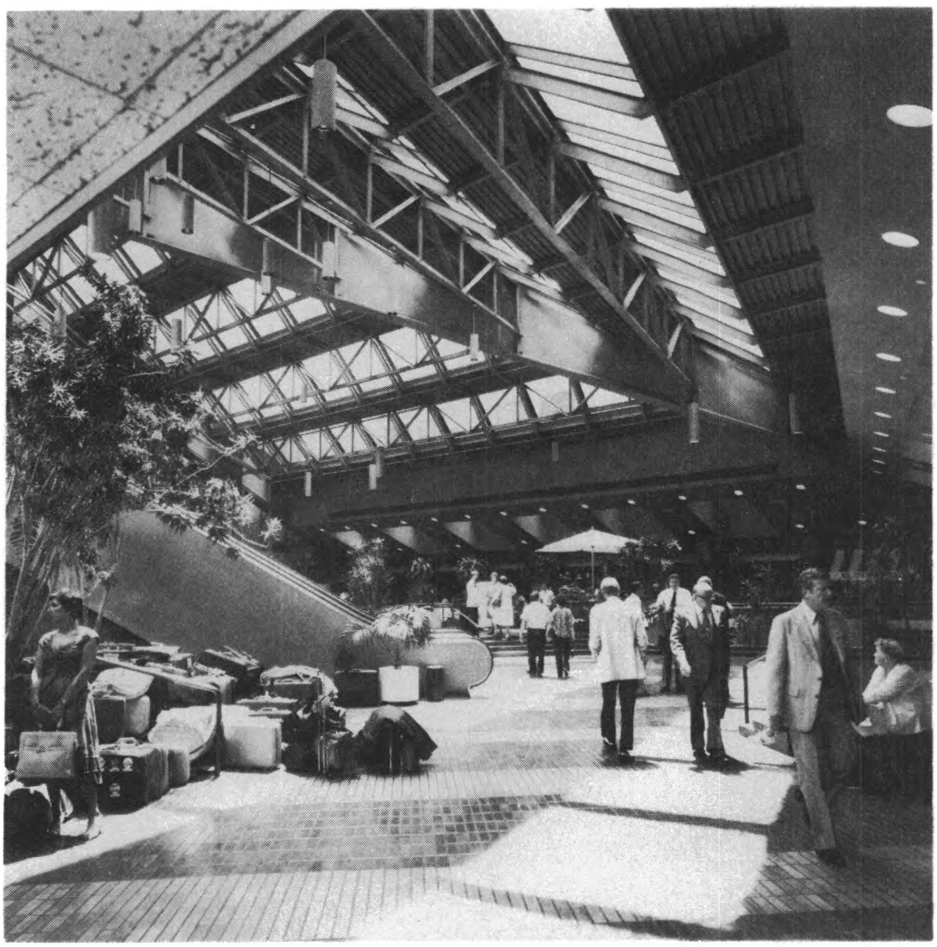
Nature and Location of the Industry

Ranging in size from small motels which may be entirely family operated to huge establishments with more than 1,000 rooms and large staffs, the hotel industry employed about 930,000 workers in 1978, in all parts of the country.

Nearly all hotels and many motels offer a variety of conveniences for their guests, including restaurants, banquet rooms, and meeting rooms. Some have swimming pools and gift shops. Motels usually have simple coffee shops, while hotels often have several restaurants and may offer live entertainment at night. Most hotels also have newstands, barber and beauty shops, laundry and valet services, theater and airline ticket counters and gift shops. Hotels and motels in resort areas often have a wide variety of, or are located near, recreational facilities including golf courses, tennis courts, and swimming pools.

Occupations in the Industry

To provide the many services they offer, hotels and motels employ workers in a wide variety of occupations. Management positions, such as general manager, food and beverage manager, personnel director, and executive chef, generally require considerable formal training and job experience. Department heads, such as comptrollers, purchasing agents, executive housekeepers, and chefs, generally require some formal training and extensive on-the-job training. Service jobs, such as bellhops, room attendants, bartenders, and waitresses, generally require less formal training.



Many hotels have luxurious surroundings and offer fine restaurants, personal service, and recreational facilities.

Housekeeping is a very important part of the business; more than one-fourth of all workers are concerned with keeping hotels and motels clean and attractive. The housekeeping staff make beds, provide guests with fresh linens and towels, vacuum rooms and halls, clean bathrooms, and move furniture. Linen room attendants and laundry room workers mark and inspect towels, sheets, and blankets and operate the washing and pressing machines in the hotel laundry. Large hotels and motels usually employ executive housekeepers to supervise these workers and purchase housekeeping supplies. Some hotels also employ managers to supervise laundry operations.

Food service personnel are the second largest group of hotel workers. These workers include cooks and chefs, waiters and waitresses, dining room attendants, dishwashers, food counter workers, and bartenders. Detailed descriptions of their duties are found elsewhere in the *Handbook*.

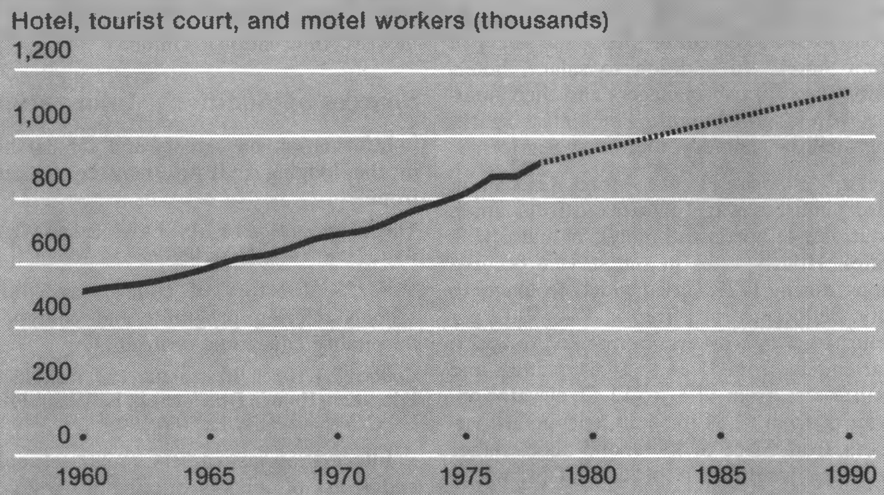
Hotel managers and assistants are responsible for the profitable operation of their establishments. They determine room rates, oversee restaurant operations, and supervise the staff. In smaller hotels and motels, a general manager performs all these tasks; in large hotels, a general manager usually has several assistants, each one responsible for a separate department, such as food service, sales, guest services, or personnel.

Nearly all hotels and motels employ clerical workers to take room reservations, bill guests, and furnish information. Most of these workers are front office clerks who greet guests, assign rooms, and handle mail. The remainder are cashiers, bookkeepers, telephone operators, secretaries, and other clerical workers, whose jobs are much like clerical jobs elsewhere.

A uniformed staff performs services for guests in most hotels, and in some motels. This staff includes bellhops, who carry baggage and escort guests to their rooms; doorkeepers, who help guests out of their cars or taxis and carry baggage into the hotel lobby; and elevator operators.

Hotels employ many workers also found

Employment in the hotel industry is expected to grow steadily through the 1980's



Source: Bureau of Labor Statistics

in other industries. Among these are accountants, personnel workers, entertainers, recreation workers, and maintenance workers, such as carpenters, electricians, stationary engineers, plumbers, and painters. Still others include security officers, barbers, cosmetologists, valets, gardeners, and parking attendants. Most of these occupations are discussed elsewhere in the *Handbook*.

Working Conditions

Since hotels are open around the clock employees frequently must work on shifts. While fewer employees work at night, those who do usually receive additional compensation. Managers and housekeepers who live in the hotel usually have regular work schedules; however, they may be called for work at any time.

Training, Other Qualifications, and Advancement

Hotel operations are becoming more complex, and more emphasis is being placed on specialized training. Therefore, the demand for persons who have special skills developed through training in colleges, junior colleges, technical institutions, vocational schools, and high schools is increasing. This training augments the more traditional on-the-job training offered to employees, particularly managers.

Advancement opportunities in the hotel industry vary widely among the occupations. Some, such as bellhops and bell captains, generally have little promotion potential, while others, like hotel managers, may rise to the top of the corporate ladder. See the chapters on housekeepers, bellhops, managers, and front office clerks, as well as the food service occupations, elsewhere in the *Handbook*.

Employment Outlook

Employment in this industry is expected to expand faster than the average for all industries through the 1980's. New hotels and motels are expected to be built to take advantage of in-town, interstate highway, or resort locations, although desirable sites are becoming scarce and very expensive. Many owners are expected to rehabilitate and modernize existing hotel properties rather than construct new buildings. More hotels are adding facilities and services for recreation in an effort to attract greater numbers of travelers, particularly from nearby areas. Older hotels, unable to modernize, are likely to experience low occupancy rates that may force them to reduce costs by eliminating some services and workers.

Although employment is expected to increase in both luxury and economy motels as Federal expenditures for highways and other transportation systems stimulate travel, both business and pleasure travel are sensitive to economic, energy, and business conditions. In addition to openings resulting from growth, thousands of workers will be needed each year to replace those who retire, die, or leave the industry.

Most of the anticipated employment growth will stem from the need to staff new hotels and motels. Many temporary jobs will continue to be available each year in resort hotels and motels that are open only part of the year.

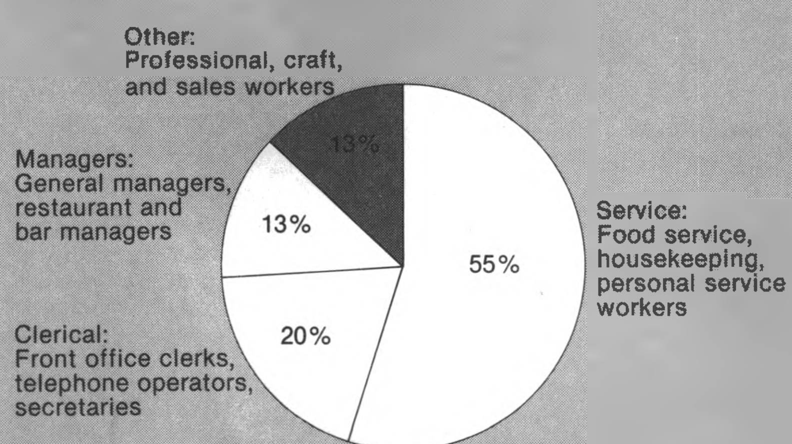
Because most hotel and motel job openings require workers with only limited training, many job openings will be available for service workers such as cleaners, porters, and some dining room and kitchen employees. More front office personnel will also be needed, but opportunities may be limited by the increasing use of computer reservation systems. Opportunities may be particularly favorable for persons who have training or experience as cooks and chefs or as food and beverage managers.

Earnings

Earnings of hotel workers depend on the location, size, and type of the hotel in which they work. Large luxury hotels and those located in metropolitan and resort areas generally pay their employees more than less expensive hotels and those located in less populated areas.

Nonsupervisory workers in the hotel industry averaged \$3.62 an hour in 1978, excluding tips—compared to \$5.69 an hour for all nonsupervisory workers in private industry, except farming. About three-fourths of all hotel workers are covered by Federal and State minimum wage laws; in 1978, workers

To provide the services guests expect, hotels and motels employ large numbers of clerks, managers, and service workers



Source: Bureau of Labor Statistics

covered by these laws earned at least $2.90 an hour. In addition to wages, workers in some occupations receive tips that add substantially to their income.

Food service personnel may receive extra pay for banquets and other special occasions and commonly receive meals. In some hotels, room attendants, elevator operators, room clerks, and others also receive free meals, or meals at reduced prices. Most employees receive 5 to 10 paid holidays a year, paid vacations, sick leave, life insurance, medical benefits, and pension plans. Some hotels offer bonuses, profit sharing plans, educational assistants, and other benefits to their employees.

Salaries of hotel managers and assistants are particularly dependent upon the size and sales volume of the hotel, and vary greatly because of differences in duties and responsibilities. Hotel manager trainees who are graduates of specialized college programs generally start at around $12,000 a year and usually are given periodic increases for the first year or two. Experienced managers may earn several times as much as beginners. For example, salaries of hotel general managers ranged from about $22,000 to $55,000 a year in late 1978, according to a survey conducted by the American Hotel & Motel Association. Hotel food and beverage managers earned from about $19,500 to $40,000 and executive housekeepers from about $9,000 to over $20,000. Managers may earn bonuses ranging from 10 to 20 percent of their basic salary in some hotels. In addition to salary, hotels sometimes furnish managers and their families with lodging in in the hotel, meals, parking facilities, laundry, and other services.

The American Hotel & Motel Association also publishes wage data taken from union contracts of hotels and motels in major U.S. cities. Hourly rates in the service occupations, during 1978, varied widely from city to city. Bellhops earned from $1.47 to $2.81 per hour; laundry workers, from $2.65 to $5.27; bartenders, from $3.34 to $6.64; waiters and waitressess, from $1.47 to $3.47; elevator operators, from $2.34 to $5.39; telephone operators, from $2.68 to $5.40; and maintenance workers, from $2.67 to $6.05. Tips, which represent a significant source of income for many employees, are not included in these data.

The Hotel and Restaurant Employees and Bartenders International Union is the major union in the hotel business. Some hotel workers, including bellhops, porters, cleaners, cooks, waiters and waitresses, maintenance engineers, elevator operators, guards, door attendants, gardeners, laundry workers, and others are members of the Service Employees' International Union.

Sources of Additional Information

Information on careers and scholarships in the lodging industry may be obtained from:

The American Hotel & Motel Association, 888 7th Ave., New York, N.Y. 10019.

For a directory of colleges and other schools offering programs and courses in hospitality education, write to:

Council on Hotel, Restaurant, and Institutional Education, Human Development Buildings, Room 12, University Park, Pa. 16802.

Information on careers in housekeeping and a list of schools offering programs in institutional housekeeping management is available from:

National Executive Housekeepers Association, Inc., Business and Professional Building, 414 Second Ave., Gallipolis, Ohio 45631.

Occupations in Laundry and Drycleaning Plants

In 1978, about 415,000 persons worked in establishments that launder and dryclean garments, household furnishings, and institutional linens and uniforms. These workers were employed throughout the country, but were concentrated in metropolitan areas.

About half the industry's workers are employed by firms that launder and dryclean customer-owned goods. Most of the remainder work for firms that specialize in renting and cleaning uniforms, towels, diapers, and other linens. A small proportion work in valet shops.

More than one-half of the industry's employment is found in firms that have 20 employees or more. Most firms, however, are owner-operated and have fewer than 10 employees. In 1978, about one-eighth of the industry's workers were self-employed.

Nature of the Work

One way to describe the work done in this industry is to follow an imaginary bundle of clothes from the time it leaves the customer until it is cleaned and returned. (See accompanying chart.) The bundle consists of some men's shirts, a business suit, and bed linens. A *route driver* (D.O.T. 292.353-010) picks up the bundle and, after leaving a receipt, takes the bundle to the plant.

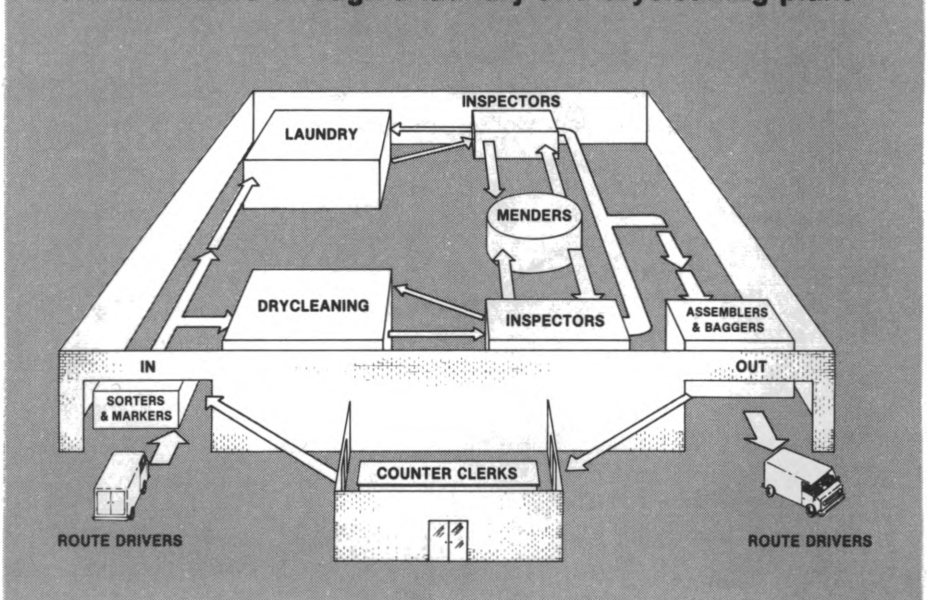
The owner of the bundle may instead leave it at the plant or drive-in store. In this case, a *counter clerk* (D.O.T. 369.477-014) makes out a receipt. Either the route driver or the counter clerk sorts the items in the bundle into laundry and drycleaning.

The bundle is turned over to a *marker* (D.O.T. 369.687-026), who puts an identifying symbol on each item so it may be matched with the customer's receipt at some later time. The marker then sends the shirts and sheets to the washroom and the suit to the drycleaning room.

A *machine washer* (D.O.T. 361.665-010) puts several hundred pounds of sheets into a huge washing machine. Shirts are loaded into another washer. These machines are controlled automatically, but the machine washer must understand how to operate the controls—water temperature, suds level, time cycles, and the amount of agitation for different fabrics. When the washing cycle is completed, the laundry is transferred to an extractor that removes about half of the water. This stage is similar to the "spin" cycle on a home washer. Conveyors move the laundry to conditioners, dryers, or tumblers where dry, heated air removes some or all of the remaining moisture, depending upon whether the work is to be conditioned or dried.

Sheets go from the drying area to *flatwork finishers* (D.O.T. 363.686-010), who shake out folds and creases, spread the sheets on moving belts, and feed them into large flatwork ironing machines for ironing and partial folding. When the sheets come out of the machine, other finishers complete the folding and stacking.

How work flows through a laundry and drycleaning plant



Shirts go directly from the extractor to *shirt finishers* (D.O.T. 363.682-018), who usually work in teams of two or three. One finisher puts the sleeves of the shirt on a "sleever," which has two armlike forms. A second finisher then puts the shirt on a "triple-head" press, which finishes the collar and the cuffs. Next a third finisher puts the shirt on a body and bosom press, which irons the front and back simultaneously. Afterwards, one of the finishers either folds the shirt or places it on a hanger, whichever the customer has indicated. In some laundries, one shirt finisher performs all these operations.

The jobs of the *drycleaner* (D.O.T. 362.-382-014) and *machine washer* (D.O.T. 361.-665-010) are similar, but the cleaning solution for drycleaning is a chemical solvent instead of water, and drycleaning machines generally are smaller than the laundry washers. The drycleaner sorts clothes according to color, fiber content, and fabric construction and selects the proper formula for each load. The drycleaner may apply special prespotting solutions to spots and stains before placing the garments in the drycleaning machine. After cleaning, the clothes are dried in a tumbler or hot-air cabinet. The *spotter* (D.O.T. 361.684-018 and 362.381-010) will use chemical reagents and steam to remove stubborn stains. In some plants, the same person does drycleaning and spotting.

If the clothes are made of a material that sheds wrinkles readily, the finisher places them on hangers and puts them in a steam tunnel or steam cabinet. The steam will remove the wrinkles and help the garment regain its shape.

Some clothes, such as men's suits, are made out of fabrics that require more attention; they are finished differently. A *men's suit finisher* (D.O.T. 363.682-018) puts the pants on special "topper" and "legger" presses. The jacket is placed on a body form that may have a second part that comes down to press and shape the shoulders and collar of the jacket while the steam is forced from the inside. Final finishing touches are done on a pressing machine, a flat surface covered with fabric.

An *inspector* (D.O.T. 369.687-022) checks finished items to see that the quality standards of the plant have been maintained. Any item in need of recleaning or refinishing may be returned to the appropriate department; occasionally, the inspector works on them instead. Repair work may be forwarded to a

Many workers in the laundry and dry-cleaning industry must stand during their entire shift.

mender (D.O.T. 787.682-030), who sews on buttons, mends tears, and resews seams. Finally, *assemblers* (D.O.T. 369.687-010) collect the linens and shirts by matching the sales invoice with the identification marks. Assemblers or *baggers* (D.O.T. 920.687-018) may remove tags before putting the items in bags or boxes for storage until called for by the customer or delivered by the route driver.

In addition to workers who are unique to laundry and drycleaning plants, many other workers are found in this industry. The manager or proprietor sees that the plant operates efficiently. Office workers keep records, handle correspondence, and prepare bills. Sales personnel search for new customers. Mechanics keep equipment and machinery operating properly. Some service workers clean, guard, and otherwise maintain the plant; others plan and serve food to plant workers. Laborers lift and carry heavy loads to machines. (Many of these occupations are discussed elsewhere in the *Handbook*.)

Working Conditions

Modern laundry and drycleaning plants are clean and well lighted. Because of the heat generated in the cleaning process, plants may be uncomfortable during the summer months. Many new, small drycleaning plants, however, are air-conditioned in the office and customer areas and well ventilated in the machinery areas. In addition, new machinery operates with a minimum of noise. Most workers in these plants must stand for long periods. Work in laundries and drycleaning plants is less hazardous than in most manufacturing plants.

Laundry and drycleaning workers average about 35 hours a week on the job. In order to provide faster service to customers, some are required to work Saturdays.

Training, Other Qualifications, and Advancement

Many workers in this industry get their first jobs without previous training. Persons who have little formal education can get production line jobs in drycleaning plants. Basic laundry and drycleaning skills may be learned on the job in a short time. Some jobs, such as folding towels and feeding pillowcases and sheets into a flatwork ironer, may require 1 or 2 days to learn. Some finishing jobs—pants presser or shirt finisher, for example—may require less than a week's training. Other jobs, such as counter clerk, marker, inspector, and assembler, may require several weeks to learn. Several months or more are needed to train a drycleaner or women's apparel finisher. It may take 6 to 12 months to become a spotter because of the variety of fibers and fabrics, spots and stains, and chemicals used in treating the stains.

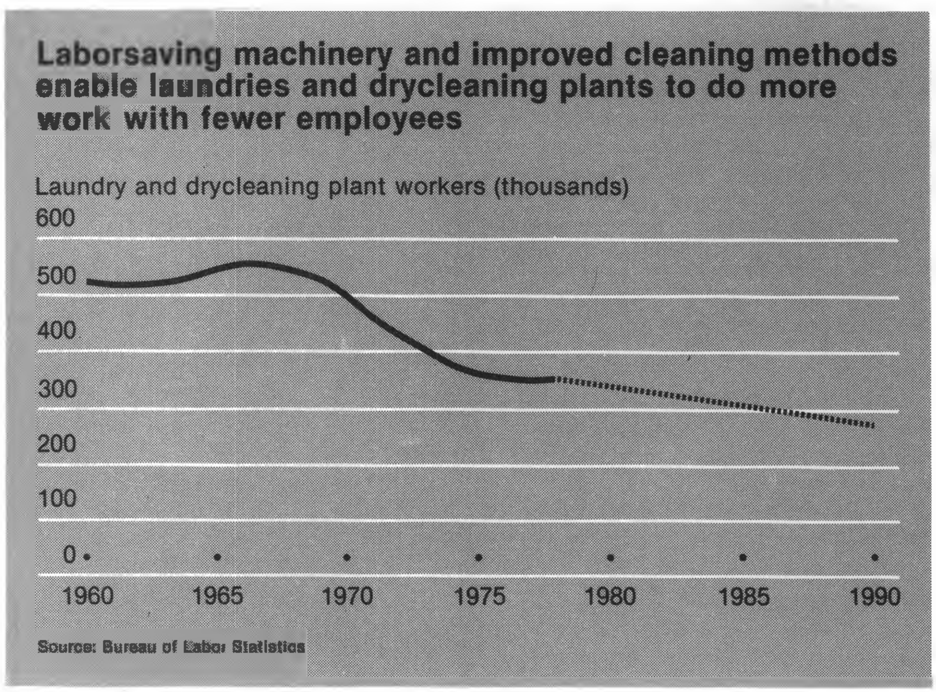
Some preemployment training in finishing, drycleaning, and spotting skills is available in vocational high schools and trade schools. Home study courses in drycleaning operations are available from the International Fabricare Institute.

Employers look for dependable workers who have physical stamina, manual dexterity, and keen eyesight. Workers must be able to adjust to the repetitive nature of many laundry and drycleaning jobs.

Advancement for most workers in this industry is limited. Many remain permanently in the same job. Nevertheless, sometimes employers send promising employees to technical or managerial training programs, which generally last anywhere from 2 1/2 days to 4 weeks. These programs are offered by the Institute of Industrial Launderers, the International Fabricare Institute, and the Textile Rental Services Association. Some men's suit finishers become skilled enough to do women's apparel finishing. Markers and assemblers interested in finishing work usually are given an opportunity to move up to this job. Finishers also may become inspectors. Supervisors and managers frequently are chosen from experienced employees already in the industry. Some drycleaners and spotters establish their own drycleaning plants.

Employment Outlook

Employment in this industry is expected to decline through the 1980's. Laborsaving machinery and more efficient methods of cleaning and finishing laundry will enable the industry to do more work with fewer employees. Nevertheless, thousands of work-



ers will be hired to replace those who retire, die, or transfer to other fields.

Although the industry's total employment is expected to decline, employment trends will differ among occupations. Employment of spotters is expected to decline because new fibers and finishes make fabrics less stainable. The number of finishers should decrease as machinery does more of the finishing work. On the other hand, more people will be needed in some maintenance occupations to repair the increasing amount of machinery and equipment used by laundry and drycleaning firms. More counter clerks will be required due to growth in the number of retail outlets operated by these firms.

Earnings

Wage levels in the laundry and drycleaning industry are not high. In 1978, the hourly average wage for nonsupervisory workers in this industry was $3.75 compared to $4.99 for all nonsupervisory workers in all service industries and $5.69 for all such workers in private industry, except farming. Earnings are higher for workers in the more highly skilled occupations, such as drycleaner, spotter, and machine washer.

Sources of Additional Information

Contact the following organizations for information about jobs in this industry:

Institute of Industrial Launderers, 1730 M St. NW., Suite 613, Washington, D.C. 20036.

International Fabricare Institute, 12251 Tech Rd., Silver Spring, Md. 20904.

Textile Rental Services Association of America, P.O. Box 1283, Hallandale, Fla. 33009.

The local office of the State employment service may have additional information on training and employment opportunities in this field.

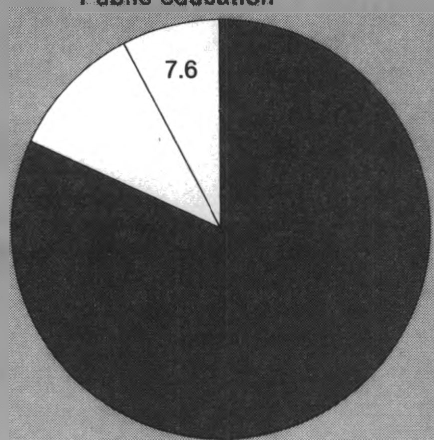
GOVERNMENT

Government service, one of the Nation's largest fields of employment, provided jobs for about 15.6 million civilian workers in 1978—about 1 out of 6 employed persons in the United States. State or local governments (county, city, township, school district, or other special division) employed 5 out of 6 government workers; the remainder worked for the Federal Government.

Government employees represent a significant portion of each State's work force. They work in large cities, small towns, and even in remote and isolated places such as lighthouses and forest ranger stations. A small number of Federal employees work overseas.

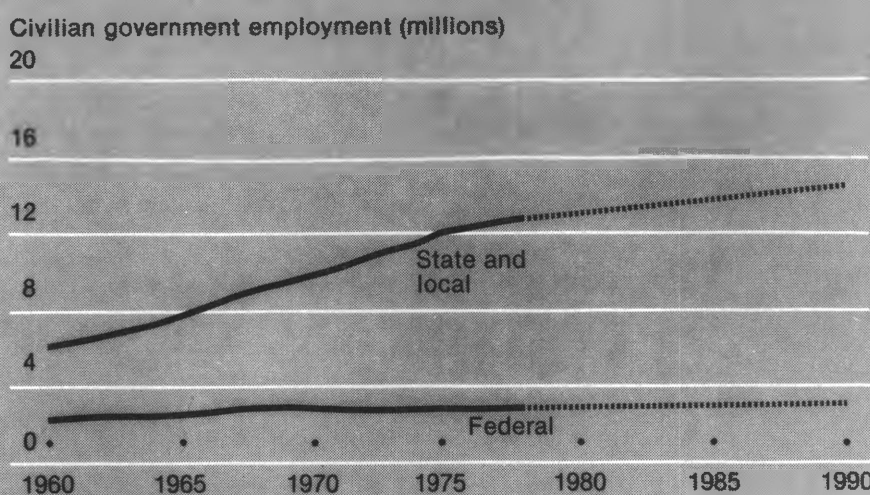
Government employment is expected to grow more slowly than the average for all industries through the 1980's. Public concern about rising tax burdens is expected to produce pressure for restraint in government spending at all levels, slowing growth of government employment. Furthermore, a slower than average growth of State and local government employment is expected as educational employment changes very little due to declining public school enrollments. Federal employment also is expected to grow more slowly than the average for all industries. Many job opportunities will arise at all levels of government, however, as workers retire, die, or leave government service.

Government, including public education, employed 18 percent of all workers in 1978



Source: Bureau of Labor Statistics

State and local governments will continue to account for almost all the growth in government employment



Source: Bureau of Labor Statistics

Government Activities and Occupations

Two-fifths of all government workers in 1977, or 6.5 million, provided educational services, mostly at the State and local levels in elementary and secondary schools. Besides teachers, others who worked in educational services included administrative and clerical workers, maintenance workers, librarians, dietitians, nurses, and counselors.

Nearly 1 million civilian employees in 1977 worked for Federal agencies concerned with national defense and international relations. Principal occupations that deal with these functions included administrative and clerical workers, health workers, teachers, engineers, scientists, technicians, and craft and other manual workers. People in these jobs work in offices, research laboratories, navy yards, arsenals, and missile launching sites and in hospitals and schools run by the military services.

Another 1.5 million workers provided health services and staffed hospitals, primarily for State and local governments. Many workers also were employed in housing and community development, police and fire protection, social security and public welfare services, transportation and public utilities, financial administration, general administrative functions, and judicial and legislative activities. The majority of these workers also were State and local government employees. All of the 650,000 government workers in postal services and a majority of the nearly 500,000 workers in natural resources, such as those in the National Park Service and the Forest Service, were employed by the Federal Government.

Because of the special character of many government activities, the occupational distribution of employment is very different from that in private industry, as shown in table 1.

Although the many government activities require a diversified work force having various levels of education, training, and skill, 2

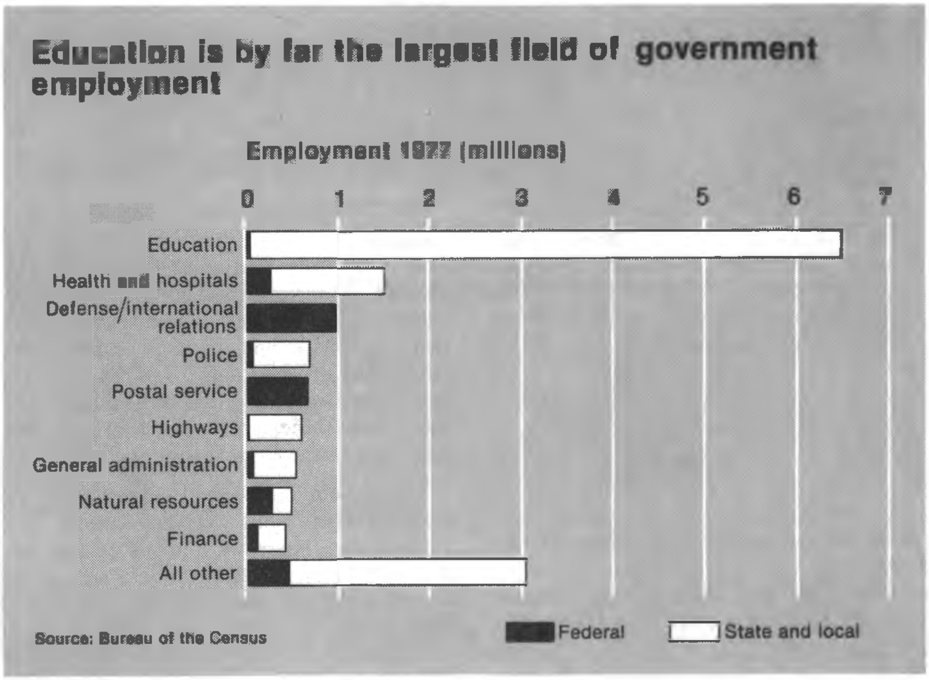


Table 1. Percent distribution of employment in government and private industry by occupation, 1978

Occupation	Government[1]	Private industry
Total	100	100
White-colla· workers	67	46
Profes· ·ıal and technical	35	11
Manage· · and administrators	8	11
Clerical	24	17
Sales	(2)	7
Blue-collar workers	14	37
Craft and related workers	6	14
Transport equipment operatives	3	4
Other equipment operatives	1	14
Nonfarm laborers	4	5
Service workers	19	13
Farm workers	(2)	4

[1]Excludes Federal employment overseas.
[2]Less than 0.5 percent

SOURCE: Bureau of Labor Statistics

out of 3 government employees are white-collar workers. Among the largest white collar occupational groups are teachers, administrators, postal clerks, and office workers such as stenographers, typists, and clerks.

Some large service, craft, and manual occupations are aircraft and automotive mechanics, repairers, police officers, firefighters, truckdrivers, skilled maintenance workers (for example, carpenters, painters, plumbers, and electricians), custodial workers, and laborers.

The following chapters discuss opportunities for civilian employment in the major divisions of government and in the various branches of the Armed Forces. A separate chapter gives information on postal service occupations.

Federal Civilian Government

Nature and Location of Employment

The Federal Government is the Nation's largest employer. In 1978, it employed about 2,750,000 civilian workers in the United States, and an additional 130,000 civilian workers—half of them U.S. citizens—in U.S. territories and foreign countries. Although the headquarters of most government departments and agencies are in the Washington, D.C., metropolitan area, only 1 out of 8 (about 360,000) Federal employees worked there in 1978. Over 250,000 worked in California, and more than 100,000 each in New York, Pennsylvania, and Texas.

Federal employees work in occupations that represent nearly every kind of job in private employment, as well as some unique to the Federal Government, such as postal clerks, regulatory inspectors, foreign service officers, and Internal Revenue agents. Most Federal employees work for the executive branch of the government; about 50,000 are employed in the legislative and judicial branches.

The executive branch includes the Executive Office of the President, the 13 cabinet departments, and nearly 90 independent agencies, commissions, and boards. This branch is responsible for activities such as administering Federal laws, handling international relations, conserving natural resources, treating and rehabilitating disabled veterans, delivering the mail, conducting scientific research, maintaining the flow of supplies to the Armed Forces, and administering other programs to promote the health and welfare of the people of the United States.

The Department of Defense, which includes the Departments of the Army, Navy, and Air Force, is the largest department. It employed over 980,000 civilian workers in 1978. The departments of Agriculture, Health and Human Services, and Treasury each employed more than 100,000 workers. The two largest independent agencies were the U.S. Postal Service, which employed 660,000 workers, and the Veterans Administration, which employed over 200,000 workers.

Nearly 40,000 people worked for the legislative branch of government, which includes the Congress, the Government Printing Office, the General Accounting Office, and the Library of Congress. More than 10,000 people worked for the judicial branch, which includes the Supreme Court and the other U.S. courts.

White-Collar Occupations. Because of its wide range of responsibilities, the Federal Government employs white-collar workers in a great many occupational fields. Nearly 2 million white-collar workers, including postal workers, worked full time for the Federal Government in late 1977. About 1 out of 4 of these were administrative and clerical workers.

Nearly 470,000 general clerical workers were employed in all Federal departments and agencies in 1977, including office machine operators, secretaries, stenographers, clerk-typists, mail and file clerks, telephone operators, and workers in computer and related occupations. In addition, there were over 500,000 postal clerks and mail carriers employed by the Federal Government.

About 150,000 government workers were employed in engineering and related fields in 1977. Included in this total were about 85,000 engineers, representing virtually every branch and specialty of engineering, and large numbers of technicians in areas such as engineering, electronics, surveying, and drafting. Nearly two-thirds of all engineers were in the Department of Defense.

Of the more than 120,000 workers employed in accounting and budgeting work, 35,000 were professional accountants or Internal Revenue agents. Among technician and administrative occupations were accounting technicians, tax accounting technicians, and budget administrators. There also were large numbers of clerks in specialized accounting work. Accounting workers were employed throughout the Government, particularly in the Departments of Defense and the Treasury and the General Accounting Office.

About 120,000 Federal employees worked in hospitals or in medical, dental, and public health activities in 1977. Three out of five were either professional nurses or nursing assistants. Professional occupations in this field included physicians, dietitians, medical technologists, and physical therapists. Technician and aide jobs included medical technicians, medical laboratory aides, and dental assistants. Employees in this field worked primarily for the Veterans Administration; others worked for the Departments of Defense and Health and Human Services.

More than 70,000 workers were engaged in administrative work related to private business and industry. They arranged and monitored contracts with the private sector and purchased goods and services needed by the Federal Government. Administrative occupations included contract and procurement specialists, production control specialists, and Internal Revenue officers. Two out of three of these workers were employed by the Departments of Defense and Treasury.

Another 60,000 persons worked in jobs concerned with the purchase, cataloging, storage, and distribution of supplies for the Federal Government. This field included many managerial and administrative positions such as supply management officers, purchasing officers, and inventory management specialists, as well as large numbers of specialized clerical positions. Most of these jobs were in the Department of Defense.

Throughout the Federal Government, almost 70,000 persons were employed in the field of law. There were about 16,000 employees in professional positions, such as attorneys or law clerks, and administrative positions, such as passport and visa examiners or tax law specialists. There also were many clerical positions that involve examining claims.

Over 50,000 persons were employed in the social sciences. Economists were employed throughout the government; psychologists and social workers worked primarily for the Veterans Administration; and foreign affairs and international relations specialists, for the Department of State. One-third of the workers in this field were social insurance administrators, employed largely in the Department of Health and Human Services.

About 50,000 biological and agricultural science workers were employed by the Federal Government, mostly in the Departments of Agriculture and Interior. Many of these worked in forestry and soil conservation activities. Others administered farm assistance programs. The largest number were employed as biologists, forest and range fire controllers, soil conservationists, and forestry technicians.

The Federal Government employed nearly 50,000 persons in investigative and inspection work. Large numbers of these were engaged in criminal investigation and health and regulatory inspections, mostly in the Departments of Treasury, Justice, and Agriculture.

In the physical sciences, the Federal Government employed more than 40,000 persons; three out of four were employed by the Departments of Defense, Interior, and Commerce. Professional workers included chemists, physicists, meteorologists, cartographers, and geologists. Aides and technicians included physical science technicians, meteorological technicians, and cartographers' technicians.

Among the nearly 15,000 persons employed in the mathematics field were professional mathematicians and statisticians, and mathematics technicians and statistical clerks. They were employed primarily by the

Departments of Defense, Agriculture, Commerce, and Health and Human Services.

Entrance requirements for white-collar jobs vary widely. A college degree in a specified field or equivalent work experience is usually required for professional occupations such as physicists, and engineers.

Entrants into administrative and managerial occupations usually are not required to have knowledge of a specialized field, but must instead indicate a potential for future development by having a degree from a 4-year college or responsible job experience. They usually begin as trainees and learn their duties on the job. Typical jobs in this group are budget analysts, claims examiners, purchasing specialists, administrative assistants, and personnel specialists.

Technician, clerical, and aide-assistant jobs have entry level positions for people with a high school education or the equivalent. For many of these positions, no previous experience or training is required. The entry level position is usually that of trainee. Persons who have junior college or technical school training, or those who have specialized skills, may enter these occupations at higher levels. Typical jobs are engineering technicians, supply clerks, clerk-typists, and nursing assistants.

Blue-Collar Occupations. Blue-collar occupations—craft, operative, laborer, and some service jobs—provided full-time employment for 500,000 Federal workers in 1977. The Department of Defense employed about three-fourths of these workers in establishments such as naval shipyards, arsenals, and air or army depots, as well as on construction, harbor, flood-control, irrigation, or reclamation projects. Others worked for the Veterans Administration, U.S. Postal Service, General Services Administration, Department of the Interior, and Tennessee Valley Authority.

The largest single blue-collar group were manual laborers. Large numbers also were employed in machine tool and metal work, motor vehicle operation, warehousing, and food preparation and serving. The Federal Government employed a wide variety of individuals in maintenance and repair work, such as electrical and electronic equipment installation and repair, and vehicle and industrial equipment maintenance and repair. All these fields require a range of skill levels and include a varity of occupations comparable to the private sector.

Although the Federal Government employed blue-collar workers in many different fields, about half were concentrated in a small number of occupations. A total of about 90,000 skilled mechanics worked as air-conditioning, aircraft, automobile, truck, electronics, sheet-metal, and general maintenance mechanics. About 60,000 craft workers were employed as painters, pipefitters, carpenters, electricians, and machinists. Nearly 70,000 persons were warehouse workers, truck drivers, and general laborers. An additional 40,000 workers were employed as janitors and food service workers.

Entrance requirements. Persons with previous training in a skilled trade may apply for a position with the Federal Government at the journey level. Those with no previous training may apply for appointment to one of several apprenticeship programs. Apprenticeship programs generally last 4 years; trainees receive both classroom and on-the-job training. After completing this training, a person is eligible for a position at the journey level. There also are a number of positions which require little or no prior training or experience, including janitors, maintenance workers, messengers, and many others. (Detailed descriptions of the duties, qualifications, and training of most white-collar, service, craft, and laborer jobs mentioned above are provided in other sections of the *Handbook*.)

The Merit System

More than 9 out of 10 jobs in the Federal Government are under a merit system. The Civil Service Act, administered by the U.S. Office of Personnel Management, covers 6 out of 10 Federal jobs. This act was passed by the Congress to insure that Federal employees are hired on the basis of individual merit and fitness. It provides for competitive examinations and the selection of new employees from the most qualified applicants. For most jobs, the Office of Personnel Management, through its network of about 50 areas offices and 70 Federal Job Information Centers, examines and rates applicants and supplies Federal departments and agencies with names of persons eligible for the jobs to be filled.

Some Federal jobs are exempt from civil service requirements, either by law or by action of the Office of Personnel Management. However, most of these positions are covered by separate merit systems of other agencies, such as the Foreign Service of the Department of State, the Federal Bureau of Investigation, the Nuclear Regulatory Commission, and the Tennessee Valley Authority.

Civil service competitive examinations may be taken by any U.S. citizen. To be eligible for appointment, an applicant must meet minimum age, training, and experience requirements for the particular job. A physical handicap will not in itself bar a person from a position, if it does not interfere with the performance of the required duties. Examinations vary according to the types of positions for which they are held. Some examinations test the applicant's ability to do the job applied for or the ability to learn how to do it. Applicants for jobs that do not require a written test are rated on the basis of the experience and training described in their applications and any supporting evidence required.

Applicants are notified as to whether they have achieved eligible or ineligible ratings, and the names of eligible applicants are entered on a list in the order of their test scores. When a Federal agency requests names of eligible applicants for a job vacancy, the Office of Personnel Management sends the agency the names at the top of the appropriate list; the agency can select any one of the top three. Names of those not selected are restored to the list for consideration for other job openings.

Employment Trends and Outlook

Federal employment is expected to grow more slowly than the average for all industries through the 1980's, continuing a trend begun in the late 1960's. Although total Federal Government employment is expected to rise somewhat, some Federal agencies will reduce their staffs as some administrative responsibilities continue to be transferred to State and local governments. The Postal Service is expected to keep the number of its employees relatively constant while the Department of Defense is expected to grow very slowly; employment growth is expected to be greater in other departments and agencies.

In addition to some new jobs, there will be openings due to the need to replace employees who transfer out of the Federal service, retire, or die. Thus, job opportunities will occur in occupations where total employment is relatively stable, as well as in those in which it is rising.

Earnings, Advancement, and Working Conditions

Most Federal civilian employees are paid according to one of three major pay systems: The General Pay Schedule, the wage system, and the Postal Service Schedule. (The Postal Service Schedule is discussed in the statement on the Postal Service elsewhere in the *Handbook*.)

Over half of all Federal workers are paid under the General Schedule (GS), a pay scale for workers in professional, administrative, technical, and clerical jobs, and for workers such as guards and messengers. General Schedule jobs are classified by the U.S. Office of Personnel Management in 1 of 18 grades, according to the difficulty of duties and responsibilities, and the knowledge, experience, and skills required of the workers. GS pay rates are set by Congress and apply to government workers nationwide. They are reviewed annually to see whether they are comparable with salaries in private industry.

The distribution of Federal white-collar employees by General Schedule grade, the entrance and maximum salaries for each grade, and the amount of each grade's periodic increases are listed in table 1. Appointments usually are made at the entrance rate for the appropriate grade. However, appointments in hard-to-fill positions may be at a higher rate.

Most employees receive within-grade pay

Table 1. Distribution of full-time Federal employees under the General Schedule by grade level, March 31, 1978, and salary scale effective Oct. 7, 1979

General schedule	Employees: Number	Employees: Percent	Salaries: Entrance	Salaries: Periodic increase	Salaries: Maximum
Total, all grades	1,396,265	100.0			
1	1,593	0.1	$ 7,210	$ 240	$ 9,126
2	22,635	1.6	8,128	271	10,327
3	94,786	6.8	8,952	298	11,634
4	176,286	12.6	10,049	335	13,064
5	188,366	13.5	11,243	375	14,618
6	87,392	6.3	12,531	418	16,293
7	129,205	9.3	13,925	464	18,101
8	27,911	2.0	15,423	514	20,049
9	140,986	10.1	17,035	568	22,147
10	26,724	1.9	18,760	625	24,385
11	153,468	11.0	20,611	687	26,794
12	150,686	10.8	24,703	823	32,110
13	108,852	7.8	29,375	979	38,186
14	55,164	4.0	34,713	1,157	45,126
15	27,251	2.0	40,832	1,361	[2]53,081
16	3,456	0.2	47,889	1,596	—
17	1,097	0.1	[2]56,099	—	—
18	407	[1]	[2]65,750	—	—

[1]Less than 0.05 percent

[2]The rate of basic pay for employees at these rates is limited by section 5308 of title 5 of the United States Code to $50,112.50 as of the above date.

SOURCE: U.S. Office of Personnel Management

increases at 1-, 2-, or 3-year intervals, if their work is acceptable. Within-grade increases may be given also in recognition of high-quality service. Some managers and supervisors receive increases based on their job performance, rather than on time in grade.

High school graduates who have no related work experience usually start in GS-2 jobs, but some who have special skills begin at grade GS-3. Graduates of 2-year junior colleges and technical schools often can begin at the GS-4 level. Most people with bachelor's degrees appointed to professional and administrative jobs, such as psychologists, statisticians, economists, writers and editors, budget analysts, accountants, and physicists, can enter at grades GS-5 or GS-7, depending on their academic record. Those who have a master's degree or Ph.D. degree, or the equivalent education or experience, may enter at the GS-9 or GS-11 level. Advancement to higher grades generally depends upon ability, work performance, and openings in jobs with high grades.

About one-quarter of the Federal civilian workers are paid according to the Federal Wage System. Under this system, craft, service, and manual workers are paid hourly rates established on the basis of "prevailing" rates paid by private employers for similar work in the same locations. As a result, the Federal Government wage rate for an occupation varies by locality. Average salaries paid Federal workers for some of the more common types of blue-collar work appear in table 2.

Table 2. Coordinated Federal Wage System average salaries for selected occupational groups, Oct. 31, 1978

Occupational group	Annual salary
Electronic equipment installation, maintenance, and operation	$18,645
General maintenance and operation	18,202
Pipefitting	18,082
Electrical installation and maintenance	17,960
Aircraft repair, propeller work, and engine overhaul	17,801
Machine-tool work	17,630
Metal work and processing	17,589
Fixed industrial equipment operation and maintenance	17,412
Woodworking	16,933
Mobile industrial equipment operation and maintenance	16,525
Warehousing	14,827
Services	13,264
Manual labor	12,628

SOURCE: U.S. Office of Personnel Management.

Federal Government employees work a standard 40-hour week. Employees who are required to work overtime may receive premium rates for the additional time or compensatory time off at a later date. Most employees work 8 hours a day, 5 days a week, Monday through Friday, but in some cases, the nature of the work requires a different workweek. Annual earnings for most full-time Federal workers are not affected by seasonal factors.

Federal employees earn 13 days of annual (vacation) leave each year during their first 3 years of service; 20 days each year until the end of 15 years; after 15 years, 26 days each year. Nine paid holidays are observed annually. Workers who are members of military reserve organizations also are granted up to 15 days of paid military leave a year for training purposes. A Federal worker who is laid off is entitled to unemployment compensation similar to that provided for employees in private industry.

Other benefits available to most Federal employees include: A contributory retirement system, optional participation in low-cost group life and health insurance programs which are partly supported by the Government (as the employer), and training programs to develop maximum job proficiency and help workers achieve their highest potential. These training programs may be conducted in Government facilities or in private educational facilities at Government expense.

Sources of Additional Information

Information on employment opportunities in the Federal Government is available from a number of sources. High school students are often able to get information from their high school guidance counselors. A college placement office is often a good source of such information for college students.

Information on Federal job opportunities is available from State employment service offices. The U.S. Office of Personnel Management operates about 70 Federal Job Information Centers in various large cities throughout the country which announce and conduct examinations required for various Federal Government jobs. They evaluate qualifications and refer eligible applicants to employing agencies for their geographic areas. They also provide a complete one-stop information service on local and nationwide job opportunities in the Federal Government.

For information about jobs in a specific agency, contact the agency directly.

Occupations in the Postal Service

The U.S. Postal Service is the most highly visible Federal Government agency—daily accepting millions of letters and packages and delivering them to our homes, places of employment, and throughout the world. An army of workers is needed to provide this vital public service, and although many postal employees—mail carriers, for example —may be seen at work in our communities, many others work in jobs that the public seldom sees.

A national postal system was recognized as essential before the United States was founded. In one of its first official acts, the Continental Congress created the U.S. postal system in 1775 and named Benjamin Franklin to head it as the first Postmaster General. The system later became the Post Office Department and grew as the Nation's needs for postal services increased. In 1970, the Post Office Department was reorganized and became the U.S. Postal Service, which is now operated independently of all other agencies of the Federal Government.

The Nation's first postal system had fewer than 50 post offices. In 1978, the more than 40,000 post offices, stations, branches, and community post offices operated by the Postal Service handled over 96 billion pieces of mail, more than 400 pieces for every individual in the country.

Postal workers are employed at postal facilities located throughout the Nation. Facilities range in size from large metropolitan post offices and mail processing centers that employ hundreds of workers to small stations that employ only a few. Most are post offices, but some are facilities that serve special purposes, such as handling packages and other bulk mail, maintaining vehicles, or processing payroll records.

Although every community receives mail service, employment is concentrated in large metropolitan areas. Post offices in cities such as New York, Chicago, and Los Angeles employ a great number of workers not only because they process huge amounts of mail for their own populations but also because they serve as mail processing centers for the smaller communities that surround them.

Occupations in the Industry

The U.S. Postal Service employed nearly 660,000 workers in mid-1978; 1 out of 5 worked part time or on a casual or substitute basis. Although 5 out of 6 postal employees worked in mail processing occupations, the U.S. Postal Service also employed more than 30,000 workers in maintenance and repair jobs, and about 80,000 professional, administrative, and clerical workers. The more than 500,000 mail carriers and postal clerks employed in mid-1978 constituted the vast majority of mail processing workers, as well as of all postal workers. Mail carriers and postal clerks are discussed in more detail elsewhere in the *Handbook*.

Mail Processing Occupations. Most people are familiar with the duties of the mail carrier, yet few are aware of the many different tasks required in processing mail. At all hours of the day and night, a steady stream of letters, packages, magazines, and papers moves through the postal system. *Mail carriers* (D.O.T. 230.363-010 and .367-010) collect mail from neighborhood mailboxes and bring it to post offices that truck it to the nearest mail processing center for sorting by *postal clerks* (D.O.T. 243.367-014). There are more than 300 large mail processing centers, each responsible for sorting the outgoing and incoming mail for an area of the United States. Outgoing mail is sorted and sent by truck or airplane to the appropriate mail processing center in another area of the country. Incoming mail is sorted for the various local post offices in the area, trucked to the post offices, and then sorted again for delivery by mail carriers to homes and business establishments.

Mailhandlers (D.O.T. 209.687-014) load, unload, and move mail sacks and bulk mail, such as parcels and packages. They separate and distribute mail sacks to postal clerks for processing. Some also rewrap parcels and packages or operate canceling machines, forklift trucks, or addressograph and mimeograph machines.

Maintenance and Repair Occupations. The U.S. Postal Service employs large numbers of workers to maintain the buildings, equipment, and vehicles used in processing mail. Custodians, maintenance technicians, carpenters, painters, and other maintenance workers keep buildings and facilities clean and in good repair. Electronics technicians and *mail processing equipment mechanics* (D.O.T. 633.261-014) maintain, test, repair, and overhaul electronic equipment and other machinery used to sort and process mail. Automobile and truck mechanics service and repair the Postal Service's nearly 200,000 vehicles.

Professional, Administrative, and Clerical Occupations. The U.S. Postal Service employs workers in a variety of supervisory, administrative, and clerical jobs. It employs administrators, lawyers, secretaries, and typists at its regional as well as national headquarters.

Postmasters (D.O.T. 188.167-066) and *mail supervisors* (D.O.T. 230.137-018 and 243.137-010) are responsible for the day-to-day operation of the post offices. They supervise mailhandlers, clerks, and technicians; hire and train employees; and set up work schedules.

Postal inspectors (D.O.T. 168.267-062) audit post offices' operations to see that they are run efficiently, that funds are spent prop-

Mailhandlers unload mail sacks and bulk mail and distribute them to postal clerks for processing.

erly, and that postal laws and regulations are observed. They also investigate crimes such as theft, forgery, and fraud involving use of the mail.

Working Conditions

Except for mail carriers, most postal employees work indoors. Mail carriers spend much of their time outdoors or driving vehicles, regardless of weather conditions.

Training, Other Qualifications, and Advancement

An applicant for a Postal Service job must pass a written examination, meet minimum age requirements, and be a U.S. citizen. Generally, the mimimum age is 18, but a high school graduate may begin work at 16 if the job is not hazardous and does not require use of a motor vehicle. Many Postal Service jobs do not require formal education or special training. Applicants for these jobs are hired on the basis of their examination scores.

Applicants should apply at the post office where they wish to work and take the entrance examination for the job they want. Examinations for most jobs include a written test that checks an applicant's vocabulary and reading ability, as well as any special abilities required, such as aptitude for remembering addresses. A physical examination is required, as well. Applicants for jobs that require strength and stamina are sometimes given a special test. For example, mailhandlers must be able to lift and carry mail sacks weighing up to 70 pounds. The names of applicants who pass the examinations are placed on a list in the order of their scores. Five points are added to the score of an honorably discharged veteran, and ten extra points to the score of a veteran wounded in combat or disabled. When a job opens, the appointing officer chooses one of the top three applicants. Others are left on the list so that they can be considered for future openings.

New employees are trained either on the job by supervisors and other experienced employees or in local training centers. Training ranges from a few days to several months, depending on the job. For example, mailhandlers and custodians can learn their jobs in a relatively short time while postal inspectors need months of training.

Postal workers are classified as casual, part-time flexible, part-time regular, or full time. Casual workers are not career employees, but are hired to help handle the large amounts of mail during the Christmas season and for other short-term assignments. Part-time flexible employees, although they have career status, do not have a regular work schedule but replace absent workers or help with extra workloads as the need arises. Part-time regulars have a set work schedule—for example, 4 hours a day. Carriers, clerks, and mailhandlers may start as part-time flexible workers and move into full-time jobs according to their seniority as vacancies occur.

Postal workers can advance to better paying positions by learning new skills. Training programs are available for low-skilled workers who wish to become technicians or mechanics. Also, employees can get preferred assignments, such as the day shift or a more desirable delivery route, as their seniority increases. When an opening occurs, eligible employees may submit written requests, called "bids," for assignment to the vacancy. The bidder who meets the qualifications for the assignment and has the most seniority gets the job.

For supervisory jobs, requirements for promotion may include training or education, a satisfactory work record, and appropriate personal characteristics such as leadership ability. Although opportunities for promotion to supervisory positions in smaller post offices are limited, workers may apply for vacancies in a larger post office and thus increase their chances.

Employment Outlook

Little change is expected in Postal Service employment through the 1980's as mail processing systems become more automated and as mail volume increases very slowly because of rising postal rates and increasing reliance on the telephone for personal communication. Possible cutbacks in the frequency of home deliveries may temper any employment growth stemming from increases in the number of homes and business establishments. Employment in maintenance and repair occupations is expected to increase as mail processing machines grow in numbers and complexity. Many thousands of job openings will result annually as workers retire, die, or transfer to other fields.

Earnings

In late 1978, most full-time employees of the U.S. Postal Service earned annual salaries of at least $14,000. The average annual salary of all full-time postal workers was about $17,350, about one and one-half times the average earnings for all nonsupervisory workers in private industry, except farming.

Postal Service employees are paid under three principal pay schedules depending upon the duties of the job. There is one schedule for production workers, such as clerks, city mail carriers, and mailhandlers; one for rural carriers; and one for supervisory, administrative, technical, and clerical workers. (Earnings of postal clerks and mail carriers are discussed elsewhere in the *Handbook*.) Most production employees receive periodic "step" increases up to a specified maximum if their job performance is satisfactory. In addition, salaries of most postal workers are automatically adjusted for changes in the cost of living. Full-time employees work an 8-hour day 5 days a week. They receive extra pay for night and Sunday work.

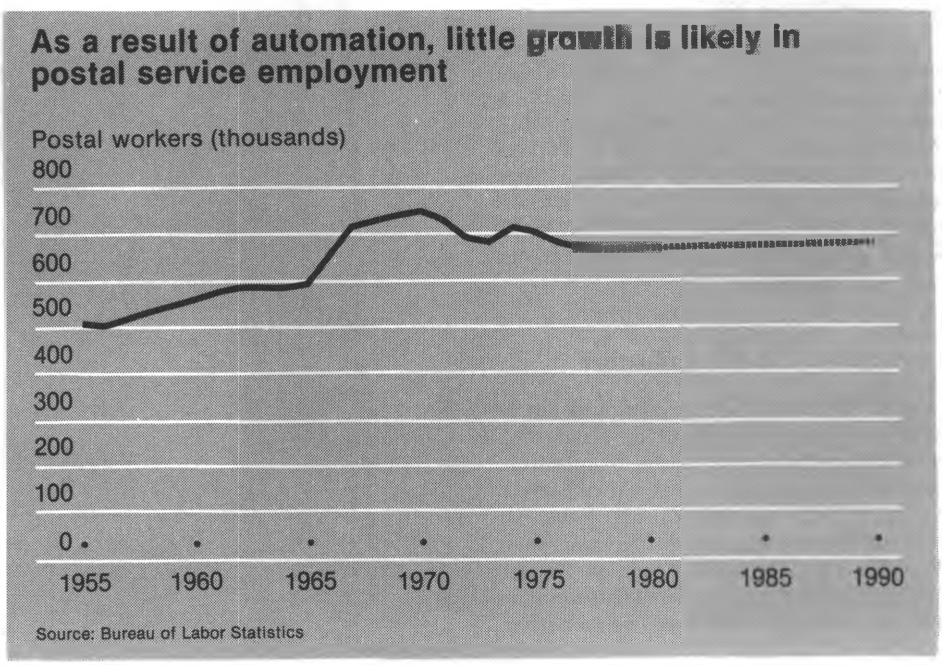
In 1978, postal employees earned 13 days of annual leave (vacation) during each of their first 3 years of service, including prior Federal civilian and military service; 20 days each year for 3 to 15 years of service; and 26 days after 15 years. In addition, they earned 13 days of paid sick leave a year regardless of length of service.

Other benefits included retirement and survivorship annuities, low-cost health insurance programs paid for in part by the Postal Service, and fully paid life insurance.

Most postal workers are members of unions and are covered by one of several negotiated bargaining agreements between the Postal Service and the unions.

Sources of Additional Information

Local post offices and State employment service offices can supply details about entrance examinations and employment opportunities in the Postal Service.



State and Local Governments

State and local governments provide a very large and expanding source of job opportunities in a wide variety of occupational fields. In 1978, about 12.8 million people worked for State and local government agencies; nearly three-fourths of these worked in units of local government, such as counties, municipalities, towns, and school districts.

Educational services account for about one-half of all jobs in State and local government. In 1977, about 6.7 million government employees worked in public schools, colleges, or other educational services. In addition to more than 3.6 million instructional personnel, school systems, colleges, and universities also employed almost 2.9 million administrative personnel, librarians, guidance counselors, nurses, dietitians, clerks, and maintenance workers. Three-fourths of these worked in elementary and secondary schools, which are administered largely by local governments. State employment in education is concentrated chiefly at the college, university, and technical school levels.

The next largest field of State and local government employment was health services. The 1.3 million workers employed in health and hospital work in 1977 included physicians, nurses, medical laboratory technicians, and hospital attendants.

General governmental control and financial activities accounted for about 800,000 workers. These included chief executives and their staffs, legislative representatives, and persons employed in the administration of justice, tax enforcement and other financial work, and general administration. These functions require the services of individuals such as lawyers, judges and other court officials, city managers, property assessors, budget analysts, stenographers, and clerks.

More than 560,000 people worked in street and highway construction and maintenance. Highway workers include civil engineers, surveyors, operators of construction machinery and equipment, truckdrivers, concrete finishers, carpenters, toll collectors, and construction laborers.

Police and fire protection is another large field of employment. More than 620,000 persons were engaged in police work, including administrative, clerical, and custodial personnel, as well as uniformed and plainclothes police. Local governments employed all of the 270,000 fire protection employees, as well as most of the police. One out of five firefighters was employed part time.

Other State and local government employees work in a wide variety of activities: Local utilities (such as water or electricity), transportation, natural resources, public welfare, parks and recreation, sanitation, corrections, local libraries, sewage disposal, and housing and urban renewal. These activities require workers in diverse occupations such as economists, electrical engineers, electricians, pipefitters, clerks, foresters, and busdrivers.

Clerical, administrative, maintenance, and custodial work make up a large portion of employment in most government agencies. Among the workers involved in these activities are clerk-typists, stenographers, secretaries, office managers, fiscal and budget administrators, bookkeepers, accountants, carpenters, painters, plumbers, guards, and janitors. (Detailed discussions of most occupations in State and local governments are given elsewhere in the *Handbook*, in the sections covering the individual occupations.)

Employment Trends and Outlook

The long-range trend in State and local government employment has been steadily upward. Much of this growth has resulted from the need to provide additional services as population increases and as people move from rural to urban areas. City development has required additional street and highway facilities; schools; police and fire protection; and public health, sanitation, welfare, and other services. Population growth and increasing personal income have generated demand for additional and improved education, housing, health facilities, and other services. Except for education, needs for these government services are expected to increase through the 1980's. Little change is expected in State and local government employment associated with education services as public elementary and secondary school enrollments declined slightly and public higher education enrollments increase slowly. Growth of State and local government employment is expected to be concentrated in areas other than education but will be restrained by generally tight budgets, reflecting increased public concern about rising tax burdens. Although State and local government employment is expected to increase more slowly than the average for all industries through the 1980's, large numbers of workers will be needed to replace employees who transfer to other fields of work, retire, or die.

Most positions in State and lcoal governments are filled by residents of the State or locality. If shortages of particular skills exists, however, it is often necessary to recruit from outside the area.

Earnings

Earnings of State and local government employees vary widely, depending upon occupation and locality. Salary differences from State to State tend to reflect differences in the general wage level in various localities.

The *Handbook* statements for individual occupations often gives salary information for State and local government employment. Salary information also can be obtained from the appropriate State and local government agencies.

A majority of State and local government positions are filled through some type of formal civil service test; that is, personnel are hired and promoted on the basis of merit. In some areas, groups of employees, such as teachers and police, have separate civil service coverage for their specific groups.

Most State and local government employees are covered by retirement systems or by the Federal social security program. They usually work a standard week of 40 hours or less, with overtime pay or compensatory time benefits for additional hours of work.

Sources of Additional Information

Persons interested in working for State or local government agencies should contact the appropriate State, county, or city agencies. Offices of local school boards, city clerks, school and college counselors or placement personnel, and local offices of State employment services have additional information.

The Armed Forces

Nature and Location of the Industry

The primary objective of the Armed Forces is the maintenance of national defense. To fulfill this objective, each branch of the Armed Forces—the Army, Navy, Marine Corps, Air Force, and Coast Guard—performs important functions. The Army is primarily concerned with land-based operations, while the Navy organizes and trains forces for sea-based activities. The Marine Corps prepares for land and sea actions in support of naval operations. The Air Force's mission is air and space defense. The Coast Guard, under the Department of Transportation (except in wartime, when it serves the Navy), has maritime responsibilities, such as conducting rescues of distressed vessels and aircraft, enforcing Federal maritime laws, and supervising the cleanup of maritime pollution.

At the beginning of 1979, about 2.1 million persons were on active duty in the Armed Forces—about 770,000 in the Army; 570,000 in the Air Forces; 530,000 in the Navy; 190,000 in the Marine Corps; and 38,000 in the Coast Guard. In addition, about 2.3 million persons were in reserve units.

Military personnel are stationed throughout the United States and in many countries around the world. In the United States, the largest numbers are in California, followed by Texas, North Carolina, Florida, Georgia, and the Washington, D.C., metropolitan area. About 470,000 are outside the United States. The majority of these—over 300,000—are stationed in Europe (particularly Germany); large numbers also are in the Western Pacific area.

The Armed Forces train personnel in hundreds of different types of jobs.

Occupations in the Industry

The range of occupations in the Armed Forces is almost as wide as in civilian life. Jobs include clerical and administrative work, skilled construction trades, electrical and electronic occupations, auto repair, and hundreds of other specialties requiring varied amounts of education and training. Each year the Armed Forces give hundreds of thousands of men and women basic and advanced training that can be used in both military and civilian careers.

A list of major job categories for enlisted personnel is presented below.

Functional Support and Administration Workers:

Personnel.
Administration.
Clerical.
Data processing.
Accounting, finance, and disbursing.
Supply and logistics.
Religious, morale, and welfare.
Information and education.

Electrical and Mechanical Equipment Repairers:

Aircraft.
Automotive.
Wire communications.
Missiles, mechanical and electrical.
Armament and munitions.
Shipboard propulsion.
Power-generating equipment.
Precision equipment.
Aircraft launch equipment.
Other mechanical and electrical equipment.

Craft Workers:

Metalworking.
Construction.
Utilities.
Construction equipment operation.
Lithography.
Industrial gas and fuel production.
Fabric, leather and rubber.
Firefighting and damage control.
Other crafts.

Service and Supply Handlers:

Food service.
Motor transport.
Material receipt, storage, and issue.
Law enforcement.
Military police.
Personal service.
Auxiliary labor.
Forward area equipment support.

Infantry, Gun Crews, and Seamanship Specialists:

Infantry.
Armor and amphibious.
Combat engineering.
Artillery/gunnery, rockets, and missiles.
Air crew.
Seamanship.
Installation security.

Electronic Equipment Repairers:

Radio/radar.
Fire control electronic systems.
Missile guidance, control, and checkout.
Sonar equipment.
Nuclear weapons equipment.
ADP computers.
Teletype and cryptographic equipment.
Other electronic equipment.

Communications and Intelligence Specialists:

Radio and radio code.
Sonar.

Radar and air traffic control.
Signal intelligence/electronic warfare.
Intelligence.
Communications center operations.
Combat operations control.

Medical and Dental Specialists:
Medical care.
Technical medical services.
Related medical services.
Dental care.

Other Technical and Allied Specialists:
Photography.
Mapping, surveying, drafting, and illustrating.
Weather.
Ordnance disposal and diving.
Scientific and engineering aides.
Musicians.

Although many people make the Armed Forces a career, some plan to use the skills and training obtained in military service in civilian jobs. A brief discussion of the relation of each military job category to civilian occupations follows.

Most private businesses and government agencies require the same basic skills that are needed for *functional support and administration* jobs in military service.

Many civilian repairer jobs rely on the same basic theories and advanced troubleshooting techniques as those used in military jobs as *electrical and mechanical equipment repairers*. In some fields, however, additional civilian training may be needed.

Civilian jobs similar to the military's *craft workers* usually require completion of an apprenticeship program. Although military training and experience will not enable a veteran to forego a civilian apprenticeship, many programs give credit for skills acquired in the service.

Many jobs as *service and supply handlers* are identical to those in civilian life, and military experience is helpful in obtaining similar civilian employment.

Most jobs in the *infantry, gun crews and seamanship specialists* group are unique to the Armed Forces. This work experience, however, may help develop leadership and supervisory skills for future civilian employment.

Although *electronic equipment repairers* generally maintain and repair specialized military equipment, most training and experience gained can relate to civilian occupations such as electronics technician, aircraft instrument mechanic, or radar and radio repairer. The service-trained specialist may need additional training on specialized equipment to gain journey worker status in civilian employment. Again, credit sometimes is given in an apprenticeship program for skills acquired in the service.

Some *communications and intelligence specialists* such as sonar, radar, and radio operators, may transfer their skills to civilian jobs. In general, however, these military jobs have very few or no civilian counterparts.

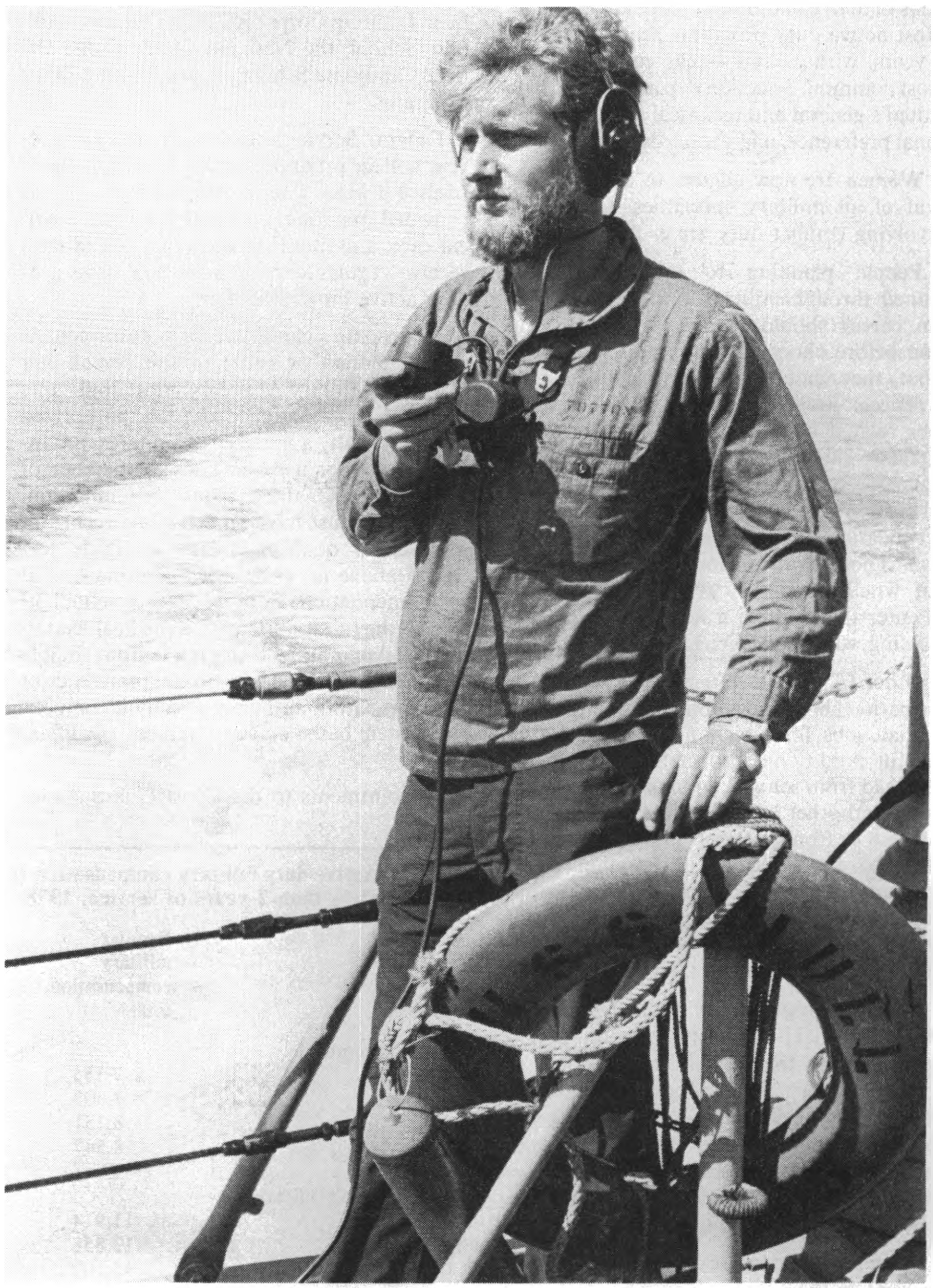
In recent years, changes in military training and civilian requirements for *medical and dental specialists* fields have greatly increased civilian employment opportunities for service-trained personnel. An examination is required in most fields to show proficiency. Civilian occupations in which service-trained individuals can become certified include: Physician's assistants; laboratory technicians; emergency medical technicians; medical technologists; dental assistants; physical therapists; and nurses (most States allow service-trained personnel to take the Licensed Practical Nurse Examination; a few, the Registered Nurse Examination).

Other technical and allied specialists include a wide range of jobs. Although many have a civilian parallel, such as photographer, meteorologist, and musician, others provide skills with limited demand in the civilian sector, such as ordnance disposal and diving.

Working Conditions

Military life is more disciplined and regimented than civilian life. There are uniform and grooming requirements. Certain military formalities, such as saluting superior officers, and special military laws must be followed.

Hours and working conditions vary substantially in the wide range of jobs found in military service. Most military personnel usually work 8 hours a day, 5 or 5 1/2 days a week. Some assignments, however, require night and weekend work, or require persons to be on call at all hours. Some jobs are dan-



Seaman stands lookout watch aboard a destroyer.

gerous, but persons with such assignments normally receive additional compensation.

Training, Other Qualifications, and Advancement

General enlistment qualifications. Although specific enlistment requirements for each service or enlistment option within a particular service may vary, all branches have certain general qualifications. Enlistees may be either single or married, but they must be between the ages of 17 and 35. All branches prefer high school graduation or its equivalent and require it for certain enlistment options. Both a written examination (Armed Services Vocational Aptitude Battery) and a physical examination are required.

Enlistment options. A variety of enlistment options, each involving different combinations of active and reserve duty are available. Most active duty programs range from 3 to 6 years, with 3- and 4-year enlistments the most common. Selection depends on the individual's general and technical aptitudes, personal preference, and the needs of the service.

Women are now eligible to enter 95 percent of all military specialties. Only fields involving combat duty are excluded.

People planning to apply the skills gained through military training to a civilian career should obtain certain information before choosing a military occupation. First, they should determine how good the prospects are for civilian employment in jobs related to the military specialty which interests them. Second, they should know the prerequisites for the related civilian job. Many occupations require licensing certification, or a minimum level of education. Those who are interested should find out whether military training is sufficient to enter the field or, if not, what additional training will be required.

Other *Handbook* statements give much information about the employment outlook for civilian jobs for which military training is helpful. Additional information often can be obtained from schools, unions, trade associations, and other organizations in the field of interest, or from a school counselor. By looking into this kind of information before choosing a specific military occupation, young people entering the Armed Forces will help insure that the type of training they obtain will fit their career plans.

Training programs for enlisted personnel. After a 6- to 11-week basic training period, depending on the service branch, most recruits enter formal classroom training to prepare for a specialized field of work. The remainder receive on-the-job training at their first duty assignment. For those not assigned directly to schools, formal classroom training follows on-the-job training.

After initial or advanced training, recruits are sent to their service assignment.

In addition to on-duty training, military personnel may choose from a variety of educational programs. Most military installations have a tuition assistance program for personnel who wish to take courses during off-duty hours.

Each service branch also offers programs for full-time education, and provides full pay, allowances, tuition, and related fees. Other programs enable enlisted personnel to take college courses and additional military training to become commissioned officers. Courses also are available to help service personnel earn their high school equivalency diploma. In addition, programs are being instituted to allow credit for military training courses towards associate or baccalaureate college degrees.

Officer training. Officer training in the Armed Forces is provided through the Federal Service Academies (Naval, Air Force, Military, and Coast Guard); the Reserve Officer Training Corps (ROTC); Officer Candidate School; the National Guard (State Officer Candidate School programs); and other programs.

Federal Service Academies provide a 4-year college program leading to a bachelor of science degree. The midshipman or cadet is provided free room and board, tuition, medical care, and monthly allowance. Graduates receive regular commissions and have a 5-year active duty obligation.

To become a candidate for appointment as a midshipman or cadet in the Naval, Air Force, or Military Academy, most applicants obtain a nomination from an authorized source (usually a member of Congress). Candidates do not need to know a member of Congress personally to request a nomination. Nominees must have an academic record of a specified quality, college apititude test scores above an established minimum, and recommendations from teachers or school officials; they also must pass a medical examination. Appointments are made from eligible nominees according to personal preference of the nominating authority and by a competitive system based on the nominees' qualifications.

Appointments to the Coast Guard Academy are made on a competitive basis. A nomination is not required.

The Reserve Officer Training Corps (ROTC) trains students in about 500 Army, Navy, Marine Corps, and Air Force units at participating colleges and universities. Trainees take 2 to 5 hours of military instruction a week in addition to regular college courses.

Students in the last 2 years of an ROTC program and all those on ROTC scholarships receive a monthly allowance while attending school and additional pay for summer training. After graduation, they serve as officers on active duty for a stipulated period of time.

College graduates can earn a commission in the Armed Forces through Officer Candidate School Programs in the Army, Navy, Air Force, Marine Corps, Coast Guard, and National Guard.

Persons trained in health professions may qualify for direct appointment as officers. Financial assistance is available for students training in some fields. Direct appointments also are available for those qualified to serve in other special duties, such as the judge advocate general (legal) or chaplain corps.

Flight training is available to commissioned officers in each branch of the Armed Forces.

Promotion opportunities. Each service has different criteria for promoting personnel. Generally, however, new enlistees are promoted from the first to the third level within the first year. Subsequent promotions are based on a more competitive system. Criteria for promotion may include time in service and grade, proficiency in assigned duties, the evaluation and recommendation of the commanding officer, and written examinations.

Employment Outlook

Although the Armed Forces are not expected to expand through the 1980's, replacement needs will be high. Many persons leave the service each year after completion of their enlistment term. In addition, many career military personnel retire early, usually between the ages of 40 and 50.

Table 1. Active duty military compensation for members of the Armed Forces who are single and have less than 2 years of service, 1978

Pay grade	Regular military compensation, total	Basic pay	Quarters allowance	Subsistence allowance
Enlisted members:				
E-1	$ 7,155	$ 5,028	$1,032	$1,095
E-2	7,803	5,604	1,104	1,095
E-3	8,151	5,820	1,236	1,095
E-4	8,547	6,060	1,392	1,095
Commissioned officers:				
0–1	11,914	9,276	1,884	754
0–2	13,858	10,692	2,412	754
0–3	15,802	12,264	2,784	754

SOURCE: U.S. Department of Defense.

Technician checks an aircraft's fuel supply.

Earnings, Allowances, and Benefits

In addition to basic pay, military personnel receive free room and board (or a living allowance), medical and dental care, a military clothing allowance, military supermarket and department store shopping privileges, recreational facilities, 30 days of paid vacation a year, and travel opportunities.

The pay grades for enlisted personnel are E-1 to E-9. The pay grades for commissioned officers are 0-1 to 0-10. Table 1 gives examples of military pay and allowances.

Special pay generally is awarded for unusually demanding or hazardous duties, assignments to certain areas outside the continental United States, and outstanding proficiency in the performance of duty.

Military personnel are eligible for retirement benefits after 20 years of service. Athletic and other recreational facilities—such as libraries, gymnasiums, tennis courts, golf courses, and movies—are available on most military installation. Help with personal or financial problems is available from personal affairs officers, legal assistance officers, and chaplains, as well as supporting agencies.

Veterans' benefits. The Veterans' Administration (VA) provides numerous benefits to those who have served in the Armed Forces. Veterans are given care in a VA hospital for service-connected disabilities; those with other medical problems can be given care if they are unable to pay the cost of hospitalization elsewhere. Veterans are eligible for certain loans, including home loans. Veterans, regardless of health, can convert a military life insurance policy to an individual policy with any participating company in the veteran's State of residence. In addition, job counseling, testing, and placement services are available.

Veterans who participated in the Veterans' Educational Assistance Program (VEAP) may receive educational benefits. Under this program, Armed Forces personnel may elect to save from $50 to $75 a month for a maximum of 36 month towards their future education. The Government will put in $2 for every $1 contributed by the service member. Therefore, service members who save the maximum, $2,700 ($75 for 36 months), will have an education fund totaling $8,100. Upon separation from active duty, the fund can be used to finance an education at any VA-approved institution. VA-approved school, include vocational, correspondence, business, technical, and flight training schools; community and junior colleges; and colleges and universities.

Information on educational and other veterans' benefits is available from officers located in each State, the District of Columbia, Puerto Rico, and the Philippines.

Additional Sources of Information

Each of the military services publishes handbooks and pamphlets that describe entrance requirements, training and advancement opportunities, and other aspects of military careers. These publications are available at all recruiting stations, most State employment service offices, and in high schools, colleges, and public libraries. For additional information, write to

U.S. Army Recruiting Command, Fort Sheridan, Ill. 60037.

Navy Recruiting Command, Code (40), 4015 Wilson Blvd., Arlington, Va. 22203.

USAF Recruiting Service, Directorate of Recruiting Operations, Randolph Air Force Base, Tex. 78148.

Director, Personnel Procument Division, Headquarters, U.S. Marine Corps, Washington, D.C. 20380.

Commandant, (G-PMR), U.S. Coast Guard, Washington, D.C. 20590.

Dictionary of Occupational Titles (D.O.T.) Index

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BLS Materials Useful to Handbook Readers

Reprints from the Occupational Outlook Handbook

Exploring Careers

A Counselor's Guide to Occupational Information

Occupational Outlook Quarterly

Occupational Outlook for College Graduates

Occupational Projections and Training Data

Motivational leaflets

Education and Job pamphlets

Display posters

Reprints from the Occupational Outlook Handbook

All sections of the 1980–81 edition of the *Occupational Outlook Handbook* are available in reprint form. Reprints are especially useful for jobseekers who want to know about a single field and for counselors who need to stretch the contents of a single *Handbook* among many students.

The titles of all 42 reprints are listed below, and an index to the reprints appears on the following pages. A flyer that lists the occupations and/or industries included in each reprint is available free from any BLS Regional Office.

Price of reprints: $1.25 each. A complete set costs only $9. Use order form on p. 661.

Bulletin No.	Title
☐ 2075-1	Tomorrow's Jobs
☐ 2075-2	Metalworking Occupations
☐ 2075-3	Printing and Publishing Occupations
☐ 2075-4	Factory Production Occupations
☐ 2075-5	Clerical Occupations
☐ 2075-6	Office Machine and Computer Occupations
☐ 2075-7	Banking and Insurance Occupations
☐ 2075-8	Business Occupations
☐ 2075-9	Service Occupations
☐ 2075-10	Food Merchandising Occupations
☐ 2075-11	Protective and Related Service Occupations
☐ 2075-12	Education and Related Occupations
☐ 2075-13	Sales Occupations
☐ 2075-14	Construction Occupations—Structural
☐ 2075-15	Construction Occupations—Finishing
☐ 2075-16	Air and Water Transportation Occupations
☐ 2075-17	Railroad Occupations
☐ 2075-18	Driving Occupations
☐ 2075-19	Environmental Scientists and Conservation Occupations
☐ 2075-20	Engineering and Related Occupations
☐ 2075-21	Physical and Life Scientists
☐ 2075-22	Mathematics and Related Occupations
☐ 2075-23	Public Utilities Occupations
☐ 2075-24	Motor Vehicle and Machinery Repairers
☐ 2075-25	Machine Repairers and Operators
☐ 2075-26	Small Business Occupations
☐ 2075-27	Health Practitioners
☐ 2075-28	Health Occupations Dental auxiliaries, nursing, therapy and rehabilitation, health services administration
☐ 2075-29	Health Occupations Medical technologists, technicians, and assistants; dispensing opticians; ophthalmic laboratory technicians; medical record personnel
☐ 2075-30	Lawyers, City Managers, and Social Science Occupations
☐ 2075-31	Counseling and Related Occupations
☐ 2075-32	Social Service Occupations
☐ 2075-33	Performing Arts and Entertainment-Related Occupations
☐ 2075-34	Design Occupations
☐ 2075-35	Communications-Related Occupations
☐ 2075-36	Agriculture and Logging and Lumber Mill Products Industries
☐ 2075-37	Energy Producing Industries
☐ 2075-38	Petroleum Refining, Industrial Chemical, Drug, and Paper and Allied Products Industries
☐ 2075-39	Aluminum, Iron and Steel, and Foundry Industries
☐ 2075-40	Aircraft, Missile, and Spacecraft; Office Machine and Computer; and Motor Vehicle and Equipment Manufacturing Industries
☐ 2075-41	Apparel, Baking, Laundry and Dry Cleaning, and Textile Mill Products Industries
☐ 2075-42	Government Occupations

Order reprint no. 2075- **If you want information about . . .**

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New Publications

Exploring Careers

A new career education resource for junior high/middle school students.

Exploring Careers was prepared by the staff of the *Occupational Outlook Handbook* specifically for youngsters of junior high school age. By means of occupational narratives, evaluative questions, suggested activities, career games, and photographs, the new publication aims to promote career awareness and introduce youngsters to the world of work.

Exploring Careers can be used in classrooms, career resource centers, and youth programs run by community, religious, government, and business organizations. The publication is packaged to facilitate either group or individual use; it is available as a 550-page reference volume or as 15 separate booklets (one for each chapter).

Price: $10 for the single volume; $2 each for 15 separate booklets; $12 for the packaged set of 15 booklets. A flyer listing the 15 chapter titles is available free from any BLS Regional Office. Order *Exploring Careers* from any BLS Regional Office listed on p. 661 with check made payable to the Superintendent of Documents.

A Counselor's Guide to Occupational Information

A revised and updated version of Counselor's Guide to Manpower Information, published in 1969. The *Guide* [new edition] identifies and describes hundreds of Federal publications on jobs and careers, and tells where to write for the publications you need. Included are annotated listings under such topics as finding a job, student financial aid, women and work, handicapped workers, and statistics on education and employment.

Price: Scheduled for publication in mid-1980. Contact any BLS Regional Office listed on p. 661 for price and ordering information.

Other Resources

Occupational Outlook Quarterly

The essential companion to your *Handbook*.

The *Quarterly* is a periodical that helps young people, guidance counselors, education planners, and training officials keep abreast of occupational employment developments between editions of the biennial **Occupational Outlook Handbook.**

Price: $6 for a 1-year subscription; $1.75 for a single copy. See inside back cover for ordering information.

Occupational Outlook for College Graduates, 1980–81 Edition

A convenient resource for jobseekers planning to continue their education beyond high school.

Descriptions of more than 100 occupations —from accountant to wholesale trade sales worker—are excerpted from the 1980–81 edition of the *Occupational Outlook Handbook*. A section on Tomorrow's Jobs for College Graduates assesses the outlook through 1990.

Price: Contact any BLS Regional Office listed on p. 661. May be ordered from BLS Regional Offices, with check made payable to the Superintendent of Documents.

Occupational Projections and Training Data, Revised 1980

A technical bulletin that presents the detailed statistics upon which the *Handbook's* descriptions of employment outlook are based.

Presents employment data for each of more than 200 occupations. Includes estimates of employment in 1978; projected requirements for 1990; average annual job openings over the 1978–90 period; and available data on the number of people completing training in the field. Also includes a discussion of ways of analyzing supply and demand for educational planning.

Price: Contact any BLS Regional Office listed on p. 661. May be ordered from BLS Regional Offices, with check made payable to the Superintendent of Documents.

Motivational Leaflets

A series of eleven leaflets that list jobs open to people with an interest or proficiency in a particular field or academic subject.

Each leaflet presents an overview of career opportunities, then identifies reprints from the 1980–81 edition of the *Occupational Outlook Handbook* that contain relevant occupational information. Titles are:

- Thinking of a Clerical Job?
- Ecology and Your Career
- English and Your Career
- Foreign Languages and Your Career
- Health Careers Without a College Degree
- Liberal Arts and Your Career
- Math and Your Career
- The Outdoors and Your Career
- Your Job as a Repairer or Mechanic
- Science and Your Career
- Social Science and Your Career.

Price: Free from any of the BLS Regional Offices listed on p. 661.

Education and Job Pamphlets

A series of five pamphlets that identify and describe jobs open to people with particular levels of education or training.

Each job brief includes a summary of the training and qualifications needed and the employment outlook through 1990.

Titles are:

- Jobs for Which You Can Qualify if You're a High School Graduate
- Jobs for Which You Can Train Through Apprenticeship
- Jobs for Which You Can Qualify if You're Not a High School Graduate
- Jobs for Which You Probably Will Need Some College or Specialized Training
- Jobs for Which You Probably Will Need a College Education.

Price: Free from any of the BLS Regional Offices listed on p. 661.

Display Posters

A series of colorful wall posters that encourage young people to think about careers and consult the *Occupational Outlook Handbook*.

Price: Free from any of the BLS Regional Offices listed on p. 661.

BLS Regional Offices

Order priced items from any BLS Regional Office.

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1515 Broadway, New York, N.Y. 10036

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P.O. Box 13309
Philadelphia, Pa. 19101

Atlanta
1371 Peachtree St. N.E.
Atlanta, Ga. 30309

Chicago
9th Floor, Federal Office Bldg.
230 South Dearborn St., Chicago, Ill. 60604

Dallas
2nd Floor, 555 Griffin Square Bldg.
Dallas, Tex. 75202

Kansas City
911 Walnut St.
Kansas City, Mo. 64106

San Francisco
450 Golden Gate Ave., Box 36017
San Francisco, Calif. 94102

Order Form

Occupational Outlook Reprints

Please send the following Reprints
from the Occupational Outlook Handbook, 1980–81 Edition.

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- ☐ Education and Jobs pamphlets (set of 5)
- ☐ Motivational leaflets (set of 11)
- ☐ Display posters

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- ☐ 1980–81 Occupational Outlook Handbook
- ☐ Occupational Outlook Quarterly
- ☐ 1980–81 Occupational Outlook Handbook reprints
- ☐ Exploring Careers
- ☐ A Counselor's Guide to Occupational Information
- ☐ 1980–81 Occupational Outlook for College Graduates
- ☐ Occupational Projections and Training Data, Revised 1980

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Heard about our

new publications?

Exploring Careers

A Counselor's Guide to Occupational Information

Turn to page 653
to find out about these and other BLS publications useful to *Handbook* readers.

Pointers on Using the Handbook

- **To locate a particular occupation or industry,** see:
  Contents, page viii.
  Index to Occupations and Industries, page 635.

- **Occupations have new code numbers.**
  This is the first *Handbook* to use the codes from the new 4th edition of the *Dictionary of Occupational Titles.* The Index to the Dictionary of Occupational Titles, on page 626, lists nearly 1,000 occupations by D.O.T. code and title and, for each, refers you to the relevant page of the *Handbook.*

- **How do economists forecast the future?**
  For a brief description of the assumptions and methods used in preparing BLS employment projections, see page 24.

- **For an overview of job prospects to 1990,**
  read the section on Tomorrow's Jobs starting on page 16.

- **Should you steer clear of a slow-growing occupation?**
  For pointers on interpreting the outlook section that appears in every *Handbook* statement, see page 4.

- **Need more career information?**
  Consult the Sources of Additional Information at the end of every statement. See page 8 for other places to look for information on occupations and careers.


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SALE
TIRE SALE
GROCERY STORE
Law Office
TRAVEL
ARCHEOLOGISTS AT WORK
KEEP OUT
PARK
ENTRANCE