(D.O.T. 075.118 through .378)

NURSING OCCUPATIONS

The nursing field, consisting of registered nurses; licensed practical nurses; and nursing aides, orderlies, and attendants, accounts for about 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 others 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 have been handled by physicians. Some nurses become head nurses with responsibility for all nursing services of a specified area of an institution, for example, a pediatrics ward.

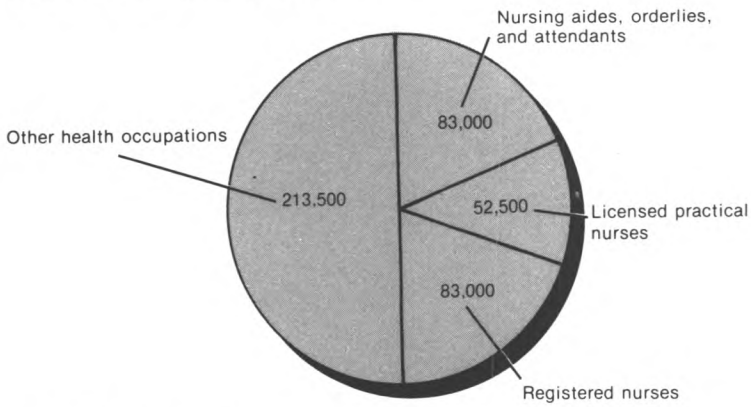
Licensed practical nurses provide skilled nursing care to sick, injured, and convalescent patients. They work under the general supervision of physicians and registered nurses, and may sometimes supervise nursing aides, orderlies, and attendants.

Nursing aides, orderlies, and attendants make up the largest group of nursing personnel. They serve meals, feed patients, and do other tasks that free professional 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 working with people because they must work closely with other members of the health team and care for patients who are uncomfortable and sometimes irritable. Nursing workers must be reliable and keep a level head in emergencies.

About 50 percent of the job openings in health occupations during the next 10 years will be for nursing personnel

Average annual openings, 1976-85



Source: Bureau of Labor Statistics

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, evaluate, 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 hospital care. Others perform research activities or instruct students. The setting usually determines the scope of the nurse's responsibilities.

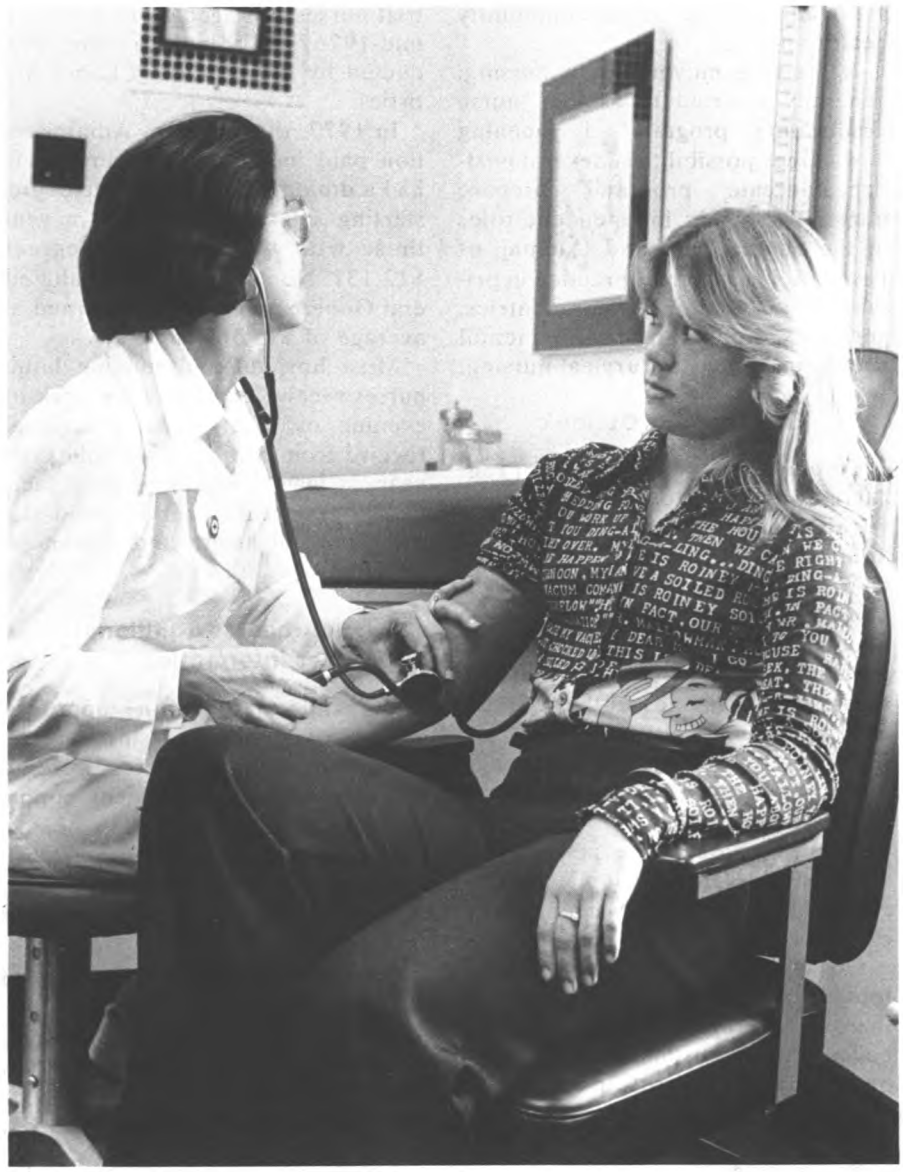
Hospital nurses constitute the largest group of nurses. Most are staff nurses who provide skilled bedside nursing care and carry out the medical treatment prescribed by physicians. They may also supervise practical nurses, aides, and orderlies. Hospital nurses usually work with groups of patients that 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.

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, in a hospital, or in a convalescent institution.

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.

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 may also instruct groups of patients in proper diet and arrange for immunizations. These nurses work with com-

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Employment opportunities for registered nurses are expected to be favorable through the mid-1980's.

munity leaders, teachers, parents, and physicians in community health education. Some community health nurses work in schools.

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.

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.

(Licensed practical nurses who also perform nursing services are discussed elsewhere in the *Handbook*.)

Places of Employment

About 960,000 persons worked as registered nurses in 1976. About one-third worked on a part-time basis.

About three-quarters 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 65,000; nurse educators in nursing schools accounted for about 33,000; and occupational health nurses in industry, about 20,000. 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 get a license, a nurse must be a graduate of a school of nursing approved by the State board of nursing and pass a written State 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, baccalaureate, and associate degree—prepare candidates for licensure. However, a minimum of a baccalaureate degree is preferred for those who aspire to administrative or management positions, and those planning to work in research, consultation, teaching, or clinical specialization, which require education at the master's level. Graduation from high school is required for admission to all schools of nursing.

Diploma programs are conducted by hospital 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 them-

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selves to registered nurses while they continue to work part time. These programs generally offer an associate of arts degree. In 1976, about 1,375 programs (associate, diploma, and baccalaureate) were offered in the United States. In addition, there were 102 master's degree and 12 doctoral degree programs in nursing.

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; must have initiative, and in appropriate situations be able to follow orders precisely or determine if additional consultation is required; and must use good judgment in emergencies. Good mental health is needed in order to cope with human suffering and frequent emergency situations. Staff nurses need physical stamina because of the amount of time spent walking and standing.

From staff positions in hospitals, experienced nurses may advance to head nurse, assistant director, and director of nursing services. A master's degree, however, often is required for supervisory and administrative positions, as well as for positions in nursing education, clinical specialization, and research. Public health agencies require a baccalaureate degree for employment. Advancement may be difficult for nurses who do not have a baccalaureate or master's degree in community health nursing.

A growing movement in nursing, generally referred to as the "nurse practitioner program" is opening new career possibilities. Several post-baccalaureate 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 mid-1980's. Some competition for more desirable, higher paying jobs is expected in areas where training programs abound, but 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 1985. 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 and Working Conditions

Registered nurses who worked in hospitals in 1976 received average starting salaries of $11,820 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 can expect to earn slightly less than those in hospitals. Salaries of industrial nurses averaged $240 a week in mid-1976, according to a survey conducted by the Bureau of Labor Statistics.

In 1977, the Veterans Administration paid inexperienced nurses who had a diploma or an associate degree starting salaries of $10,370 a year; those with baccalaureate degrees, $12,131. Nurses employed in all Federal Government agencies earned an average of $15,500 in 1977.

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 service, and also some type of health and retirement benefits.

Sources of Additional Information

For information on approved schools of nursing, nursing careers, loans, scholarships, salaries, working conditions, and employment opportunities, contact:

Coordinator, Undergraduate Programs, Department of Nursing Education, American Nurses' Association, 2420 Pershing Rd., Kansas City, Mo. 64108.

For career information and a list of schools of nursing, contact:

Career Information Services, National League for Nursing, 10 Columbus Circle, New York, N.Y. 10019.

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. 079.378)

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

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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 needed by patients. 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 units, recovery rooms, or burn units. 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 also 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.



LPN's provide much of the bedside care needed by hospital patients.

Places of Employment

In 1976, about 460,000 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 become licensed, applicants must complete a course of instruction in practical nursing that has been approved by the State board of nursing and pass a written examination. Educational requirements for enrollment in State-approved training 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. Physical examinations and aptitude tests are usually required. Volunteer hospital work can provide a useful background for practical nursing, but most applicants have no prior work experience.

In 1976, over 1,350 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 are generally 1 year long and include both classroom study and clinical practice. Classroom instruction cov-

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ers nursing concepts and principles and related subjects including anatomy, physiology, medical-surgical nursing, pediatrics, obstetrics, psychiatric nursing, administration of drugs, nutrition, first aid, and comply their skill to an actual nursing situation through supervised clinical experience—usually in a hospital.

Those who wish to become licensed practical nurses should have a deep concern for human welfare. They must be emotionally stable because working with sick and injured people sometimes can be upsetting.

As part of a health care team, they must be able to follow orders and work under close supervision. Good health is very important, as is the physical stamina needed to work while standing a great deal.

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. Under career ladder programs, nurses' aides may attend training to become LPN's while continuing to work part-time. Similarly, 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 mid-1980's. Employment is expected to continue to rise much faster than the average for all occupations zn response to the needs of a growing population 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 and Working Conditions

The average starting salary of LPN's in hospitals was about $9,100 a year in 1976, according to a national survey conducted by the University of Texas Medical Branch.

Federal hospitals offered beginning LPN's an annual salary of $7,408 in 1977.

Many hospitals give pay increases after specific periods of satisfactory service. Practical nurses generally work 40 hours a week, but often this workweek includes some work at night and on weekends and holidays. Many hospitals provide paid holidays and vacations, health insurance, and pension plans.

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 to the practical nurse in setting work hours and determining the length and frequency of vacations.

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 42d 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 St., New York, N.Y. 10019.

Information about employment opportunities in U.S. Veterans Administration hospitals is available from your local Veterans Administration hospital, as well as:

Department of Medicine and Surgery, Veterans Administration, Washington, D.C. 20420.

NURSING AIDES, ORDERLIES, AND ATTENDANTS

(D.O.T. 355.687 through .887)

Nature of the Work

Nursing aides, orderlies, and attendants perform a variety of duties to care for sick and injured people. Other job titles include *hospital attendant*, *nursing assistant*, *auxiliary nursing worker*, *geriatric aide*, and (in mental institutions) *psychiatric aide*.

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 work in hospital pharmacies or supply rooms storing and moving supplies.

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 other household tasks. In others, under the supervision of registered nurses and licensed practical nurses, they may assist in the care of patients. The tasks performed for patients differ considerably, and depend on whether the patient is confined to bed following major surgery, is recovering after a disabling accident or illness, or needs assistance with daily activities because of infirmity caused by 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 doing the cooking and other light housework. (See statement on homemaker-home health aides elsewhere in the *Handbook*.)

Places of Employment

About 1 million persons worked as nursing aides, orderlies, and attendants in 1976. 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

Although some employers prefer high school graduates, many, such as

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Over 1 million persons worked as nursing aides, orderlies, and attendants in 1976.

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 the close supervision of registered or licensed practical nurses, with classroom instruction. Trainees learn to take and record temperatures, bathe patients, change linens on beds that are 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 promotions 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 mid-1980's. In addition to those needed because of occupational growth, many thousands of nursing aides will be needed each year to replace workers who 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 expected occupational growth 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 health insurance.

Earnings and Working Conditions

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 considerably less than those in hospitals. Depending on the experience of the applicant, starting salaries of nursing aides in Veterans Administration hospitals ranged from $125 to $140 a week in 1977. The average salary earned by nursing aides employed by the Federal Government was $185 a week in 1977.

With few exceptions, the scheduled workweek of attendants in hospitals is 40 hours or less. Because nursing care must be available to patients on a 24-hour-a-day basis, scheduled hours include nightwork and work on weekends and holidays.

Attendants in hospitals and similar institutions generally receive paid vacations which, after 1 year of service, may be a week or more in length. Paid holidays and sick leave, hospital and medical benefits, shift differentials, and pension plans also are available to many hospital employees.

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Sources of Additional Information

Information about employment may be obtained from local hospitals and nursing homes. Additional information about the work of nursing aides, orderlies, and attendants is available from:

Division of Careers and Recruitment, American Hospital Association, 840 N. Lake Shore Dr., Chicago, Ill. 60611.

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THERAPY AND REHABILITATION OCCUPATIONS

Persons disabled by accident, burns, strokes, and disease, as well as the emotionally disturbed, all benefit from the care given by therapy and rehabilitation workers. After an accident or serious illness leaves a victim fully or partially disabled, *physical therapists*, and *physical therapist assistants* and *aides* work to restore the patient to the fullest possible level of activity. *Occupational therapists* and *occupational therapy assistants and aides* guide the disabled further along the road to realizing a satisfying and productive life. They teach disabled and emotionally disturbed clients skills and crafts that help build coordination and self-confidence, and, in many cases, prepare them to return to work. They also help the elderly in nursing homes by involving them in interesting and absorbing hobbies. Also described in this section are *speech pathologists* and *audiologists*, who specialize in helping those with speech and hearing problems to overcome their handicaps.

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 clients affected by severe handicaps.

Other occupations also provide opportunity for 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. 079.128)

Nature of the Work

Occupational therapists plan and direct educational, vocational, and recreational activities designed to help mentally and physically disabled patients become self-sufficient. They evaluate the capacities and skills of clients, set goals, and plan a therapy program together with the client and members of a medical team which may include physicians, physical therapists, vocational counselors, nurses, social workers, and other specialists.

About two therapists out of five work with 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 leather working, and business and industrial skills such as typing and the use of power tools. These skills are taught to restore mobility and coordination and to help the patient regain physical and emotional stability. Therapists also plan and direct games and other activities, especially for children. They may design and make special equipment or



Occupational therapists help handicapped people prepare for employment.

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splints 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 hospitals 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.

Places of Employment

About 10,600 occupational therapists were employed in 1976. About 4 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.

Training, Other Qualifications, and Advancement

A degree or certification in occupational therapy is required to enter the profession. In 1976, 49 colleges and universities offered programs in occupational therapy which were accredited by the American Medical Association and the American Occupational Therapy Association. All of these schools offer bachelor's degree programs. Some have 2-year programs 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 for previous academic performance 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. 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. 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.

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 do research.

Employment Outlook

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.

However, the increasing number of graduates from occupational therapy programs may exceed the number of openings that will occur each year due to growth in the occupation and replacement of those who will die or retire. As a result, new graduates may face competition in some geographic areas through the mid-1980's.

Earnings and Working Conditions

Beginning salaries for new graduates of occupational therapy programs working in hospitals averaged about $12,000 a year in 1976, according to a national survey conducted by the University of Texas Medical School. Some experienced therapists earned as much as $17,000, and some administrators as much as $25,000 to $30,000. In 1976, the average salary of experienced occupational therapists was 1 1/2 times the average earnings for all nonsupervisory workers in private industry, except farming.

In 1977, beginning therapists employed by the Veterans Administration (VA) earned starting salaries of $10,370 a year. The average salary paid occupational therapists working for the VA was about $16,000 at that time.

Many part-time positions are available for occupational therapists. Many therapists work for more than one employer and must travel between job locations.

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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 & AIDES

(D.O.T. 079.368)

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.



Occupational therapy assistants must be able to teach a broad range of skills.

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.

Places of Employment

About 8,900 people worked as occupational therapy assistants and aides in 1976. Almost half of all occupational therapy assistants work in hospitals. Others work in nursing homes, schools for handicapped children and the mentally retarded, rehabilitation and day 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 most often 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 of about 1 year's duration. In 1976, 42 schools offered educational programs approved by the American Occupational Therapy Association. Most of these are 2-year college programs leading to an associate degree.

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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 1976, about 2,640 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 varies depending on the level of difficulty of the duties that aides 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 since 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, due to 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 through the mid-1980's.

Employment opportunities for occupational therapy assistants are expected to be very good through the mid-1980's, particularly for graduates of approved programs. Many openings will be created each year by growth in the occupation and even more will occur as workers die, retire, or leave the field for other reasons.

The number of 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 and Working Conditions

In 1976, annual salaries generally ranged from $7,500 to $9,000 for inexperienced assistants. Experienced occupational therapy assistants earned between $8,500 and $12,000 a year, according to the limited information available. Those who completed an approved program generally earned higher starting salaries than beginners without any training. Occupational therapy assistants working for the Veterans Administration earned starting salaries of $7,408 annually in 1977, and the average of salaries paid to all occupational therapy assistants with the Federal Government was about $11,500 a year.

Occupational therapy aides earned beginning salaries of about $6,200 a year in 1976, according to the limited information available.

Occupational therapy assistants and aides occasionally may work evenings, weekends, and part time.

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. 079.378)

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, crippled 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 the patients' progress with physicians, psychologists, occupational therapists, and other specialists. When advisable, physical therapists revise the therapeutic procedures and treatments. They help disabled persons to accept their physical handicaps and adjust to them. They show members of the

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Physical therapists develop programs for treatment of disabled persons of all ages.

patients' families how to continue treatments at home.

Therapeutic procedures include exercises for increasing strength, endurance, coordination, and range of motion; electrical stimuli to activate paralyzed muscles; instruction in carrying out everyday activities and in the use of helping devices; and the application of massage, heat and 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, amputations, arthritis, or paralysis. Others teach or are consultants.

Places of Employment

About 25,000 persons worked as licensed physical therapists in 1976. 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. Others work in rehabilitation centers or schools for crippled 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 and the District of Columbia 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 board examination. Applicants may prepare for State board 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 certification in physical therapy through special programs lasting 12 to 16 months. These applicants also have the option of working for a master's degree in physical therapy.

In 1976, 11 certificate programs, 76 bachelor's degree programs and 5 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 17 other master's degree programs that provided advanced training to those already in the field. One of the certificate 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

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to patients in a hospital or treatment center.

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.

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. High school courses that are useful include health, biology, social science, mathematics, and physical education.

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 faster than the average for all occupations through the mid-1980's because of increased public recognition of the importance of rehabilitation. As programs to aid crippled 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. Many part-time positions should continue to be available.

However, the rapidly growing number of new graduates is expected to exceed the number of openings that will occur each year due to growth in the occupation and replacement of those who will die or retire. As a result, new graduates are expected to face some competition through the mid-1980's. Employment opportunities will be best in surburban and rural areas.

Earnings and Working Conditions

Starting salaries for new physical therapy graduates averaged about $11,200 a year in 1976, according to a national survey conducted by the University of Texas Medical School. Earnings of experienced physical therapists averaged about $14,000, about one and a half times as much as average earnings for all nonsupervisory workers in private industry, except farming.

Beginning therapists employed by the Veterans Administration (VA) earned starting salaries of $10,473 a year in 1977. The average salary paid therapists employed by the VA in 1977 was $15,700 annually; supervisory therapists may earn over $20,000.

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. 355.878)

Nature of the Work

Physical therapist assistants and aides work under the supervision of professional physical therapists to rehabilitate disabled persons so that they may again lead useful and productive lives. They work 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



Aide helps patient do therapeutic exercises.

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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 the physical therapist to instruct patients on how to use 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. They also 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 most of the duties of the therapist, within the limits of his or her training.

Places of Employment

About 12,500 persons worked as physical therapist assistants and aides in 1976. 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 crippled 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. In 19 States, assistants are licensed. They must be graduates of approved 2-year associate degree programs and pass a written proficiency examination. A few of these States have a "grandfather" clause that allows the educational requirement to be waived for those who learned their skills before associate degree programs became available. In States not requiring a license, physical therapy aides can advance to assistants by acquiring the necessary knowledge and skills on the job, although employers often prefer graduates of approved programs.

There were 37 approved programs to train physical therapist assistants in 1976. 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 exercises, 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 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, psychology, physical education, mathematics, and typing.

Physical therapist assistants and aides need good physical health. They also need good manual dexterity to adjust equipment, body coordination to assist in positioning 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. Some aides may become physical therapy assistants on the basis of acquired job experience. The opportunities for aides to advance in this way are best in areas where associate degree programs for physical therapist assistants are unavailable.

Physical therapist assistants with an associate degree from an approved 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.

Employment Outlook

Job opportunities for physical therapist assistants and aides who are graduates of approved programs are expected to be excellent through the mid-1980's. In communities where there are large classes in physical therapist assistant programs, some graduates may find it necessary to move to other locations where no associate degree programs are available. For the Nation as a whole, however, the number of openings for physical therapist assistants caused by growth and replacement needs are expected to far exceed the number of graduates from these programs.

The number of physical therapist assistants and aides is expected to increase faster than the average for all occupations as the demand for professional physical therapists grows. Overall demand in the field stems from increased public awareness of the importance of rehabilitation and the growing number of nursing homes which provide therapeutic services to the elderly. Expanded physical therapy services planned by hospitals, nursing homes, schools for

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crippled children, facilities for mentally retarded, and other health and rehabilitation centers are expected to further increase the need for physical therapist assistants and aides.

Earnings and Working Conditions

In 1976, weekly salaries averaged about $116 for beginning physical therapist aides and about $170 for those with experience, according to the limited information available. Physical therapist assistants received higher salaries than aides, beginning at about $175 a week. Experienced physical therapist assistants earned as much as $325 weekly. Physical therapist assistants working for the Veterans Administration (VA) earned starting salaries of $115 a week in 1977, and the average of salaries paid to all physical therapist assistants with the VA was about $214 weekly.

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. 079.108)

Nature of the Work

About one out of ten 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 having speech or hearing impairments often have problems in job adjustment. Speech pathologists and audiologists provide direct services to these people by evaluating their speech or hearing disorders and then providing treatment.



Speech pathologists and audiologists help people overcome speech and hearing disorders.

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, either in schools or other locations, 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, directors of speech and hearing clinics and coordinators of speech and hearing in schools, health departments, or government agencies may be totally involved in administration.

Places of Employment

Over 38,000 persons worked as speech pathologists and audiologists

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in 1976. Over 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 require a master's degree or its equivalent for speech pathologists and audiologists. In addition, many Federal programs, such as Medicare and Medicaid, require participating speech pathologists and audiologists to have a master's degree. Some States require a teaching certificate to work in the public schools. In 29 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 early 1977, about 228 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 with clients having 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 and Hearing Association's (ASHA) requirements for a Certificate of Clinical Competence usually is necessary in order to advance professionally and to earn a higher salary. To earn the CCC, a person must have a master's degree or its equivalent and complete a one-year internship approved by the Association. Passing a national written examination also is required.

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 is important. Speech pathologists and audiologists receive satisfaction from seeing clients' speech or hearing improve as a result of their work.

Employment Outlook

The employment of speech pathologists and audiologists is expected to increase faster than the average for all other occupations through the mid-1980's. However, temporary reductions in government spending on speech and hearing programs may decrease the number of new positions available at any one time. 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 some graduates will have to relocate in order to find 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, is one of the factors underlying the expected expansion in employment of speech pathologists and audiologists through the mid-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 which 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 and Working Conditions

In 1977, the annual starting salary in the Federal Government for speech pathologists and audiologists with a master's degree was $14,097. Those having a doctoral degree were eligible to start at $17,056. The average salary of all speech pathologists and audiologists working for the Federal Government was $21,804.

Salaries of speech pathologists outside of government tend to be higher in areas having large urban populations. Many speech pathologists and audiologists, particularly those in colleges and universities, supplement their incomes by acting as consul-

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tants, engaging in research projects, and writing books and articles.

Many speech pathologists and audiologists work over 40 hours a week. Almost all receive fringe benefits such as paid vacations, sick leave, and retirement programs.

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 and Hearing Association, 9030 Old Georgetown Rd., Washington, D.C. 20014.

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OTHER HEALTH OCCUPATIONS

DIETITIANS

(D.O.T. 077.081 through .168)

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 a dietetic department also decide on departmental policy; coordinate dietetic service 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. Among their duties, 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 keep on these diets after leaving the hospital or clinic. In a small institution, one person may be both the administrative and clinical dietitian.

Research dietitians conduct, evaluate, and interpret research to improve the nutrition of both healthy and sick people. This research may be in nutrition science and education, food management, or food service systems and equipment. They may conduct studies of how the body uses food. Research projects may investigate the nutritional needs of the aging, or persons with a chronic disease, or space travelers. Research dietitians usually are employed in medical centers or education facilities, but also may work in community health programs. (See statement on food scientists elsewhere in the *Handbook*.)

Dietetic educators teach dietetics to dietetic, medical, dental, and nursing students and to interns, residents, and other members of the health care team. They usually work in medical and educational institutions.



Clinical dietitians plan meals for patients in hospitals, nursing homes, or clinics.

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 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 as an integral part of a 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.

Places of Employment

About 45,000 persons worked as dietitians in 1976. 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 as teachers or in 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 commissioned officers in the Armed Forces.

Training, Other Qualifications, and Advancement

A bachelor's degree, preferably 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. College courses usually re-

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quired are in food and nutrition, institution management, chemistry, bacteriology, physiology, and related courses such as mathematics, data processing, psychology, sociology, and economics.

For a dietitian to qualify for professional recognition, the American Dietetic Association (ADA) recommends the completion after graduation of an approved dietetic internship or an approved 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 1976, 68 internship programs were approved by the American Dietetic Association. A growing number of coordinated undergraduate programs, located in schools of medicine and in allied health and home economics departments of both colleges and universities, enable students to complete both the requirements for a bachelor's degree and the clinical experience requirement in 4 years. The ADA approves coordinated undergraduate programs.

Persons meeting the qualifications established by the ADA's Commission on Dietetic Registration can become Registered Dietitians (R.D.'s). Registration with the ADA is acknowledgement of a dietitian's competence.

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 in this field. Graduate study in institutional or business administration is valuable to those interested in administrative dietetics.

Persons who plan to become dietitians 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 opportunities for qualified dietitians on both a full-time and part-time basis are expected to be good through the mid-1980's. 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.

Employment of dietitians is expected to grow about as fast as the average for all occupations through the mid-1980's to meet the 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 dietitians needed because of occupational growth, many others will be required each year to replace those who die, retire, or leave the profession for other reasons.

Earnings and Working Conditions

Starting salaries of hospital dietitians averaged $11,300 a year in 1976, according to a national survey conducted by the University of Texas Medical Branch. Experienced dietitians received annual salaries ranging from $13,900 to $25,300, according to the American Dietetic Association. The median salary paid by colleges and universities to dietitians with bachelor's degrees was $13,900 a year in 1976. The median salary for those with bachelor's degrees working in commercial or industrial establishments was $14,400 a year; for those in public and voluntary health agencies, $13,000. For self-employed dietitians with a bachelor's degree, the median salary was over $16,000 a year in 1976.

The entrance salary in the Federal Government for those completing an approved internship was $11,523 in 1977. Beginning dietitians with a master's degree who had completed an internship earned $14,097. In 1977, the Federal Government paid experienced dietitians average salaries of $18,109 a year.

Most dietitians work 40 hours a week; however, dietitians in hospitals may sometimes work on weekends, and those in commercial food service have somewhat irregular hours. Some hospitals provide laundry service in addition to salary. Dietitians usually receive paid vacations, holidays, and health insurance and retirement benefits.

Sources of Additional Information

For information on approved dietetic internship programs, scholarships, employment opportunities, and registration, and a list of colleges providing training for a professional career in dietetics, contact:

The American Dietetic Association, 430 North Michigan Ave., 10th floor, Chicago, Ill. 60611.

The U.S. Civil Service Commission, 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 in the District of Columbia government programs.

DISPENSING OPTICIANS

(D.O.T. 713.251, and 299.884)

Nature of the Work

About 100 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

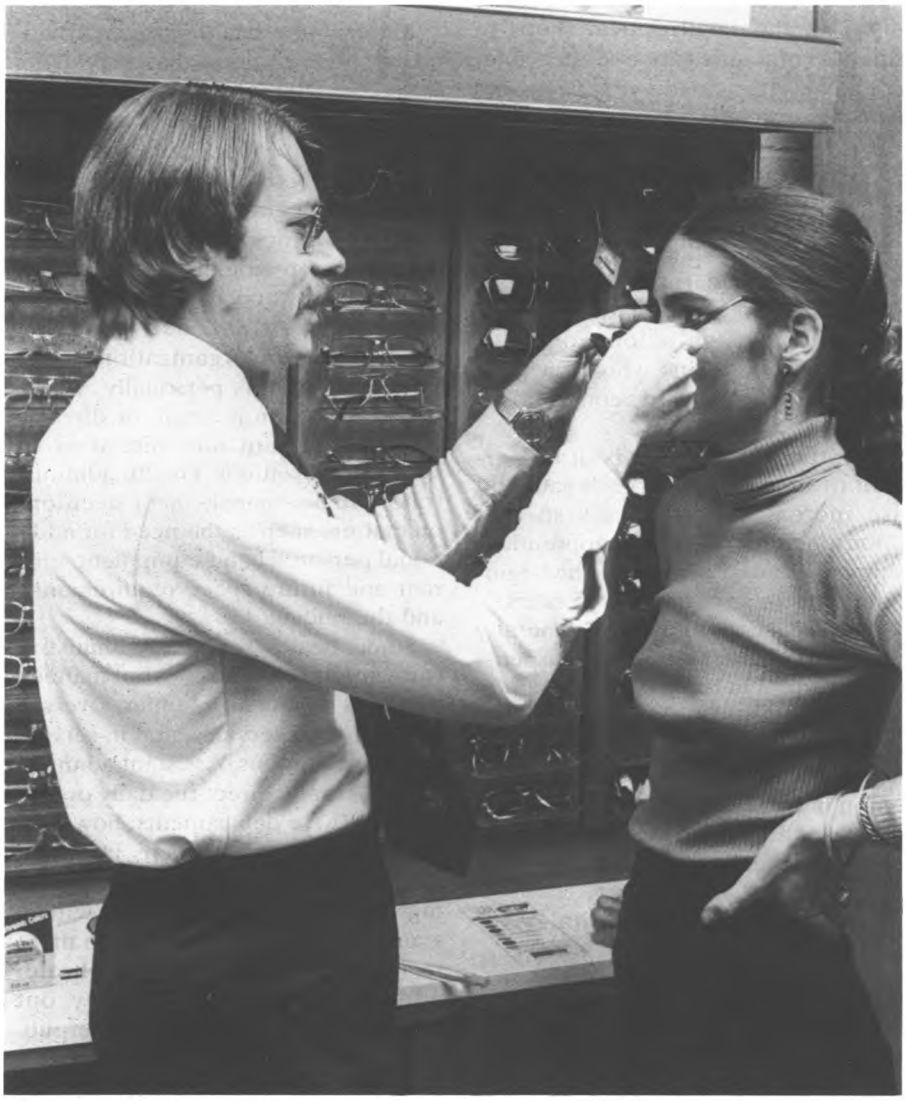
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relation to the customer's eyes by measuring the distance between the centers of the pupils. They also assist the customer in selecting the proper eyeglass frame by measuring the customer's facial features and showing the various styles and colors of frames.

Dispensing opticians analyze and interpet precriptions 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 quality 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, cornea, lids, and contact lens 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 prosthesis (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.



Dispensing optician adjusts finished glasses to fit the customer.

Places of Employment

About 14,500 persons worked as dispensing opticians in 1976. 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 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.

Formal institutional training for the dispensing optician is available for high school graduates. In 1977, 15 schools offered 2-year full-time courses in optical fabricating and dispensing work leading to an associate degree. In addition, large manufacturers of contact lenses offer nondegree courses in lens-fitting that usual-

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ly last a few weeks. A small number of opticians learn their trade in the Armed Forces.

High school graduates also can prepare for optical dispensing work through 3- 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 technicial training, apprentices are given an opportunity to work directly with patients in the fitting of both 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 1976, 19 States had licensing requirements governing dispensing opticians: Alaska, Arizona, California, Connecticut, Florida, Georgia, Hawaii, Kentucky, Massachusetts, Nevada, New Jersey, New York, North Carolina, Rhode Island, South Carolina, Tennessee, Vermont, Virginia, 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 mid-1980's. In addition to the 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. The demand for eyeglasses is expected to increase as a result of increases in population and a greater awareness of the need for eyeglasses. 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 will be particularly favorable for dispensing opticians who have associate degrees in opticianry. Opportunities will be best in metropolitan areas because many of the retail optical shops in small communities are operated solely by owners and do not need dispensing opticians.

Earnings and Working Conditions

Hourly wage rates for dispensing opticians ranged from $5 to $8 in 1976 based on information from a small number of union contracts. Dispensing opticians who own their own shops can earn considerably more.

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.

Working conditions are generally pleasant, quiet, and clean. Dispensing opticians in retail shops generally work a 5 1/2- or 6-day week.

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).

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, 300 Jay St., Brooklyn, N.Y. 11201.

For general information about the occupation, contact:

International Union of Electrical, Radio and Machine Workers, 1176 16th St. NW., Washington, D.C. 20036.

National Federation of Opticianry Schools 300 Jay St., Brooklyn, N.Y. 11201.

Opticians Association of America, 1250 Connecticut Ave. NW., Washington, D.C. 20036.

HEALTH SERVICES ADMINISTRATORS

(D.O.T. 169.168, 187.118, and 187.168)

Nature of the Work

Medical and health care is provided by organizations that vary from large teaching hospitals to small walk-in clinics. Each of these requires effective management to function properly. Health administrators, under the general supervision of boards of directors or other governing bodies, provide this management.

Administrators coordinate 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 management decisions on matters such as the need for additional personnel and equipment, current and future space requirements, and the budget.

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 to carry out fundraising drives and promote public participation in health programs. This phase of the administrator's job often includes speaking before civic

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Administrators coordinate the various activities of a health organization.

groups, arranging publicity, and coordinating the activities of the organization with those of government or community agencies.

Places of Employment

About 160,000 persons worked as health services administrators in 1976. 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 to health facilities at a specified contract price.

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 conduct research and provide care and treatment for victims of particular diseases or physical impairments.

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 more complicated administrative structures 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.

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 the 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 1976, over 40 bachelor and associate degree programs in health services administration were offered—the majority were 4-year curriculums. In addition, there were about 52 programs in hospital or health services administration that led to the master's degree, and 19 schools of public health offered programs leading to a master's degree in 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 bache-

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lor's degree, plus some amount of experience in the field.

Personal qualifications needed for success as a health administrator include initiative and an interest in helping the sick. Administrators should be able to work with and motivate people, and organize and direct large-scale activities. They also should enjoy public speaking.

Health administrators advance in the profession by taking increasingly more responsible positions. For example, some hospital administrators begin their careers in small hospitals in positions with broad responsibilities, such as assistant administrator. They advance by moving to jobs as associate or chief administrator in larger hospitals. More commonly, they start in a large institution in a position that is somewhat narrow in scope—for example, as department head in charge of purchasing. Regardless of the path of advancement chosen, the ultimate occupational goal in hospitals and nursing homes is the job of chief executive or chief administrative officer.

Employment Outlook

The number of graduate programs in health administration has increased rapidly in recent years and administative specialists with graduate degrees in other fields also have entered the profession. Consequently, it may become more difficult for those with less than 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 to 1985 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 monthly fee paid in advance). 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 and Working Conditions

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 up to 199 beds earned an average of $25,500 a year in 1976. Some, in larger hospitals, earned over $45,000. Recent recipients of master's degrees in health administration starting work in Veterans Administration (VA) hospitals earned $14,097 a year in 1977. The average salary paid administrators of Federal hospitals was $26,700.

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 ranging from lieutenant (junior grade) to 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. Most administrators employed by voluntary health agencies earned between $15,000 and $30,000 a year in 1976.

Health administrators often work long hours. Because health facilities such as nursing homes and hospitals operate around the clock, administrators in these institutions may be called at all hours to settle emergency problems. Also, some travel may be required to attend meetings or, in the case of regional, State or local public health department and voluntary health agency administrators, to inspect facilities in the field.

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, Illinois 60611.

Association of University Programs in Health Administration, One Dupont Circle, NW., Washington, D.C. 20036.

American Public Health Association, Division of Program Services, 1015 18th St., 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. 100.388)

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

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Medical record administrators develop systems for documenting, storing, and retrieving medical information.

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.

Places of Employment

Most of the 12,300 medical record administrators employed in 1976 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. Some medical record administrators work for firms that manufacture equipment for recording and processing medical data and develop and print health insurance and medical forms. 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 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 1977, there were 41 programs in medical record administration approved by the Council on Medical Education of the American Medical Association and the American Medical Record Association (AMRA). High school courses that are useful 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). There were about 5,000 employed RRA's in 1976, according to AMRA.

Medical record administrators must be accurate and interested in detail. They also must be able to communicate clearly in speech and writing. Because medical records are confidential, medical record administrators must be discreet in processing and releasing information. Supervisors must be able to organize and analyze work procedures and 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

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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 mid-1980's. Employment is expected to grow faster than 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 Medicare 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, in research, and in consulting work for health care facilities.

Earnings and Working Conditions

The salaries of medical record administrators are influenced by the location, size, and type of employing institution, as well as by the duties and responsibilities of the position. The average starting salary for medical record administrators in 1976 was $12,312 a year, according to a national survey conducted by the University of Texas Medical Branch at Galveston. Top salaries averaged $14,916 a year, with some earning as much as $27,612.

Newly graduated medical record administrators employed by the Federal Government generally started at $9,303 a year in 1977; those having bachelor's degrees and good academic records were eligible to begin at $11,523. In 1977, the Federal Government paid experienced medical record administrators average salaries of $15,700 a year.

Medical record administrators usually work a regular 36- to 40-hour week and receive paid holidays and vacations.

Sources of Additional Information

Information about approved schools and employment opportunities is available from:

American Medical Record Association, John Hancock Center, Suite 1850, 875 N. Michigan Ave., Chicago, Ill. 60611.

PHARMACISTS

(D.O.T. 074.181)

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 often test drugs for purity and strength.

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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. An increasing number of 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 or pharmaceutical detailers 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.

Places of Employment

About 120,000 persons worked as licensed pharmacists in 1976. Over 90,000 pharmacists worked in community pharmacies. Of these, more than two-fifths owned their own pharmacies; the others were salaried employees. Most of the remaining salaried pharmacists worked for hospitals, pharmaceutical manufacturers, and wholesalers. Quite a few community and hospital pharmacists did 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 were civilian employees of the Federal Government, working 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 served in the Armed Forces or taught 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 be a graduate of an accredited pharmacy college, pass a State board examination and—in nearly all States—have a specified amount of practical experience or internship under the supervision of a registered pharmacist. Internships generally are served in a community or hospital pharmacy. In 1976, 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. or B. Pharm. degrees may serve as the entry degree for purposes of licensure as a pharmacist. The profession is considering standardizing requirements and offering only one professional degree instead of two.

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. While a number of pharmacy graduates interested in further training pursue a Pharm. D. or a master's or Ph. D. 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 (study of physical and chemical properties of drugs an dosage forms), pharmacology (study of the effects of drugs on the body), pharmacognosy (study of the drugs derived from plant or animal sources), hospital pharmacy, clinical pharmacy, and pharmacy administration (study of the social and economic factors related to pharmacy practice). 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 enter executive or managerial positions.

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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 colleges of pharmacy increasingly are emphasizing direct patient care as well as consultative services to other health professionals in their academic programs.

A limited number of Federal scholarships and loans are available for students studying full time toward a degree in pharmacy. A number of scholarships also 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 with interest in this type of practice should have some business ability, as well as an interest in medical science and the ability to gain the confidence of their 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 mid-1980's. However, if the number of pharmacy college graduates continues to rise as rapidly as it has in recent years, the job market may change; graduates may begin to experience competition for jobs. Growth is expected to be about as fast as the average for all occupations. Most openings, however, will result from deaths, retirements, and other separations from the labor force.

Employment will grow as new pharmacies are established, in large residential areas as well as in small towns and rural locations. Many community pharmacies, also, 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, nursing homes, 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 these health facilities. Because drug manufacturers are experiencing lower rates of return on investment in research and development due to increasing government regulation, pharmacists may face decreasing opportunities in production, research, distribution, and sales. Pharmacists with advanced training will be needed for college teaching and top administrative posts.

Earnings and Working Conditions

Based on limited information, the starting salary for pharmacists generally ranges from $14,000 to $17,000 a year. Experienced pharmacists, particularly owners or managers of pharmacies, often earn considerably more. In general, salaries of experienced pharmacists are higher than the average for all nonsupervisory workers in private industry, except farming.

The minimum entrance salary in the Federal Government for a new graduate with a bachelor's degree from an approved college of pharmacy was $11,523 a year in 1977. However, most graduates qualified for a beginning salary of $14,097 a year; those with 2 years of graduate work, $17,056 a year. Pharmacists with additional years of experience may start at a higher salary. The average salary for all federally employed pharmacists was about $18,600.

The average annual starting salary for pharmacists in hospitals and medical centers was about $14,600 in 1976, according to a survey conducted by the University of Texas Medical School. Top salaries for experienced pharmacists in these settings averaged $18,300, and some were as high as $26,200. Pharmacists who do consulting work in addition to their primary job may have total earnings considerably higher than this.

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 1977 were as follows: deans, about $36,000; assistant and associate deans, about $25,000; full professors, around $30,000; associate professors, around $23,000; and assistant professors, about $20,000.

Based on the latest Pharmacy Manpower Information Project initiated by the American Association of Colleges of Pharmacy, 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. Pharmacists in community settings generally work longer hours than those employed in institutional settings. Pharmacies often are open in the evenings and on weekends, and all States require a registered pharmacist to be in attendance during store hours. Self-employed pharmacists often work more hours than those in salaried positions.

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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 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:

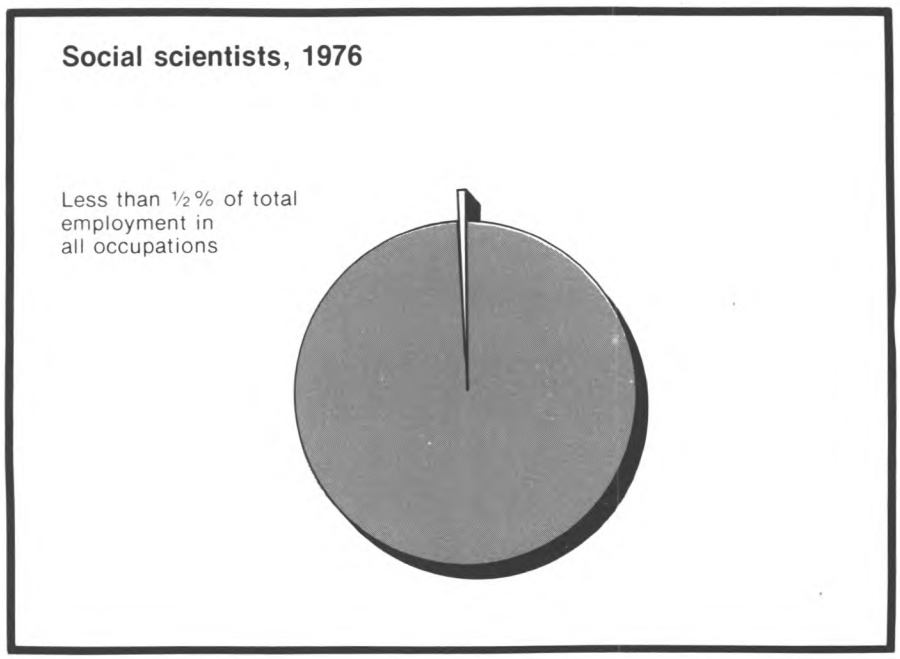
National Association of Boards of Pharmacy, One East Wacker Dr., Chicago, Ill. 60601.

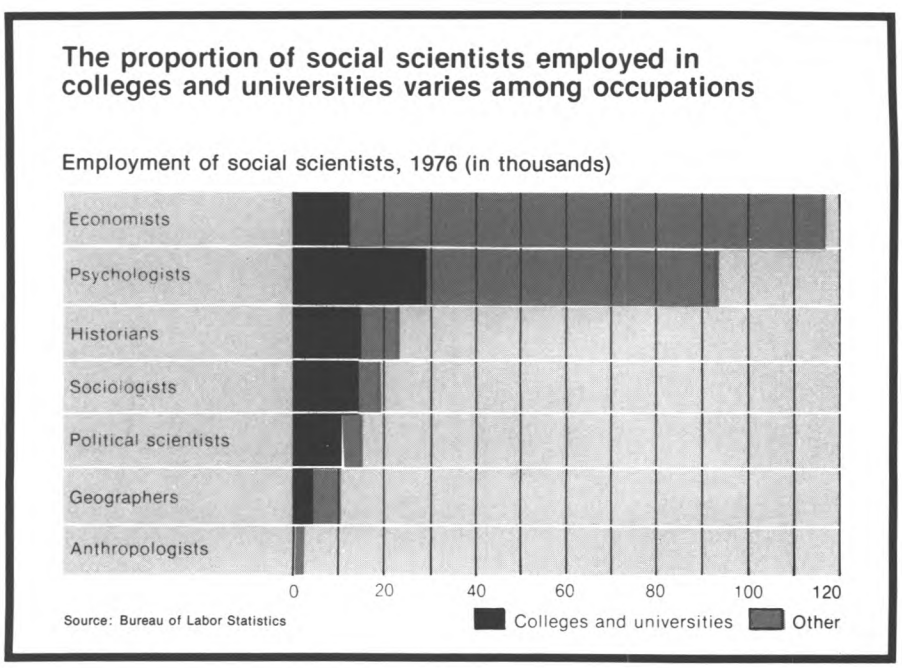
Information on college entrance requirements, curriculums, and financial aid is available from the dean of any college of pharmacy.

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SOCIAL SCIENTISTS

Social scientists study all aspects of human society—from the origins of man to the latest election returns. Regardless of their field of specialization, they are concerned with some aspect of society, culture, or personality. Anthropologists study primitive tribes and modern communities, reconstruct civilizations of the past, and analyze the physical characteristics, cultures, and languages of all people, past and present. Economists study the allocation of land, labor, and capital, and the production, distribution, and consumption of goods and services. Geographers study the relationship between geographic factors and economics, politics, urban problems, culture, health problems, and other areas. They also seek to explain changing patterns of human settlement. Historians describe and interpret the people, ideas, institutions, and events of the past and present. Political scientists study the theories, objectives, and organization of all types of government. Psychologists study the behavior of humans and lower animals in order to understand and explain their actions, and assist in adjustment or rehabilitation when necessary. Sociologists analyze the behavior and relationships of groups—such as the family, the community, and minorities—to the individual or to society as a whole. Besides these basic social science occupations, a number of closely related fields are covered in separate statements elsewhere in this *Handbook*. (See statements on statisticians, social workers, and other social service occupations.)



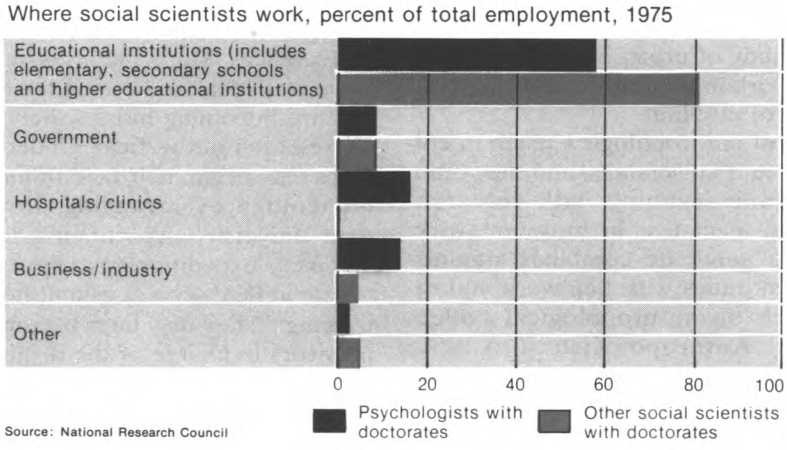


The basic social science occupations provided employment for about 280,000 persons in 1976. Overlapping among the basic social science fields makes it difficult to determine the exact size of each profession. Economists, however, make up the largest social science group and anthropologists the smallest.

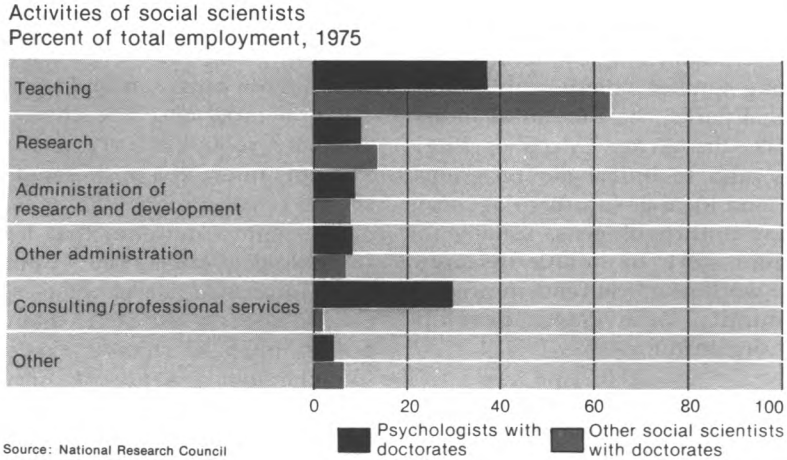
About one-third of all social scientists work in colleges and universities. However, the two largest social science occupations, economists and psychologists, are not as heavily concentrated in institutions of higher

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Significant proportions of psychologists with doctoral degrees work in nonacademic settings



Teaching is the principal activity of social scientists with doctoral degrees



education as other social scientists. (See chart.)

Federal, State, and local government agencies, research and consulting firms, hospitals and other health facilities, and unions, associations, and nonprofit organizations also employ social scientists. Business firms of all kinds are important employers of social scientists. Banks, insurance companies, retailers, and manufacturing concerns all employ social science majors as trainees for sales, research, administrative, and executive positions.

Overall employment in the social sciences is expected to grow about as fast as the average for all occupations through the mid-1980's. Economists, psychologists, and geographers are expected to experience faster than average growth; anthropologists will grow about as fast as average; and political scientists, sociologists, and historians will grow more slowly than average. Colleges and universities, the traditional employers of many highly qualified social scientists, are not expected to offer as many job opportunities through 1985 as they did in the past, because of the slowing of enrollment growth. Top graduates of prestigious universities should have an advantage for the limited number of academic positions. Most employment growth should occur in nonacademic areas, and many highly qualified social scientists are expected to seek such positions. Despite this anticipated growth, the number of persons seeking to enter the social science field is likely to exceed the available job openings. The following statements present more detailed information about the prospective outlook in the individual occupations.

ANTHROPOLOGISTS

(D.O.T. 055.088)

Nature of the Work

Anthropologists study man—his origins, physical characteristics, and culture. These areas of study examine people's traditions, beliefs, customs, languages, material possessions, social relationships, and value systems. Although anthropologists generally specialize in one of four specific areas—cultural anthropology, archeology, linguistics, and physical anthropology—they are expected to have a general knowledge of all of them.

Most anthropologists specialize in cultural anthropology, sometimes called ethnology. *Ethnologists* may spend long periods living with tribal groups or in modern communities to learn about their ways of life. The cultural anthropologist lives with a group of people to observe and write about their social customs, beliefs, and material possessions. They usually learn the native language in the process. They also make comparative studies of the cultures and societies of various groups. In recent years, investigations have included fewer primitive societies and more complex urban societies, including

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ghetto inhabitants, drug addicts, and the aged.

Archeologists study cultures which no longer exist or have changed greatly. They study the remains of homes, tools, clothing, ornaments, and other evidences of human life and activity to reconstruct the inhabitants' history and customs. For example, in a desert in New Mexico, archeologists uncovered an ancient kiva— an Indian religious chamber. In a cave by the Dead Sea, some have found pieces of ancient scrolls 2,000 years old. Archeological teams also have excavated three large prehistoric communities along the Illinois River.

Linguistic anthropologists study the evolution of language and the place of language in a culture. They examine the sounds and structure of a society's language and relate them to the behavior and thought patterns of members of that society. Such studies may be used to trace the diffusion of a language or people over wide geographical areas.

Physical anthropologists studying human evolution investigate how the physical characteristics of different races or groups of people are influenced by heredity and environment. This work requires extensive training in human anatomy, biology, genetics, and the study of primates (the order of mammals that includes man, apes, and monkeys). A physical anthropologist may identify a fossil of a human ancestor or teach a chimpanzee to communicate with sign language. A knowledge of body structure enables physical anthropologists to work as consultants on projects such as the design of cockpits for airplanes and spaceships, and the sizing of clothing.

Most new employment opportunities are expected to be in *applied anthropology*, a specialty which uses the findings of anthropology in a practical manner. Applied cultural anthropologists may, for example, provide technical guidelines to ease the transition of nonindustrial societies to a more complex level of socioeconomic organization, or a medical anthropologist studying cultural attitudes towards health and medical treatment may help formulate and administer a health program for an ethnic minority. Many medical schools hire medical anthropologists as instructors.

Applied linguistic anthropologists may create a written alphabet to help advance literacy in societies with unwritten languages. Another related specialty area is *urban anthropology*, the study of urban life, urbanization, rural-urban migration, and the influence of city life.

Most anthropologists teach in colleges and universities, and they often combine teaching with research. Some specialize in museum work, which generally combines administrative duties with fieldwork and research on anthropological collections. Anthropologists also write cultural, social, and archeological impact statements for proposed Government projects. Some work in business and industry including construction firms or engage in nontechnical writing.

Places of Employment

About 3,500 persons worked as anthropologists in 1976. About four-fifths of all anthropologists work in colleges and universities. The Federal Government employs a small but growing number, chiefly in museums, national parks, the Bureau of Indian Affairs, the Army Corps of Engineers, and technical aid programs. State and local government agencies employ anthropologists, usually for museum work or health research. Some work as consultants in private, community, or overseas development organizations.

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. Many colleges and universities require a Ph. D. degree for permanent teaching appointments. Persons with a master's or bachelor's degree in anthropology may be hired as government social science analysts or placed in managerial positions by private employers.

A student interested in studying anthropology should have a strong background in the social and physical sciences. Mathematics is helpful, since statistical and computer methods are becoming more widely used for research in this field. 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.

Nearly 300 colleges and universities have bachelor's degree programs in anthropology; some 130 offer master's degree programs and about 80, doctoral programs. The choice of a graduate school is very important. Students interested in museum work should select a school which is associated with a museum that has anthropological collections. Similarly, those interested in archeology should choose either a university that offers opportunities for summer experience in archeological fieldwork, or attend an archeological field school elsewhere during summer vacations.

Anthropologists should have special interest in natural history and social studies and enjoy reading, research, and writing. Traveling to remote areas, working in an uncomfortable climate, and living in primitive housing are sometimes necessary.

Anthropologists work with ideas and have the opportunity for self-expression. They should be able to work independently and with detail.

(For information on advancement, see the *Handbook* statement on College and University Teachers.)

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Employment Outlook

Employment of anthropologists is expected to increase about as fast as the average for all occupations. Most new jobs are expected to be in private industry, the Federal Government, mental and public health agencies, and urban planning departments of city governments. College and university teaching, which will remain the largest area of employment for anthropologists, is likely to have little growth due to the projected slowdown in college enrollments.

The number of qualified anthropologists seeking to enter the field will likely exceed available positions. As a result, doctorate holders may face keen competition through the mid-1980's, particularly for jobs in colleges and universities. Graduates with only bachelor's and master's degrees are expected to face very keen competition, although they may be preferred for some nonacademic positions. Some teaching positions may be available in junior colleges or high schools for those who meet state certification requirements.

Earnings and Working Conditions

Starting salaries for anthropologists with a Ph. D. degree were generally about $16,000 a year in 1976. Most experienced anthropologists earned between $17,000 and $27,000 a year, according to limited data available. In general, salaries of experienced anthropologists are a little less than the average for all social science professional workers.

In the Federal Government, anthropologists having a bachelor's degree could begin as trainees at $9,303 or $11,523 a year in 1977, depending upon the applicant's academic record. The starting salary for those having a master's degree was $14,097 a year, for those having a Ph. D., $17,056. Anthropologists in the Federal Government averaged around $23,800 in 1977.

Many anthropologists in colleges and universities supplement their regular salaries with earnings from other sources such as summer teaching and research grants.

Anthropologists sometimes are required to do fieldwork under adverse weather conditions. They also must adapt themselves to cultural environments which are materially and socially different.

Sources of Additional Information

For information about employment opportunities and schools that offer graduate training in anthropology, contact:

The American Anthropological Association, 1703 New Hampshire Ave. NW., Washington, D.C. 20009.

The Archeological Institute of America, 260 W. Broadway, New York, N.Y. 10013.

ECONOMISTS

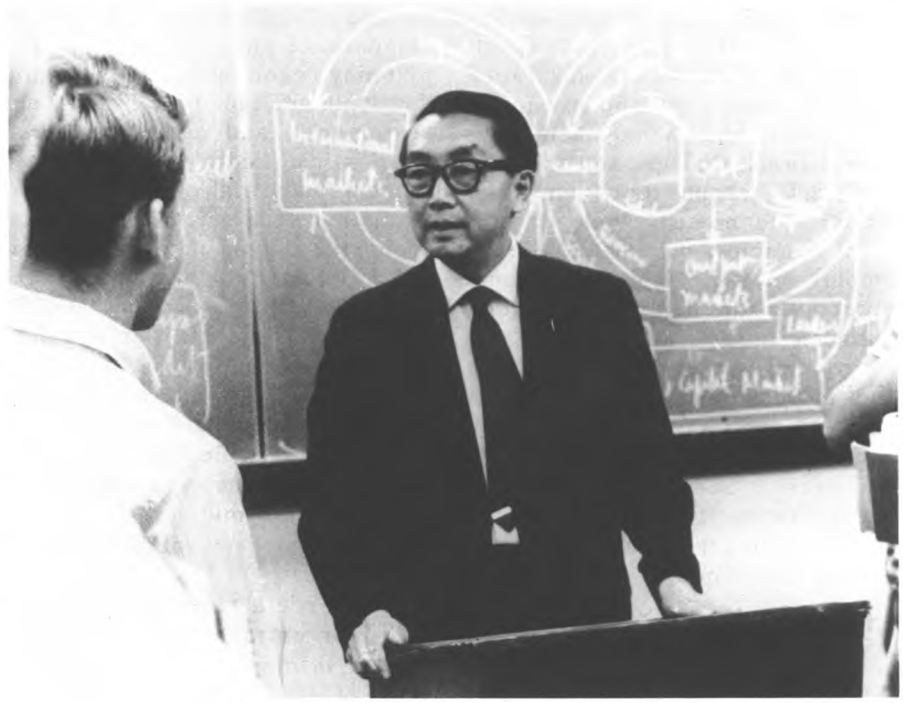
(D.O.T. 050.088 and .118)

Nature of the Work

Economists are concerned with how to utilize scarce resources such as land, raw materials, and human resources to provide goods and services for society. Economists analyze the relationship between the supply and demand of goods and services and study how they are produced, distributed, and consumed. Some economists are concerned with specific fields such as farm, wage, tax, and tariff problems and policies, while others attempt to develop theories explaining the causes of employment and unemployment or inflation. Most economists analyze and interpret a wide variety of economic data in the course of their work.

Economists in colleges and universities are engaged primarily in teaching the theories, principles, and methods of economics. In addition, economics faculty members often are involved in research, writing, and other nonteaching activities. They frequently act as consultants to business firms, government agencies, or individuals.

Economists in government collect and analyze data and prepare studies used to assess economic conditions and the need for changes in government policy. Most government economists are in the fields of agriculture, forestry, business, finance, labor, transportation, or international trade and development. For example, economists in the U.S. Department of Commerce study domestic production, distribution, and consumption of commodities or services;



Economics is the largest social science field.

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in the Federal Trade Commission, economists prepare economic evidence or industry analyses to assist in enforcing Federal statutes designed to eliminate unfair, deceptive, or monopolistic practices in interstate commerce; economists in the Bureau of Labor Statistics assist in survey planning and analyze data on prices, wages, employment, and productivity.

Economists who work for business firms provide management with information to make decisions on marketing and pricing of company products; analyze the effect of government policies on business or international trade; or look at the advisability of adding new lines of merchandise, opening new branch operations, or otherwise expanding the company's business. Business economists working for firms that carry on extensive operations abroad may be asked to prepare short- and long-term forecasts of foreign economies as well as forecasts of the U.S. economy.

Places of Employment

Economics is the largest social science field. About 115,000 persons worked as economists in 1976, excluding those teaching in secondary schools. About 3 out of 4 of these jobs are in private industry or research organizations. Important employers of economists include manufacturing firms, banks, insurance companies, securities and investment companies, and management consulting firms. Colleges and universities employ about 10 percent of the Nation's economists while government agencies, primarily Federal, employ another 10 percent. Some economists run their own consulting businesses.

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 overseas, mainly for the U.S. Department of State including the Agency for International Development.

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 one or more of 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 organization, 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 part-time employment in nearby government or private organizations engaged in economic research where students may gain valuable experience.

In the Federal Government, candidates for entrance positions must have a minimum of 21 semester hours of economics and 3 hours of statistics, accounting, or calculus.

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 many large colleges and universities, completion of all the requirements for a Ph. D. degree, except the dissertation, is necessary for appointment as a teaching assistant or instructor. The Ph. D. degree usually is required for a professorship and almost always is necessary to gain tenure.

In government, industry, research organizations, and consulting firms, economists who have a graduate degree usually can qualify for more responsible research and administrative positions. 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 230, master's; and about 120, doctoral programs.

Persons who consider careers as economists should be able to work accurately and in detail since much time is spent on careful analysis of data. Frequently, the ability to work as part of a team is required. Economists must be objective in their work and be able to express themselves effectively both orally and in writing.

Employment Outlook

Employment of economists is expected to grow faster than the average for all occupations through the mid-1980's. However, most openings will result from deaths, retirements, and other separations from the labor force.

Private industry and business will continue to provide the largest number of employment opportunities for economists because of the increasing complexity of the domestic and international economies and the increased reliance on quantitative methods of analyzing business trends, forecasting sales, and planning purchases and production operations. Employers will seek those well-trained in econometrics and statistics. In addition, the increasing need for business economists to assist

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lawyers, accountants, engineers, and other professionals in solving problems should stimulate employment growth. Employment of economists in State and local government agencies is expected to increase because of the growing responsibilities of local governments in areas such 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. Colleges and universities, the traditional employer of many highly qualified economists, are not expected to significantly increase employment. As a result, many such economists may seek nonacademic positions.

Persons who graduate with a bachelor's degree in economics through the mid-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 assistants. Candidates who hold master's degrees in economics face very strong competition for teaching positions in colleges and universities, but they should find good opportunities for administrative, research, and planning positions in private industry and government. Ph. D.'s are likely to face competition for academic positions, although those graduating from high-ranking universities should have an advantage. Ph. D.'s should have favorable opportunities in government, industry, research organizations, and consulting firms.

Economists specializing in the environment, energy and natural resources, health, and transportation are expected to have good job opportunities. However, since practicing economists may shift from one specialty to another, fields of specialization offering favorable job opportunities may change over short periods of time. A strong background in economic theory and econometrics provides the tools for acquiring any specialty within the field.

Earnings

According to the 1975-76 College Placement Council Salary Survey, bachelor's degree candidates in the social sciences received offers averaging around $10,000 a year; master's degree candidates in the social sciences, around $12,000; bachelor's degree candidates offered positions in the field of finance and economics, around $10,600.

According to an American Economic Association survey, average salary offers made to new Ph. D.'s for the academic year 1975-76 were as follows: in colleges and universities, around $13,100 to $14,600 for the 9-month academic year; in business and industry, $18,000 a year; in banking and finance, $17,775 a year; in consulting and research, $17,500 a year; in the Federal Government, $18,750 a year; and in State and local government, $15,500 a year. Average salaries of economists employed in colleges and universities for the academic year 1975-76 were as follows: for professors, about $25,400; for associate professors, about $18,700; for assistant professors, about $15,300; and for instructors, about $12,100.

Economists who have a Ph. D. generally are paid higher salaries than those who have lesser degrees and similar experience. A substantial number of economists supplement their salaries by consulting, teaching, and research activities. In general, salaries of experienced economists are much higher than the average for all nonsupervisory woqkers in private industry, except farming.

The Civil Service Commission recognizes education and experience in certifying applicants for entry level positions in the Federal Government. In general, the entrance salary for economists having a bachelor's degree was $9,303 a year in 1977; however, those with superior academic records could begin at $11,523. Those having a master's degree could qualify for positions at an annual salary of $14,097, while those with a Ph. D. could begin at $17,056. Economists in the Federal Government averaged around $25,100 in 1977. 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.

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

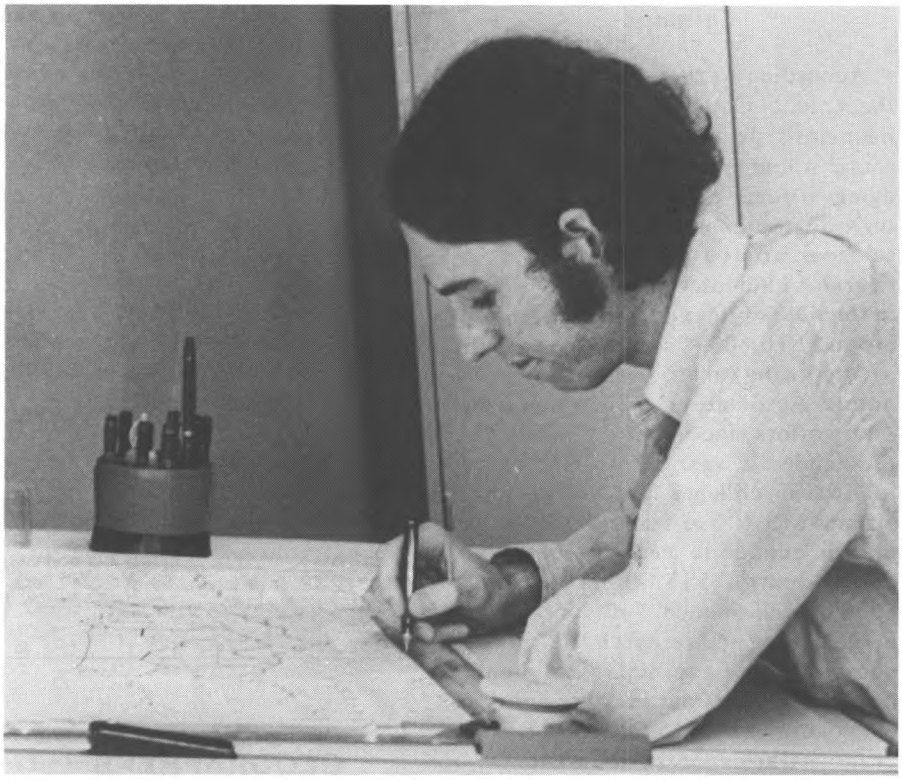
(D.O.T. 017.281, 029.088, and 059.088)

Nature of the Work

Geographers study the spatial characteristics of the earth—and all that is found on it. 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; others are involved in research, writing, and other nonteaching activities. Their research includes the study and analysis of the distribution of land forms, climate, soils, vegetation, mineral, water, and human resources. They also analyze the distribution and structure of political organizations, transportation systems, marketing systems, urban systems, agriculture, and industry. Many geographers spend considerable time in field study, using surveying and meteorological instruments. They analyze maps, aerial photographs, and data transmitted by remote sensing equipment on satellites, and apply advanced statistical techniques in their

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Some geographers specialize in making maps.

work. Some geographers also construct maps, graphs, and diagrams.

Economic geographers deal with the geographic distribution of economic activities—including manufacturing, mining, agriculture, trade, and communications. *Political geographers* study the relationship of geographic conditions to political affairs. *Urban geographers* study cities and their problems and make recommendations about community planning and development, including housing, transportation, and industrial plant sites. (See statement on Urban Planners elsewhere in the *Handbook*.) The physical characteristics and processes affecting the earth are the concerns of *physical geographers*. Typically, they specialize in a particular branch of physical geography such as hydrology—the study of water and its effects, or geomorphology, which is the study of land forms. *Regional geographers* study the physical, economic, political, and cultural characteristics of a particular region or area, which may range in size from a river basin or an island, to a State, a country, or even a continent. *Cartographers* compile and interpret data and design and construct maps and charts. They also conduct research in surveying and mapping techniques and procedures. A growing number of *medical geographers* are concerned with the geographic aspects of human health problems and planning of health services. They study the effect of the natural environment on health, including such factors as climate, vegetation, mineral traces in water, and atmospheric pollution, as well as the geographic distribution of human health problems and health care facilities.

Formal training in geography provides the background for a wide range of jobs requiring expertise in environmental resources and planning, research methods, and a variety of other areas. 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 combinations include geography and economics, political science, sociology, anthropology, or urban planning.

Places of Employment

About 10,000 persons worked as geographers in 1976, excluding those teaching in secondary schools.

Colleges and universities employ about three-fifths of all geographers. However, the Federal Government 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, aerial photograph interpretation, and remote sensing are important.

The principal Federal employers are the Departments of Defense, Interior, Commerce, and Agriculture. Other agencies include the Departments of State; Transportation; and Health, Education, and Welfare; and the Environmental Protection Agency (EPA), National Aeronautical and Space Administration (NASA), Energy Research and Development Agency (ERDA), and Central Intelligence Agency (CIA).

State and local governments employ a growing number of geographers, mostly on city and State planning and development commissions.

Private industry employs a small but growing number of geographers involved in research, planning, and location analysis. Most work for textbook and map publishers, travel agencies, manufacturing firms, real estate development corporations, insurance companies, communications and transportation firms, or chain stores. Others 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. Bachelor's degree holders would find it helpful to have training in a specialty such as cartography, aerial photograph or remote sensing data

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interpretation, statistical analysis, or environmental analysis.

A master's degree usually is the minimum requirement for the position of college instructor, and is important for advancement in business and government. In many colleges and universities, however, a Ph. D. degree usually is required for a professorship and often is necessary to gain tenure. The Ph. D. degree often is necessary for senior level planning, research, and administrative positions in government, industry, research organizations, and consulting firms.

In the Federal Government, geographers generally must have a minimum of 24 semester hours in geography or related fields. Requirements may vary for certain specialties such as cartography.

About 400 colleges and universities offered programs in geography in 1976. 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, 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 1976, about 150 institutions offered master's degree programs; 55 offered Ph. D. programs. Applicants are required to have a bachelor's degree in any of the social or physical sciences with a substantial background in geography. Requirements for advanced degrees include field and laboratory work as well as advanced classroom study in geography and preparation of a thesis. Many graduate schools also require course work in advanced mathematics, statistics, and computer science because of the increasing emphasis on these areas in the field. A language may be required for those students who plan to enter the field of foreign regional geography.

Students should select graduate schools that offer appropriate areas of specialization and good research opportunities in nearby libraries, archives, laboratories, and field stations. Employment often is available at area government agencies or research, scientific, or industrial firms.

Persons who want to become geographers should enjoy reading, studying, and research because they must keep abreast of developments in the field. Geographers must work with abstract ideas and theories as well as do practical studies. They also must be able to work independently and communicate their ideas orally and in writing.

Employment Outlook

Employment of geographers is expected to grow faster than the average for all occupations through the mid-1980's. However, most openings are likely to result from deaths, retirements, and other separations from the labor force.

Little growth is anticipated in college and university teaching, the traditional employer of many highly qualified geographers; as a result, many such geographers may seek nonacademic positions. Many opportunities are becoming available in the fields of health services planning and environmental management and planning, including such areas as land and water resources planning and flood management. Significant growth in the number of jobs requiring knowledge of remote sensing, cartography, and climatology also is expected. 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 areas such as 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 mid-1980's for research and administrative positions in government, industry, research organizations, and consulting firms. Ph. D. 's may face competition for academic positions, although those graduating from high-ranking universities should have an advantage. Those with the master's degree are likely to face competition for academic positions, but should have good opportunites for planning and marketing positions in government and industry.

Graduates with a bachelor's degree in geography are expected to face competition for jobs as geographers. Some may find jobs as cartographers, climatologists, or intelligence analysts, while many of these degree holders may find employment in government and industry as management 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 and Working Conditions

According to the 1975-76 College Placement Council Salary Survey, bachelor's degree candidates in the social sciences received offers averaging around $10,000 a year; master's degree candidates in the social sciences, around $12,000.

According to an Association of American Geographers survey, Ph. D.'s with no teaching experience earned starting salaries between $12,000 and $14,000 for the academic year 1975-76, while the average salary of geographers employed in colleges and universities was

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$19,000. 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. In general, salaries of experienced geographers are higher than the average for all nonsupervisory workers in private industry, except farming.

The Civil Service Commission recognizes education and experience in certifying applicants for entry level positions in the Federal Government. In general, geographers in the Federal Government with the bachelor's degree and no experience started at $9,303 or $11,523 a year in 1977, depending on their college achievement. Those with a master's degree started at $14,097 a year, and those with the Ph. D. at $17,056. Geographers and cartographers in the Federal Government averaged around $21,100 in 1977.

Geographers sometimes must do field work in primitive regions of the world, requiring an ability to adapt to different social and cultural environments.

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.

HISTORIANS

(D.O.T. 052.038 and .088)

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 relate their knowledge of the past to current events in an effort to explain the present.

Historians may specialize in the history of a specific country or area, or era—ancient, medieval, or modern. They also may specialize in the history of a field, such as economics, medicine and disease, philosophy, religion, science, culture, military affairs, the labor movement, art, or architecture. Other specialties are concerned with historic preservation, women, business, archives, quantitative analysis, and the relationship between technological and other aspects of historical development.

In this country, many historians specialize in the social or political history of either the United States or modern Europe; however, a growing number are specializing in African, Latin American, Asian, or Near Eastern history. Some historians specialize in phases of a larger historical field, such as the American Civil War.

Most historians work in colleges and universities and are primarily concerned with teaching. They often lecture, write, and do research outside the academic setting. Other historians employed in colleges and universities are involved in research and development, administration, and other non-teaching activities. Some specialists, called *archivists*, work for museums, special libraries, historical societies, and other organizations. They collect historical documents and objects, prepare historical exhibits, and edit and classify historical materials for use in research and other activities. A growing number of historians are concerned with the interpretation and preservation of historic buildings, treasures, documents, and other items. A few serve as consultants to editors, publishers, and producers of materials for radio, television, and motion pictures. Some historians are administrators in government or researchers who prepare studies, articles, and books on their findings.



Colleges and universities employ about 70 percent of all historians.

Places of Employment

An estimated 22,500 persons worked as professional historians in 1976, excluding those teaching in secondary schools. Colleges and universities employ about seventy percent of all historians. Historians also work in archives, libraries, museums, research organizations, historical societies, publishing firms, large corporations, and government agencies. Historians employed in the Federal Government work principally in the National Archives, Smithsonian Institution, or in the Departments of Defense, Interior, and State. Other Federal agencies that employ historians include the National Aeronautics and Space Administration, Central Intelligence Agency, National Security Agency, and the Departments of Agriculture, Commerce, Transportation, and Health, Education and Welfare. A small but growing number work for State and local governments.

Historians are employed in virtually all U.S. institutions of higher education. Most historians who work for the Federal Government are in Washington, D.C. Historians in other types of employment usually work in localities having museums or libraries with collections adequate for historical research.

Training, Other Qualifications, and Advancement

Graduate education usually is necessary for employment as a historian. A master's degree in history is the minimum requirement for the position of college instructor. A Ph. D. degree usually is required for a professorship and for administrative positions, and almost always is necessary to gain tenure.

While historians in the Federal Government generally must have 24

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semester hours in history, requirements may vary for certain specialists such as archivists, who usually must have 30 hours of graduate work in history. 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 collection and preservation of historical data, a knowledge of archival work is helpful.

Training for historians is available in many colleges and universities. Over 1,250 schools offer programs for the bachelor's degree; about 440, the master's; and about 145, doctorates.

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; many college programs include them. Most doctoral candidates must exhibit competence in a foreign language.

Historians spend a great deal of time studying, doing research, writing papers and reports, and giving lectures and presentations. Therefore, they must possess analytical skills and the ability to communicate their ideas effectively, orally and in writing. The ability to work both independently and as part of a group also is essential.

Employment Outlook

Employment of historians is expected to grow more slowly than the average for all occupations through the mid-1980's. Job openings will result chiefly from deaths, retirements, and other separations from the labor force.

Only a small number of historians will be needed to fill positions in colleges and universities, junior colleges, libraries, archives, museums, secondary schools, research organizations, publishing firms, and government agencies. Persons with training in historical specialties such as historic preservation and business history, in addition to those well-trained in quantitative methods in historical research are expected to have the most favorable job opportunities. Those who are able to teach several areas of history should have the best opportunities for jobs in colleges and universities.

Although information is limited on patterns of entry to the field, it is clear that 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 keen competition for positions through the mid-1980's. Those graduating from prestigious universities should 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, many Ph. D.'s are expected to accept part-time, temporary assignments as instructors with little or no hope of gaining tenure. Persons with the master's degree in history will encounter very keen competition for jobs as historians. However, some of them will find teaching positions in community and junior colleges or high schools; such jobs may have State certification requirements.

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 some jobs in international relations, journalism, and other areas, and for continuing education in law, business adminstration, 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 1975-76 College Placement Council Survey, bachelor's degree candidates in the social sciences received offers averaging around $10,000 a year; master's degree candidates in the social sciences, around $12,000.

According to information from the American Historical Association, large public colleges and universities offered starting salaries ranging from about $13-$15,000 for academic year 1975-76. Smaller public and private academic institutions generally offered lower salaries. Full professors and top administrators may earn $25-$30,000 a year or more. In general, salaries of experienced historians are higher than the average for all nonsupervisory workers in private industry, except farming.

The Civil Service Commission recognizes education and experience in certifying applicants for entry level positions in the Federal Government. In general, historians having a bachelor's degree could start at $9,303 or $11,523 a year in 1977, depending upon the applicant's academic record. Starting salaries for those having a master's degree were $14,097 a year, and for those having a Ph. D., $17,056. Historians and archivists in the Federal Government averaged around $22,400 a year in 1977.

Many historians, particularly those in college teaching, supplement their income by teaching summer classes, writing books or articles, or giving lectures.

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 programs in historic preservation, contact:

National Trust for Historic Preservation, 740 Jackson Place, N.W., Washington, D.C. 20006.

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Additional information on nonteaching opportunities for historians is available from:

Organization of American Historians, Indiana University, 112 North Bryan St., Bloomington, Ind. 47401.

POLITICAL SCIENTISTS

(D.O.T. 051.088)

Nature of the Work

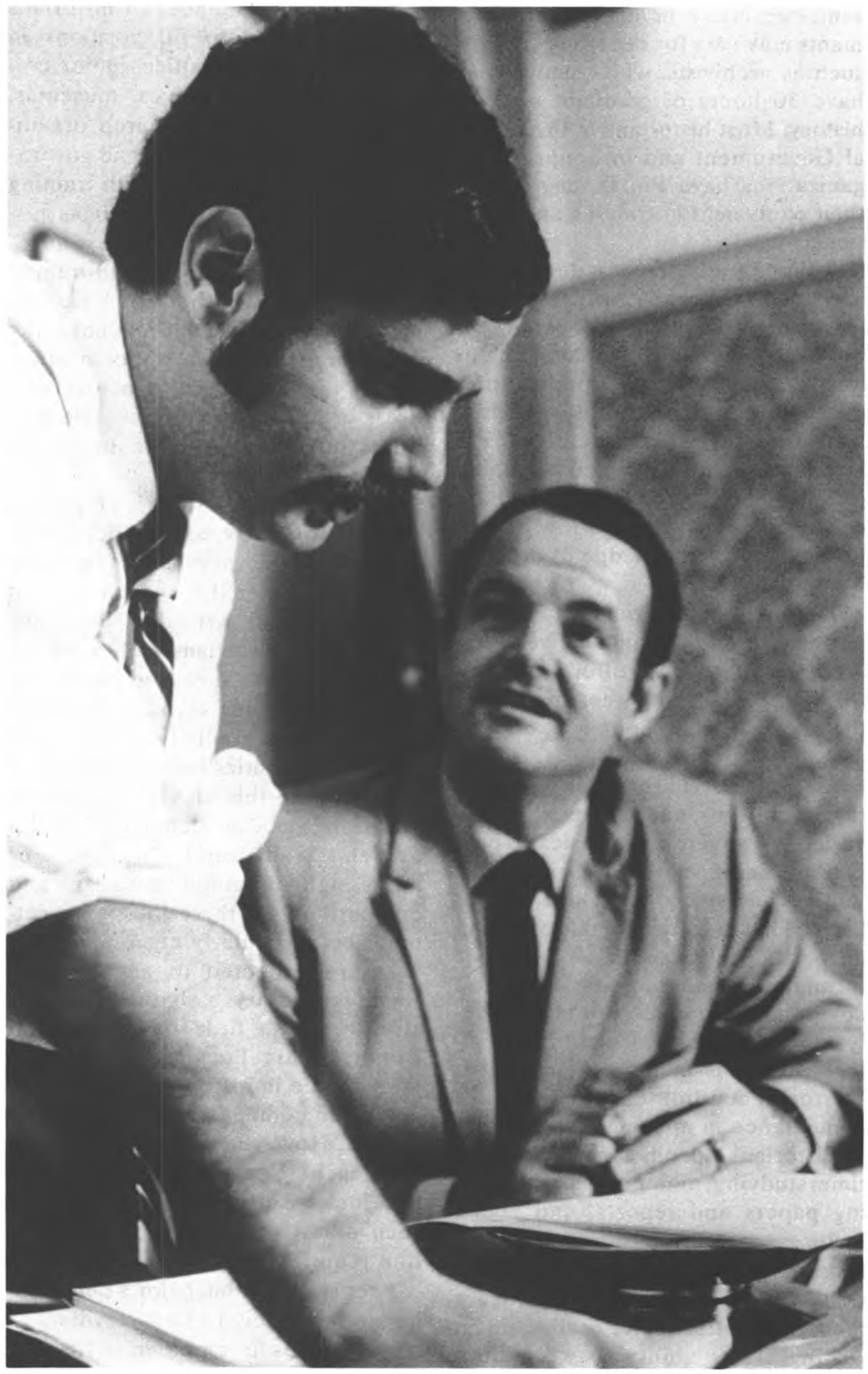
Political scientists study the functions and workings of governments. Many of them specialize in a general area of political science including political theory, U.S. political institutions and processes, comparative political institutions and processes, or international relations and organizations. Some specialize in a particular type of political institution or in the politics of a specific era.

Most political scientists teach in colleges and universities where they may combine research, consultation, or administrative duties with teaching. Some are primarily researchers who survey public opinion on political questions for private research organizations, or study proposed legislation for Federal, State, and municipal governments, legislative reference bureaus, or congressional staffs and committees. Others analyze the operations of government agencies, specialize in foreign affairs, or do administrative or research work for either government or nongovernment organizations. Some political scientists serve as consultants to political groups or business firms.

Places of Employment

About 14,000 persons worked as political scientists in 1976, excluding those teaching in secondary schools. About four-fifths work in colleges and universities. Most of the remainder work in government, management consulting firms, political organizations, research organizations, civic and taxpayers associations, and large business firms.

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. The Federal Government employs political scientists both domestically and abroad. Those on overseas assignment work primarily for agencies of the U.S. Department of State, such as the Foreign Service, and the U.S. Agency for International Development. Other employing agencies in-



Some political scientists survey public opinion on political questions for private research organizations.

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clude the U.S. Information Agency, Energy Research and Development Agency, Central Intelligence Agency, and the Departments of Defense, Treasury, Justice, and Commerce. Political scientists in the Federal Government primarily are concerned with foreign affairs, international relations, and intelligence. Those employed in State and local government often are concerned with the administration of housing, economic development, transportation, environmental protection, and health programs. Political scientists in the business world may deal with marketing, personnel, advertising, public relations, banking, 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 becoming the prerequisite for appointment to academic positions, and almost always is required for one to gain a professorship and tenure. The Ph. D. also is helpful for advancement in government, industry, and other nonacademic areas.

College graduates with a master's degree can qualify for various administrative and research positions in government, industry, and nonprofit research or civic organizations. A master's degree in international relations, foreign service, or area study (for example, Soviet Government) is helpful in obtaining positions in Federal Government agencies concerned with foreign affairs. Intelligence, foreign affairs, and international relations specialists in the Federal Government generally must have 24 semester hours in political science, history, economics, or related fields.

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 and international relations.

In 1976, about 1,100 colleges and universities offered a bachelor's degree in political science, around 270 had master's programs, and about 115 had doctoral programs. Many colleges and universities offer field training and internships that provide experience in government work or teaching.

Undergraduate programs in political science include courses in the principles of government and politics, State and local government, comparative studies, political theory, foreign policy, public administration and policy, political behavior, constitutional, administrative, and international law, and many other offerings. Other specialized political science courses and seminars deal with the problems of detente, politics of growth and technology, politics of health, legal status of women, political warfare in the age of nuclear destruction, and political culture and the psychological processes of death. 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 American politics, comparative politics, international politics, 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 careers as political scientists should like to work with details. They must be objective and able to work independently or as part of a team. Ability to express themselves clearly, orally and in writing, is important to political scientists.

Employment Outlook

Employment of political scientists is expected to increase more slowly than the average for all occupations through the mid-1980's. Most jobs openings will result from deaths, retirements, and other separations from the labor force. The largest area of employment will continue to be in college and university teaching.

The number of persons who graduate with advanced degrees in political science will greatly exceed available job openings through 1985. As a result, those with a Ph. D. face stiff competition for positions through the mid-1980's, although Ph. D.'s from prestigious universities are likely to have an advantage. Many Ph. D.'s are expected to accept part-time, temporary assignments as instructors with little or no hope of gaining tenure. Graduates trained in quantitative methods of research, American Government, public administration, or policy science should have an advantage for both academic and nonteaching positions. Those with knowledge of economic theory, transportation, health care delivery systems, and environmental questions may be in particular demand. Graduates seeking to enter the foreign service are expected to face very stiff competition. Master's degree holders will face very keen competition finding academic positions, but those with specialized training in areas such as policy science or public administration may find jobs in Federal, State and local government, research bureaus, political organizations, and business firms.

New graduates with the bachelor's degree are expected to find few opportunities for jobs as professional political scientists. However, 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 1975-76 College Placement Council Salary Survey, bachelor's degree candidates in the social sciences received offers averaging around $10,000 a year; master's degree candidates in the social sciences, around $12,000.

According to an American Political Science Association Survey, the median beginning salaries for new

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faculty members during 1975-76 were $12,300 for Ph. D.s and $11,200 for those without a Ph. D. The median annual salaries of political scientists employed in educational institutions in 1975-76 were: $22,000 for full professors; $17,000 for associate professors; $13,500 for assistant professors; and $11,500 for lecturers and instructors. In general, salaries of experienced political scientists are higher than the average for all nonsupervisory workers in private industry, except farming.

The Civil Service Commission recognizes education and experience in certifying applicants for entry level positions in the Federal Government. In general, the entrance salary for those with a bachelor's degree was $9,303 or $11,523 a year in 1977, depending upon the applicant's academic record. Starting salaries for those with a master's degree were $14,097 a year, and for those with a Ph. D., $17,056. Intelligence, foreign affairs, and international relations specialists in the Federal Government averaged around $25,300 in 1977.

Some political scientists, particularly those in college teaching, supplement their income by teaching summer courses or consulting.

Sources of Additional Information

Additional information on careers, job openings, and schools offering various graduate programs in political science and related fields is available from:

American Political Science Association, 1527 New Hampshire Ave. NW., Washington, D.C. 20036.

PSYCHOLOGISTS

(D.O.T. 045.088 and .108)

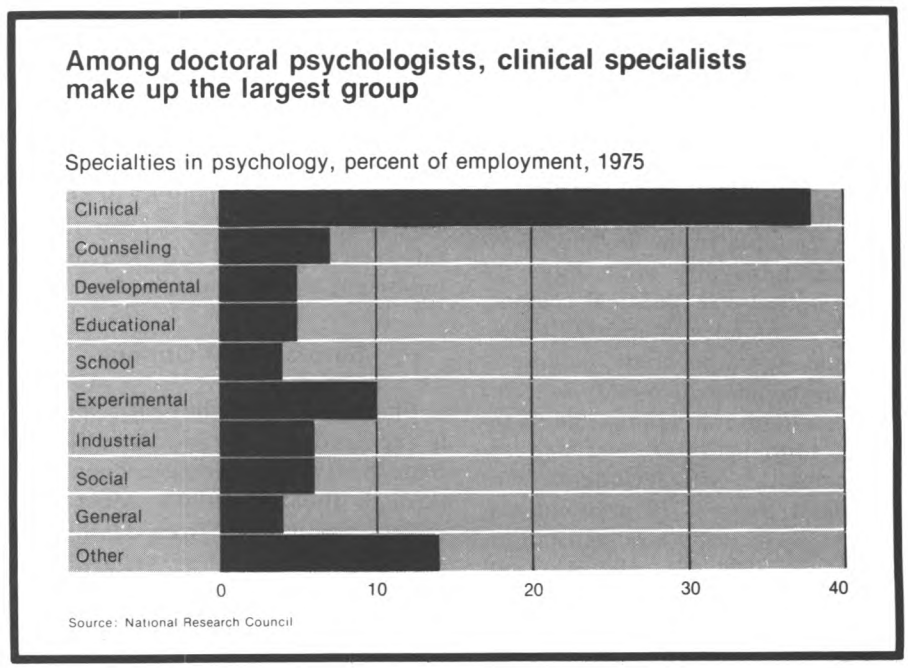
Nature of the Work

Psychologists study the behavior of individuals and groups in order to understand and explain their actions. During their work, they may be concerned with the effect of one member's emotional stress upon a family, causes of low morale at work, or the most effective way of dealing with terrorists. Some engage in teaching, research, and administrative activities in colleges and universities; others provide counseling services, plan and conduct training programs for employees, conduct research, advise on psychological methods and theories, or administer psychology programs in hospitals, clinics, or research laboratories. Many psychologists combine several of these activities.

Psychologists gather information about the capacities, interests, and behavior of people in various ways. They interview individuals, develop and administer tests and rating scales, study personal histories, and conduct controlled experiments. Also, psychologists often design and conduct surveys.

Psychologists specialize in a wide variety of areas. *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 the origins of human 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, and dependency relationships. Psychologists in *evaluation research* study social programs and their effects and recommend improvements as a result of increased understanding. *Environmental psychologists* study the influences of environments on people, and their perceptions of these environments. *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.

Psychologists often combine several areas in their specialty. *Clinical psychologists*, the largest specialty, generally work in mental hospitals or



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clinics, or maintain their own practices. They may help the mentally or emotionally disturbed readjust to life with altered physical capabilities. They interview patients, give diagnostic tests, provide individual, family, and group psychotherapy, and design and carry through behavior modification 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. *School psychologists* diagnose educational problems, facilitate school adjustment, and help solve learning and social problems in the schools. *Industrial and organizational psychologists* engage in personnel research, policy, and 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 community life. *Consumer psychologists* study the psychological factors that determine an individual's behavior as a consumer of goods and services.

Places of Employment

About 90,000 people, excluding secondary school teachers, worked as psychologists in 1976. About one-half worked in educational institutions, primarily colleges and universities (including medical schools), either as teachers, researchers, administrators, or counselors.

The second largest group of psychologists work in hospitals, clinics, rehabilitation centers, and other health facilities, while many others work for Federal, State, or local government agencies. They typically administer and interpret intelligence, interest, and aptitude tests; diagnose and treat mental disorders; and conduct educational, vocational, and personal adjustment counseling. Federal agencies that employ the most psychologists are the Veterans Administration, the Department of Defense, and the Public Health Service. Other employing agencies include the Departments of Justice, Commerce, Treasury, Interior, Labor, and Transportation, the Civil Service Commission, the National Aeronautical and Space Administration, and the Environmental Protection Agency.

Psychologists also are employed in correctional institutions, research organizations, and business firms. Some are in independent practice or work as consultants.

Training, Other Qualifications, and Advancement

A doctoral degree almost always is the minimum requirement for employment as a psychologist. The degree is needed for many entrance positions and is becoming increasingly important for advancement. People with doctorates in psychology qualify for the more responsible research, clinical, and counseling positions, as well as for teaching positions in colleges and universities and administrative posts in Federal and State programs. The doctoral degree is necessary to gain academic tenure, a process that is becoming more difficult and taking longer than in the past.

People with a master's degree in psychology can qualify as psychological assistants, administering and interpreting some kinds of psychological tests. Working under the supervision of psychologists, they may collect and analyze data, conduct experiments, or perform administrative duties. They also qualify for certain counseling jobs or—if they have previous teaching experience—may be hired as school psychologists or counselors. (See the statements on school counselors and rehabilitation counselors.)

People with a bachelor's degree in psychology may work directly under psychologists and other professionals in community mental health centers, vocational rehabilitation offices, and correctional programs; as research or administrative assistants; as trainees in government or business; or—provided they meet State certification requirements—as high school teachers.

In the Federal Government, some positions are filled at the entrance grade with candidates having at least 24 semester hours in psychology and one course in statistics. Most positions, however, are filled at a higher grade. Clinical psychologists generally must have completed the Ph. D. requirements and have served an internship; counseling psychologists 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. An additional 3 to 5 years of graduate work usually are required for a Ph. D. In clinical or counseling psychology, the requirements for the Ph. D. degree generally include an additional year or more of internship or supervised experience. Doctoral candidates at some universities must exhibit competence in a foreign language. Some gain postdoctoral appointments for special study and research.

The Ph. D. degree culminates in a dissertation based on original research which contributes to psychological knowledge. Another professional degree, the Psy. D. (Doctor of Psychology), is based on practical work and examinations rather than a dissertation.

Some universities require graduate school applicants in psychology to have a major in that field. Others prefer only basic psychology with courses in the biological, physical, and social sciences, statistics, and mathematics. Some persons trained in other fields such as social work, counseling, and education find graduate education in psychology useful.

Competition for admission into graduate psychology programs is keen. Only the most highly qualified applicants can expect to be admitted to graduate study.

Over 1,100 colleges and universities offer a bachelor's degree program in psychology; about 325, a master's; about 165, a Ph. D.; and about 20, a Psy. D. The American Psychological Association (APA) presently accredits doctoral training programs in clinical, counseling, and school psychology. In 1976, over 100 colleges and universities offered fully

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approved programs in clinical psychology; over 20, in counseling psychology; and fewer than 10, in school psychology. APA also has approved about 120 facilities offering internships for doctoral training in clinical and counseling psychology.

Although financial aid is becoming increasingly difficult to obtain, some graduate students may receive fellowships, scholarships, or part-time employment. The Veterans Administration offers a number of predoctoral traineeships to students while they work as interns in VA hospitals, clinics, and related training agencies. The National Science Foundation, Department of Health, Education, and Welfare, various branches of the Armed Forces, and many other organizations and foundations also provide fellowships, grants, 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 1976, 49 States and the District of Columbia had these requirements. Licensing laws vary by State, but generally require a doctorate in psychology, 2 years of professional experience, and an examination.

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 of qualifying experience, and professional endorsements, and also must pass an examination.

People pursuing a career in psychology must be emotionally stable, mature, and able to deal effectively with people. Sensitivity, patience, and a genuine interest in others are particularly important for work in clincal and counseling psychology. Research psychologists should be able to do detailed and independent work; verbal and writing skills are necessary to communicate research findings.



Sensitivity, patience, and a genuine interest in others are particularly important for work in clinical and counseling psychology.

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Employment Outlook

Employment of psychologists is expected to grow faster than the average for all occupations through the mid-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. First is increased public concern for the development of human resources, particularly among the aging and minority groups. Growing awareness of the need for testing and counseling children also should increase the demand. Federal legislation emphasizing good health rather than treatment of illness may produce new roles for psychologists in preventive and therapeutic situations and in group practice. Inclusion of psychological services in a future national health insurance program also may heighten demand.

Other openings are likely to occur as psychologists move into new fields such as 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. In addition, psychologists are becoming involved in program evaluation in such fields as education, military service, and law enforcement. Government agencies, business, and industry also are making increased use of the services that psychologists can provide in counseling, employee assessment and training, and market research.

A doctorate is increasingly necessary for those wishing to enter the field. However, the growing number of doctoral degrees awarded in psychology each year means that new Ph. D.'s will face increasing competition for jobs through 1985, particularly academic positions in large colleges and universities. Those willing to work in smaller and newer institutions should have better employment prospects.

Persons holding doctoral degrees from prestigious universities should have an advantage on the job market.

Those with doctorates in applied areas such as clincial, counseling, and industrial or organizational psychology are expected to have more favorable job prospects than those trained in traditional academic specialties such as experimental, physiological, and comparative psychology.

As more and more people earn doctorates in psychology, master's degree holders will face increasingly keen competition, particularly for research or teaching jobs in colleges and universities. Opportunities are likely to be best in industry, government, and human service organizations, all of which will have some jobs for persons with training in applied areas including evaluation research.

Bachelor's degree holders will be able to enter the field only as assistants or trainees, working under the direct supervision of psychologists and other professionals. However, for persons who wish to continue their education in fields such as law, medicine, social work, sociology, counseling, recreation, gerontology, or related disciplines, psychology provides an excellent undergraduate background.

Earnings and Working Conditions

In 1975, the median starting salary for psychologists holding a master's degree was about $11,000 a year, according to the American Psychological Association. The median beginning salary for those holding a doctorate was about $13,000 for 9-month academic jobs and between $16,000 and $17,000 for 12-month jobs.

According to a 1975 survey by the National Research Council, the median annual salary for all doctoral psychologists was about $22,000. In educational institutions, the median was about $20,900; in the Federal Government, about $26,600; in State and local government, about $21,500; in hospitals and clincs, about $21,400; in nonprofit organizations, about $24,600; and in business and industry, about $30,600. Ph. D. psychologists in private practice and in applied specialties generally have higher earnings than other psychologists. In general, salaries of experienced psychologists are much higher than the average for all nonsupervisory workers in private industry, except farming.

The Civil Service Commission recognizes education and experience in certifying applicants for entry level positions in the Federal Government. In general, the entrance salary for psychologists having a bachelor's degree was $9,303 or $11,523 a year in 1977; counseling psychologists with a master's degree and 1 year of counseling experience started at $14,097; clinical psychologists having a Ph. D. degree and 1 year of internship started at $17,056. The average salary for psychologists in the Federal Government was about $25,200 a year in 1977.

Psychologists in colleges and universities receive the same benefits as other faculty members—sabbatical leaves of absence, life and health insurance, and retirement benefits. Working hours are generally flexible, but often entail evening work with individual students or groups. Clinical and counseling psychologists often work in the evenings since their patients sometimes are unable to leave their jobs or school during the day.

Sources of Additional Information

For information on career opportunities and job openings for psychologists, admission and degree requirements in colleges and universities offering graduate programs in psychology, accreditation, certification or licensure requirements, and financial assistance for graduate students in psychology, contact:

American Psychological Association, Educational Affairs Office, 1200 17th St. NW., Washington, D.C. 20036.

Information on traineeships and fellowships is available from colleges and universities that have graduate psychology departments.

SOCIOLOGISTS

(D.O.T. 054.088)

Nature of the Work

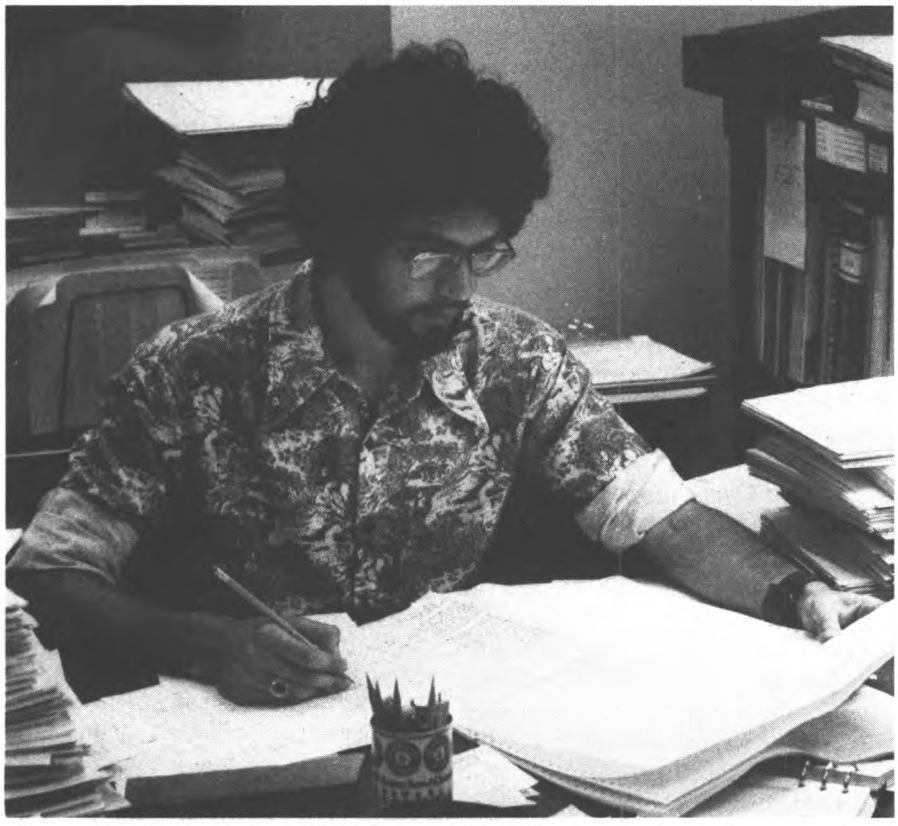
Sociologists study human society and social behavior by examining the groups that humans form. These groups include families, tribes, communities, and governments, along with a variety of social, religious, political, business, and other organizations. Sociologists study the behavior and interaction 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 groups to which they belong.

Important fields of specialization for sociologists include social organization, social pathology and psychology, rural or urban sociology, criminology and penology, demography, industrial sociology, and medical sociology—the study of social factors that affect mental and public health. Increasingly, sociologists are finding opportunities to apply their professional knowledge and methods in areas of practice as diverse as intergroup relations, family counseling, public opinion analysis, law, education, public relations, regional and community planning, and environmental planning.

Most sociologists are college and university teachers; some are involved in research, writing, administration, and other nonteaching activities. Sociological research, like other kinds of social science research, involves collecting information, preparing case studies, testing, and conducting surveys and laboratory experiments. Increasingly, sociologists apply advanced statistical and computer techniques in their research. The results of sociological research often aid educators, lawmakers, administrators, and other officials interested in local, national, or international social problems. Sociologists work closely with members of other professions including psychologists, physicians, economists,

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Sociologists spend a great deal of their time in study and research.

political scientists, anthropologists, and social workers.

Some sociologists supervise the operation of social service agencies such as family and marriage clinics. Others, acting as consultants, advise on diverse problems such as the management of hospitals for the mentally ill, the rehabilitation of juvenile delinquents, or the development of effective advertising programs to promote public interest in particular products such as television sets or cars.

Places of Employment

About 19,000 persons worked as sociologists in 1976, excluding those teaching in secondary schools.

Colleges and universities employ about four-fifths of all sociologists. A number work for Federal, State, local, or international government agencies, and are professionally concerned with such subjects as poverty, welfare services and other public assistance programs, population problems, social rehabilitation, community development, and environmental impact studies. Some work in private industry, research firms, management consulting firms, welfare or other nonprofit organizations, or else are self-employed. Some work in positions that require training in sociology and related disciplines, but are not classified as professional sociologists. Related fields include social work, recreation, and public health.

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 and a major in sociology usually is the minimum requirement for employment as a sociologist. The Ph. D. degree is essential for appointment as a professor and for tenure in almost all colleges or universities. The Ph. D. commonly is required for directors of major research projects, important administrative positions, or consultants.

Sociologists with master's degrees can qualify for many administrative and research positions, provided they have sufficient training in research, statistical, and computer methods. Advancement from these to supervisory positions in both public and private agencies generally is based on experience. Sociologists with master's degrees may qualify for some college instructorships. Most colleges, however, appoint as instructors only people who have training beyond the master's level—frequently the completion of all requirements for the Ph. D. degree except the doctoral dissertation. Outstanding graduate students may get teaching or research assistantships that provide both financial aid and valuable experience.

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 statistics may get positions as beginning analysts or statisticians.

Over 1,200 colleges and universities offer bachelor's degree programs in sociology; about 145 offer master's degrees; and about 125 have doctoral 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.

In the Federal Government, candidates generally must have 24 semester hours in sociology, with course work including theory and methods of social research. However, since positions as professional sociologists are quite limited, 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 re-

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search facilities and offer appropriate areas of specialization such as theory, social psychology, or quantitative methods. Opportunities to gain practical research experience also may be available, and sociology departments frequently aid in the placement of graduates.

Sociologists spend a great deal of their time in study and research. They must be able to communicate effectively, both orally and in writing. The ability to work as part of a group as well as independently is important.

Employment Outlook

Employment of sociologists is expected to increase more slowly than the average for all occupations through the mid-1980's. Most openings will result from deaths, retirements, and other separations from the labor force. Some academic openings will result from the growing trend to include sociology courses in the curriculums of other professions, such as medicine, law, business administration and management, and education. Demand in the nonteaching area will center around public and private programs dealing with the development of human resources, particularly those designed to cope with social and welfare problems.

The number of persons who will graduate with advanced degrees in sociology is likely to greatly exceed available job openings. Graduates with a Ph. D. face increasing competition for academic positions, although those with degrees from prestigious institutions may have an advantage in securing a teaching job. Some Ph. D.'s may accept temporary, part-time positions as instructors. Others may find research and administrative positions in government, research organizations, and consulting firms. Graduates with training in business administration including management and accounting should have the most favorable job opportunities in business and industry. Persons with a master's degree will continue to face very keen competition for academic positions, although some jobs may be available in junior and community colleges. Some may find research and administrative jobs in government, research firms, and private industry.

Bachelor's degree holders are expected to find very limited opportunities as professional sociologists. However, many graduates are expected to gain positions as trainees in government, business, and industry. 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.

Sociologists well trained in quantitative research methods, survey methods, advanced statistics, and computer science will have the widest choice of jobs. Demand is expected to be particularly strong for research personnel to work in such areas as urban studies, ethnic studies, race relations, deviant behavior, community development, population analysis, medical sociology, and the sociology of law, work, and education.

Earnings and Working Conditions

According to the 1975-76 College Placement Council Salary Survey, bachelor's degree candidates in the social sciences received offers averaging around $10,000 a year; master's degree candidates in the social sciences, around $12,000.

Salaries of sociologists working in educational institutions and non-academic settings are comparable to those for other social scientists. In general, salaries of experienced sociologists are higher than the average for all nonsupervisory workers in private industry, except farming.

The Civil Service Commission recognizes education and experience in certifying applicants for entry level positions in the Federal Government. In general, the entrance salary for sociologists with a bachelor's degree was $9,303 or $11,523 a year in 1977, depending upon the applicant's academic record. The starting salary for those with a master's degree was $14,097 a year, and for those with a Ph. D., $17,056. Sociologists in the Federal Government work primarily in the Departments of Health, Education, and Welfare; Defense; Agriculture; Interior; Commerce; Transportation; and Housing and Urban Development, as well as the Veterans Administration and Environmental Protection Agency. They averaged around $23,800 in 1977.

In general, sociologists with the Ph. D. degree earn substantially higher salaries than those with master's degrees. Many sociologists, particularly those employed by colleges and universities for the academic year (September to June), supplement their regular salaries with earnings from other sources, such as summer teaching and consulting work.

Sources of Additional Information

Additional information on careers, employment opportunities, and graduate departments of sociology is available from:

The American Sociological Association, 1722 N St., NW., Washington, D.C. 20036.

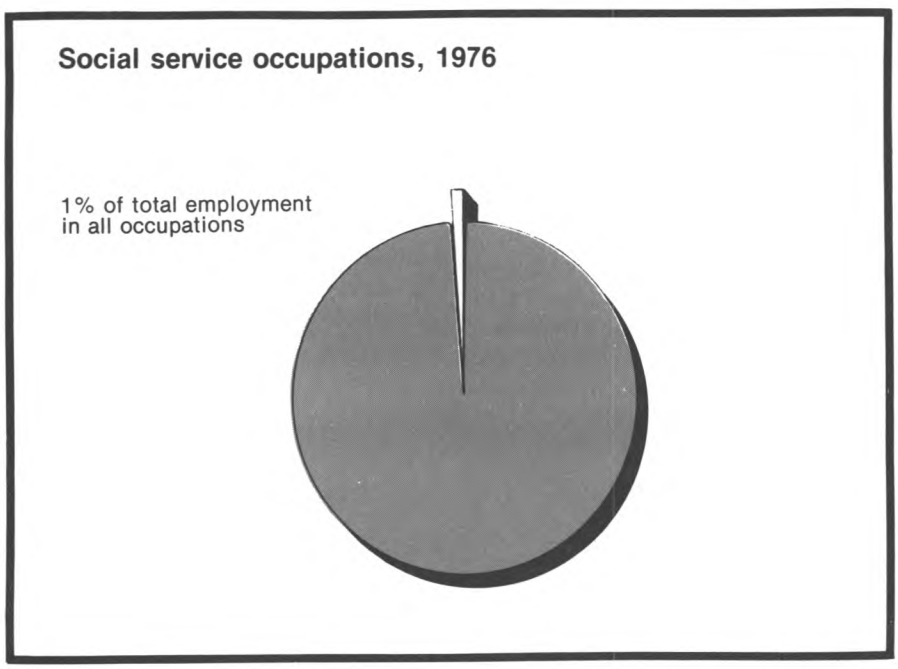
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SOCIAL SERVICE OCCUPATIONS

Workers in social service occupations help people in a number of different ways. School counselors help students develop educational plans that fit the student's abilities, interests, and career potential. Employment counselors guide people of all ages in planning careers and finding jobs. Their advice helps clients select an appropriate field of endeavor, and then prepare for it. 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 a career and advise them on the kind of training or experience that will best help them find a job.

Members of the clergy, whether Rabbis, Protestant Ministers, or Catholic Priests, 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. These are privileged communications. The work of the clergy is never done, and its importance cannot be overstated.

Other occupations involve social service as well. Cooperative extension service workers deal 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 liveable—consumer economics, housing, home management, home furnishings and equipment, food and nutrition, clothing and textiles, and family development and relations. Park, recreation, and leisure service workers plan, organize, and direct activities that help people of various ages and socioeconomic groups enjoy their nonworking hours. Social service aides assist rehabilitation counselors, social workers, and other professionals. Social workers help individuals, families, groups, and communities in solving their problems so that they can live more effectively in society.



People in social service occupations become closely involved with their clients' lives, and the services they provide can have farreaching effects. Advice on schools, jobs, careers, rehabilitation, or emotional and family problems may lead an individual to make fundamental decisions about his or her 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. For these reasons, a genuine concern for people and a desire to help them improve their lives are important for anyone considering a career in the social service field. Patience, tact, sensitivity, and compassion are necessary personal qualities. Moreover, people in social service occupations must have appropriate training and should be dedicated to high standards of professionalism. Anything less may

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prove disastrous to the people being served.

In general, knowledge of the particular social service field is gained through college and graduate education. 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.

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COUNSELING OCCUPATIONS

At some point in their lives, most people seek advice or assistance for personal, education, 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 vocational planning and may work for State or private, nonprofit agencies. 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; rehabilitation; employment; 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 productive individuals.

Employment counselors counsel persons—the unemployed or unskilled, for example—who cannot find a job and/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. 045.108)

Nature of the Work

Uncertainty about career choice, learning disabilities, or an unhappy home life are typical 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.

A counselor role is to help students understand themselves better—their abilities, talents, 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 also work with problems affecting the school as a whole or 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

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School counselors must keep up to date on opportunities for education and vocational training.

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.

Places of Employment

About 43,000 people worked full time as public school counselors during 1976. 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. (See statements on elementary and secondary school teachers for certificate requirements.) 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 2 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 earn the Ph. D. degree.

Employment Outlook

Employment of school counselors is likely to grow more slowly than the average for all occupations through the mid-1980's as declining school enrollments coupled with financial constraints limit demand. If Federal assistance for career education is increased, however, many more jobs should result. Thus, future growth in counselor employment will depend

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largely on the amount of funds that the Federal Government provides to the States.

Earnings and Working Conditions

According to a recent survey, the average salary of school counselors ranged from $11,646 to $18,929. 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.

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, 1607 New Hampshire Ave. NW., Washington, D.C. 20009.

EMPLOYMENT COUNSELORS

(D.O.T. 045.108)

Nature of the Work

Uncertainty about career plans is a problem faced not only by youngsters in school but also by many adults. Many persons lack realistic career goals, adequate job training, or knowledge about the labor market. Some become unemployed. Veterans and school dropouts are examples of other individuals who often do not know how to turn their talents and abilities into marketable skills. Employment counselors (sometimes called vocational counselors) help these and other jobseekers.

Most employment counselors assist persons who turn to State or community agencies for advice. The handicapped, older workers, and individuals displaced by automation and industry shifts or unhappy with their present occupational fields are typical applicants. Some jobseekers are skilled in specific occupations and ready for immediate job placement; others, who have little education and lack marketable skills, need intensive training to prepare for jobs. In State employment services, the counselor also helps those who are least employable, such as welfare recipients, ex-prisoners, and the educationally and culturally deprived.

Counselors interview jobseekers to learn employment-related facts about their interests, training, work experience, work attitudes, physical capacities, and personal traits. If necessary, they may get additional data by arranging for aptitude and achievement tests and interest inventories, so that more objective advice may be given. They also may get additional information by speaking with the applicant's former employer or school principal.

When a jobseeker's background—the person's abilities and limitations has been thoroughly reviewed, the employment counselor discusses occupational requirements and job opportunities in different fields within the potential of the jobseeker. Then the counselor and the client develop a vocational plan. This plan may specify a series of steps involving remedial education, job training, work experience, or other services needed to enhance the person's employability.

In many cases, employment counselors refer jobseekers to other agencies for physical rehabilitation or psychological or other services before or during counseling. If, for example, a person is hampered in a job search because of stuttering, the counselor might suggest visits with city or county medical personnel. Proper referrel requires that counselors be familiar with the available community services so that they can select those most likely to benefit a particular jobseeker.

Counselors may help jobseekers by suggesting employment sources and appropriate ways of applying for work. In some cases, counselors may contact employers about jobs for applicants, although in State employment services agencies, placement specialists often handle this work. After job placement or entrance into training, counselors may follow up to determine if additional assistance is needed.

The expanding responsibility of public employment service counselors for improving the employability of disadvantaged persons has increased their contacts with these persons during training and on the job. Also, it has led to group counseling and the stationing of counselors in neighborhood and community centers.

Places of Employment

In 1976, about 3,400 persons worked as employment counselors in State employment service offices, located in every large city and many smaller towns. In addition, about 3,000 employment counselors worked for various private or community agencies, primarily in the larger cities. Some worked in institutions such as prisons, training schools for delinquent youths, and mental hospitals. Also, the Federal Government employed a limited number of employment counselors, chiefly in the Veterans Administration and in the Bureau of Indian Affairs. Some counselors teach in graduate training programs or conduct research.

Training, Other Qualifications, and Advancement

The national qualification standard for first level employment counselors in State employment service offices calls for 30 graduate semester hours of counseling courses beyond a bachelor's degree. However, 1 year of counseling-related experience may be substituted for 15 graduate semester hours.

All States require counselors in their public employment offices to meet State civil service or merit system requirements that include minimum educational and experience standards.

Applicants with advanced degrees and additional qualifying experience may enter at higher levels on the counselor career ladder. Many States

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also make provision for individuals with extensive experience in the employment service, whether or not they have college degrees, to enter the counselor career ladder and move upward by acquiring the prescribed university coursework and qualifying experience for each level.

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 some in-service training programs for their new counselors or trainees. In addition, both their new and experienced counselors often are given part-time 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 enroll in courses in psychology and basic sociology. At the graduate level, requirements for this field usually include courses in 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 experience in counseling under the supervision of an instructor.

Persons aspiring to be employment counselors should have a strong interest in helping others make vocational plans and carry them out. They should be able to work independently and to keep detailed records.

Well-qualified counselors with experience may advance to supervisory or administrative positions in their own or other organizations. Some may become directors of agencies or of other counseling services, or area supervisors of guidance programs; some may become consultants; and others may become professors in the counseling field.

Employment Outlook

Employment counselors with master's degrees or experience in related fields are expected to face some competition in both public and community employment agencies through the mid-1980's. Actual growth in employment of counselors will depend in large part on the level of Federal funding to State, local and community agencies to provide counseling services. Some openings for employment counselors will result, however, from the need to replace those who die, retire, or transfer to other occupations.

Earnings and Working Conditions

Salaries of employment counselors in State employment services vary considerably from State to State. In 1976, 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 1976 was $8,500. The average for experienced workers was $16,000. In general, salaries of employment counselors are about 1 1/2 times as high as average earnings for all nonsupervisory workers in private industry, except farming.

Most counselors work about 40 hours a week and have various benefits, including vacations, sick leave, pension plans, and insurance coverage. Counselors employed in community agencies may work overtime.

Sources of Additional Information

For general information on employment or vocational counseling, contact:

National Employment Counselors Association, 1607 New Hampshire Ave., NW., Washington, D.C. 20009.

National Vocational Guidance Association, 1607 New Hampshire Ave. NW., Washington D.C. 20009.

U.S. Department of Labor, Employment and Training Administration, USES, Division of Counseling and Testing, Washington, D.C. 20210.

The administrative office for each State's employment security agency, bureau, division, or commission can supply specific information about local job opportunities, salaries, and entrance requirements for positions in public employment service offices.

REHABILITATION COUNSELORS

(D.O.T. 045.108)

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 dangerous 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 uisabled 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

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this information to develop a rehabilitation plan.

A rehabilitation program generally includes specific job training, such as secretarial studies, 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 reguarly to discuss progress in the rehabilitation program and any problems that may arise.

Counselors also must find jobs for disabled persons and often make follow-up 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.

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.

Because job placement is 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, alcoholics or 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. Usually, counselors in private organizations can spend more time with clients than their counterparts in State agencies. 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.



Rehabilitation counselor assisting blind person in use of tape recorder.

Places of Employment

About 19,000 persons worked as rehabilitation counselors in 1976. About 70 percent worked in State and local rehabilitation agencies financed cooperatively with Federal and State funds. Some rehabilitation counselors and counseling psychologists worked for the Veterans Administration. Rehabilitation centers, sheltered workshops, hospitals, labor unions, insurance companies, special schools, and other public and private agenices 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 social 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.

More than 75 college and universities offered graduate programs in rehabilitation counseling in 1976. Usu-

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ally, 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 growth 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. 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 and Working Conditions

Salaries of beginning rehabilitation counselors in State agencies averaged $10,441 a year in 1976. Beginning salaries ranged from $7,200 in Puerto Rico to $15,774 in Alaska.

The Veterans 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 $17,056 in 1976. Those with a Ph. D. and a year of experience, and those with a 2-year master's degree and much experience, started at $20,442. Some rehabilitation counselors with a bachelor's degree were hired at starting salaries of $11,523 and $14,097. In general, salaries of rehabilitation counselors are above the average earnings for all nonsupervisory workers in private industry, except farming.

Counselors 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 generally work a 40-hour week or less, with some overtime work required to attend community and civic meetings in the evening. They usually are covered by sick and annual leave benefits and pension and health plans.

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, 1607 New Hampshire Ave. NW., Washington, D.C. 20009.

National Rehabilitation Counseling Association, 1522 K St. NW., Washington, D.C. 20005.

Information on certification requirements and procedures is available from:

Commission on Rehabilitation Counselor Certification, 520 North Michigan Ave., Chicago, Ill. 60611.

COLLEGE CAREER PLANNING AND PLACEMENT COUNSELORS

(D.O.T. 166.268)

Nature of the Work

Choosing a career is a decision faced by many college students. Finding an occupation that matches one's likes, dislikes, and talents can be difficult and time consuming. And, once the decision is made, there is still the problem of writing resumes, being interviewed, and searching out prospective employers—often 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 assist students in making career selections by encouraging them to examine their interests, abilities, and goals, and then helping them to explore possible career alternatives. They may, for example, arrange part-time or summer employment with a local government agency for an architectural student considering a career as a city planner. Or they

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Counselor discusses career alternatives with college student.

may discuss employment options and training requirements with students majoring in history. Ofen, counselors suggest additional courses or further training to enchance employment prospects.

Career planning and placement counselors also arrange for job recruiters to visit the campus to discuss their firm's 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 job market developments by reading literature in the field and maintaining contact with industry and government personnel recruiters.

Some career planning and placement counselors, especially those in junior or community colleges, advise administrators on curriculum and course content. They may suggest courses that employers believe would train students more adequately. In addition, some 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.

Places of Employment

Nearly all 4-year colleges and universities and many of the increasing number of junior colleges provide career planning and placement services to their students and alumni. Large 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 some colleges, especially the smaller ones, 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 3,900 persons worked as career planning and placement counselors in colleges and universities in 1976. Nearly three-fourths worked in 4-year institutions. The remainer worked in junior and community colleges.

Training, Other Qualifications, and Advancement

Although no specific educational program exists to prepare persons for career planning and placement work, a bachelor's degree, preferably in a behavioral science, such as psychology or sociology, is customary for entry into the field, and a master's degree is increasingly being stressed.

In 1976, 120 colleges and universities offered graduate programs in college student personnel work.

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Graduate courses that are helpful for career planning and placement counseling include counseling theory and techniques, vocational testing, theory of group dynamics, and occupational research and employment trends.

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.

College career planning and placement counselors must have an interest in people. They must be able to communicate with and gain the confidence of students, faculty, and employers in order to develop insight into the employment needs of both employers and students. 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. 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 expected to increase through the mid-1980's. Demand will be greatest in junior and community colleges, where, in many cases, there are no career planning and placement programs at present. In addition, the large number of adults entering community colleges who have been out of the labor market or who are seeking a mid-career change will require specialized counseling.

Also contributing to the demand in all postsecondary institutions will be the expected continued expansion in services to students from minority and low-income groups, who require special counseling in choosing careers and assistance in finding part-time jobs. Growth also is expected in services to the handicapped and to adults participating in continuing education.

However, many institutions of higher education faced financial problems in 1976. If this situation persists, colleges and universities may be forced to limit expansion of counseling and placement services, resulting in competition for available positions.

Earnings and Working Conditions

Salaries vary greatly among educational institutions. According to the limited information available, the average salary of college career planning and placement directors was more than $17,000 a year in 1976.

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.

Sources of Additional Information

A booklet on the college student personnel professions, as well as other information on career counseling and placement, is available from:

The College Placement Council, Inc., P.O. Box 2263, Bethlehem, Pa. 18001.

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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]ct 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.

PROTESTANT MINISTERS

(D.O.T. 120.108)

Nature of the Work

Protestant ministers lead their congregations in worship services and administer the rites of baptism, confirmation, and Holy Communion. They prepare and deliver sermons and give religious instruction to persons who are to become new members of the church. 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.

Places of Employment

In 1976, about 190,000 ministers served more than 72 million Protes-



The services that ministers conduct differ among Protestant denominations and also among congregations within a denomination.

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tants. Most ministers serve individual congregations. In addition, however, thousands of ministers work 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 or ministers retired from full-time pastoral responsibilities. Although most ministers are located in urban areas, many live in less densely populated areas where they may serve two congregations or more.

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 1976, there were 138 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. 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 trend toward merger and unity among denominations, combined with the closing of smaller parishes and the downturn in financial support, has reduced demand for Protestant ministers in recent years. As a result, new graduates of theological schools will face increasing competition in finding positions. The supply-demand situation will vary among denominations and the chance of obtaining employment will depend, in part, on the length of the candidate's formal preparation. Most of the openings for clergy that are expected through the mid-1980's will therefore result from the need to replace those in existing positions who retire, die, or leave the ministry. The need for ministers in Evangelical churches, however, is expected to continue to grow.

Although fewer opportunities may arise for Protestant ministers to serve individual congregations, newly ordained ministers may find work in youth, family relations, and welfare organizations; religious education; and 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, education, denomination, size and wealth of congregation, type of community, and geographic location. According to a study by the Institute for Church Development, average income including benefits for Protestant ministers in five denominations was about $13,650 in 1976. These earnings are somewhat higher than the average for Protestant denominations as a whole. Annual vacations average 3 weeks and there often is opportunity for time off.

Because of the wide range of service that the minister provides, he or she may work long or irregular hours, often involving considerable travel.

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. 120.108)

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

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and deliver sermons at services on the Sabbath and on Jewish holidays. Rabbis customarily are available at all times to counsel members of their congregation, other followers of Judaism, and the community at large. 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. The 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.

Places of Employment

About 4,000 rabbis served over 6 million followers of the Jewish faith in this country in 1976; approximately 1,550 were Orthodox rabbis, 1,350 were Conservative, and 1,200 Reform. Others work as chaplains in the military services, in hospitals and other institutions, or in one of the many Jewish community service agencies. A growing number 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, Illinois, Massachusetts, Florida, Maryland, and the Washington, D.C. metropolitan area.

Training and Other Qualifications

To become eligible for ordination as a rabbi, a student must complete a prescribed course of study in a seminary. Entrance requirements and the curriculum depend upon the branch of Judaism with which the seminary is associated.

Nearly 30 seminaries train Orthodox rabbis in programs of varying lengths. The required course of study to prepare for ordination is usually 3 or 4 years. However, students who are not college graduates may spend a longer period at these seminaries and complete the requirements for the bachelor's degree while pursuing the rabbinic course. Some Orthodox seminaries do not require a college degree to qualify for ordination, although students who qualify usually have completed 4 years of college.

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 branch that has approved the training and ordination of women as rabbis. In 1976, almost half the entering class at the Reform seminary 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 a thorough preparation in the classics as well as extensive practical training in dealing with the social and political problems in the community. Training for alternatives



Rabbi instructing nursery school children about the Friday evening Sabbath meal.

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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 demand for Rabbis has declined in recent years because some established congregations have closed and fewer new ones are being formed. As a result, many newly ordained Rabbis will take positions in smaller Jewish communities and as assistant Rabbis in larger Jewish congregations. Opportunities still exist for Rabbis to teach in colleges and universities, to serve as chaplains in the Armed Forces, and to work in hospitals and other institutions or in one of the many Jewish social service agencies. Openings in established congregations will come largely from a need to replace those Rabbis who retire or die.

The employment outlook for rabbis varies among the three major branches of Judaism, however. Reform rabbis may face some competition for available positions and Orthodox clergy are expected to encounter very keen competition. Conservative rabbis, on the other hand, will have good employment opportunities, if present trends continue.

Earnings and Working Conditions

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 1976 the annual earnings of rabbis averaged between $15,000 and $20,000, including pension and housing allowance. Earnings of Orthodox rabbis tended to be at the lower end of the scale. Average earnings of newly ordained Conservative and Reform rabbis were about $19,000; more experienced rabbis earned much higher salaries and, with other benefits, averaged as much as $35,000 a year. Some senior rabbis in large temples earned up to $60,000 a year.

Rabbis' working hours are determined by their role in the congregation. Besides conducting regular religious services, they also may spend considerable time in administrative, educational, and community service functions, as well as presiding over various ceremonial services. Rabbis also must be available to serve the emergency needs of their congregation members.

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, New York 10027.

The Rabbi Issac Elchanan Theological Seminary, an affiliate of Yeshiva University, (Orthodox), 2540 Amsterdam Ave., New York, N.Y. 10033.

Hebrew Union College and Jewish Institute of Religion, (Reform), whose three campuses are located at 40 W. 68th St., New York, N.Y. 10023; at 3101 Clifton Ave., Cincinnati, Ohio 45220; and at 3077 University Mall, Los Angeles, Calif. 90007.

ROMAN CATHOLIC PRIESTS

(D.O.T. 120.108)

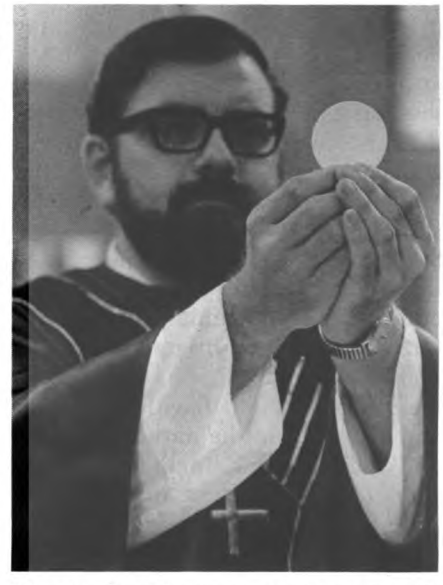
Nature of the Work

Roman Catholic priests attend to the spiritual, pastoral, moral, and educational needs of the members of their church. Their duties include presiding at liturgical functions; offering religious enlightenment in the form of a sermon; hearing confessions; administering the Sacraments (including the sacraments of Marriage and Penance); and conducting funeral services. They also comfort the sick, console relatives and friends of the dead, counsel those in need of guidance, and assist the poor.

Priests spend long hours working for the church and the community. 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 engage in specialized activities such as teaching or missionary work assigned to them by superiors of their order.

Both religious and diocesan priests



The number of priests has been insufficient to fill all the needs of Catholic institutions.

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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 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.

Places of Employment

Approximately 59,000 priests served nearly 49 million Catholics in the United States in 1976. 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 seminary institutions where students may 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. Field work experience usually is required in addition to classroom study; 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 are not permitted 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 at other universities 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, the church authorities may make arrangements for student scholarships or loans. 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

A growing number of priests will be needed in the years ahead to provide for the spiritual, educational, and social needs of the increasing number of Catholics in the Nation. 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 recent drop in seminary enrollments continues. However, permanent deacons, who may marry and hold full-time jobs outside the Church, are being ordained as Catholic ministers to preach and perform other liturgical functions, such as communion and baptism. They are not permitted to celebrate Mass or hear confession. Although priests usually continue to work longer than persons in other professions, the varied demands and long hours create a need for young priests to assist the older ones. Also, an increasing number of priests have been acting in many diverse areas of service—in social work; religious radio, newspaper, and television work; and labor-management mediation. They also have been serving in foreign posts as missionaries, particularly in countries that have a shortage of priests.

Earnings and Working Conditions

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. These may include priests working as lawyers, counselors, consultants, etc.

Due to the wide range of duties which most clergy have, priests often must work long and irregular hours. Their working conditions vary widely with the type and area of assignment.

Sources of Additional Information

Young men interested in entering

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the priesthood should seek the guidance and counsel of their parish priest. 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.

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OTHER SOCIAL SERVICE OCCUPATIONS

COOPERATIVE EXTENSION SERVICE WORKERS

(D.O.T. 096.128)

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.

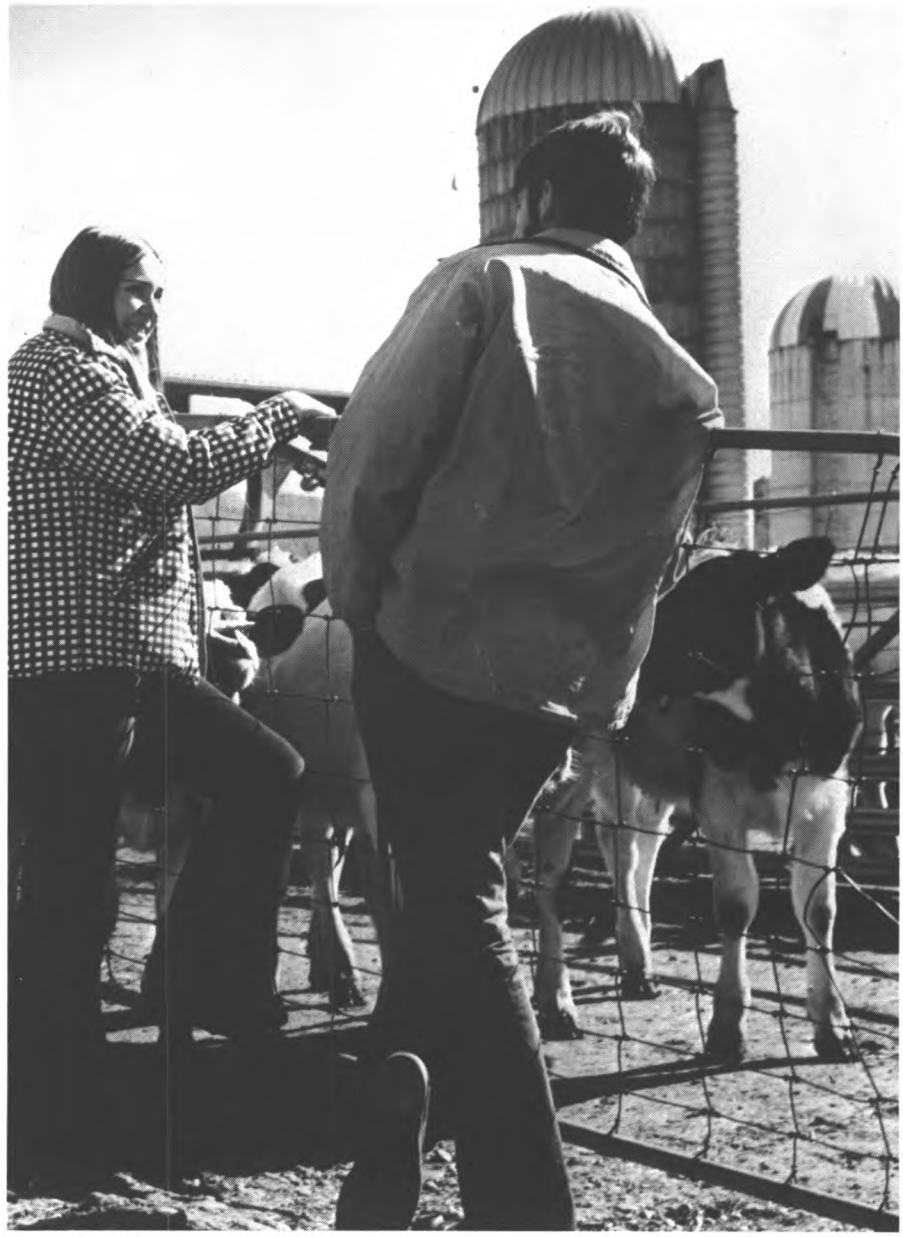
Extension agents usually work with groups of people. For example, the extension agent for youth activities conducts 4-H meetings for members in the area. During the summer, they may hold day camps to organize youth recreational activities. Agents who work in home economics set up meetings and programs to illustrate the benefits of proper nutrition and to educate homemakers in good nutrition.

Agriculture science extension agents conduct group meetings on topics of special interest to area farmers. In a county which has much dairy farming, extension agents arrange seminars covering dairy herd health or the raising of forage crops. During these seminars, agents instruct farmers in using the proper feeds to meet cows' nutritional needs and to raise their output of milk, and recognizing and combating health hazards including the possible establishment of 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, they also do field work with individuals. If a farmer is having a problem with his or her 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



County extension worker gives technical advice to dairy farmer.

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agents write articles dealing with their areas of specialization for publication in local newspapers. Often these are regular feature columns that appear once a week. Others 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 who work 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 may teach classes 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.

Places of Employment

More than four-fifths of the approximately 16,000 cooperative extension service workers are 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 clientele 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 preinduction 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. Beside 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 occupation through the mid-1980's. 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 farming practices. This may increase the demand for extension agents since extension agents relay advances in farming practices from researchers to farmers.

Earnings and Working Conditions

The salaries of extension workers vary by locality, but, for the most part, they are competitive with salaries of other municipal and county professional employees, such as school teachers.

Extension agents work in offices and in the field. Since most extension service offices are located in small towns, persons who wish to live outside the city may find extension work the ideal career. Extension agents often get great satisfaction out of helping others.

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, Washington, D.C. 20250.

HOME ECONOMISTS

(D.O.T. 096.128)

Nature of the Work

Home economists work to improve products, services, and practices that affect the comfort and well-being of the family. Some specialize in specific areas, such as consumer economics, housing, home management, home furnishings and equipment, food and nutrition, clothing and textiles, and child development and family relations. Others have a broad knowledge of the whole professional field.

Most home economists teach. Those in high schools teach students about foods and nutrition; clothing selection, construction and care; child development; consumer education; housing and home furnishings; family relations; and other subjects related to family living and homemaking. They also perform the regular duties of other high school teachers that are described in the statement on secondary school teachers elsewhere in the *Handbook*.

Teachers in adult education programs help men and women to increase their understanding of family relations and to improve their homemaking skills. They also conduct training programs on secondary, postsecondary, and adult levels for jobs related to home economics. Special emphasis is given to teaching those who are disadvantaged and handicapped. College teachers may combine teaching and research and

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often specialize in a particular area of home economics.

Home economists employed by private business firms and trade associations promote the development, use, and care of specific home products. They may do research, test products, and prepare advertisements and instructional materials. They also may prepare and present programs for radio and television; serve as consultants; give lectures and demonstrations before the public; and conduct classes for sales persons and appliance service workers. Some home economists study consumer needs and help manufacturers translate these needs into useful products.

Some home economists conduct research for the Federal Government, State agricultural experiment stations, colleges, universities, and private organizations. The U.S. Department of Agriculture employs the largest group of researchers to do work such as study the buying and spending habits of families in all socioeconomic groups and develop budget guides.

Home economists who work for the Cooperative Extension Service conduct adult education programs and 4-H Club and other youth programs in areas such as home management, consumer education, family relations, and nutrition. Extension Service home economists also train and supervise volunteer leaders and paid aides who teach adults and youth. (See statement on Cooperative Extension Service workers elsewhere in the *Handbook*.)

Federal, State, and local governments and private agencies employ home economists in social welfare programs to advise and counsel clients on the practical knowledge and skills needed for effective everyday family living. They also may help handicapped homemakers and their families adjust to physical as well as social and emotional limitations by changing the arrangements in the home; finding efficient ways to manage activities of daily living; aiding in the design, selection, and arrangement of equipment; and creating other methods and devices to enable disabled people to function at their highest possible level. Other home economists in welfare agencies supervise or train workers who provide temporary or part-time help to households disrupted by illness.

Home economists in health services provide special help and guidance in home management, consumer education, and family economics as these relate to family health and well-being. Activities of home economists working in health programs include the following: collaboration and consultation with other professionals on economic and home management needs of patients and their families; direct service to patients through home visits; clinic demonstrations and classes in homemaking skills and child care; counseling in the management of time and resources, including financial aspects; assisting socially and mentally handicapped parents in developing their potential skills for child care and home management; working with agencies and community resources; and supervising homemaker aides.

Places of Employment

About 141,000 people worked in home economics professions in 1976. This figure includes 45,000 dietitians and 5,600 Cooperative Extension Service workers who are discussed in separate statements elsewhere in the *Handbook*.

About 75,000 home economists are teachers, about 50,000 in secondary schools and 7,000 in colleges and universities. More than 15,000 are adult education instructors, some of whom teach part time in secondary schools. Others teach in community colleges, elementary schools, kindergartens, nursery schools, and recreation centers.

More than 5,000 home economists work in private business firms and associations. Several thousand are in research and social welfare programs. A few are self-employed.

Training, Other Qualifications, and Advancement

About 350 colleges and universities offer a bachelor's degree in home economics, which qualifies graduates for most entry positions in the field. A master's or doctor's degree is required for college teaching, for certain research and supervisory positions, for work as an extension specialist, and for most jobs in nutrition.

Home economics majors study sciences and liberal arts—particularly social sciences—as well as special-



Some home economists work with children.

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ized home economics courses. They may concentrate in a particular area of home economics or in what is called general home economics. Advanced courses in chemistry and nutrition are important for work in foods and nutrition; science and statistics for research work; and journalism for advertising, public relations work, and all other work in the communications field. To teach home economics in high school, students must complete the courses required for a teacher's certificate.

Scholarships, fellowships, and assistantships are available for undergraduate and graduate study. Although colleges and universities offer most of these financial grants, government agencies, research foundations, businesses, and the American Home Economics Association Foundation provide additional funds for graduate study.

Home economists must be able to work with people of various incomes and cultural backgrounds and should have a capacity for leadership. Poise and an interest in people also are essential for those who deal with the public. The ability to write and speak well is important. Among the subjects recommended for high school students interested in careers in this field are home economics, speech, English, health, mathematics, chemistry, and the social sciences.

Employment Outlook

Home economists, especially those wishing to teach in high schools, will face keen competition for jobs through the mid-1980's. Other areas of home economics also will experience competitive job market conditions as those unable to find teaching jobs look for other positions. However, for those willing to continue their education toward an advanced degree, employment prospects in college and university teaching are expected to be good.

Although little change is expected in the employment of home economists, many jobs will become available each year to replace those who die, retire, or leave the field for other reasons. The growth that is expected to occur will result from increasing awareness of the contributions that can be made by home economists in child care, nutrition, housing and furnishings design, clothing and textiles, consumer education, and ecology. They also will be needed to promote home products, to act as consultants to consumers, and to do research for improvement of home products and services.

Earnings and Working Conditions

Home economics teachers in public schools generally receive the same salaries as other teachers. In 1976, the average annual salary for public secondary school teachers was $12,395, according to the National Education Association. Teachers with a bachelor's degree in school systems with enrollments of 6,000 or more received starting salaries averaging $8,233 per year in the 1974-75 school year. Beginning teachers with a master's degree started at $9,159 a year. Annual salaries for teachers at the college and university level in 1975-76 ranged from an average minimum of $7,272 for instructors in private 2-year institutions to an average maximum of $25,387 for professors at 4-year public institutions.

The Federal Government paid home economists with bachelor's degrees starting salaries of $9,300 and $11,500 in 1977, depending on their scholastic record. Those with additional education and experience generally earned from $11,500 to $20,400 or more, depending on the type of position and level of responsibility. In 1977, the Federal Government paid experienced home economists average salaries of $20,500 a year.

Cooperative Extension Service workers on the county level averaged $14,000 per year in 1976; those on the State level received substantially higher salaries. In general, home economists earn about 1 1/2 times as much as the average for all nonsupervisory workers in private industry, except farming.

Home economists usually work a 40-hour week. Those in teaching and extension service positions, however, frequently work longer hours because they are expected to be available for evening lectures, demonstrations, and other work. Most home economists receive fringe benefits, such as paid vacation, sick leave, retirement pay, and insurance benefits.

Sources of Additional Information

A list of schools granting degrees in home economics and additional information about home economics careers and graduate scholarships are available from:

American Home Economics Association, 2010 Massachusetts Ave. NW., Washington, D.C. 20036

HOMEMAKER-HOME HEALTH AIDES

Nature of the Work

Homemaker-home health aide is an awkward but descriptive title for this occupation, since the job entails both domestic and social services as well as health care. Employed and supervised by social and health agencies, homemaker-home health aides work in the home to provide whatever assistance is necessary to enable sick persons who cannot perform basic tasks for themselves to remain in their own homes. They provide homemaking services, personal 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.

Homemaking services provided by the aides are manifold. Basic duties include cleaning a client's room, kitchen, and bathroom, doing the

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laundry, and changing bed linens. Aides also plan meals (including special diets), shop for food, and prepare meals.

Among the personal 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 an 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 wheel chair, 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.

Places of employment

Approximately 70,000 persons were employed as homemaker-home health aides in 1976. Although they work in clients' homes, aides are employed and supervised by social and health agencies that are responsible to the clients for the service provided. 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.

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.

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

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work as aides, replacing regular employees who are on vacation.

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, 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.

Supervisors give additional training informally when required for specific case assignments. 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 persons who need help with prescribed exercises, or clients with failing eyesight. In some larger agencies, experienced homemaker-home health aides can specialize in caring for clients with a specific type of problem.

In addition to on-the-job training given by supervisors, many agencies offer seminars from time to time on specific topics such as diets for diabetics, exercises for clients with a heart condition, or coping with depression. As aides gain experience in different types of cases, they 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 case management.



Persons who are interested in and well suited for work with the elderly should have no trouble finding a job.

Employment Outlook

Employment of homemaker-home health aides is expected to grow much faster than the average for all occupations through the mid-1980's. This very rapid growth of the occupation will occur as a result of growing public awareness of the availability of home care services, and probable changes in Federal legislation to encourage more widespread use of these services.

Over the next 10 years, employment growth in this field will be affected by heightened awareness on the part of the public and the medical profession of the availability of home care services. Support is growing for services that enable people to remain in their own homes as long as possible. 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, publicity surrounding investigations into the nursing home industry has raised much interest in alternatives to institutional care for those who do not require constant nursing or personal care. The general awareness of homemaker-home health aide service, then, can be expected to grow in the future.

An equally 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 probably will be enacted in the future. Such legislation might

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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 that would expand health and social services to people in their own homes. 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 the States have given high priority to homemaker-home health services in allocating the social service funds alloted them. 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 and Working Conditions

Earnings for homemaker-home health aides vary considerably. Beginning wages ranged from about $0.10 to $1.50 an hour higher than the minimum wage, or from $2.10 to $3.60 an hour in 1975. 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. Limited data indicate that pay for experienced aides averaged about $3.25 an hour in 1975 with some agencies paying over $4 an hour.

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; earns between $2.25 and $3.25 an hour, depending on length of employment and level of responsibility; 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.

Even though agencies carefully screen applicants before they hire a new employee, many homemaker-home health aides leave the occupation during the first few months of employment. The most frequent reasons for leaving center on the nature of the work. Often new employees like the personal care element of the work, but do not like the housekeeping chores. Other new employees dislike the demanding work schedule. The inability of new employees to cope with the physical or emotional problems of clients is another frequent reason for leaving. Agencies fire employees who are irresponsible, repeatedly refuse cases, are absent from work, or perform their work unsatisfactorily.

Homemaker-home health aides who stay in their job have many reasons for liking the 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.

Sources of Additional Information

Information may be obtained by contacting:

National Council of Homemaker-Home Health Aide Services, 67 Irving Place, New York, N.Y. 10003.

PARK, RECREATION, AND LEISURE SERVICE WORKERS

(D.O.T. 079.128, 159.228, 187.118, 195.168, 195.228)

Nature of the Work

Participation in organized recreation is more important today than

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ever before as many Americans find the amount of leisure time in their lives increasing. Park, recreation, and leisure service workers plan, organize, and direct individual and group activities that help people enjoy their leisure hours. They work with people of various ages and socioeconomic groups; the easy-to-reach, and those who have tuned out society; the sick and the well; the emotionally and physically handicapped. Employment settings range from the wilderness to rural to suburban and urban, including the inner city. Jobs can be found in municipal, county, special district, State and Federal tax-supported agencies; voluntary youth service organizations; commercial enterprises; and colleges and universities.

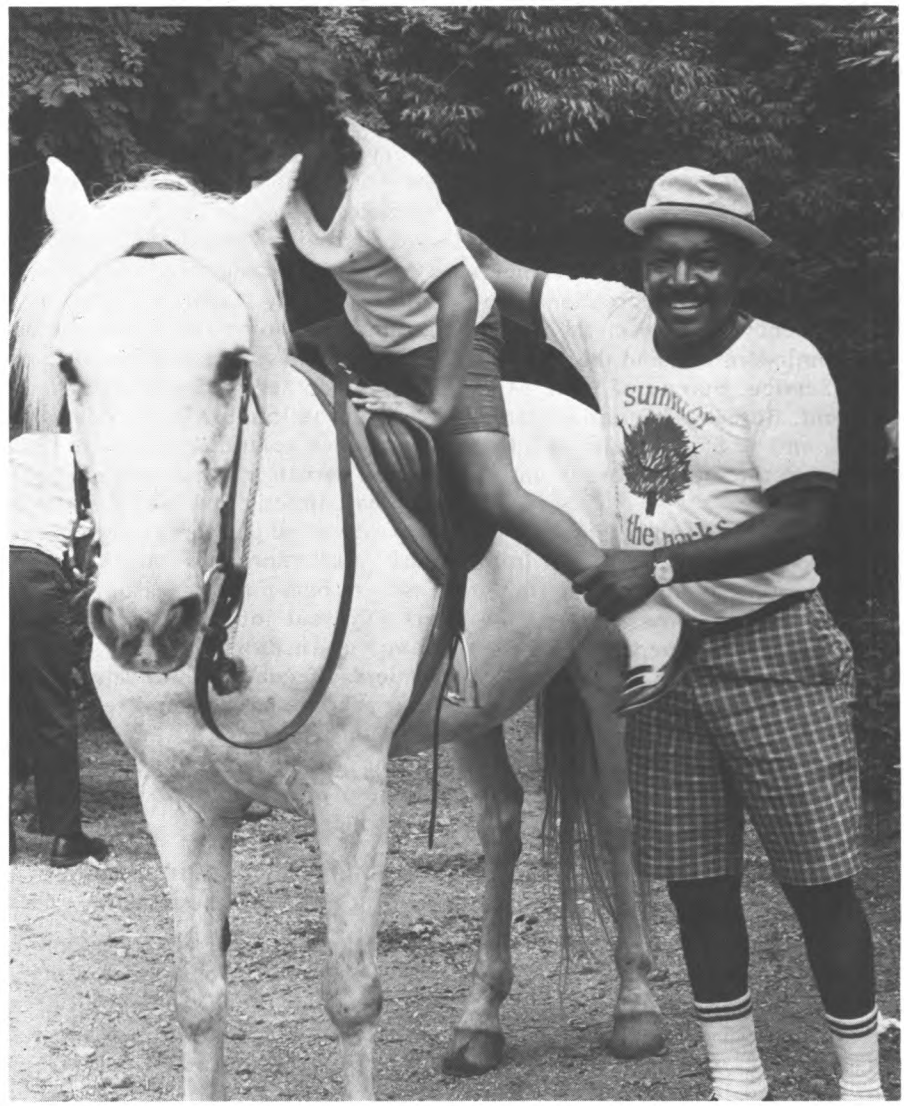
The park, recreation, and leisure service field provides career opportunities in two major areas which, despite some overlap, involve distinctive characteristics and training requirements. Activity with and for people is the chief characteristic of *Recreation Program Services*. Examples of recreation program jobs include playground leaders; program specialists in dance, drama, karate, tennis, the arts, and other physical activity; recreation center directors; therapeutic recreation specialists; camp counselors and wilderness leaders; senior citizen program leaders; civilian special services directors in the Armed Forces; and industrial recreation directors. Participants engage in recreational activity as a means of achieving personal satisfaction and other goals. Skilled leadership is required. The other major career area is *Park Management and Natural Resources*, which focuses on activities in natural and constructed areas, facilities, and environments. Job examples include outdoor recreation planners and park managers. These personnel work closely with others including grounds and facilities maintenance personnel; park rangers; landscape architects; foresters; and soil, range and wildlife conservationists. An understanding of the natural environment, physical planning, and maintenance and operation are essential job requirements. (Separate statements on foresters, range managers, landscape architects, soil conservationists, life scientists, and other closely related occupations are found elsewhere in the *Handbook*).

Park, recreation, and leisure service workers in full-time, year-round jobs occupy a variety of positions at different levels of responsibility. *Recreation program leaders* and *park technicians and aides* provide face-to-face leadership, give instruction in crafts, games, and sports, keep records, maintain recreation facilities, assist park rangers, and staff visitor centers.

Specialists include those trained in dance, drama, and the arts, in landscape architecture, horticulture, forestry, biology, and a variety of other fields. These specialists are employed by many park and recreation agencies and often are involved in program development, planning, implementation, and management.

Supervisors plan programs; supervise recreation leaders or park personnel; manage recreation facilities; provide direction in areas of specialization such as arts and crafts, music, drama, dance, and sports; or supervise leadership personnel over an entire region.

Administrators include directors of parks and recreation, superintendents of parks and/or recreation, and various division heads. These individuals have overall responsibility for administration, budget, personnel, programming and/or park management.



A majority of all paid employees in the park, recreation, and leisure service field are part time or seasonal workers.

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Educators teach park and recreation courses, supervise field work students, do research, and provide public service expertise.

Places of Employment

About 85,000 persons were primarily employed year round as park, recreation, and leisure service workers in 1976. The majority worked in public, tax-supported agencies including 2,018 municipal park and recreation departments, 1,211 county park and recreation agencies, 345 special districts, and the State park systems. In addition to these public agencies, a number of other employment settings provide year-round jobs for park, recreation, and leisure service workers.

Several thousand persons work for the Federal Government as recreation specialists (sports, art, music, theatre, therapeutic), outdoor recreation planners, park managers and technicians, and recreation assistants and aides. They work primarily for the Forest Service and Soil Conservation Service of the Department of Agriculture; the Corps of Engineers and Armed Forces Recreation of the Department of Defense; the Veterans Administration; and the National Park Service, Bureau of Land Management, Bureau of Outdoor Recreation, and U.S. Fish and Wildlife Service of the Department of Interior.

Peace Corps and Vista employ park and recreation personnel in 68 foreign countries and in the United States to plan and supervise recreational activities for deprived persons.

Boys' and Girls' Clubs provide a variety of recreational, guidance, and instructional activities to help youngsters grow and work together, to discover their needs, understand themselves, and achieve a sense of responsibility.

Senior centers and retirement communities offer older people a range of recreation and leisure activities, and often employ trained staff to supervise and coordinate the assistance provided by volunteers.

Therapeutic recreation is a rapidly growing specialized field which provides services to help an individual recover or adjust to illness, disability, or a specific social problem. Places where recreational therapists work include hospitals, correctional institutions, health and rehabilitation centers, nursing homes, and private schools and camps for the mentally retarded, emotionally disturbed, and physically handicapped. Therapeutic recreation workers, in conjunction with physicians, prescribe activities on a one-to-one basis.

Many jobs for park, recreation, and leisure service workers are found in private and commercial recreation—including amusement parks, sports and entertainment centers, wilderness and survival enterprises, tourist attractions, vacation excursions, resorts and camps, health spas, clubs, apartment complexes, and other settings.

The park, recreation, and leisure service field is characterized by an unusually large number of part-time, seasonal, and volunteer jobs. Volunteers represent perhaps three out of every four individuals performing service in public park and recreation agencies. Some serve on local park and recreation boards and commissions. The vast majority serve as volunteer activity leaders at local playgrounds, or in youth organizations, nursing homes, hospitals, senior centers, and other settings. Many park and recreation professionals have found that volunteer experience, as well as part-time work during school, can lead directly to a full-time job. A majority of all paid employees in the park, recreation, and leisure service field are part-time or seasonal workers. Typical jobs include summer camp counselors and playground leaders, lifeguards, craft specialists, after school and weekend recreation program leaders, park rangers, maintenance personnel, and others. Many of these jobs are filled by teachers and college students.

Training, Other Qualifications, and Advancement

A college degree with a major in parks and recreation is increasingly important for those seeking full-time career positions in the park, recreation, and leisure service field. Generally, an applicant's level of formal education and training determine the type of job he or she can get.

A number of aide, recreation program leader, and park technician positions currently are filled by high school graduates. However, those seeking career potential should obtain a minimum of an associate degree. Some jobs at the recreation leader level require specialized training in a particular field, such as art, music, drama, or athletics.

Positions as specialists normally require a minimum of a baccalaureate degree. However, the degree usually is in the area of specialization, such as forestry or biology, rather than in parks and recreation.

Most supervisors have a baccalaureate degree plus experience. A degree in parks and recreation may improve chances for career advancement.

A baccalaureate degree and experience are considered minimum requirements for administrators. However, increasing numbers are obtaining master's degrees in parks and recreation as well as in related disciplines. Many persons with backgrounds in other disciplines including social work, forestry, and resource management pursue graduate degrees in recreation.

In 1975, over 1,200 educators taught parks and recreation in junior and community colleges and senior colleges and universities. On the junior college level, 90 percent of the faculty had a master's degree or less while on the senior college level, one-half had a master's degree and the other half had a doctorate.

In 1975, about 165 2-year community colleges offered associate degree recreation leadership and park technician programs; 180 4-year colleges and universities offered park and recreation curriculums. In addition, over 80 master's degree programs and about 25 doctoral programs were offered. Programs in therapeutic recreation were offered by about 45 community and junior colleges and 95 4-year colleges and universities. A number of graduate programs were taught.

The National Recreation and Park Association (NRPA) is beginning a process of accrediting park and recreation curriculums. Students in accredited baccalaureate degree programs will devote about one-half of their time to general education

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courses in which they may gain knowledge of the natural and social sciences including an understanding of human growth and development and of people as individuals and as social beings; history and appreciation of human cultural, social, intellectual, spiritual, and artistic achievements; and other areas of interest. Another one-fourth of their time will involve exposure to professional park and recreation education including history, theory, and philosophy; community organization; recreation and park services; leadership supervision and administration; understanding of special populations such as the elderly or handicapped; and field work experience. Students may spend the remainder of their time developing competencies in specialized professional areas such as therapeutic recreation (courses in psychology, health, education, and sociology are recommended), park management, outdoor recreation, park and recreation administration, industrial or commercial recreation (courses in business administration are recommended), camp management, and other areas.

Persons planning park, recreation, and leisure service careers must be good at motivating people and sensitive to their needs. Good health and physical stamina are required. Activity planning calls for creativity and resourcefulness. Willingness to accept responsibility and the ability to exercise judgment are important qualities since park and recreation personnel often work alone. To increase their leadership skills and understanding of people, students are advised to obtain related work experience in high school and college. Opportunities for part-time, summer, or after-school employment, or for volunteer work, may be available in local park and recreation departments, youth service agencies, religious or welfare agencies, nursing homes, camps, parks, or nature centers. Such experience may help students decide whether their interests really point to a human service career. Students also should talk to local park and recreation professionals, school guidance counselors, and others.

After a few years of experience, aides or recreation program leaders may become supervisors. However, additional education may be desired. Although promotion to administrative positions may be easier for persons with graduate training, advancement usually is possible through a combination of education and experience.

An effort currently is underway to establish professional status and recognition for the field of parks and recreation (accreditation of curriculums is discussed earlier in the statement). There currently is no licensing requirement for individuals employed in public park and recreation agencies. However, NRPA has developed national standards for professional and technical personnel, including both education and experience requirements. NRPA expects many States to adopt these standards in the coming years. Some therapeutic recreation workers are subject to mandatory requirements that denote competence to practice their profession. Those working in long-term care facilities must be registered by the NRPA, National Therapeutic Recreation Society's Board of Registration, or by the State in which they work.

Employment Outlook

The need for trained park, recreation, and leisure service workers is expected to grow as physical fitness and recreation become increasingly important to millions of Americans; as the number of older people using senior centers and nursing homes increases; as the demand for camp sites, lakes, streams, trails, and picnic areas increases; as correctional institutions recognize the need for such personnel; as the need develops for creative expression in the arts and humanities; and as the citizen's understanding of the use of our leisure and natural resources increases. However, because of financial uncertainty in both the public and private sectors, this need for trained personnel may not necessarily result in actual employment growth. Many openings, nevertheless, will arise annually from deaths, retirements, and other separations from the labor force.

A 1976 National Recreation and Park Association study indicates that competition is keen for many jobs in municipal, county, special district, and State park systems. Contributing to the competitive job situation are recent sizable increases in the number of park and recreation graduates and the austerity budgets adopted by many local governments and municipalities since the early 1970's.

The long-term employment outlook is difficult to assess, largely because of uncertainty about future funding levels for these and other public services. Furthermore, persons with a wide variety of experience and education may seek to become park, recreation, and leisure service workers. However, persons with formal training and experience in parks and recreation are expected to have the best job opportunities in this field; those with graduate degrees should have the best opportunities for supervisory and administrative positions. If the number of park and recreation curriculums continues to grow, master's and Ph. D. degree holders may find favorable teaching opportunities.

Additional job opportunities are expected in therapeutic recreation, private and commercial recreation, and—to a lesser extent—in senior centers and youth organizations. Opportunities for specially trained therapeutic recreation workers are likely to be favorable, in line with the anticipated need for additional staff in many health-related occupations. By contrast, competition for jobs as camp directors is expected to be very keen.

Job experience prior to graduation will greatly help a graduate find a position. Although competition is expected to be keen, many opportunities for part-time and summer employment will be available for recreation program leaders and aides in local government recreation programs. Many of the summer jobs will be for counselors and craft and athletic specialists in camps.

Earnings and Working Conditions

Starting salaries in State and local governments for recreation program leaders with a bachelor's degree averaged about $9,300 in 1976, ac-

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cording to a survey by the International Personnel Management Association. There was a wide salary range among employers—in general, salaries were highest in the West and lowest in the South. Average earnings for park and recreation workers are higher than those for nonsupervisory workers in private industry, except farming.

According to NRPA, 2-year associate degree graduates received starting salaries ranging from $6,500 to $9,500 in 1976. Individuals with baccalaureate degrees obtained park and recreation positions with annual salaries that were in the $7,200 to 12,000 range. Persons with graduate degrees generally received higher salaries. All salaries varied widely depending on the size and type of employing agency and geographic area.

Supervisors' salaries ranged from $10,000 to $20,000. Salaries for specialists varied greatly, but generally were equivalent to those of supervisory personnel. The average salary for chief administrators in public park and recreation agencies was about $20,000, and ranged up to $45,000.

The average annual starting salary for recreational therapists (positions requiring a college degree in recreational therapy or a related field) in hospitals and medical centers was about $10,200 in 1976, according to a survey conducted by the University of Texas Medical School. Top salaries for experienced recreational therapists in these settings averaged $12,200, and some were as high as $17,800.

Starting salaries for recreation and park professionals in the Federal Government in 1977 were $9,303 for applicants with a bachelor's degree; $11,523 for those with a bachelor's degrees plus 1 year of experience; $14,097 for those with a bachelor's plus 2 years' experience or a master's degree; and $17,056 for those with a bachelor's plus 3 years' experience or a Ph. D. Recreation and park assistants, aides, and technicians earn considerably less than these professionals.

The average week for recreation and park personnel is 35-40 hours. Many camp recreation workers live at the camps where they work, and their room and board are included in their salaries. Most public and private recreation agencies provide vacation and other fringe benefits such as sick leave and hospital insurance.

People entering the park, recreation, and leisure service field should expect some night work and irregular hours. In addition, workers often spend much of their time outdoors when the weather permits.

Sources of Additional Information

Information about parks, recreation, and leisure services as a career, employment opportunities in the field, colleges and universities offering park and recreation curricula, accreditation, and registration and certification standards is available from:

National Recreation and Park Association, Division of Professional Services, 1601 North Kent St., Arlington, Va. 22209.

For information on careers in industrial recreation, contact:

National Industrial Recreation Association, 20 North Wacker Dr., Chicago, Ill. 60606.

For information on careers in camping and job referrals, send postpaid return envelope to:

American Camping Association, Bradford Woods, Martinsville, Ind. 46151.

SOCIAL SERVICE AIDES

(D.O.T. 195.208)

Nature of the Work

Social service or human service aides enable social service agencies to help greater numbers of people by providing services that supplement the work of professional social workers and rehabilitation counselors. Social service aides work under the close guidance and supervision of other professional staff.

Social service aides serve as a link between professional social workers or rehabilitation counselors and people who seek help from social agencies. Aides explain the services and facilities of the agency and help new applicants fill out any required forms. Social service aides perform much of the routine paperwork required in welfare programs. They may keep records on clients up to date, maintain a filing system of reports or 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 to assist 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. Aides called *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 he or she meets the requirements for financial assistance or other services.

Aides usually referred to as *casework aides* or *assistants* work directly with clients. They may help clients locate and obtain adequate housing, food stamps, or medical care, help them apply for unemployment or social security benefits, or refer them to job training. Family crises often bring clients to social service agencies, and aides counsel parents about such problems as children in trouble with the police. Casework aides serve as advocates for clients by accompanying them to clinics to ensure that they receive necessary medical care, making appointments for them at legal aid offices, or by helping them through the red tape that surrounds many welfare programs.

Many social service aides spend most of their work day 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. Their jobs call for assisting clients in their neighborhoods or homes. Aides called *neighborhood* or *outreach workers* personally contact the residents of an area to explain and discuss agency services. They learn the

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needs of individuals and families and refer routine cases to a counselor or to the appropriate community service agency. They report more difficult problems to a 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 the supervisor.

Employment aides also work with clients in the neighborhoods where they live. 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 pool rooms, laundromats, and street corners or through employment or welfare agency referrals. They give the unemployed information about the services of the local State employment service office, available job and training opportunities, and help them fill out the necessary 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*.



Social service aides are a link between professional social workers and the people who seek help.

Places of Employment

About 100,000 people worked as social service aides in 1976. Most work 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, and 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 levels of responsibility often are a function of formal educational attainment. For example, persons with

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a grade school education may enter the field in clerical positions. Those persons with a college degree, on the other hand, may immediately assume more professional responsibilities.

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. In addition to these personal qualities, typing skills and knowledge of an appropriate foreign language for aides working in certain ethnic communities may be helpful.

When hiring, an individual's need for work, potential for upgrading his or her skills, and making 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 emphasize the development of career ladders with opportunities for advancement through a combination of on-the-job training, work experience, and further education. For example, entry level positions as employment aides can lead to a job as an employment interviewer, and, after special training, to employment counselor. Aides usually are trained on the job from 1 to several months. Aides often must acquire knowledge of many social programs including social security, food stamps, and Medicare. They also must receive training from social workers, rehabilitation counselors, nurses and other professionals. Those without high school diplomas often receive classroom instruction to help them pass a high school equivalency examination. Employing agencies frequently pay part of the cost of further education for social service aides.

Aides with college training in this field generally are given the more difficult assignments, sometimes including duties normally performed by social workers. 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." Training may include course work in sociology and psychology; skills in interviewing, observation and recording of behavior, individual counseling, group dynamics, activity therapy, and behavior modification; and field experience at local helping agencies. Some college graduates with degrees in non-social service areas work as social service aides.

Employment Outlook

Employment of social service aides is expected to grow faster than the average for all occupations through the mid-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 social services of many kinds for our aging 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 and Working Conditions

Full-time social service aides with no prior experience or formal education in the field earned salaries ranging from about $6,000 to $7,500 a year in 1976. Those with experience or additional education usually earned more. The Federal Government paid beginning social service aides salaries ranging from $5,810 to $9,303 in 1977 depending upon their education and prior work experience; experienced aides earned as much as $11,523. Many aides in both public and private agencies work part time and earn less. Average earnings for social service aides are about the same as those for nonsupervisory workers in private industry, except farming.

Although much of their time is spent in offices of social service departments and agencies, aides frequently may visit the homes of clients or offices of other social service agencies, hospitals, and business establishments. They often must work evenings or weekends when clients can be reached.

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. 195.108, .118, .168, and .228)

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 ones to those arising from social unrest within a group or community. These problems, aggravated by the growing complexity of society, have greatly increased the need for social services. Social workers assist individuals, families, groups and communities in using these services to solve their problems, and work to improve the resources available to enhance social functioning.

The three traditional approaches to social work have been casework, group work, and community organization. The approach chosen usually is determined by the nature of the problem and the time and resources available for solving it. Social workers often combine these approaches in dealing with a specific problem. However, recently developed ways of

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organizing curriculums and training social workers have resulted in other approaches to the field. In addition to the traditional methods, social workers may specialize in social institutions which encompasses health, education, and other areas; social problems including poverty; and along other organizing principles and fields of practice.

In casework, social workers use interviews to identify the problems of individuals and families. They then help people to understand and solve their problems and secure the appropriate resources, services, education, or job training. In group work, social workers help people understand themselves and others, overcome racial and cultural prejudices, and work with others in achieving a common goal. They plan and conduct activities for children, teenagers, adults, older persons, and other groups of people in settings such as community centers, hospitals, nursing homes; and correctional institutions. In community organization, social workers coordinate the efforts of groups, such as 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 social services, organize fund raising for community social welfare activities, and aid in the development of new community services.

The majority of social workers provide social services directly to individuals, families, or groups. However, a substantial number are directors, administrators, or supervisors. Directors of social service agencies have responsibilities much like those of administrators anywhere. They hire and train personnel, make budgetary decisions, develop and evaluate agency problems, solicit new funds, supervise the staff, and serve as a spokesperson for the agency's clients. Some social workers are college teachers, research workers, or consultants. Others work for community agencies and planning bodies at all levels of government, voluntary agencies, and other private organizations.

Social workers apply their training and experience in a variety of settings. While most work for agencies or institutions, growing numbers of social workers are in private practice and provide counseling services on a fee basis.

Social workers in family and child service positions in public and in voluntary agencies such as those run by religious charities, provide counseling and social services that assist individual adjustment, strengthen personal and family relationships, and help clients to cope with their problems. They provide information and referral services in many areas—advising clients on how to plan family budgets and manage money, finding homes for families who have nowhere to go, arranging homemaker assistance for elderly couples who no longer can manage household chores, providing information on job training and day care for parents trying to support a family, and providing help with interpersonal difficulties.

Social workers in child welfare positions 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 also be called upon to institute legal action for the protection of neglected or mistreated children, provide services to unmarried parents, and counsel couples who wish to adopt a child. After making appropriate case evaluations and home studies, they may place and oversee children in suitable adoption or foster homes or in specialized institutions.

School social workers aid children whose unsatisfactory school progress is related to their social problems. These workers consult and work with parents, teachers, counselors, and other school and community personnel to identify and solve problems that hinder satisfactory adjustment and learning.

Social workers also are employed in medical and psychiatric settings, such as hospitals, clinics, mental health agencies, rehabilitation centers, and public welfare agencies. They aid patients and their families with social problems that may ac-



Some social workers specialize in child welfare.

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company illness, recovery, and rehabilitation. As members of medical teams, social workers help patients respond to treatment and guide them in readjusting to their homes, jobs, and communities. Renal social workers (those who deal with patients suffering from kidney disease and their families) and social workers specializing in drug addition perform such functions. (The related occupation of rehabilitation counselor is discussed in a separate statement.)

A growing number of social workers specialize in the field of aging. Many work with elderly persons in public welfare agencies and family service agencies, although workers also are employed in senior centers, helping people deal with financial and role changes brought about by retirement; in area agencies, focusing on planning and evaluating services to the elderly; and in nursing homes, helping patients and their families adjust to illness and the need for institutionalization.

Social workers in correctional institutions and others engaged in correctional programs help offenders and persons on probation and parole readjust to society. They counsel on social problems faced in returning to family and community life, and also may help secure necessary education, training, employment, or community services.

Places of Employment

About 330,000 social workers were employed in 1976. Among these, two-thirds provide direct social services working 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, while still others work for schools or for 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 establish agencies, schools, or assistance programs.

Training, Other Qualifications, and Advancement

Only in the last few 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, a master's degree in social work 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. The student may develop expertise in a specialized area and make contacts helpful in later securing a permanent position. Previous training in social work is not required for entry into a graduate program, but courses in related fields such as psychology, sociology, economics, political science, history, social anthropology, and urban studies, as well as social work, are recommended. Some graduate schools recently have established 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 1976, over 170 colleges and universities offered accredited undergraduate programs in social work while over 80 offered accredited graduate programs. More than 20 have incorporated a gerontological emphasis into their programs. Graduate students may specialize in clinical social work, community organization, administration, teaching, research, social policy planning, and a variety of other areas. Some schools offer concentrations in many areas while others offer fewer choices.

A limited number of scholarships and fellowships are available for graduate education. Because of increased costs, social welfare agencies have reduced their practice of granting workers "educational leave" to obtain graduate education.

A graduate degree and experience generally are required for supervisory, administrative, or research work, the last also requiring 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. In government agencies, most applicants for employment must pass a written exam, with the exception of some high-level positions.

In mid-1976, 20 States had licensing or registration laws regarding social work practice and the use of professional social work titles by those who qualify. 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 those members having at least 2 years of postmaster's 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

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must be able to handle responsibility, work independently, and maintain good working relationships with clients and coworkers.

Students should obtain as much related work experience as possible during high school and college to determine whether they have the interest and capacity for professional social work. They may do volunteer, part-time, or summer work in places such as camps, settlement houses, hospitals, community centers, or social welfare agencies. Some voluntary and public social welfare agencies occasionally hire students for jobs in which they assist social workers.

Employment Outlook

Employment of social workers is expected to increase faster than the average for all occupations through the mid-1980's. The recent passage of Title XX of the Social Security Act, the potential development of national health insurance, and the expansion of services in public education should contribute to a continued increase in employment in social services. Many new positions will come from the expansion of health services in hospitals, nursing homes, community mental health centers, and home health agencies. Other areas expected to offer employment opportunities include services for the aging; counseling in the areas of consumerism, rape, and drug and alcohol abuse; and social planning. 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 such fields as 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 1960's and early 1970's, persons having bachelor's degrees in social work will face increasing job competition. Graduates of master's and doctor's degree programs in social work are more qualified for a wider range of jobs including administrative, research, planning, and teaching positions, and are expected to have good opportunities through the mid-1980's.

Because many cities are experiencing financial crises often resulting in budget cuts in human service activities, applicants in these areas may face keen competition. Graduates often prefer to work in major metropolitan areas, since small towns and rural areas offer less opportunity for professional contact with colleagues and have fewer academic institutions for continuing education necessary for advancement. However, job opportunities may be more favorable in rural areas and small towns.

Earnings and Working Conditions

Salaries for social workers at all levels vary greatly by type of agency (private or public, Federal, State, or local) and geographic region. Average earnings for social workers are higher than those for nonsupervisory workers in private industry, except farming. Salaries generally are highest in large cities and in States with sizable urban populations. Private practitioners and those in administration, teaching, and research often earn considerably more than social workers in other settings.

Starting salaries for social case workers (positions requiring a bachelor's degree) in State and local governments averaged about $9,500 in 1976, according to a survey by the International Personnel Management Association; for psychiatric social workers and case work supervisors (positions requiring a master's degree), about $12,000.

The average annual starting salary for social workers (positions requiring an MSW and 1 year of related experience) in hosptials and medical centers was about $12,100 in 1976, according to a survey conducted by the University of Texas Medical School. Top salaries for experienced social workers in these settings averaged $15,600, and some were as high as $25,300.

In the Federal Government, social workers with an MSW and no experience started at $11,523 or $14,097 in 1977. Graduates with a Ph. D. or job experience may start at higher salaries. Most social workers in the Federal Government are employed by the Veterans Administration and the Departments of Health, Education, and Welfare, Justice, and Interior.

Most social workers have a 5-day, 35 to 40-hour week. However, many, particularly in private agencies, work part time. In some agencies, the nature of the duties requires some evening and weekend work, for which compensatory time off is given. Most social work agencies provide fringe benefits such as paid vacation, sick leave, and retirement plans.

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.

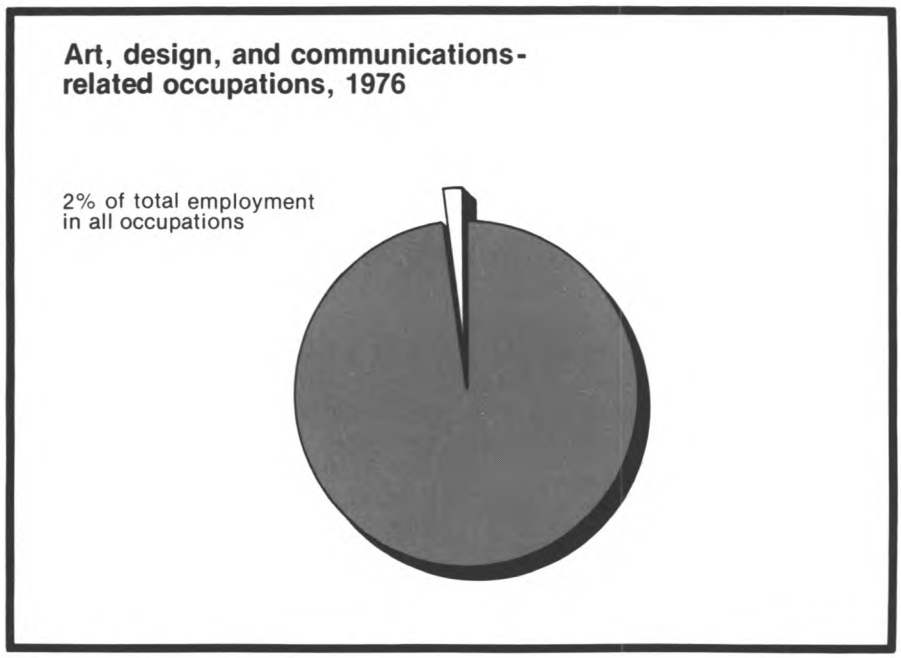
Information on accredited graduate and undergraduate college programs in social work is available from:

Council on Social Work Education, 345 East 46th St., New York, N.Y. 10017.

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ART, DESIGN, AND COMMUNICATIONS RELATED OCCUPATIONS

Creativity and the ability to communicate ideas are prerequisites for work in occupations related to art, design, and communications. For example, an architect's blueprint is the embryo of a building; floral designers express a mood of love, sympathy, or other emotion in a flower arrangement; and actors project a character on the stage or screen for the enjoyment of their audiences. Newspaper reporters communicate newsworthy events to their reading audiences; dancers express emotion, mood, or thought through physical movements; and photographers capture an emotion or idea through camera angle, lighting, and the flick of a shutter.



This section of the *Handbook* describes in detail occupations that require creative and communicative talents: The performing arts—actors, dancers, singers, and musicians; the design occupations—architects, photographers, and six other related occupations; and communications-related occupations—interpreters, newspaper reporters, technical writers, and radio and TV announcers.

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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 this introduction give detailed information on musicians, singers, actors, and dancers.

ACTORS AND ACTRESSES

(D.O.T. 150.028 and 150.048)

Nature of the Work

Making a character come to life before an audience is a job that has great glamour and fascination. This demanding work requires special talent and involves many difficulties and uncertanties.

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.

Actors who prepare for stage, screen, and television roles rehearse many hours. They must memorize their lines and know their cues.

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.

Places of Employment

About 13,000 actors and actresses worked in stage plays, motion pictures (including films made especially for television), industrial shows, and commercials in 1976.

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 theatres," repertory companies, and dinner theatres, which provide opportunities for local talent as well as for professional actors and actresses. Normally, plays are produced and casts are selected in New York City for shows that go "on the road."

Employment in motion pictures and film television is essentially 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 employ local professionals and nonprofessionals as "day players" and "extras." A number of American-produced films are being 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 theatres and other acting groups for experience.

Formal training in acting, which is increasingly necessary, can be obtained at dramatic art schools, located chiefly in New York, and in hundreds of colleges and universities throughout the country. About 760 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, speech, pantomime, 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.

Acting demands patience and total commitment, since aspiring actors

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and actresses must wait for parts or filming schedules, work long hours, and often do much traveling. 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." 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.

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.

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's working life depends largely on skill and versatility. Great actors and actresses can work almost indefinitely. On the other hand, 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 unstable employment conditions and financial pressures.

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. Moreover, 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 opportunites for American actors and actresses. Television employs a large number of actors on TV programs and commercials. However, employment in this media has been reduced by the FCC ruling that decreased major TV network prime time programming. Local stations often substitute with reruns or with 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 profes-



Acting demands patience and total commitment.

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sional acting companies in cities. The number of such acting groups is growing. The recent growth of summer and winter stock companies, outdoor and regional theatre, 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 about as fast as the average for all occupations through the mid-1980's, the number of persons seeking to enter the profession is expected to far exceed available openings. Even highly talented young people are likely to face stiff competition and economic difficulties.

Earnings and Working Conditions

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 show producers 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 higher salaries than those specified in the basic agreement.

The minimum weekly salary for actors in Broadway productions was about $285 in 1976. Those in small "off-Broadway" theaters received a minimum of $175 a week. For shows on the road, the minimum rate was about $395 a week. (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 1976, motion picture and television actors and actresses earned a minimum daily rate of $172.50, or $604 for a 5-day week. For extras, the minimum rate was $52.50 a day. Actors and actresses who did not work on prime time network television received a minimum program fee of about $232.50 for a single program and 8 hours of rehearsal time. 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 recent surveys by the Actors' Equity Association (which represents actors who work on the stage) and the Screen Actors Guild, almost three quarters of their members earned $2,500 or less a year from acting jobs, and only about 3 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, non-acting jobs.

In all fields, many well-known actors and actresses have salary rates above the minimums. 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. Evening work is, of course, 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.

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.

Sources of Additional Information

Information on colleges and universities and conservatories that offer a major in drama is available from:

American Theater Association, 1029 Vermont Ave., NW., Suite 402, Washington, D.C. 20005.

DANCERS

(D.O.T. 151.028 and 151.048)

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 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 supplement other types of entertainment, such as opera, musical comedy, and television.

In dance productions, performers most often work as a group. However, a very few top artists do solo work.

Many dancers combine stage work with full-time teaching. A few dancers become choreographers and create new routines. Others are dance directors who train dancers in new productions.

(This statement does not include instructors of ballroom, American or international folk dance, or other social dancing.)

Places of Employment

About 8,000 dancers performed on the stage, screen, and television in 1976. Many others taught in secondary schools, in colleges and universities, in dance schools, and in private studios. A few teachers, trained in

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dance therapy, worked in mental hospitals.

Dance teachers are located chiefly in large cities, but many smaller cities and towns have dance schools as well. 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, Los Angeles, Minneapolis, Seattle, Boston, and Philadelphia.

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.

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, a dancer should study music, literature, and history along with the arts to help in the interpretation of dramatic episodes, ideas, and feelings.

Over 115 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.

Although a college education is an advantage in obtaining employment as a dance teacher in a college or university, it is of little use for one who teaches professional dance or choreography in a studio situation. Professional schools usually require teachers to have experience as a performer; colleges and conservatories generally require graduate degrees, but experience as a performer 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.

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, grace, and a feeling for music, as well as a creative ability to express oneself through dance.

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.

Because of the strenous nature of the art, young dancers have an advantage over older dancers in competing for jobs. 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.



The dancer's life is one of rigorous practice and self-discipline.

Employment Outlook

Employment of dancers is expected to grow about as fast as 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 media offers new outlets for dance. New professional dance companies formed from the increasing number of civic and community groups offer additional employment opportunities. As a result of the increased general popularity of dance in recent years, the best employment opportunities are in teaching dance.

Earnings and Working Conditions

Professional dancers who perform usually are 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 fa-

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vorable than the basic agreement regarding salary, hours of work, and working conditions.

In 1976, the minimum salary for dancers in opera and other stage productions was about $250 a week. The single performance rate for ballet dancers was about $100 for a solo dance and about $50 per dancer for a group. Dancers on tour received an allowance of $30 a day in 1976 for room and board, with the employer paying the cost of transportation. For a brief appearance in a performance on television or a few days' work in a movie, the minimum rate was higher, relative to time worked. However, this difference was offset by the brevity of the engagement and the long period likely waiting for the next one.

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. Some dancers who are qualified to teach combine teaching with performing.

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. (See 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. Most stage performances take place, of course, in the evening, and rehearsals require very long hours, often on weekends and holidays. For shows on the road, weekend travel often is required.

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.

Sources Of Additional Information

Information on colleges and universities that give a major in the dance or some courses in the dance, as well as details on the types of courses and other pertinent information is available from:

National Dance Association, a division of the American Alliance for Health, Physical Education and Recreation, 1201 16th St. NW., Washington, D.C. 20036.

For information on all aspects of dance, counseling services, and job listings, contact:

American Dance Guild, 1619 Broadway, Room 603, New York, N.Y. 10019.

MUSICIANS

(D.O.T. 152.028 and .048)

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 arrangers and composers.



Since a high quality of performance requires constant study and practice, self-discipline is vital.

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A few musicians specialize in library science or psychology for work in music libraries or in the field of music therapy in hospitals. Others work as orchestra conductors or band directors.

Places of Employment

About 127,000 persons worked as performing musicians in 1976. 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.

Most performing musicians work in cities where entertainment and recording activities are concentrated, such as New York, 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 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.

Almost 500 colleges, universities, and music conservatories offer bachelor's and/or higher degrees in instrumental or vocal music. These programs provide training in musical performance, composition, and theory, and also offer liberal arts courses. In addition, about 750 conservatories and colleges and universities offer a bachelor's degree program 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 of 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 about as fast as the average through the mid-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, playing popular music in night clubs 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 and Working Conditions

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 1976 ranged from $200 to $400 a week, according to the American Symphony Orchestra League. 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. About half of them have 50- to 52-week seasons. Few of the metropolitan or community orchestras have seasons of 50 to 52 weeks, however.

Musicians in large metropolitan areas who played at dances, club dates, variety shows, ballets, musical comedies, concerts, and industrial shows generally earned minimums ranging from $40 to $53 for 3 hours of work. Musicians in these areas who had steady engagement contracts earned between $6 and $8 per hour for a 5-day week. 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 $93 for a 3-hour session; those employed in television commercials earned a minimum of $48 for a 1-hour session. Musicians employed by manufacturers of phonograph recordings were paid a minimum of $110 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*.)

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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.

Musicians customarily work at night and on weekends, and they must spend considerable time in practice and in rehearsal. Performing engagements usually require some travel.

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 of 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).

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.

Information about the requirements for certification of organists and choir masters is available from:

American Guild of Organists, 630 Fifth Ave., New York, N.Y. 10020.

A list of accredited schools of music and degree programs offered is available from:

National Association of Schools of Music, 11250 Roger Bacon Dr., Reston, Va. 22090.

Further information about careers in music is available from:

Music Educators National Conference, 1902 Association Dr., Reston, Va. 22091.

A book entitled *Careers in Music* can be obtained for $1 from:

American Music Conference, 150 E. Huron, Chicago, Ill. 60611.

SINGERS

(D.O.T. 152.028 and .048)

Nature of the Work

Singing is an age-old form of communication 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 entertainment places. The best known popular music singers make and sell many recordings.

Some singers combine their work as performers with other 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, music conservatories, or colleges and universities.

Places of Employment

About 23,000 persons worked as professional singers in 1976. 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, Tennessee, 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 church singers and choirmasters.

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 music 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, 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 bachelor's degree program in music

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Young people who want to sing professionally should acquire a broad background in music.

education. In addition, almost 500 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 degree or Ph. D. 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 about as fast as the average through the mid-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 singers who record popular music to do radio and television commercials. However, these short-term jobs are not enough to provide steady employment for all qualified singers.

Earnings and Working Conditions

Singers generally work at night and on weekends, and must spend much time in practice and in rehearsals. Work in the entertainment field is seasonal and few performers have steady jobs. Except for a few well-known concert soloists, opera stars, top recording artists of popular music, and some dance band singers, 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.

Concert singers who were part of a chorus earned a minimum daily rate of $25 in 1976, or $45 to $50 per performance. Members of an opera chorus earned a minimum daily rate of $30, or $40 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 singers on television ranged from around $143 to about $161 per singer for a 1-hour show, depending on the number of singers in the group.

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 live 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 the movies belong to the Screen Actors Guild, Inc.

Sources of Additional Information

Information about accredited schools and departments of music is available from:

National Association of Schools of Music, 11250 Roger Bacon Dr., Reston, Va. 22090.

Further information about careers in music is available from:

Music Educators National Conference, 1902 Association Dr., Reston, Va. 22091.

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DESIGN OCCUPATIONS

Good design can improve the appearance and usefulness of the products that we use and the places where we live and work, as well as increase sales by improving their "eye appeal." Making products or places more appealing and functional and bringing them to the attention of the public is the job of people in design occupations.

Different design careers require varying levels of training and education. For example, while floral designers often learn their duties on the job and do not need a high school diploma, architects must have at least 5 years of college and professional education. Regardless of the amount of formal training required, people in design occupations should be creative and be able to communicate ideas through their designs and displays.

Job opportunities in design occupations are expected to increase through the mid-1980's, primarily because a growing and more affluent population is becoming more design conscious.

This chapter describes 8 design occupations: architects, commercial artists, display workers, floral designers, industrial designers, interior designers, landscape architects, and photographers. (Other jobs that often require design skills—for example, engineers—are described elsewhere in the *Handbook*.)

ARCHITECTS

(D.O.T. 001.081)

Nature of the Work

Attractive buildings improve the physical environment of a community. But buildings also must be safe and must allow people both inside and around them to perform their duties properly. Architects design buildings that successfully combine these elements of attractiveness, safety, and usefulness.

Most architects provide professional services to clients planning a building project. They are involved in all phases of development of a building or project, from the initial discussion of general ideas to the final piece of 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, as well as any preference in design that the client may have. The architect then prepares schematic drawings to show the scale and structural relationships of the building.

If the schematic drawings are accepted, the architect develops a final design showing the floor plans and the structural uetails of the project. For example, in designing a school, the architect uetermines 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.

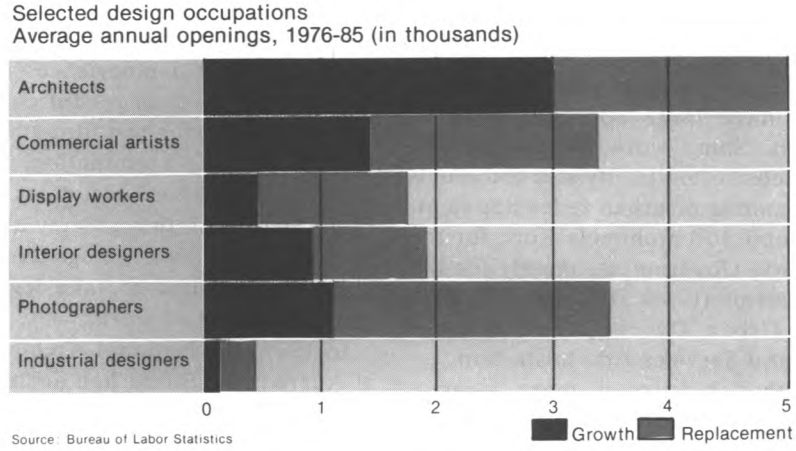
Next the architect prepares working drawings showing the exact dimensions of every part of the structure and the location of plumbing, heating units, electrical outlets, and air conditioning.

Architects also specify the building materials, and, in some cases, the interior furnishings. In all cases, the architect must insure 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 house plan is too expensive and ask the architect to make modifications. Or clients may decide that their own ideas are more appealing than those of the architect. As a result, architects could become frustrated, redesigning their plans to meet the clients' expectations.

After all drawings are completed, the architect assists the client in selecting a contractor and negotiating

Although architects have the largest number of job opportunities within the design field, job opportunities also will occur in other occupations as well

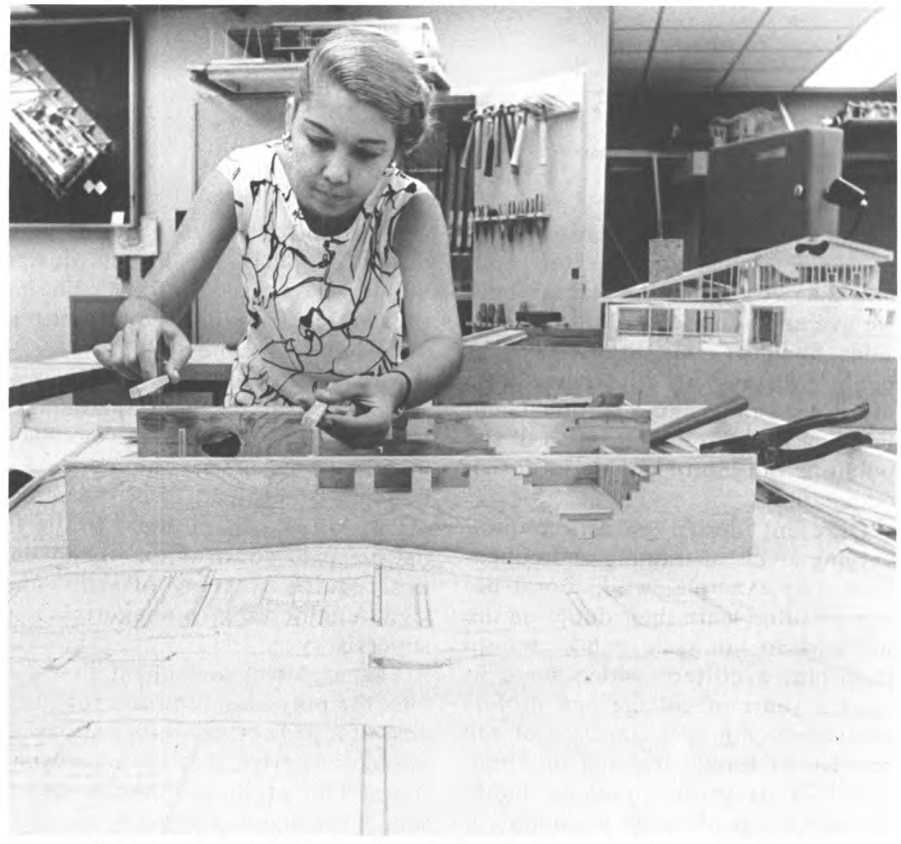


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the contract. As construction proceeds, the architect makes periodic visits to the building site to insure that the contractor is following the design, using the specified materials, and meeting the specified quality standards. The job is not completed until construction is finished, all required tests are made, bills 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 other design personnel.



New graduates usually begin as junior drafters in architectural firms.

Places of Employment

About 50,000 registered (licensed) architects were employed in 1976. In addition, many unlicensed architectural school graduates also work as architects, but they must work under the supervision of licensed architects.

Most architects work in architectural firms, for builders, for real estate firms, or for other businesses that have large construction programs. Some work for government agencies, often in city and community planning or urban redevelopment. About 1,300 architects work for the Federal Government, mainly for the Departments of Defense, 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 architects to be licensed. To qualify for the 2-day licensing exam, a person must have either a bachelor of architecture degree followed by 3 years of 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 architectural 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 1976, the National Architectural Accrediting Board had accredited 80 of the 101 schools offering professional degrees in architecture. Most of these schools offer 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 architectural schools also offer graduate education for those who already have their first professional degree. Although such training is not essential for practicing architects, it often is desirable for those in research and teaching. A typical college architectural program includes courses in architectural theory, design, graphics, engineering, and urban planning, as well as in English, mathematics, chemistry, sociology, economics, and a foreign language.

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 dur-

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ing summer vacations is useful for gaining practical knowledge.

New graduates usually begin as junior 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 directions explaining the architect's plan to the builder. Employees who become associates in their firms receive, in addition to a salary, a share of the profits. Usually, however, the architect's goal is to own yis or her own business.

Employment Outlook

Architects are expected to face competition for jobs through the mid-1980's. Although employment of architects is expected to rise about as fast as the average for all workers during this period, the number of degrees granted in architecture also has been increasing rapidly. If this trend continues, the number of people seeking employment in the field could exceed the number of openings from growth, deaths, and retirements. The best employment prospects are expected to occur in the South and in those States which do not have architectural schools.

The outlook for these workers may change, however, during short-run periods. Because the demand for architects is highly dependent upon the level of new construction, any significant upsurge or downturn in building could temporarily alter demand.

Most job openings are expected to be in architectural firms but some openings are also expected to occur in colleges and universities, construction firms, and the Government.

The major factor contributing to the increase in employment of architects is the expected rapid growth of nonresidential construction. In addition, the projected increase in enrollments in architectural programs should result in additional requirements for architects to teach in colleges and universities.

Growing public concern about the quality of the physical environment is expected to increase the demand for urban redevelopment and city and community environmental planning projects. This should create further opportunities for employment. (See statement on urban planners elsewhere in the *Handbook*.)

Earnings and Working Conditions

The average salary for architects in 1976 was well over $20,000, 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 earned well over $35,000 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 1977, the average salary for architects working in the Federal Government was about $23,000.

Most architects spend long hours at the drawing board in well equipped offices. An architect somdtimes has to work overtime to meet a deadline. The routine often is varied by interviewing clients or contractors and discussing the designs, construction procedures, or building materials of a project with other architects or engineers. Contract administrators frequently work outdoors during inspections at construction sites.

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 schools of architecture and a list of junior colleges offering courses in architecture are 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.

COMMERCIAL ARTISTS

(D.O.T. 141.031 and .081, 970.281 and .381, and 979.381)

Nature of the Work

A team of commercial artists with varying skills and specializations often creates the artwork in newspapers and magazines and on billboards, brochures, and catalogs. This team is supervised by an art director, whose main function is to develop a theme or idea for an ad or an advertising campaign. After the art director has determined the main elements of an ad or design, he or she will turn it over to two specialists for further refinement. The *sketch artist*, also called a *renderer*, does a rough drawing of any pictures required. The *layout artist*, who is concerned with graphics rather than art work, constructs or arranges the illustrations or photographs, plans the typography and picks colors for the ad. What emerges is a "rough visual," a sketch of the finished ad. Both the sketch artist and the layout artist work closely with the art director; they may do several sketches or rough visuals before the director is satisfied.

Other commercial artists, usually with less experience, are needed to turn out the finished product. *Letterers* put together headlines and other words on the ad. They use set or photo lettering, and must have a knowledge of type faces and the ability to reproduce them in a variety of sizes and mediums such as ink, pencil, or cutout pieces of paper. *Mechanical artists* paste up an engraver's guide of the ad with all the elements in the exact size and place in which they will finally appear. Since this pasteup will be the engraver's blueprint, mechanical artists must be very precise.

Pasteup artists and other beginners do more routine work such as cutting

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Some salaried commercial artists also do freelance work in their spare time.

mats, assembling booklets, or running errands.

In a small office, the art director may perform the layout and more routine work with the help of trainees. In a large office, however, the art director develops concepts with the copywriter; sets standards; deals with clients; and purchases needed photographs, illustrations, lettering, and other artwork from freelancers.

Advertising agencies or advertising departments who lack time or personnel hire *freelance illustrators* to prepare sketches. These artists must be highly talented and able to work quickly—an agency, for example, may require a finished sketch in 1 day. Only the highly talented will receive enough assignments to maintain a sufficient income.

Advertising artists create the concept and artwork for a wide variety of items. These include direct mail advertising, catalogs, counter displays, slides, and filmstrips. They also design or lay out the editorial pages and features of newspapers and magazines and produce or purchase the necessary illustrations or artwork. Some commercial artists specialize in producing fashion illustrations, greeting cards, or book illustrations, or in making technical drawings for industry.

Places of Employment

About 67,000 persons worked as commercial artists in 1976. Although some commercial artists can be found in nearly every city, the majority work in large cities, such as New York, Los Angeles, Boston, Washington, D.C., and Chicago, where the largest users of commercial art are located.

Most commercial artists work as staff artists for advertising departments of large companies, advertising agencies, printing and publishing firms, textile companies, photographic studios, television and motion picture studios, department stores, and a variety of other business organizations. Many are self-employed or freelance artists. Some salaried commercial artists also do freelance work in their spare time. A few thousand commercial artists work for Federal Government agencies, principally in the Defense Department. A few teach in art schools.

Training, Other Qualifications, and Advancement

Artistic ability, imagination, neatness, and a capacity to visualize ideas on paper are important qualifications for success in commercial art. However, these qualities may be developed by specialized training in the techniques of commercial and applied art.

Persons can prepare for a career in commercial art by attending a 2- or 4-year trade school, or a junior college, college, or university which offers a program in commercial art. In 1976, about 900 institutions offered instruction in commercial art.

Most artists who enter the field are graduates of trade schools. Admission to these schools is based upon high school grades, a portfolio of art work, and an interview. A growing number of colleges and universities, however, confer degrees in commercial art. These college programs supplement art instruction with liberal arts courses such as English or history. Although many employers prefer graduates of a college or university program in commercial art, the quality and reputation of a particular program is more important than the type of institution offering it.

Limited training in commercial art also may be obtained through public vocational high schools and practical experience on the job. There is no formal training program for the commercial art trainee, however. Instead, trainees may run errands for the art director or do other general chores while learning. Additional training usually is needed for advancement. Beginners also should supplement their formal education and training by making posters, layouts, illustrations, and similar projects for schools and other organizations.

The first year in art school may be spent studying fundamentals—perspective, design, color harmony, composition—and the use of pencil, crayon, pen and ink, and other art media. Subsequent study, generally more specialized, includes drawing from life, advertising design, graphic design, lettering, typography, illustrations, and other courses in the student's particular field of interest.

In order to advance beyond a be-

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ginner's job, commercial artists must develop specialized skills. For example, letterers and retouchers must do precise and detailed work that requires excellent coordination. A sketch artist must be able to draw anything adequately in almost any medium, including die marker, pencil, ink or transparencies. Most commercial artists advance by specializing either in the mechanical elements of producing an ad (letterers and mechanical and layout artists) or in the pictorial elements (sketch artists and illustrators). Thus, a successful sketch artist may not be very skilled in typography. Art directors, however, need a strong educational background in art and business practices in addition to experience with photography, typography, and printing production methods. Advertising art directors require a special kind of creativity—the ability to conceive ideas that will stimulate the sale of the client's products or services.

Commercial artists usually assemble their best artwork into a "portfolio," to display their work. A good portfolio is essential for initial employment, for freelance assignments, and for job changes.

Employment Outlook

Talented and well-trained commercial artists may face competition for employment and advancement in most kinds of work through the mid-1980's. Those with only average ability and little specialized training are likely to encounter keen competition for beginning jobs and have very limited opportunities for advancement.

Employment of commercial artists is expected to increase about as fast as the average for all occupations through the mid-1980's. One anticipated area of growth is in visual advertising such as television graphics, packaging displays, and poster and window displays. The expanding field of industrial design also is expected to require more qualified artists for three-dimensional work with engineering concepts. (See statement on industrial designers.) In addition, a few thousand jobs for commercial artists are expected to open each year throughout the period to replace workers who will die, retire, or leave the field for other reasons.

The demand for commercial artists is expected to vary by specialization or type. For example, demand for freelance artists is expected to increase and experienced paste-up and mechanical artists are always needed; jobs for art directors and layout artists, however, will be fewer, much sought after, and open only to experienced, very talented, and creative artists. Employment opportunities are expected to be best for those who have a variety of skills rather than expertise in one or two specialties.

Commercial art occupations are particularly sensitive to changes in business conditions. Therefore, jobseekers may find that opportunities vary from year to year depending upon economic conditions.

Earnings and Working Conditions

In 1976, beginning commercial artists having no training beyond vocational high school typically earned from $90 to $110 a week; graduates of 2-year professional schools, $100 to $125 a week; and graduates of 4-year post-high school programs, $120 to $175 a week, according to the limited data available. Talented artists who had strong educational backgrounds and good portfolios, however, started at higher salaries. After a few years of experience, qualified illustrators may expect to earn $185 to $300 a week. Art directors, executives, well-known freelance illustrators, and others in top positions generally have much higher earnings, from $480 to $580 a week or more.

Earnings of freelance artists vary widely, since they are affected by factors such as skill level, variety, and popularity of work. Freelance artists may be paid by the hour or by the assignment. Commercial artists who worked for the Federal Government in 1977 had an average annual salary of $15,550 or about $300 a week.

Salaried commercial artists generally work 35 to 40 hours a week, but sometimes they must work additional hours under considerable pressure to meet deadlines. Freelance artists usually have irregular working hours.

Sources of Additional Information

Information on institutions offering programs in commercial art is available from:

National Art Education Association, National Education Association, 1916 Association Dr., Reston, Va. 22091.

DISPLAY WORKERS (RETAIL TRADE)

(D.O.T. 298.081)

Nature of the Work

It happens every shopping day: A person browsing through a clothing store notices a mannequin wearing an attractive suit and, without having planned to, purchases a similar outfit. A fishing enthusiast sees a display of angling equipment in a store window, goes in, and buys a new reel.

Incidents like these show how displays in stores and store windows can attract customers and encourage them to buy. Knowing the effectiveness of this form of advertising, some stores allot a large share of their publicity budget to displays.

Display workers specialize in designing and installing such exhibits. Their aim is to develop attractive, eye-catching ways of showing store merchandise to best advantage. 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

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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 executives, such as advertising and sales managers, to select merchandise for promotion and to plan displays.

Places of Employment

About 36,000 persons worked as display workers in retail stores in 1976. Most worked in department, clothing, and homefurnishing stores; others in variety, drug, and shoe stores and in book and gift shops. Several thousand additional freelance or self-employed display workers serviced small stores that needed professional window dressing but could not afford full-time display workers.

Geographically, employment is distributed much like the Nation's population, with most jobs in large towns and cities.



Display workers need imagination as well as knowledge of color harmony.

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.

When hiring inexperienced workers, most employers will consider only high school graduates. 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.

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 money is needed to start a freelance business. However, this is a highly competitive field, and self-employ-

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ment may be a struggle at the outset unless an excellent reputation has first been 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 more slowly than the average for all occupations through the mid-1980's. Greater overall coordination of activities by store managements and increased specialization of job duties will tend to limit the number of display workers needed in each store. In addition to the jobs resulting from employment growth, however, many 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 and Working Conditions

Among large employers, wages for beginners ranged from $2.50 to $3.75 an hour in 1976. 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 $120 to $240 a week, depending largely on experience and ability. Most display directors earned between $12,000 and $20,000 a year. Experienced directors 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.

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.

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.

FLORAL DESIGNERS

(D.O.T. 142.081)

Nature of the Work

Floral designers assemble flowers and foliage into a specific 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 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, however.

A funeral order may read "easel spray of red and white flowers." For the foundation, the designer attaches 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 are strengthened with wood sticks for easy insertion into the base.

To provide a background for the flowers, the designer inserts leafy branches such as chamadorea or fern into the base. Gladioluses are spaced so that the tips of the flowers approximate an oval or diamond shape. Carnations are placed between the gladioluses to provide contrasting form, color harmony, and depth. A bow is placed at the focal point of the spray, and foliage is added to hide construction. On the back of the sympathy card are the description 6f 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, and prepare accessories for a coming season—for example, bows and streamers for football corsages or dressings for flowering plants. The variety of duties performed by a floral designer depends on the size of the shop and the number of designers employed.

Places of Employment

About 37,000 floral designers were employed in 1976. Nearly all designers work in the retail flower

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Floral arrangements express the designer's artistic talent.

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 now take courses in floral design to prepare for a career in this field. Courses in flower arranging 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. A background of formal training gives a prospective designer an advantage in obtaining a job over other 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 copy simple arrangements that use one type of flower. If they work quickly with their hands and recognize the shape, color and position of flowers that make attractive arrangements, instruction in more complex arrangements is 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 supervisor in large flower shops. Managers who have the necessary capital may open their own shops.

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Employment Outlook

Employment of floral designers is expected to increase faster than the average for all occupations through the mid-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 and Working Conditions

Limited information indicates that in 1976 experienced designers usually earned between $2.50 and $5 an hour. Inexperienced floral designers generally earned the minimum wage. Although their earnings are often low, designers achieve the additional satisfaction of doing creative work and seeing their ideas transformed into reality.

In small shops, floral designers often work 8 hours a day, Monday through Saturday. In many large shops, designers who work Saturday get a day off during the week. Designers generally work long hours around certain holidays, such as Easter and Valentine's Day, when the demand for flowers 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 Retail Clerks International Association.

Floral designers must be able to stand for long periods. Work areas are kept 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.

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. 142.081)

Nature of the Work

When people buy a product, whether it's a home appliance, a new car, or a ball point 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 compare the product with competing products, and gather information about such things as 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 engineers, production supervisors, and sales and market research personnel about the practicability and sales appeal of each idea. Teamwork is important to get the best information about specialized areas of concern, such as engineering problems or new production or marketing methods.

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 changed. After any necessary revisions, a final or working model is made, usually of the material to be used in the finished prod-



Industrial designers confer on plans for new product.

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uct. The approved model then is put into production.

Although most industrial designers are product designers, many others employed by business organizations are involved in different facets of design. Some industrial designers seek to create favorable public images for companies and for government services such as transportation by developing 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 employed by a manufacturing company usually work only on the products made by their employer. This may involve filling day-to-day design needs of the company or long-range planning of new products. Consultant designers who serve more than one industrial firm often plan and design a great variety of products.

Places of Employment

About 12,000 persons were employed as industrial designers in 1976. 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. Industrial designers with industrial firms usually work in or near the manufacturing plants of their companies, which often are located in small and medium-sized cities.

Training, Other Qualifications, and Advancement

Completing a course of study in industrial design in an art school, in the design or art department of a university, or in a technical 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 designers who have a bachelor's degree in the field.

In 1976, 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.

Industrial design programs may take either 4 or 5 years, and lead to a bachelor's degree in industrial design or fine arts. Some schools require applicants to submit sketches and other examples of their artistic ability for prior approval. Some schools also award a master's degree in industrial design.

Industrial design programs differ considerably among schools. 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 those that are part of 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 see familiar objects in new ways. 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 important. A sound understanding of marketing, sales work, and other business practices is important for design consultants.

Applicants for jobs should assemble a "portfolio" of drawings and sketches to demonstrate their creativity and ability to communicate ideas.

New graduates of industrial design programs frequently do simple assignments for experienced designers. As they gain experience, they 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 more slowly than the average for all occupations. In recent years, the trend has been away from frequent redesign of household products, automobiles, and industrial equipment. However, 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 growth, some employment opportunities will arise each year as designers die, retire, or transfer to other fields.

Earnings and Working Conditions

Salaries for inexperienced industrial designers with a bachelor's degree generally ranged from $9,000 to $12,000 a year in 1976, according to limited data. After several years' experience, it is possible to earn $14,000 to $18,000 a year. Salaries

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of those with many years of experience averaged more than $25,000 a year in 1976, 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.

Industrial designers generally work a 5-day, 35-40 hour week, with occasional overtime necessary to meet production deadlines. Independent consultants, who often are paid by the assignment, may work longer hours.

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, 1750 Old Meadow Rd., McLean, Va. 22101.



A successful designer must be creative, have good color sense and good taste, and be able to work well with people.

INTERIOR DESIGNERS

(D.O.T. 142.051)

Nature of the Work

The creative work of interior designers, sometimes called *interior decorators*, 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 a room, designers first consider the purpose of the area and the client's budget and taste. A very expensive couch that is easily soiled, for example, may not suit a family's needs for their recreation room.

Next, most designers prepare sketches of their plans. The sketches show all the furniture and accessories the designer is considering as well as any changes in the structure itself, such as a new wall to separate the dining and living rooms. Sometimes, the clients may not like the plans, in which case the designer must start all over again; other times, the client may want to make only minor changes, such as putting a table and chair where the designer had placed a couch.

Once the client approves both the plans and the cost, the designer may look for and then buy 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 properly.

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 sometimes 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. Sometimes, though, they 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 have unusual jobs such as designing interiors of ships and aircraft or stage sets used for motion pictures or television.

All designers, regardless of where they are working, must deal with paperwork. They must place orders, figure estimates, and maintain records of where to purchase hundreds of different types of furnishings.

Places of Employment

About 37,000 persons worked as interior designers in 1976, primarily in large cities.

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Some experienced interior designers manage their own establishments, either alone or as partners with other designers. Most designers work for large design firms that employ designers to work independently with their clients or as assistants to senior designers.

Other interior designers work in large department or furniture stores, and a few have permanent jobs with hotel and restaurant chains. Some work for architects, furniture suppliers, antique dealers, furniture and textile manufacturers, or other manufacturers in the interior furnishing field. Interior designers also work for magazines that feature articles on home furnishings.

Training, Other Qualifications, and Advancement

Formal training in interior design is becoming increasingly important for entry into this field. Most architectural firms, well-established design firms, department and furniture stores, and other major employers will accept only 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 master's degree or Ph. D. The curriculum usually includes principles of design, history of art, freehand and mechanical drawing, painting, study of the essentials of architecture as they relate to interiors, design of furniture and exhibitions, and study of various materials, such as wood, plastics, metals, and fabrics. A knowledge of furnishings, art pieces, and antiques is important. In addition, courses in sales and business subjects are valuable.

Membership in the American Society of Interior Design 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.

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, they may open their own businesses.

A successful designer must be creative, have good color sense and good taste, and be able to work well with people. At times, designers' tastes may not match those of their clients, so designers must be willing to make changes in plans they consider attractive and functional.

Employment Outlook

Persons seeking beginning jobs in interior design are expected to face competition through the mid-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 mid-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 and Working Conditions

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 $140 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 $6,000 to $12,000 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.

Designers' work hours are sometimes long and irregular. Designers usually adjust their workday to suit the needs of their clients, meeting with them during the evenings or on weekends when necessary.

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.

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LANDSCAPE ARCHITECTS

(D.O.T. 019.081)

Nature of the Work

Everyone enjoys attractively designed residential areas, public parks, and commercial zones. Landscape architects design these areas to satisfy functional needs as well as people's aesthetic sense.

Landscape architects assist many types of organizations in planning and designing a project, from a real estate firm starting a new suburban development to a city constructing an airport or park. They may plan and arrange trees, shrubbery, walkways, open spaces, and other features as well as supervise the necessary grading, construction, and planting.

Landscape architects first consider the nature and purpose of the project, the funds available, and the proposed buildings 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, after consulting 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.



Persons planning careers in landscape architecture should be interested in art and nature.

Although landscape architects help design and supervise a wide variety of projects, some 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.

Places of Employment

About 13,000 persons worked as landscape architects in 1976. Most were self-employed or worked for architectural, landscape architectural, or engineering firms. Government agencies concerned with forest management, water storage, public housing, city planning, urban renewal, highways, parks, and recreation also employed many landscape architects. The Federal Government employed over 550 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.

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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. A good background in English grammar also is important, since landscape architects must be able to express their ideas verbally as well as graphically.

College courses 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, and mathematics. 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 creative imagination, drawing talent, and an appreciation for nature. Self-employed landscape architects also 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 office.

Employment Outlook

Employment of landscape architects is expected to grow faster than the average for all occupations through the mid-1980's. Additionally, new entrants will be needed as replacements for landscape architects who retire or die.

Anticipated rapid growth in new construction is expected to play a major role in increasing demand for landscape architects. However, during slow periods the demand could be limited.

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 could also 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.

Earnings and Working Conditions

Newly graduated landscape architects generally earned from $10,500 to $12,500 a year in 1976. Most experienced landscape architects earned between $15,000 and $20,000 a year, although some highly skilled persons earned salaries of over $30,000 a year. Salaries 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 1977, paid new graduates with a bachelor's degree annual salaries of $9,300 or $11,500 depending on their qualifications. Those with an advanced degree had a starting salary of $14,100 a year. Landscape architects in the Federal Government averaged $22,500 a year.

Salaried employees both in government and in landscape architectural firms usually work regular hours, although employees in private firms may also work overtime during seasonal rush periods or to meet a deadline. Self-employed persons often work long hours.

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., 1750 Old Meadow Rd., McLean, Va. 22101.

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.

PHOTOGRAPHERS

(D.O.T. 143.062, .282, and .382)

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 constructed to use

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Commercial photographers must be imaginative and original.

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 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 photographic 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, there is a growing demand for photographers who have training in both areas.

In addition to knowing how to use their equipment and materials, photographers must be capable of composing the subjects of their photographs and recognizing a potentially good photograph.

Many photographers specialize in a particular type of photography, such as portrait, commercial, or industrial work. Portrait photographers 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 be the ones to collect payments and keep records, and therefore must be good business persons.

Commercial photographers 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 such items as clothing, furniture, automobiles, and food, and may specialize in one such area. Advertising photographers must know how to use many different photographic techniques.

The work of industrial photographers is used in company publications to report to stockholders or to advertise company products or services. Industrial photographers also photograph groups of people for employee news magazines or may 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.

Other photographic specialties include photojournalism, or press photography, which combines a "nose for news" with photographic ability; and educational photography (preparing slides, filmstrips, and movies for use in the classroom).

Places of Employment

About 85,000 photographers were employed in 1976. 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 photographers 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

Photographic training is available in colleges, universities, junior colleges, and art schools. Over 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. (See the statement on commercial artists elsewhere in the *Handbook*.) The Armed Forces also train many young people in photographic skills.

Although a high school education is desirable, the photography profession has no set entry requirements with regard to formal education or training. However, the training a prospective photographer has determines the type of work for which he or she qualifies.

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

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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 be able to recognize a potentially good photograph and act quickly, for otherwise an opportunity to capture an important event on film may be lost. 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 more slowly than the average for all occupations through the mid-1980's. In addition to openings resulting from growth, others will occur each year as workers die, retire, or transfer to other occupations.

Growth of employment in business and industry is occurring as greater importance is placed upon visual aids for use 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 commerical 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. The increased use of self-processing cameras in commercial photography also has contributed to the crowding in this field, since little photographic training is required for such work.

Earnings and Working Conditions

Beginning photographers who worked for newspapers that have contracts with The Newspaper Guild had weekly earnings between $128 and $432 in 1976, with the majority earning between $175 and $225. Newspaper photographers with some experience (usually 4 or 5 years) averaged about $320 a week in 1976. Almost all experienced newspaper photographers earned over $225; the top salary was nearly $505 a week.

Photographers in the Federal Government earned an average of $14,900 a year in 1976. Depending on their level of experience, newly hired photographers in the Federal Government earned from $8,320 to $11,520 a year. Most experienced photographers earned between $11,520 and about $18,460 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 conditons and the type and size of their community and clientele.

Photographers who have salaried jobs usually work a 5-day, 35-40 hour week and receive benefits such as paid holidays, vacations, and sick leave. Those in business for themselves usually work longer hours. Freelance, press, and commercial photographers travel frequently and may have to work in uncomfortable surroundings. Sometimes the work can be dangerous, especially for news photographers assigned to cover stories on natural disasters or military conflicts.

Sources of Additional Information

Career information on photography is available from:

Photographic Art & Science Foundation, 111 Stratford Rd., Des Plaines, Ill. 60016.

Professional Photographers of America, Inc. 1090 Executive Way, Des Plaines, Ill. 60018.

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COMMUNICATIONS-RELATED OCCUPATIONS

The art of communications is as old as humanity. 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, of which radio, television, newspapers, magazines, and books are the most familiar.

The communications field includes a broad range of occupations having to do with research, writing, editing, and production; it also encompasses public relations, advertising, and other specialties. The following section of the *Handbook* describes four of these occupations—interpreters, newspaper reporters, radio and television announcers, and technical writers. Other communications jobs are described elsewhere in the *Handbook*, in the statements on occupations in radio and TV broadcasting; occupations in the printing and publishing industry; advertising workers; public relations workers; photographers; and commercial artists.

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 interpreters and technical writers, for example, put foreign or 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.

In addition to a broad education and outstanding language skills, people in communications jobs need to be very well informed about certain subjects. Depending on the job, they may need to be versed in economics, law, politics, 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 smalltown 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.

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. Attending social functions is only part of a journalist's job, however; many hours a day may be spent on the tedious but essential tasks of making contacts, checking facts, and following leads.

Despite the keen competition, jobs will be available through the mid-1980's for bright and talented people. 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 communications field.

INTERPRETERS

(D.O.T. 137.268)

Nature of the Work

Interpreters help people of different nations and different cultures overcome language barriers by translating what has been said by one person into a language that can be understood by others.

There are two basic types of oral translation or interpretation: simultaneous and consecutive. In simultaneous interpretation, the interpreter translates what is being said in one language as the speaker continues to talk in another. This technique requires speed and fluency in the foreign language on the part of the interpreter and it is made possible by the use of electronic equipment, which allows for the transmission of the simultaneous speeches. Conference interpreters often work in a glass-enclosed booth from which they can see the speaker. While listening through earphones to what is being said, they simultaneously give the translation by speaking into a microphone. People attending the conference who do not understand the language being spoken may listen to an interpreter's rendition by simply pushing a button or turning a dial to get the translation in the language they know. Simultaneous interpretation generally is preferred for conferences, and the development of portable equipment has extended its use to other large-scale situations.

Consecutive interpretation also involves oral translation. However, the speaker and the interpreter take turns speaking. A consecutive interpreter must have a good memory and generally needs to take notes in order to give a complete and exact translation. The chief drawback of consecutive interpretation is that the process is time consuming, because the speaker must wait for the translation before proceeding.

Since interpreters are needed whenever people find language a barrier, the work involves a variety of

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topics and situations. Interpreters may be needed, for example, to explain various aspects of American life to a group of foreign visitors, or they may be required to interpret highly technical speeches and discussions for medical or scientific gatherings. They may work at the United Nations, or find themselves in a courtroom or escorting foreign leaders or business people visiting the United States.

Places of Employment

An estimated 175 persons worked full time as interpreters in the United States in 1976. The largest single concentration of interpreters was at the United Nations in New York where about 90 people held full-time posts. Various other international organizations, located primarily in Washington, D.C., also employed regular staff interpreters. Among these are the Organization of American States, the International Monetary Fund, the Pan American Health Organization, and the World Bank. Within the Federal Government, the Departments of State and Justice were the major employers of full-time interpreters.

An estimated 500 persons worked as freelance interpreters. Freelance interpreters may work for various employers under short-term contracts. About four-fifths were under contract on a temporary basis to the Department of State and the Agency for International Development to serve as escort interpreters for foreign visitors to the United States. Some of these interpreters worked a great portion of the year; others worked for only a few days. The remainder of the freelance interpreters worked in the freelance conference field. These interpreters provided for both the supplementary needs of the international and Federal agencies and for the periodic, short-term needs of various international conferences that are held in this country. The Organization of American States employs many people in this area. Besides persons who work strictly as interpreters, many others do some interpretation work in the course of their jobs.



Interpreters must instantaneously call to mind words or idioms corresponding to foreign ones.

Training, Other Qualifications, and Advancement

A complete command of two languages or more is the usual requirement for becoming an interpreter. Interpreters must instantaneously call to mind words or idioms corresponding to the foreign ones. An extensive working vocabulary and ease in making the transition from one language structure to another are necessary.

Students who want to become interpreters should become fluent in several languages. Interpreters who work at the United Nations, for example, must know at least three of the six official U.N. languages: Arabic, Chinese, English, French, Russian, and Spanish. Portuguese and, to some extent, Japanese and German are also valuable to interpreters in the United States.

Two schools in the United States offer special programs for interpreter training. Both require foreign language proficiency upon entry. The Georgetown University School of Languages and Linguistics in Washington, D.C., has a 1- or 2-year course of study leading to a Certificate of Proficiency as a conference interpreter. The certificate is recognized by the International Association of Conference Interpreters. Applicants to Georgetown University must qualify on the basis of an entrance test and a minimum of previous studies at the university level; successful candidates usually hold a bachelor's degree, often a master's degree. The Monterey Institute of Foreign Studies in Monterey, Calif., through its Department of Translation and Interpretation, offers a 2-year graduate program leading to a master's degree in Intercultural Communication and a graduate certificate in either translation, translation/interpretation, or in conference interpretation. Applications to the Institute must have a bachelor's degree and pass an aptitude test. They must be fluent in English, plus one other language if studying translation, or in two other languages if wishing to enter the interpretation field. After taking the basic courses in translation and interpretation theory, students must pass a qualifying examination in order to enter the translation or interpretation program. This qualifying examination usually takes place after two semesters of work at the Institute.

Many individuals may qualify as interpreters on the basis of their foreign backgrounds for positions in which extensive experience and a broad education are not as crucial as for other types of interpretation. For example, consecutive interpreters employed by the Immigration and Naturalization Service of the U.S. Department of Justice serve primarily in interpreting legal proceedings, such as hearings for aliens.

Besides being proficient in languages, interpreters are expected to be generally well informed on a broad range of subjects, often including technical subjects such as medicine or scientific or industrial technology. Work as a translator may serve as a useful background in maintaining an up-to-date vocabulary in various specialized or technical areas. The experience of living abroad also is very important for an interpreter.

Although there is no standard requirement for entry into the profession, a university education usually is considered essential.

People interested in becoming interpreters should be articulate speakers and have good hearing. The exacting nature of this profession requires quickness, alertness, and a constant attention to accuracy. Working with all types of people requires good sense, tact, and the emo-

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tional stamina to deal with the tensions of the job. It is essential that interpreters maintain confidentiality in their work and that they give honest interpretations.

Advancement in the interpreting field generally is based on satisfactory service. There is some advancement from escort level interpreting to conference level work.

Employment Outlook

Interpreters traditionally face very stiff competition for the limited number of openings. Little change is expected in the number of full-time interpreters through the mid-1980's. Most opportunities, therefore, should result from the need to replace workers who die, retire, or leave their jobs for other reasons. Experience has shown that any slight or sporadic increase in the demand for interpreters can be met by the existing pool of freelance workers. Only highly qualified applicants will find jobs.

Qualified interpreters also may find work abroad. The demand for interpreters in Europe, where so many different languages are spoken, is far greater than in the United States.

People who have linguistic abilities also may find some employment opportunities as translators. In fact, many interpreters find the ability to do translation work, if not requisite, an occupational asset. Foreign language competence also is important for careers in the fields of foreign service, international business, and language education.

Earnings and Working Conditions

Salaries of interpreters depend upon the type of interpreting done as well as the ability and performance of the individual. The tax-free annual starting salary for conference interpreters at the United Nations was $14,300 in 1976. Outstanding U.N. interpreters could expect to earn almost $30,000.

Beginning salaries for interpreters in various other international organizations were over $15,000 a year, according to the limited information available. In addition, international organizations often paid supplementary living and family allowances.

Junior interpreters who worked for the U.S. Department of State received $17,056 a year in 1977. Starting salaries were somewhat lower for interpreters in other Federal agencies.

In the freelance field, interpreters are paid on a daily basis. Conference interpreter salaries ranged from about $125 to $160 a day in 1976. The U.S. Department of State paid a daily salary of $125.

Freelance escort interpreters received salaries ranging from about $40 to over $80 a day, based on the individual's skill and prior performance. Interpreters on assignment usually could expect to be paid for a 7-day week. Interpreters are paid transportation expenses by the employing agency and also receive an allowance to cover the cost of accommodations, meals, and other expenses incidental to their assignments.

The conditions under which interpreters work vary widely. In freelancing, there is little job security because of demand fluctuations, and the duration of various freelance assignments ranges from a few days for a typical conference to several weeks for some escort assignments. Although the hours interpreters work are not necessarily long, they are often irregular. In some instances, especially for escort freelance workers, a great deal of travel to a wide variety of locations is required.

Sources of Additional Information

Information on the interpreting profession is available from:

The American Association of Language Specialists, 1000 Connecticut Ave. NW., Suite 9, Washington, D.C. 20036.

For information on entry requirements and courses of study at the two schools offering specialized programs for interpreters, contact:

Division of Interpretation and Translation, School of Languages and Linguistics, Georgetown University, Washington, D.C. 20057.

Department of Translation and Interpretation, Monterey Institute of Foreign Studies, P.O. Box 1978, Monterey, Calif. 93940.

Information about employment opportunities is available from:

Language Services Division, U.S. Department of State, Washington, D.C. 20520.

Secretariat Recruitment Service, United Nations, New York, N.Y. 10017.

NEWSPAPER REPORTERS

(D.O.T. 132.268)

Nature of the Work

Newspaper reporters gather information on current events and use it to write stories for publication in daily or weekly newspapers. In covering events, they may interview people, review public records, attend news events, and do research. As a rule, reporters take notes or use tape recorders while collecting facts, and write their stories upon return 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 some reporters to "beats," such as police stations or the courts, to gather news originating in these places. General assignment reporters handle various types of local news, such as a story about a lost child or an obituary of a community leader. Specialized reporters with a background in a particular subject interpret and analyze the news in fields such as medicine, politics, science, education, business, labor, and religion.

Reporters on small newspapers may cover not only all aspects of local news, but 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.

Places of Employment

More than 40,000 persons worked as newspaper reporters in 1976. The majority of reporters work for urban daily newspapers; others work for suburban, community, or small town weekly papers and press services.

Reporters work in cities and towns of all sizes. Of the 1,762 daily and 7,579 weekly newspapers, the great majority are in medium-sized towns.

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Reporters gathering news information.

However, most reporters work in cities, since big city dailies employ many reporters, whereas a small town 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. Many editors prefer graduates who have a degree in journalism, which usually includes training in the liberal arts along with professional journalism training. Some editors consider a liberal arts degree sufficient. Others prefer applicants who have a liberal arts bachelor's degree and a master's degree in journalism. High school courses that are useful include English, journalism, social science, and typing.

Bachelor's degree programs in journalism are available in almost 250 colleges. About three-fourths of the courses in a typical undergraduate journalism curriculum are in liberal arts. Journalism courses include reporting, copyreading, editing, feature writing, history of journalism, law, and the relation of the press to society.

More than 500 junior colleges offer journalism programs. Twelve to fifteen hours of credit earned is transferable to most 4-year college programs in journalism. A few junior colleges also offer programs especially designed to prepare the student directly for employment as a general assignment reporter on a weekly or small daily newspaper. The Armed Forces also provide some training in journalism.

A master's degree in journalism was offered by more than 90 schools in 1976; 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.

Persons who wish to prepare for newspaper work through a liberal arts curriculum should take English courses that include writing, as well as subjects such as sociology, political science, economics, history, psychology, computer science, and speech. Ability to read and speak a foreign language is desirable. Those who look forward to becoming reporters in a specialized field such as science should concentrate on course work in their subject matter areas. Skill in typing is essential because reporters type their own news stories. On small papers, knowledge of news photography also 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. In addition, more than 2,700 journalism scholarships, fellowships, and assistantships were awarded to college journalism students by universities, newspapers, and professional organizations in 1976.

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. Important personal characteristics include a "nose for news," curiosity, persistence, initiative, resourcefulness, an accurate memory, and the physical stamina necessary for an active and often fast-paced life.

Some who compete for full-time reporter jobs find it is helpful to have

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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. 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 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

Competition for newspaper reporting jobs is expected to continue through the mid-1980's. If enrollments continue at record levels as they have in the past few years, record numbers of journalism graduates will be looking for jobs. However, employment in the communications field is not expected to expand sufficiently to absorb all those seeking jobs, and a sizable number of journalism graduates will have to launch careers in other fields.

Newspaper reporters in particular face heightened job competition. Although the communications field is expected to expand through the mid-1980's, newspapers are not expected to share fully in this growth. As a result, employment of reporters will increase more slowly than the average for all occupations. Most job openings will arise from the need to replace reporters who are promoted to editorial or administrative positions, transfer to other fields of work, retire, or leave the profession for other reasons.

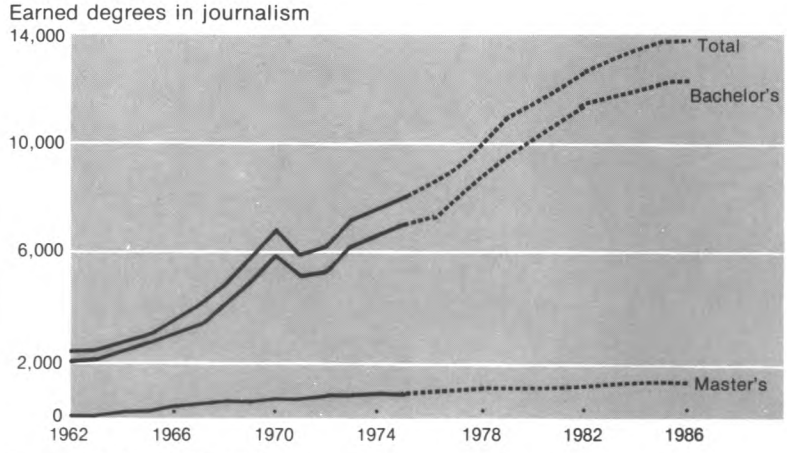
Bright, energetic persons with exceptional writing ability will have the best opportunities for beginning jobs as newspaper reporters. Talented writers who are able to handle news about highly specialized scientific or technical subjects will also be at an advantage in the competitive job market.

Weekly or daily newspapers located in small towns and suburban areas are expected to continue to offer most of the opportunities for beginners entering newspaper reporting. Openings arise on these papers as reporters gain experience and move up to other editorial positions or transfer to reporting jobs on larger newspapers or to other types of work. Beginning reporters able to help with photography and other specialized aspects of newspaper work and who are acquainted with the community are likely to be given preference in employment on small papers.

Most big city dailies require experience and do not ordinarily hire new graduates. Sometimes, however, new graduates find newsroom jobs on major metropolitan dailies because of outstanding credentials in an area for which a particular paper has a pressing need. Occasionally, the experience and contacts gained through an internship program lead to a reporting job directly after graduation.

In addition to newspaper reporting, college graduates who have majored in journalism have the background for jobs in related fields such as advertising, public relations, trade and technical publishing, radio and television, and law. Because continued high enrollment is foreseen in journalism education programs, opportunities to teach journalism are expected to be good. College teaching jobs currently require professional experience and at least a master's degree.

Rapid increase in the number of journalism graduates will produce intense competition for communications jobs



Source: National Center for Education Statistics

Earnings and Working Conditions

Reporters working for daily newspapers having contracts negotiated by The Newspaper Guild had average starting salaries of $10,600 in late 1976. In general, earnings of newspaper reporters in 1976 were above average earnings received by nonsupervisory workers in private industry, except farming.

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Minimum salaries of reporters having 4 or 5 years of experience who worked for daily newspapers with Guild contracts averaged $16,700 in 1976. The minimums ranged from $9,960, paid by the smallest dailies, to more than $26,000 paid by the largest. Many reporters, however, were paid salaries higher than these minimums. Reporters working for national wire services received annual salaries of at least $19,000.

Most newspaper reporters generally work a 5-day, 35- or 40-hour week. Reporters working for morning papers usually start work in the late afternoon and finish at about midnight. Most reporters also receive benefits such as paid vacations, group insurance, and pension plans.

Sources of Additional Information

Information about opportunities for reporters with daily newspapers is available from:

American Newspaper Publishers Association Foundation, P.O. Box 17407, Dulles International Airport, Washington, D.C. 20041.

For information on opportunities in the newspaper field and starting salaries of journalism graduates, as well as a list of journalism scholarships, fellowships, assistantships, and loans available at colleges and universities, write to:

The Newspaper Fund, Inc., Box 300, Princeton, N.J. 08540.

Information on union wage rates is available from:

The Newspaper Guild, Research and Information Department, 1125 15th St. NW., Washington, D.C. 20005.

For general information about careers in journalism contact:

American Council on Education for Journalism, School of Journalism, University of Missouri, Columbia, Mo. 65201.

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 daily 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 large newspaper offices.

RADIO AND TELEVISION ANNOUNCERS

(D.O.T 159.148)

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.

Places of Employment

About 26,000 announcers were employed by radio and television broadcasting stations in 1976. The average commercial radio or television station employs four to six announcers, although larger stations employ 10 or more. In addition to staff announcers, several thousand 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

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. The most successful announcers have a combination of personality and a knack for dramatization that makes them attractive to audiences.



Announcers usually specialize in a particular area such as news, sports, or weather.

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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.

Most announcers get their first broadcasting jobs in small stations. Because announcers in small radio stations sometimes operate transmitters, prospective announcers often obtain an FCC Radiotelephone Third Class Operator License which enables them to operate a radio transmitter and, therefore, makes them much more useful to these stations.

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 intense, and announcers usually 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 keen through the mid-1980's. The great attraction of the broadcasting field, plus its relatively small size, will continue to mean many more jobseekers than jobs. Over the next decade, 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.

Employment of announcers is expected to increase faster than the average for all occupations through the mid-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 will not keep pace with the increase in the number of stations, however, because of the increased use of automatic programming equipment. Many jobs in this relatively small occupation will result from the need to replace experienced announcers who transfer to other occupations, retire, or die.

Earnings and Working Conditions

Salaries of beginning announcers in commercial television ranged from about $185 to $230 a week in 1976, and those of experienced announcers ranged from about $300 to $500, according to the limited information available. Many well-known announcers earn much more. 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 work beyond 40 hours. In small stations, many announcers work 4 to 12 hours of overtime each week. 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.

Working conditions are usually pleasant because of the variety of work and the many personal contacts that are part of the job. Announcers also receive some satisfaction from becoming well known in the area their station serves.

Sources of Additional Information

For general career information, write to:

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

Corporation for Public Broadcasting, 1111 16th St. NW., Washington, D.C. 20036.

For information on how to obtain an FCC license, write to:

Federal Communications Commission, Washington, D.C, 20554.

TECHNICAL WRITERS

(D.O.T. 139.288)

Nature of the Work

Technical writers put scientific and technical information into language that can readily be understood by people who need to use it. 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.

Some organizations use job titles other than "technical writer." Depending on the particular employer, people in technical writing jobs may be called publications engineers, communications specialists, industrial writers, medical writers, communicators, or instructional materials developers.

Technical writers set out either to instruct or 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

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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.

Many technical writers prepare reports on the results of research projects. By communicating research developments to other scientists, engineers, and technicians, these reports speed scientific and technical progress and help prevent duplication of effort. 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 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 materials, management provides the budget, 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 text for exhibits and displays; and handle technical documentation.

When they begin a writing assignment, technical writers usually start by learning as much as they can about the subject. They study reports, sometimes blueprints; read technical journals; consult with engineers, scientists, and technicians who have worked on the project; or 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 accompanies a finished document and may work directly with technical illustrators, drafters, or photographers.

Places of Employment

An estimated 22,000 technical writers and editors were employed in 1976. 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 also employ many technical writers.

Research laboratories employ significant numbers of technical writers. Some laboratories are affiliated with manufacturing companies to 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 technical writers and editors in areas as diverse as the physical sciences, weapons development, agriculture, health, and space exploration. Three out of four technical writers and editors in the Federal Government work for the Department of Defense. Other agencies that employ technical writers include 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; professional journals in engineering, medicine, physics, chemistry, and other sciences; and publishers of scientific and technical literature.

The rapidly growing information industry provides a new 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 free-lance basis or open their own agencies or consulting firms.

Technical writers are employed all over the country but the largest concentrations are in the Northeast, Texas, and California.

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 or work experience indicates that they are familiar with a technical subject and can write about it effectively. 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 or the liberal arts. Depending on their line of business, these employers almost always require course work or

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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 must be able to deal precisely with a mass of detailed material. Because they often work as part of a team, 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.

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 department. 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 journals. A portfolio of writing samples is helpful when applying for a job.



The majority of technical writers have work experience as technicians, scientists, or engineers.

In 1976, 10 colleges and universities offered programs leading to a bachelor's degree in technical writing, and 4 schools had associate degree programs. Graduate programs leading to a master's degree in technical writing were offered at six schools, one of which also offered a Ph. D. These programs have various names, including science or medical writing, science information, technical journalism, and technical communication.

Most undergraduate programs in technical writing are interdisciplinary. While such programs may be based in the communications, journalism, or language and literature department, 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. 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, 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 take the form of 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

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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 mid-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 writing ability and a scientific or technical background. 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.

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 defense, space exploration, energy, pollution control, medicine, and communications technology. Through the mid-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 declined since the late 1960's, and most vacancies will occur as Federal employees retire or transfer to other jobs.

Earnings and Working Conditions

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. Free-lancing can be an important source of additional income, but freelance earnings vary greatly because they depend on the writer's ability and reputation.

Starting salaries for college graduates began at about $10,000 in 1976, although graduates with degrees in engineering, science, or technical communications generally began at $12,000 or more. Experienced technical writers averaged around $19,500 a year in 1976, while those in supervisory positions earned $25,000 or more. There were substantial regional variations, however.

In the Federal Government in 1977, beginning technical writers with a bachelor's degree and about five science courses were paid $9,303 a year; those with a bachelor's degree and 1 year's specialized experience could start at $11,523 a year. The average salary for technical writers in Federal agencies was $19,901.

Technical writers, in and out of government, may work under considerable pressure, frequently working overtime to meet publication deadlines. Their working environment generally is clean and well-lighted.

Sources of Additional Information

For information about careers in technical writing, and the names of colleges and universities that offer programs in technical communication, contact:

Society for Technical Communication, Inc., Suite 421, 1010 Vermont Ave. NW., Washington D.C. 20005.

For information about careers and workshops in the field of health communication, contact:

American Medical Writers Association, Suite 290, 5272 River Rd., Bethesda, Md. 20016.

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The Outlook for Industries

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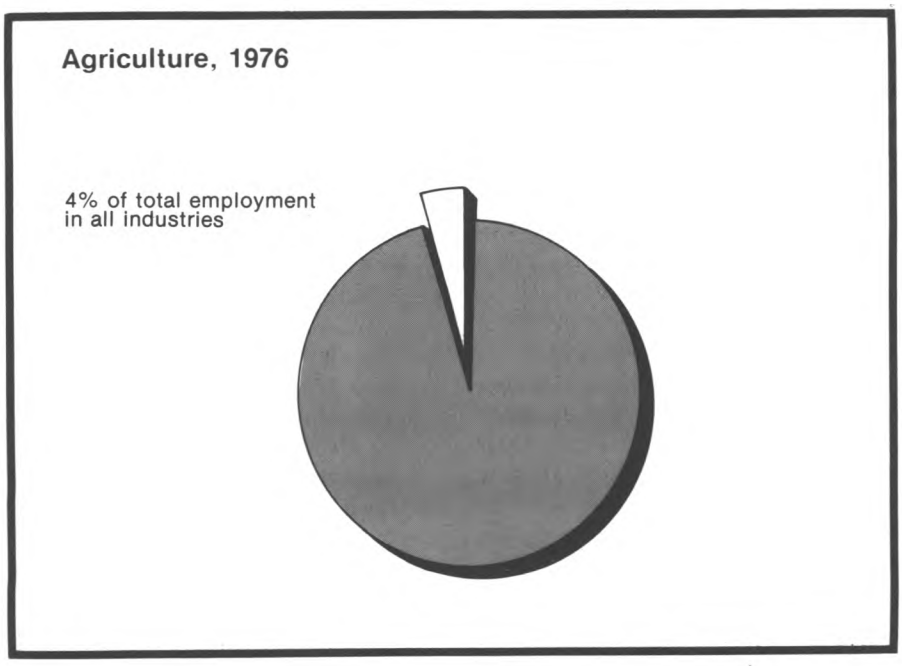
For decades the word agriculture has referred to agricultural production or farming—a major American industry that employed over 3 million workers in 1976. But today this word encompasses more than just farm production. Agriculture is closely related to many other industries in the economy—food and fiber processing, marketing and distribution industries, farm implement producers and dealers, and feed and fertilizer manufacturers.

Although jobs requiring agricultural knowledge or skills long have been available in off-farm locations, the number and variety of these agricultural jobs have increased dramatically in recent years. At the same time, significant improvements in agricultural productivity have reduced the number of jobs actually 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 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, about 2 million workers still will be needed in basic agricultural production in 1985. This statement begins with a discussion of the occupations in basic farm production and the factors to consider in making the decision to farm. Subsequent sections describe the increasing variety of work available in the growth sector of agriculture—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 1976. 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 farm owners 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 *tenant farmer* (D.O.T. 409.181). The remainder are run by hired farm managers or partners. The specific tasks a farm operator must do are determined by the type of farm he or she runs, 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 that farm operators must do or arrange to have done, they also must make the management decisions required of modern agricultural production. Farm operators 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

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keep their livestock to take advantage of better prices later in the year.

Farm operators make other important management decisions, such as determining when to seed, fertilize, cultivate, and harvest. 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 family and hired 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 land owner 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 land owner may furnish one or more of these. Most tenant farm operators turn over an agreed-upon percentage of the crop to the land owner for the use of the land. Others may pay a flat yearly rent to the land owner.

Farm laborers and farm labor supervisors. Very few farms today can be run by only one person. In 1976, approximately 975,000 hired workers, 340,000 family workers, and 30,000 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. 421.883) on a farm devoted to 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. Farm hands must mix feed and additives, and fill feed and water troughs. They clean barns and animal pens and check livestock regularly for signs of disease or infection. Often farm hands must vaccinate livestock, such as cattle and poultry, against diseases or spray them with insecticides to protect against harmful parasites. Also, farm hands 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, they cultivate fields to loosen soil and reduce the number of weeds. Often, crops are sprayed to control weeds, harmful insects, and fungi. Farm hands also assist in harvesting, and storing, packing, and transporting crops.

Many of the tasks performed by farm hands require the use of 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.

Farm hands 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 farm hand working in an orchard (D.O.T. 404.883) 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 job duties depending on the location of the farm. In areas where rain is insufficient, *irrigators* (D.O.T. 422.887) 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 of the field to another.

Farms such as those producing fruit or vegetables often need a large number of woqkers to harvest their crops. These farms employ laborers with more specialized job duties. For instance, if produce is packed on the farm to prepare it for shipment, then *produce sorters* (D.O.T. 529.687) and *produce packers* (D.O.T. 920.887) 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. 429.131) are needed to coordinate work activities such as planting, cultivating, and harvesting. 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 statement on blue-collar worker supervisors, eleswhere in the *Handbook*.)

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 States 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

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number of employees during the harvesting season. Thus many hired laborers work on these farms on a seasonal basis. About 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 is on a day-to-day basis, so 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 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, crop science, agricultural economies, horticulture, and animal science. Also, colleges usually offer special programs of study concerning products that are important to the area in which they are located, such as grain science programs at colleges in the Plains States.

In addition to the knowledge of agricultural practices that farming requires, 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 to the operation of the farm 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 the knowledge of financial management, accounting, and tax accounting that is 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 large 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 land owner 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 very limited; however, they may advance to become 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. A 6- or 7-day workweek is common during busy seasons and is 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

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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 the agriculture industry is expected to continue to decline through the mid-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 to get started in a type of specialty farming that requires less land, and in which they have an 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 intensified 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 thus 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 hard skin and can be machine harvested without damaging the tomatoes. 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 occupations through the mid-1980's, and beginning farmers may find opportunities in this field.

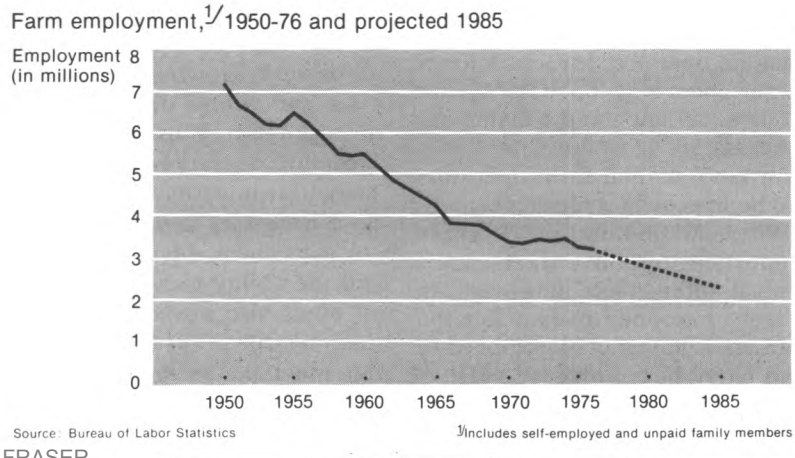
Earnings and Working Conditions

No information is currently available on the average earnings of farm operators. 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.

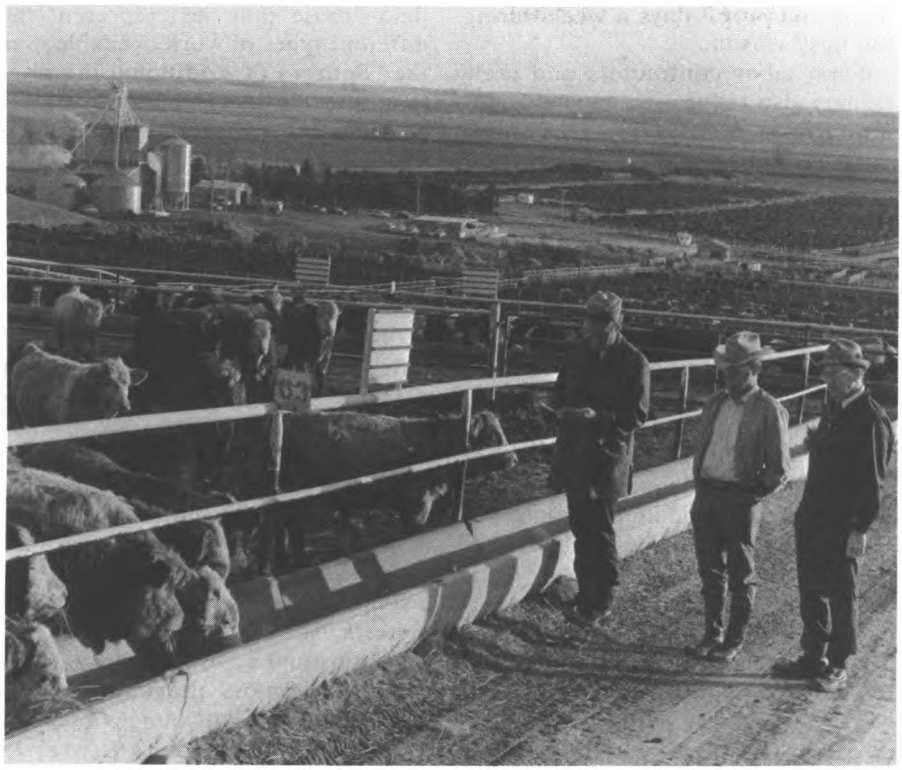
Farm laborers are generally among the lowest paid workers; in 1976 average hourly earnings of all hired farm workers were only $2.66. In comparison, average hourly earnings of all production workers in private nonagricultural industries were $4.87 in the same year. Average wage rates for hired farm workers ranged from $2.47 an hour for field and livestock workers to $4.39 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 benefits such as paid vacations, sick leave, or health benefits.

Many types of agriculture are very 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

Even though farm output has increased by 50 percent since 1950, employment has been cut in half and is expected to continue to decline



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Over 1 million farmers and farm workers raise livestock.

harvesting seasons. Farm workers often work fewer than 6 to 7 months a year on the farm, and, while many can find off-farm employment, others are often unable to find outside employment during the winter months.

On farms on which animals are raised for meat or dairy products, the work is distributed more evenly throughout the year. However, these farms cannot be left unattended 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 travel.

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 farm machinery. Also, farm workers are subject to illnesses and diseases from handling and breathing in 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.

Many farm laborers, especially those in California, are represented by the United Farmworkers Union (UFW), and others are represented by the International Brotherhood of Teamsters, Chauffeurs, Warehousemen, and Helpers. Many of them are members of local and regional cooperatives that enable them to reduce the cost of their supplies and also to market their products.

Agricultural Service Occupations

The agricultural services industry offers careers in hundreds of occupations, many requiring specialized skills or the ability to operate farm equipment. In 1976, 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 are employed as laborers, many others work in professional occupations, such as veterinarians or agricultural scientists. Others work as managers, agricultural technicians, writers, mechanics, machine operatives, clerks, and secretaries.

Many occupations in the agricultural services industry 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. 073.081) 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. 419.181) 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. 467.384) and *artificial inseminators* (D.O.T. 467.384) 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. 180.168) who manage insemination distributorships.

Several occupations in livestock services may be learned more 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, as well. Poultry hatcheries employ several types of animal caretakers to vaccinate poultry, place eggs on trays in incubators, and

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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 land owners 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 technical skills or specialized equipment, but can be learned through technical training, on-the-job training, or training in another job. For example, *agricultural pilots* (D.O.T. 196.283) 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 with special equipment supplement their incomes by providing corn shelling, hay baling, threshing, or other services 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 the 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 to young farm people.

For information about opportunities in off-farm activities, contact individual colleges of agriculture or the U.S. Department of Agriculture, Washington, D.C. 20250.

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 farm managers and operators about the 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 to perform their jobs.

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. 050.088) 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 analysis,

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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 which 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 aboard.

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 the farm to the 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. 091.228) 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 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. 096.128) also do educational work in fields such as agricultural production and home economics and may conduct agricultural educational programs through youth groups such as the 4-H Clubs.

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 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. 040.081) 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. 041.081) study the causes of plant diseases to develop methods to control noxious weeds, insect pests, and plant diseases.

Plant physiologists (D.O.T. 041.081) 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. 041.081) 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. 041.081) study bacteria and other microorganisms to better understand their relation to human, plant, and animal health, and learn how these microorganisms function in the production of vitamins, antibiotics, amino acids, alcohols, and sugars.

Animal physiologists (D.O.T. 041.081) study the functions of various parts of the bodies of livestock.

Animal scientists (D.O.T. 040.081) 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 developing new livestock and poultry feeds.

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Entomologists (D.O.T. 041.081) 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. 077.128) 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. 040.381) conduct tests on samples of seeds to determine their rate of germination, purity, and noxious weed content.

Agricultural chemists (D.O.T. 022.081) 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. 022.081) such as dairy products 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. 040.081) 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. 054.088) 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 013.081) 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 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. 168.287) 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. 469.387) 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. 529.687) 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 in conducting experiments. 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 fields and other experimental areas, such as greenhouses, barns, or growth houses. They assist agricultural scientists in experiments conducted under actual growing conditions.

Research technicians may perform a varity 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 animal, 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

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distribute agricultural products employ persons in urban as well as rural areas. While some of these people work in occupations that require some agriculture-related training, others work 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 feed store 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 dealers* (D.O.T. 277.358) 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.

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, and 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, 90 Park Ave., New York, N.Y. 10016.

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 teacher trainer in 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 written on the subject of jobs in agribusiness discuss opportunities in much greater detail and may be available in your local high school and public libraries.

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MINING AND PETROLEUM

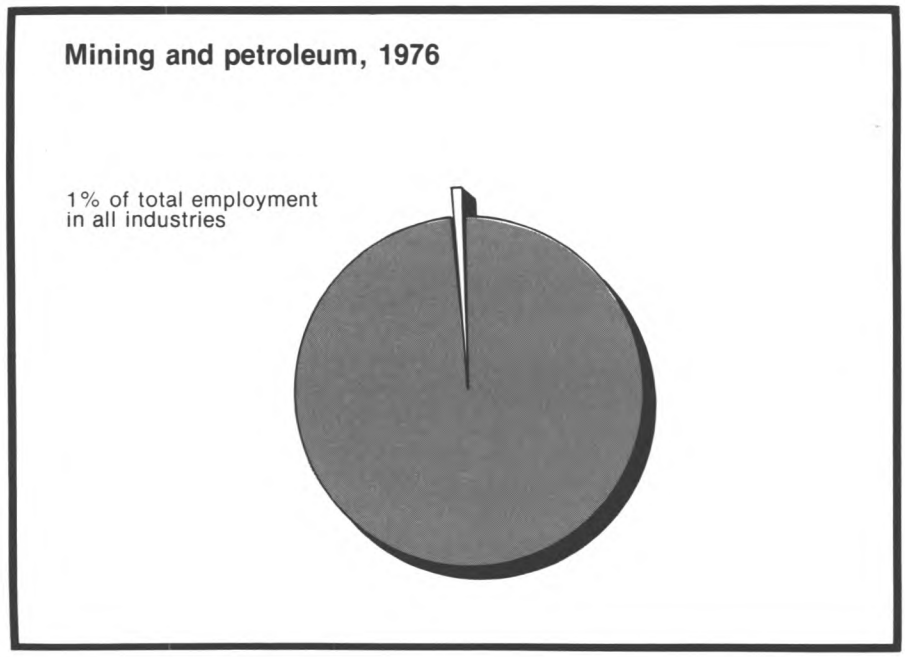
The mining and petroleum industry provides most of the basic raw materials and energy sources for industry and consumer use. Metal mines provide iron, copper, gold, and other ores. Quarrying and other nonmetallic mining yield many of the basic materials such as limestone and gravel for building schools, offices, homes, and highways. Nearly all of the Nation's energy for industrial and personal use comes from oil, gas, and coal. Few products from mines reach the consumer in their natural state; nearly all require further processing.

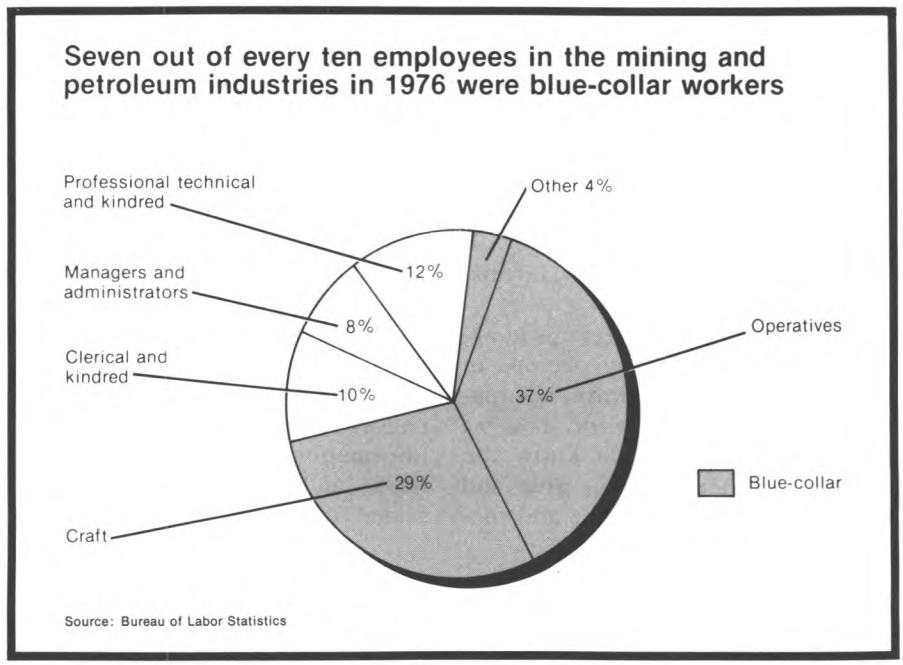
The mining and petroleum industry employed about 770,000 workers in 1976. Almost half of these worked in the exploration for and removal of crude petroleum and natural gas. Coal mining accounted for over one-fourth of the industry's workers. The remaining workers were in metal mining and quarrying and nonmetallic mineral mining.

As shown in the accompanying chart, blue-collar workers (craft workers and operatives) account for nearly seven-tenths of the industry's employment. Operatives is the largest occupational group in the industry. Included in the operative group are oil well drillers, mining machinery operators, and truck and tractor drivers. Skilled craft workers constitute the second largest occupational group. Mechanics and repairers maintain the complex equipment and machinery used in mining and in oil well drilling. Many operators of heavy equipment, such as power shovels and bulldozers, work 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 constitute 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 compose the remaining three-tenths of the industry's employment.

Professional and technical workers are concentrated largely in petroleum and gas extraction. Most are en-





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gineers, 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 mid-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 statements 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*.

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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.

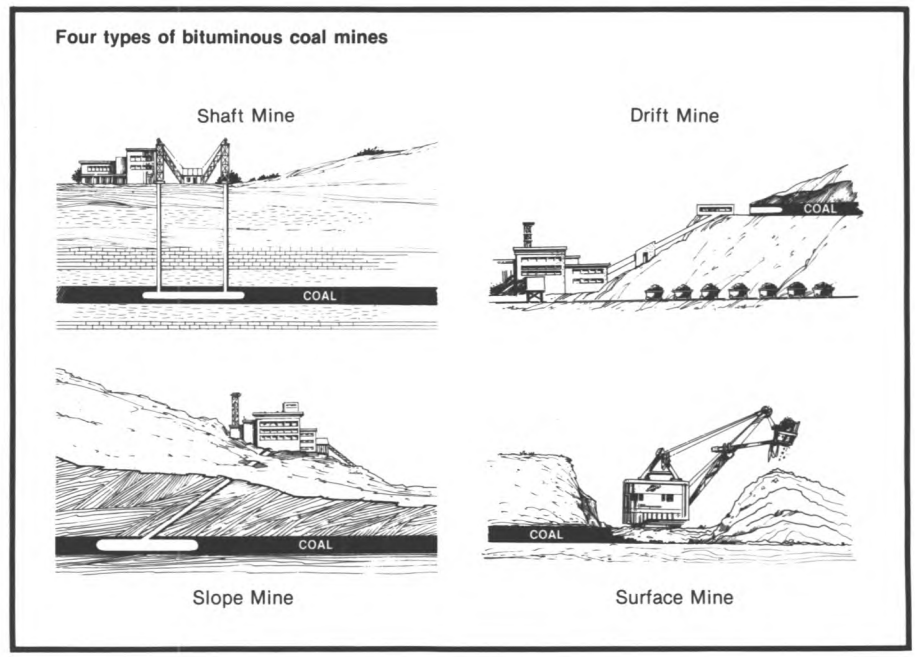
After the coal seam has been reached, nearly all underground mines are constructed the same way. Miners make a network of interconnecting tunnels so that the mine resembles a maze with passageways going off in predetermined directions, sometimes extending over many miles. As coal is removed, the tunnels become 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.

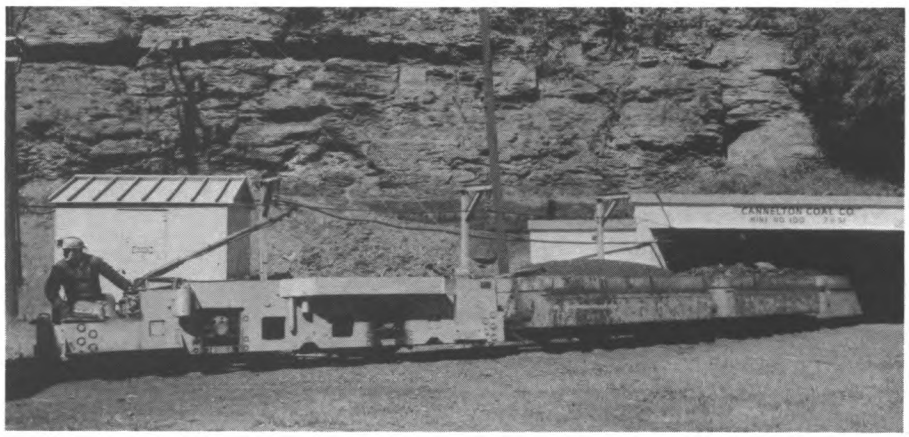
Occupations in the Industry

In 1976 about 210,000 people worked in the bituminous coal and lignite mining industry. An additional 4,000 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



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Most coal miners operate machines.

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. 930.883) 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. 930.782) drills holes into the coal where the *shot firer* (D.O.T. 931.281) 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. 932.883) scoops up and dumps the coal into small rubber-tired cars, which are run by the *shuttle car operator* (D.O.T. 932.883). 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. 930.883) sits or lies in a cab and operates levers to cut or 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* 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 *fire boss* or preshift examiner (D.O.T. 939.387) inspects the work area for loose roof, dangerous gases, and adequate ventilation. If safety standards are not met, the fire boss will not allow the miners to enter. The *rock-dust machine operator* (D.O.T. 939.887) 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. 930.883) 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. 869.884) constructs doors, walls, or partitions in the passageways to force air through the tunnels to working areas. The supervisor, called a *face boss* (D.O.T. 939.138), 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. 859.883) 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. 932.883) rips coal from the seam and loads the coal into trucks to be driven to the preparation plant. In auger mines, the *rotary auger operator* (D.O.T. 930.782) runs the machine that pulls the coal from sides of hills. *Tractor operators* (D.O.T. 929.883) 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, called *fitters* (D.O.T. 801.281), fix all types of mining machinery, and electricians 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

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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 central control operator* (D.O.T. 549.138) who oversees all operations. Plants that are not as mechanized, however, need workers at each step, such as the *wash box attendant* (D.O.T. 541.782) and *separation tender* (D.O.T. 934.885). Wash box attendants operate equipment that sizes and separates impurities from coal. The separation tender operates a device that further cleans coal with currents of water. 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. 010.081 and .187) 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. 007.081, .151, .168, and .187) oversee the installation of equipment, such as centralized heat and water systems, while *safety engineers* (D.O.T. 010.081) are in charge of all health and safety programs.



High-speed loading of rail cars at coal preparation plant.

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. 018.188) help map out the mining areas. Engineering and sci-



Mining engineer and supervisor discuss design of a mine.

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ence technicians may assist in research efforts.

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 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. Mining Enforcement and Safety 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.

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 fuels. Growth in production also depends on how quickly economical methods of coal gasification and liquification 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, on the types of mines opened, and the mining methods and machinery used. In addition to openings due to growth, several thousand openings will occur each year as experienced miners retire, die, or transfer to other fields of work.

Earnings and Working Conditions

In 1976, union wage rates for miners ranged from $48.62 to $58.92 a day; workers in underground mines generally earned slightly more than those in surface mines or preparation plants. In comparison, production workers in manufacturing averaged $41.52 a day.

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. As their length of service increases, they gain extra vacation days up to a total of 29. Union workers also receive benefits from a welfare and retirement fund, and workers suffering from pneumoconiosis (black lung) receive Federal aid.

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, backs, or stomachs 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 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.

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.

Mining Enforcement and Safety Administration, Department of Interior, Washington, D.C. 20240.

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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 is formed by a similar process.

Oil and natural gas have assumed a position of such importance that they now furnish more than three-fourths of our energy needs. Oil and natural gas run 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 petroleum as a source of energy, petroleum and natural gas will continue to supply the major portion of our energy needs for many years to come.

Although U.S. production of oil and natural gas has been on the decline in recent years, most experts feel that there are large amounts of petroleum in this country that have not yet been discovered. Locating and extracting these petroleum 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 1976, about 355,000 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 elsewhere in 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. There are hundreds of firms 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 600,000 wells in this country in 1976, and a large part of the petroleum industry's 250,000 production workers were needed to operate and maintain them.

Oil and gas are transported to refineries by pipeline, ship, railroad, barge, or truck. Many refineries are thousands of miles from oil fields, but gas processing plants usually are near the fields so that water, sulfur compounds, and other impurities can be removed before the liquid gas is piped to customers.

Although drilling for oil and gas is done in 35 States, about nine-tenths of the industry's workers are employed in 10 States. Texas leads in the number of oilfield jobs, followed by Louisiana, Oklahoma, California, Wyoming, Kansas, New Mexico, Colorado, Ohio, and Illinois. Thousands of additional Americans are employed by oil companies overseas, mostly in the Middle East, Africa, Western Europe, South America, and in Indonesia and other Far Eastern countries.

Occupations in the Industry

Workers with a wide range of education 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 possible existence 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. 024.081), 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. 024.081) study fossil remains in the earth to locate oil-bearing layers of rock; *mineralogists* (D.O.T. 024.081) study physical and chemical properties of mineral and rock samples; *stratigraphers* (D.O.T. 024.081) determine the rock layers most likely to contain oil and natural gas; *photogeologists*

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(D.O.T. 024.081) examine and interpret aerial photographs of land surfaces; and *petrologists* (D.O.T. 024.081) 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) and *surveyors* (D.O.T. 018.188), 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 *geophysicist* (D.O.T. 024.081) usually leads a seismic prospecting crew that may include: *prospecting computers* (D.O.T. 010.288), who perform the calculations and prepare maps from the information recorded by the seismograph, which is an instrument that measures the earth's vibrations; and *observers* (D.O.T. 010.168), who operate and maintain electronic seismic equipment. Other workers whose activities are related to exploration are: *scouts* (D.O.T. 010.288), 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. 191.118), who make the necessary business arrangements with landowners or with 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.

Wells are almost always started in the same way. *Rig builders* (D.O.T. 869.884) and a crew of *rig-builder helpers* (D.O.T. 869.887) install a portable drilling rig to support the machinery and equipment that raises and lowers the drilling tools. 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 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, and carry crushed rock to the surface so that 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 supervisor* (D.O.T. 930.130) 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. 930.782) supervises the crew and operates machinery that controls drilling speed and pressure, and records operations. The *rotary rig engine operator* (D.O.T. 950.782) is in charge of engines that provide the power for drilling and hoisting. The *derrick operator* (D.O.T. 930.782), 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 drill helpers* (D.O.T. 930.844), 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. 869.884) 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, and into gas traps 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. 010.081) 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. Engineers are increasingly using computers for analytical work. Some engineers specialize in areas such as overcoming effects of corrosion on well casing, in the selection and design of production equipment and processes, or in the prevention of pollution. Some companies hire engineer aides to make tests, keep records, post maps, and otherwise assist engineers.

Pumpers (D.O.T. 914.782) 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. 914.381) measure and record the flow and take samples to check quality. *Treaters* (D.O.T. 541.782) 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.

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Natural Gas Processing. Most gas processing workers are operators. The *dehydration-plant operator* (D.O.T. 541.782) tends an automatically controlled treating unit which removes water and other impurities from natural gas. The *gas-plant operator* (D.O.T. 953.380) tends compressors that raise the pressure of the gas for transmission in the pipelines. The *gas-compressor operator* (D.O.T. 950.782) 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 *cementers* (D.O.T. 930.281), who mix and pump cement into the space between the steel casing and the well walls to prevent cave-ins; *acidizers* (D.O.T. 930.782), who force acid into the bottom of the well to increase the flow of oil; *perforator operators* (D.O.T. 931.782), who use subsurface "guns"to pierce holes in drill pipes or casings to make openings for oil to flow through; *sample-taker operators* (D.O.T. 931.781), who take samples of soil and rock formations from wells to help geologists determine the presence of oil; and *well pullers* (D.O.T. 930.883), 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 offshore work is being done off the west coast of the United States. Some drilling is expected to take place soon off the east coast. 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 operations. In addition, offshore operations require radio operators, cooks, ship's 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.)

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 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.

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. A statement on petroleum refining can be found elsewhere in the *Handbook*.

Employment Outlook

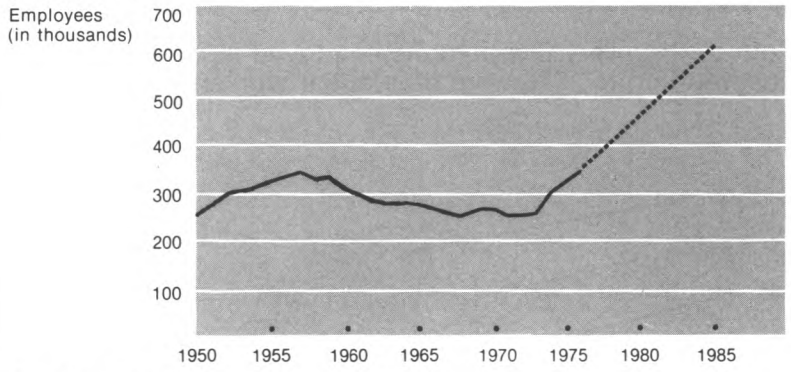
Employment in petroleum and natural gas production is expected to increase faster than the average for all industries through the mid-1980's. Besides the job openings created by employment growth, many openings will occur as workers retire, die, or leave the industry for other reasons.

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 con-

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Very rapid growth in the oil and gas extraction industry will result from expansion of exploration and drilling activities

Wage and salary workers in oil and gas extraction, 1950-76 and projected 1985



Source: Bureau of Labor Statistics

centrated in exploration and drilling, and many more workers will be needed in most occupations associated with these activities. Opportunities should be particularly good in offshore drilling.

Earnings and Working Conditions

In 1976, nonsupervisory employees in oil and gas extraction averaged $5.70 an hour. In comparison, the average for all nonsupervisory workers in private industry, except farming, was $4.83 an hour. Earnings usually are higher in offshore operations than in land operations.

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 power tools and handtools 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.

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 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 jobs in the petroleum industry may be available from the personnel offices of individual oil companies. For information on scientific and technical jobs, write to:

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.

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CONSTRUCTION

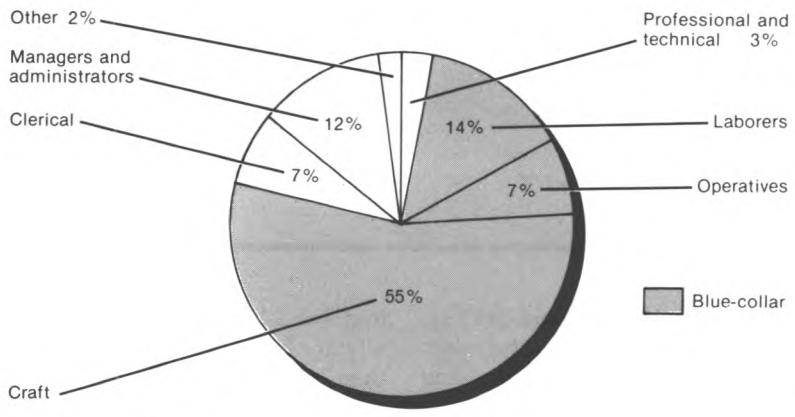
The activities of the construction industry touch nearly every aspect of our daily lives. The houses and apartments in which we live; the factories, offices, and schools in which we work; and the roads on which we travel are examples of some of the products of this industry. The industry includes not only new construction, but also additions, alterations, and repairs to existing structures.

In 1976, about 3.6 million people worked in contract construction. An additional 1.4 million workers not in contract construction are estimated to be either self-employed—mostly owners of small building firms—or are Federal, State, or local government employees who build and maintain our Nation's vast highway systems.

The contract construction industry is divided into three major segments. About half of the jobholders work for electrical, air-conditioning, plumbing, and other special trade contractors. Almost one-third work for the general building contractors that do most residential, commercial, and industrial construction. The remaining one-fifth build dams, bridges, roads, and similar heavy construction projects.

As illustrated in the accompanying chart, craft and kindred workers account for 55 percent of the total employment in this industry—a much higher proportion than in any other major industry. Some examples of craft workers are carpenters, painters, plumbers, and bricklayers. Laborers are the next largest occupational group and account for 14 percent of employment. They provide materials, scaffolding, and general assistance to skilled workers. Semiskilled workers (operatives), such as truckdrivers and welders, represent about 8 percent of the industry's work force. Managers and administrators—mostly self-em-

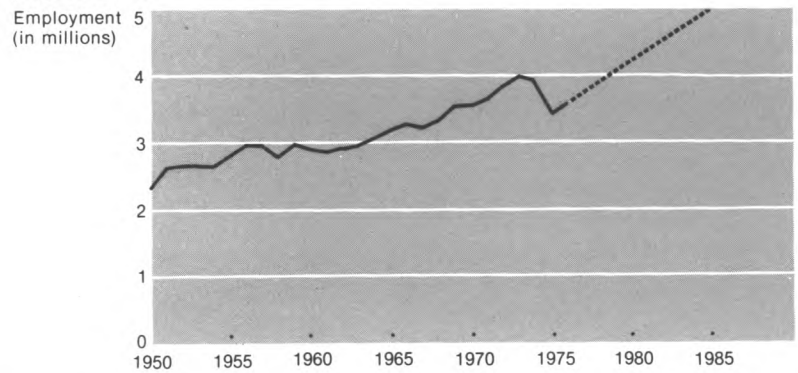
Four out of every five persons employed in contract construction in 1976 were blue-collar workers



Source: Bureau of Labor Statistics

Although employment in the construction industry fluctuates with the state of the economy, the trend through 1985 shows growth

Wage and salary workers in contract construction, 1950-76 and projected 1985



Source: Bureau of Labor Statistics

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ployed—account for about 12 percent of employment. Clerical workers, largely typists, secretaries, and office machine operators, constitute another 7 percent of the industry's employment. Professional and technical workers, mostly engineers and engineering technicians, drafters, and surveyors, make up the remaining 3 percent of the work force.

Construction industry employment is expected to rise faster than the average for all industries through the mid-1980's, as population and income growth create a demand for more houses, schools, factories, and other buildings. However, employment may fluctuate from year to year because construction activity is sensitive to changes in economic conditions.

Construction trade workers in the industry earned an average of $7.68 per hour in 1976. This was about 50 percent more than the hourly average of production or nonsupervisory workers in private industry, except farming. Yearly earnings of construction workers generally are lower than the hourly rate would indicate, however, because the annual number of hours they work can be adversely affected by poor weather and fluctuations in construction activity.

Contract construction is the major source of employment for skilled craft workers such as bricklayers, painters, and carpenters. For information on these and other construction crafts, see the chapter on construction occupations elsewhere in the *Handbook*.

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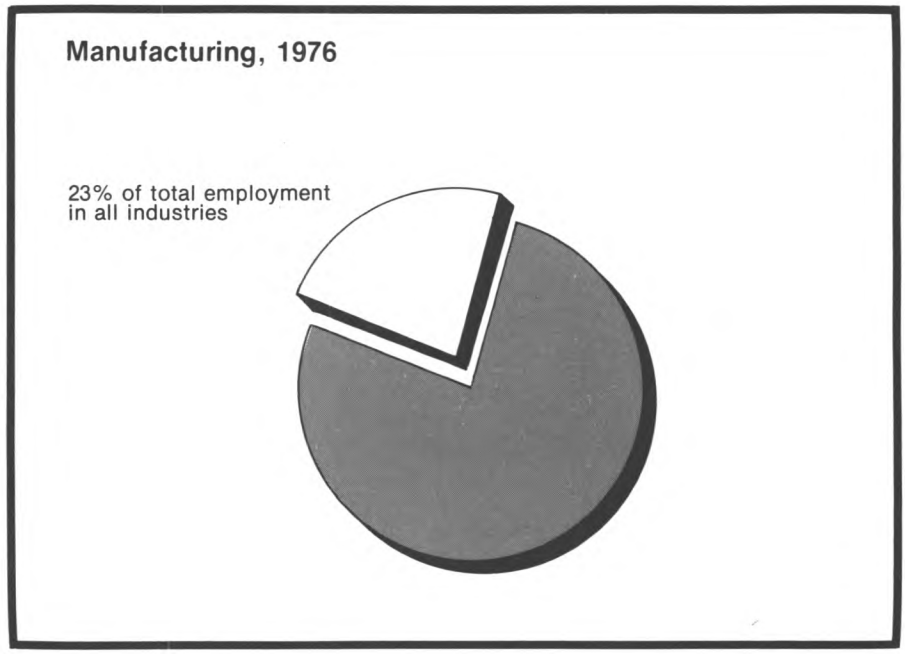
MANUFACTURING

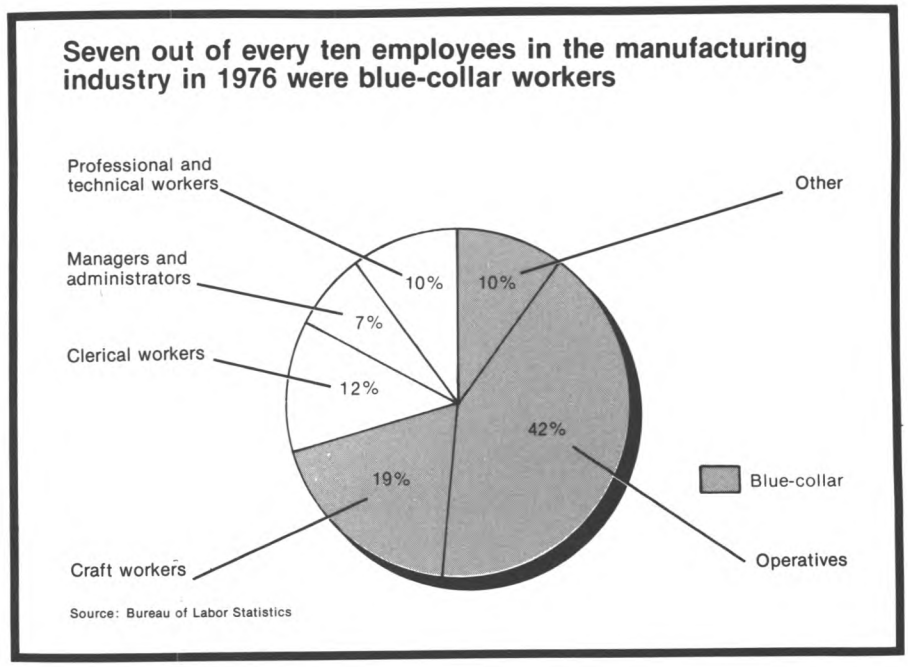
Our Nation's economy is composed of nine major industry divisions that provide us with a wide variety of goods and services. These nine divisions are agriculture; mining; contract construction; manufacturing; transportation and public utilities; wholesale and retail trade; finance, insurance, and real estate; services; and government. In terms of the impact it has on our lives, manufacturing may well be the most important.

Almost everything we use in our work, leisure, and even in our sleep is a product of a manufacturing industry. Factories produce goods that range in complexity from simple plastic 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 almost 20 million workers in 1976, was the largest of the major industry divisions. 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 the mining industry needs very few workers in these occupational groups. Like all





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industries, manufacturing has its own unique occupational composition.

As illustrated in the accompanying table, blue-collar workers (craft workers, operatives, and laborers) make up about two-thirds of manufacturing employment. Operatives, who are needed to run the machines used 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 required in all factories. Others are directly involved in production. Machinists, for example, are especially important in the metalworking industries, as are skilled inspectors and assemblers. In the printing and publishing industries, compositors, typesetters, photoengravers, lithographers, and pressworkers make up a large share of the work force. The craft group also includes supervisors of blue-collar workers.

Laborers account for about 1 out of every 20 jobs in manufacturing. Many of these workers help 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 sales workers) account for nearly one-third of employment in manufacturing establishments. Clerical workers, such as secretaries and office machine operators, are 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, and other paperwork that is found in all types of business activity.

Professional, technical, and kindred workers account for about 1 out of every 10 jobs in manufacturing establishments. Engineers, scientists, and technicians represent a large share of the professional workers. These highly trained workers include not only those who oversee and guide the production processes, but also those who carry out the extensive research and development activities needed in the aerospace, electronics, chemical, petroleum, and other industries.

Managers and administrators account for about 1 out of every 16 workers. In addition to the managers who run the factories, many workers in this category are responsible for buying the numerous goods and raw materials used in manufacturing.

Sales workers constitute a very small part of employment in manufacturing, only about 1 out of every 50 workers, but they perform the vital function of selling the goods made in the factories.

Population growth, rising personal income, and expanding business activity will create a substantial increase in the demand for manufactured products through the mid-1980's. Employment in manufacturing, however, is expected to increase at a slower pace than production as technological advances and improvements in manufacturing methods increase the amount of goods each worker can produce.

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 mid-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 found in manufacturing as well as in many other industries appears elsewhere in the *Handbook*. (See index in the back of the book.)

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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 1976, more than 700,000 people worked in the industry—nearly 500,000 in the manufacture and assembly of complete aircraft, aircraft engines, propellers, and auxiliary parts and equipment; 85,000 in the manufacture of missiles and spacecraft; and 160,000 in companies that make electronic equipment and instruments for aircraft, missiles, and spacecraft. Thousands of workers in other industries produced parts, machinery, and equipment used in the manufacture of aerospace vehicles. Also, thousands of Federal workers were engaged in aerospace-related work, since the Government is a major purchaser of the industry's products. These workers were primarily employed in the National Aeronautics and Space Administration (NASA) and the Department of Defense.

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, and Florida.

Nature 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.

Aircraft vary from small personal or business planes that do not cost much more than an automobile to multi-million dollar jumbo transports and supersonic fighters. In dollar value most aircraft production is for military use although the value of planes made for commercial and private use has been increasing.

Missiles are for military use and generally carry destructive warheads. While some are capable of traveling 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 of the Nation's spacecraft are built for NASA and the Department of Defense to explore outer space or to monitor conditions within the earth's atmosphere. On manned flights, a cabin capsule carries the astronauts. Some spacecraft probe the space environment and then fall back to earth, while others, such as those that monitor weather conditions, enter into earth orbit and become artificial satellites. Still others orbit or land on the moon or go to other planets. All spacecraft carry instruments that record and transmit scientific data to earth stations.

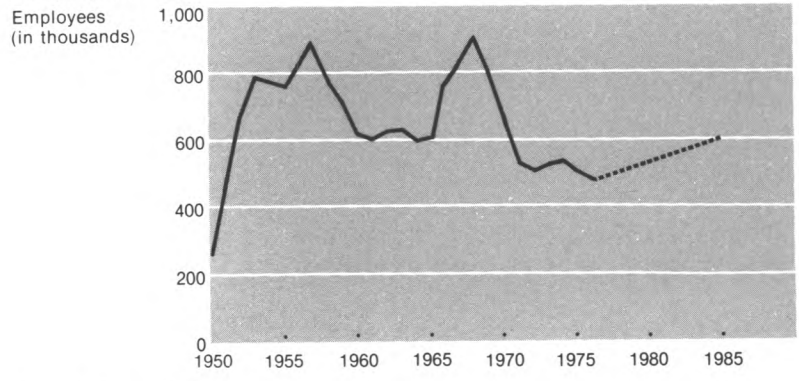
Major aircraft, missile, and spacecraft firms contract with government or private business to produce an aerospace vehicle. As a contractor, the firm is responsible for managing and coordinating the entire project. This involves design, production, assembly, and inspection of the vehicle.

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 produce, such as bearings, rocket fuels, or special lubricants. Other subcontractors produce subassemblies such as communication or guidance equipment or jet engines. Some of these firms depend on still other subcontractors to supply parts for their subassemblies.

In producing an aerospace vehicle, the contractor's engineering department first prepares design drawings and specifications, usually after long

Employment in aircraft and parts manufacturing increases sharply in times of accelerated defense spending

Wage and salary workers in aircraft and parts manufacturing, 1950-76 and projectd 1985



Source: Bureau of Labor Statistics

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Operator of braiding machine for aircraft ducts.

consultations with the purchaser. 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 in order to make parts or to assemble the aerospace vehicle. This is especially true when a firm is developing an experimental or ultra-sophisticated vehicle requiring specially designed parts or assemblies.

Once parts and components are developed, they are tested and inspected many times before being assembled. If the tests prove satisfactory, assembly of the entire craft may begin. Finally, the finished vehicle is checked out by a team of mechanics, or flight-tested if it is an aircraft, before it is delivered.

Occupations in the Industry

Because of the complex and changing nature of aerospace technology, firms need workers with many different types of skills. The types of workers required also will depend on the specific function of an aerospace plant. For example, a plant primarily engaged in research and development or in producing experimental prototypes requires many more scientists and engineers than a firm producing large quantities of parts for aircraft.

Major jobs in aerospace manufacturing are described under three main 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 many areas such as developing vehicles with greater speeds, ranges, and reliability; engines with more power; and more advanced sources of rocket propulsion such as nuclear and electric energy. Metals and plastics also are continually being developed for wider capabilities, as are electronic guidance and communication system

Emphasis on R&D makes the aerospace industry an important source of jobs for technical personnel. In 1976, 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 velocity, 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 is made from a preliminary drawing and is tested in wind, temperature, and shock tunnels and other testing 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

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production may begin. Even after production has started, however, further changes often are made.

Due to the wide range of R&D 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 needed in this industry. Scientists in the industry include physicists, mathematicians, chemists, metallurgists, and astronomers. These engineers and scientists work in a wide and varied 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 the procedures to be followed in producing the object.

Engineering and science technicians assist scientists and engineers in R&D. They usually operate complex machinery and equipment to carry out tests under the supervision of a scientist or engineer.

Other workers who help scientists and engineers include *production planners* (D.O.T. 012.188), 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), 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 departments such as sales, purchasing, accounting, and industrial relations. 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 checkout; and materials handling, maintenance, and custodial.

Sheet-Metal Occupations. Following blueprints and other engineering information, *sheet-metal workers* (D.O.T. 804.281) 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 a part must fit perfectly.

Less skilled workers usually specialize in the use of a single machine to fabricate parts required in large numbers. Some of these workers are *punch press operators* (D.O.T. 615.782), *power hammer operators* (D.O.T. 617.782) and *power shear operators* (D.O.T. 615.782 and .885).

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 metal-working 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 and .281) 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. 609.885) produce metal parts in large volume. They generally operate a single type of machine tool such as a lathe, drill press, or milling machine. 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) build jigs—metal devices used as guides for tools. *Tool-and-die makers* (D.O.T. 601.280) 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. 709.884), who form tubings used for oil, fuel, hydraulic, and electrical conduit lines; and *riveters* (D.O.T. 800.884) and *welders* (D.O.T. 810.782 and .884; 811.782 and .884; 812.884 and 813.380 and .885), 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. 504.782) heat sheet-metal parts to keep the metal soft and malleable for metal-shaping work *Painters* (D.O.T. 845.781) and *platers* (D.O.T. 500.380) 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 compon or spacecraft. In an aircraft, for example, this work involves joining wings and tails to the fuselage and installing the en-

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gine and auxiliary equipment such as the fuel system and flight controls. Assemblers rivet, drill, bolt, weld and solder parts together.

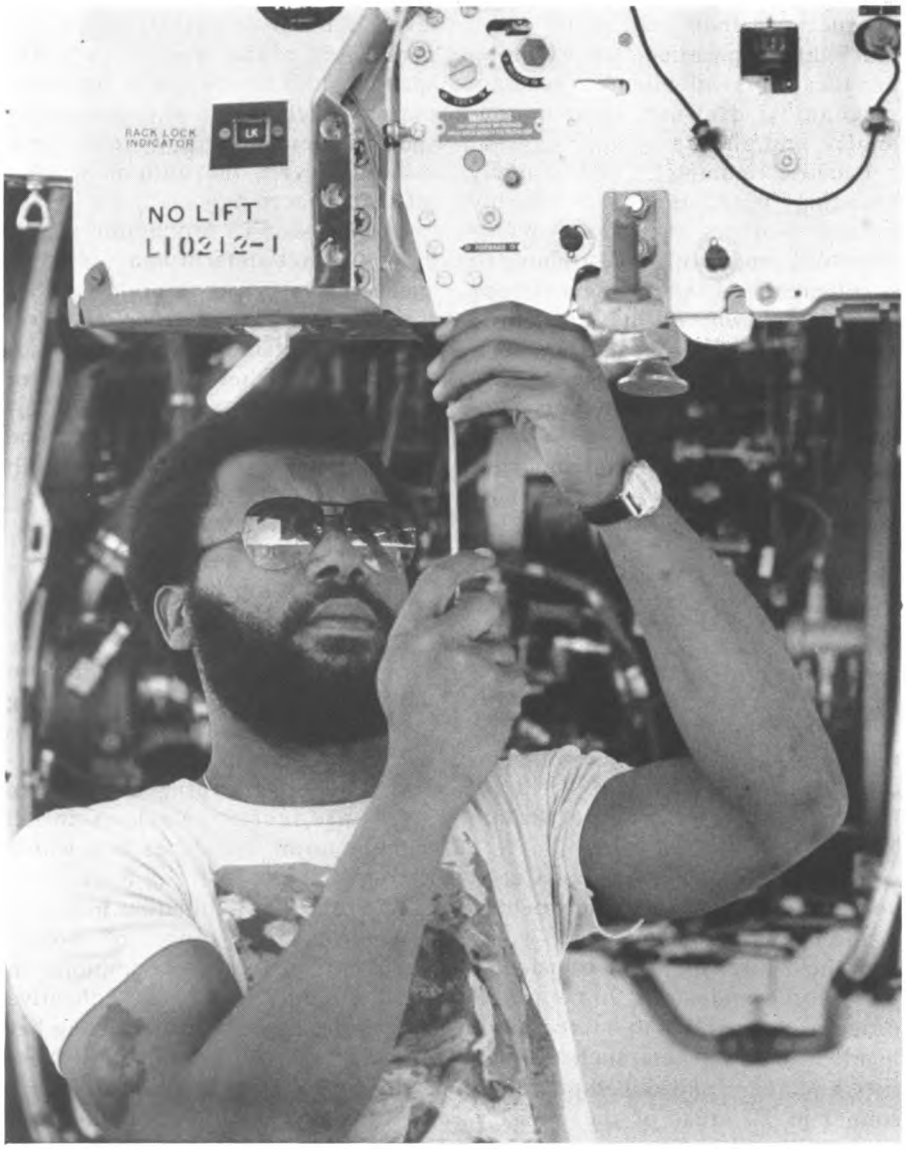
Many assemblers are skilled mechanics and installers who read blueprints and interpret other engineering specifications as they take apart, inspect, and install complex mechanical and electronic assemblies. Often, assembly work is not as repetitive as in other industries. An assembler in an aerospace plant, for example, may spend a few months assembling a huge 747 aircraft and then work on the assembly of a small, two-seater plane. Some assemblers, such as *final assemblers* (D.O.T. 806.781) of complete aircraft and *missile or rocket assembly mechanics* (D.O.T. 625.281), do general assembly work, and often work on experimental, prototype, or special craft.

Other skilled assemblers who work in plants that produce relatively large numbers of aircraft and missiles rather than a few experimental types, however, often specialize in the assembly of one specific part of a space vehicle. Assemblers also specialize in systems such as electrical wiring, heating, and plumbing.

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. 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.

Most inspectors specialize in a certain area of aerospace manufacturing. Using complex machinery, they 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. 806.381) 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. *Machined parts inspectors* (D.O.T. 609.381) examine machined parts and fabricated sheet-metal and *assembly inspectors* (D.O.T. 806.381) inspect complete major assemblies and installations such as fuselage, wing, and nose sections to insure 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* specialize in checking 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.



Flight line mechanic tightens wing pylon during final assembly.

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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.

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. 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 graduates of vocational courses in electronics or mechanics often are preferred. Inexperienced plant workers generally start out in semiskilled positions and learn skills on the job and in classroom courses. 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.

Apprenticeship programs sometimes are available for craft occupations such as machinists, tool-and-die makers, sheet-metal workers, aircraft mechanics, and electricians. The programs vary in length from 3 to 5 years depending on the trade. 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 major producers conduct training classes or pay tuition and related costs for outside courses. Some classes are held during working hours; others are after working hours.

Employment Outlook

Employment in the aerospace industry is expected to rise above recent levels by the mid-1980's. 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 either military hardware or 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, aerospace 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 1976 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 remain fairly stable through the mid-1980's. Nevertheless, thousands of new workers will be required in this sector of the industry to replace those who die, retire, or transfer to other fields.

Earnings and Working Conditions

Plant workers' earnings in the aerospace industry are higher than those in most other manufacturing industries. In 1976, for example, production workers in plants making aircraft and parts averaged $6.45 an hour; production workers in all manufacturing industries as a whole averaged about $5.19 an hour.

The following tabulation indicates an approximate range of hourly wages for selected occupations in 1976 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 work-

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ers' skills and experience, and partly because wages differ from plant to plant, depending upon type of plant, locality, and other factors.

Aircraft mechanics	$5.94–7.15
Assemblers	5.72–6.49
Electronics technicians	6.49–7.45
Heat treaters	5.84–6.77
Inspectors and testers	5.39–7.45
Jig and fixture builders	6.13–7.45
Machinists	5.67–7.45
Maintenance crafts	5.55–7.40
Riveters	5.61–6.27
Tool-and-die makers	6.37–7.45
Welders	5.84–7.17

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 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.

Most plant workers in the aerospace field are union members. They are represented by several unions including the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; and the International Union of Electrical, Radio and Machine Workers. Some craft workers, guards, and truckdrivers are members of unions that represent their specific occupational groups.

Sources of Additional Information

Additional information about careers in the aerospace field is available from:

National Aeronautics and Space Administration, Washington, D.C. 20546.

Electronics Industries Association, 2001 Eye St. NW., Washington, D.C. 20006.

For specific information about an occupation, or apprenticeships contact:

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, AFL-CIO, 1126 16th St. NW., Washington, D.C. 20036.

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OCCUPATIONS IN THE ALUMINUM INDUSTRY

Aluminum was once considered a specialty metal having limited applications. Today it is produced in quantities second only to iron and steel. 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 1976, the industry produced about 12.9 billion pounds of primary aluminum, or about twice the output of only 10 years earlier.

This statement describes occupations in plants that produce ingots (bars) 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 93,000 persons worked in the aluminum industry in 1976. 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 by using electricity to create chemical changes that separate pure aluminum from other materials. Alumina—a fine, white powder processed from bauxite ore—is placed in large containers called "pots" that are filled with a special liquid. Suspended in the liquid are poles (anodes); 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; 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. 512.885) 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 *tapper* (D.O.T. 514.884) and *tapper helper* (D.O.T. 514.887) signal the *hot-metal crane operator* (D.O.T. 921.883 place the overhead crane near the pot. Using automatic equipment, they break a hole in the crust of waste materials that forms on the top of the liquid. One end of a curved, cast iron tube is inserted into the pot; the other end is placed into a crucible and 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. 502.887) weigh and sample 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. 512.885) adds portions of aluminum scrap, other molten metal, or chemicals that will produce metal with the desired properties. Finally, hand skimmers remove waste products that have been forced to the surface of the molten metal.

The metal is then transferred to the second or holding compartment of the furnace until a sufficient supply is obtained for pouring. The *d.c. casting operator* (D.O.T. 514.782) has charge of the pouring station

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where the molten metal is cast into ingots—large blocks of metal. The operator controls the cooling conditions of the casting unit by keeping the molds full of metal and spraying water against the molds to produce ingots of uniform size and quality.

After a pot has been operating for a number of months, the heat and chemical reactions make holes in the pot's lining so that the liquid metal contacts the steel container. When this happens, the pot is shut down and the liquid drained so that *pot liners* (D.O.T. 519.884) can make repairs. Depending on the condition of the pots liners may patch holes in the lining or may completely remove and 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 desired, several methods may be used to shape the ingot. Aluminum products such as plate, sheet, and strip are produced by rolling.

The first step in rolling is to remove surface impurities from the ingot. The *scalper operator* (D.O.T. 605.782) manipulates levers of a scalper machine and cuts thin layers of the rough metal from the ingots so that the surfaces are smooth. Then, the ingots are heated to proper working temperatures for rolling. Workers operating overhead cranes lower the ingots into furnaces, or "soaking pits," where they are kept sealed for 12 to 18 hours. *Soaking pit operators* (D.O.T. 613.782) manage the furnace and control the temperature and heating time.

After being heated, the huge ingots are positioned on the "breakdown" or hot rolling mill where they are converted into elongated slabs. *Rolling mill operators* (D.O.T. 613.782) 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. 613.885) 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. 504.782) occasionally heats (anneals) the metal.

To relieve internal stress created during the rolling process or surface contours the metal may be stretched. *Stretcher-level-operators* (D.O.T. 619.782) and *stretcher-level-operator helpers* (D.O.T. 619.886) position the finished plate or sheet in clamps, determine the stretch required to remove surface contours, 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.

In the 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. 614.782) operate machines that pull the cold wire through a series of holes (dies) 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 (bars) inside a cylinder in a powerful press. A hydraulic ram that usually has a force of several million pounds pushes the metal through a hole (die) at the other end of the cylinder. The metal takes the shape of the die and then 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. 614.782) 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 alumi-



Aluminum ingot is removed from vertical casting unit.

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num comes out of the mold, it moves onto a conveyor belt where it is cut to the desired lengths.

During both the production and the shaping process, workers and machines inspect the metal to assure quality. *Radiographers* (D.O.T. 199.381) operate various types of X-ray equipment to inspect the metal. Computers monitor operations and automatically adjust metal temperature and mill speed.

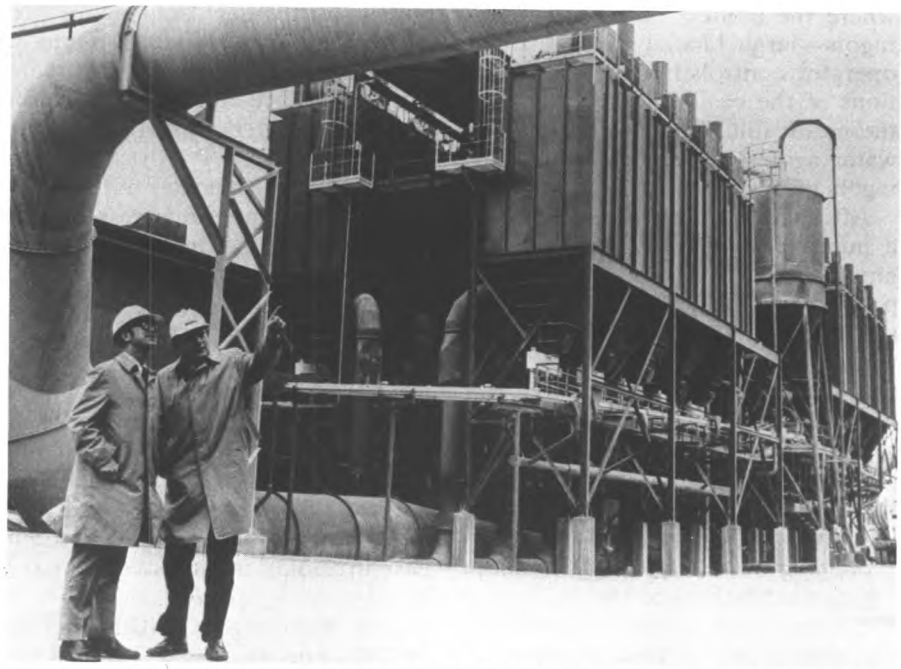
Other production workers in the aluminum industry keep machines and equipment operating properly. Some move materials, supplies, and finished products throughout the plants; still others are in service occupations such as guard and custodian.

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 dies used in aluminum metalworking operations; 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 one employee in ten is a professional or technical worker; about the same proportion are clerks. The few 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.



Engineers examine air pollution abatement equipment installed in an aluminum plant.

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 that are required to make or repair production machinery.

A wide range of other profesional and administrative workers is needed in the manufacture of aluminum. Top executives manage the companies and determine policy. Middle managers and superintendents direct individual departments, offices, and production operations. The industry also employs other adminstrative personnel, as well 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.

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 positon in a shop or department.

Production workers, such as pot tenders or liners, receive their training on the job. Under the guidance of experienced workers, these employees 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

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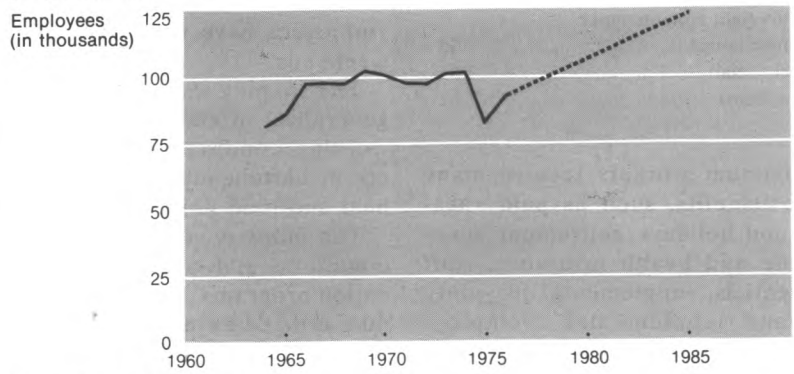
include classroom or home study courses, as well as on-the-job training. Generally, candidates for these programs are chosen from promising young workers already employed by the company. The length of the apprenticeship varies according to the craft, although most require 3 to 4 years. Examples of crafts that can be learned through apprenticeship are: Electrician, welder, brickmason, carpenter, machinist, maintenance mechanic, pipefitter, and general maintenance mechanic.

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 who have an engineering or science background and have been promoted to these jobs. Some new graduates who have 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.

Although long-term employment growth is expected in the aluminum industry, the number of job openings each year will fluctuate with economic conditions

Wage and salary workers in aluminum industry, 1964-76, and projected 1985



Source: Bureau of Labor Statistics

Employment Outlook

Employment in the aluminum industry is expected to grow about as fast as the average for all industries through the mid-1980's. In addition to openings created by growth of the industry, many 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 population increases and aluminum is substituted for other materials. Industries that represent major markets for aluminum are growing industries with potential for new product development. For example, aluminum studs are replacing wood studs in the construction of large buildings and for residential construction and remodeling. With the growing emphasis on fuel economy, car and truck manufacturers are expected to use more aluminum in the future to reduce the weight of vehicles.

Employment, however, will grow more slowly than the demand for aluminum. Furthermore, the aluminum industry supports a strong research and development program and an aggressive marketing program which should continue to develop new alloys, processes, and products. As a result, the number of engineers, scientists, and technical personnel is expected to increase as a proportion of total employment. Technological developments, such as continuous casting and computer-controlled rolling operations, will limit employment growth among some production occupations.

Earnings and Working Conditions

Hourly earnings of plantworkers in the aluminum industry are higher than the average for manufacturing industries. In 1976, production workers in plants which make aluminum averaged $7.29 an hour, and those in aluminum rolling and drawing plants averaged $6.27. In comparison, production workers in manufacturing industries as a whole averaged $5.19 an hour.

Skilled operators and skilled maintenance and craft workers hold the highest paying plant jobs. Hourly rates in 1976 for selected occupations in a number of plants covered by one major union-management contract are shown below.

Occupation	*Hourly wage rate*
Making Aluminum:	
Anode rebuilder	$7.09
Pot liner	6.57
Pot tender	6.74
Head tapper	7.00
Charge weigher	6.30
Shaping Aluminum:	
Scalper operator	6.74
Soaking pit operator	6.48
Hot mill operator, junior	7.35
Continuous mill operator	7.61
Annealer	6.30
Stretcher and flattener operator	6.39
Inspector	6.57
Extrusion press operator	7.00

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Occupation	*Hourly wage rate*
Maintenance:	
Boiler operator	6.57
Brickmason	7.44
Welder	7.35
Pipefitter	7.35
Millwright (maintenance mechanic)	7.35
Electrician	7.61
Machinist	7.61

Aluminum workers receive many fringe benefits, such as paid vacations and holidays, retirement benefits, life and health insurance, shift differentials, supplemental jury-duty pay, 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 week's pay every 5 years.

Making aluminum requires high temperatures and some potrooms may be hot, dusty, and smoky. However, working conditions in plants have been improved as a result of control programs and other projects. Because making aluminum is a continuous process, some production employees have to work nights and weekends.

The shaping sector of the industry generally offers more 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 the rate for aluminum rolling and drawing mills has been about the same as the average. However, the average number of workdays lost for each injury in the aluminum industry has been greater than the average for all metal industries.

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 greatest number of 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 aluminum production and uses, as well as careers in the industry, many be obtained from:

The Aluminum Association, 750 Third Ave., New York, N.Y. 10017.

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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 and drapes and other products made from cloth such as tents and parachutes. To do all this, the industry employs about 1.3 million people—nearly 4 out of 5 make clothes.

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 an inexpensive supply of workers. New York City was then the undisputed apparel manufacturing capital of the country.

Today, New York City is no longer the Nation's dominant apparel center, although it is still important—almost 1 out of every 5 employees in the industry works in or around New York City. However, many firms have moved to the South so as to lower their taxes and labor costs. As a result, about 25 percent of the industry's employees work in North Carolina, Georgia, Texas, Tennessee, South Carolina, and Alabama. Other firms have moved to large cities such as Los Angeles, Chicago, Boston, St. Louis, and Dallas, where large clothing markets exist.

More than half 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.

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 pattern making, 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 cocktail 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* (D.O.T. 142.081), who creates new types and styles of apparel. Inspiration for a new design may come from any of a variety of experiences—traveling, observing life styles, and 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 pattern making, 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. 785.381) use this experimental dress as a guide in cutting and sewing fabrics to make a finished sample of the dress. After management has approved the sample, a *pattern maker* (D.O.T. 781.381) constructs a master pattern. Working closely with the designer, the pattern maker translates the sketch or sample dress into paper or fiberboard pieces, each one representing a part of the garment. A *pattern grader* (D.O.T. 781.381) 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.

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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.

Hand spreaders (D.O.T. 781.887) lay out bolts of cloth into exact lengths on the cutting table. *Machine spreaders* (D.O.T. 781.884) are aided by machines in laying the cloth evenly across the table.

Markers (D.O.T. 781.484) 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.

Following the pattern's outline on the cloth, a *cutter* (D.O.T. 781.884) 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.

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), 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.

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 moderate-priced clothing, sewing machine operators constitute the great majority of workers in this area.



Markers arrange pattern pieces to get the greatest number of garments from the smallest quantity of cloth.

Using industrial machines that are heavier and run faster than the ones found in the home, *sewing machine operators* (D.O.T. 787.782) 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 blindstitch 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. 782.884) use needle and thread to perform various operations ranging from simple sewing to complex



Sewing machine operators use machines that are heavier and run faster than the ones found in the home.

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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 operator* places the garment part on a 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. 929.887) who move garment bundles from one sewing operation to another.

At various stages of the sewing operations, *inspectors* and *checkers* (D.O.T. 789.687) examine garments. They mark defects, such as skipped stitches or bad seams, which the inspectors sometimes repair before the garments are passed on to the next sewing operation. *Hand trimmers* (D.O.T. 781.887), often called thread trimmers and cleaners, remove loose threads, basting stitches, and lint from garments.

Tailoring Occupations. *Tailors* (D.O.T. 785.261 and .381) and *dressmakers* (D.O.T. 785.361) 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. 785.281) 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. 363.782, .884, and .885), 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. 783.781), 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. 787.782) sew these pelts together to make garment sections. A *fur nailer* (D.O.T. 783.884), 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) 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 programmers and operators, and systems analysts. Sales workers, 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*.

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 pattern maker, cutter, and tailor. Some employees take courses in pattern making, 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

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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 pattern makers pick up the skills of the trade by working for several years as helpers to experienced pattern makers. Cutters and pattern graders occasionally are promoted to pattern making. Pattern makers 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, pattern making, 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 sample making, pattern making, 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

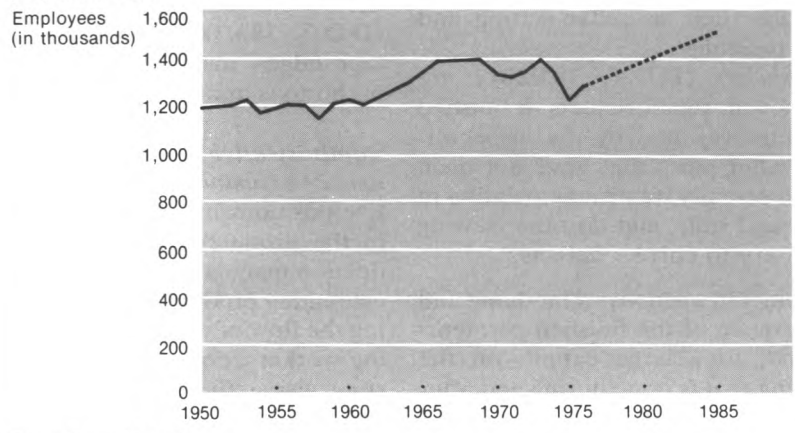
Apparel industry employment is expected to grow about as fast as the average for all industries through the mid-1980's. Most job openings will arise from the need to replace experienced workers who retire, die, or transfer to other fields of work. The number of openings may fluctuate greatly from year to year, as the demand for apparel is highly sensitive to changes in the economy.

Demand for apparel is expected to increase over the long run as population and incomes continue to grow. The industry's greater emphasis on styling also may stimulate demand. Employment in the industry, however, 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 pattern making, 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, particularly in clothing. For these and other reasons,

The number of jobs in the apparel industry fluctuates with the economy

Wage and salary workers in the apparel industry, 1950-76 and projected 1985



Source: Bureau of Labor Statistics

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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 high skilled craft workers such as pattern makers, 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.

Earnings and Working Conditions

Earnings in the apparel industry are relatively low. In 1976, production workers in apparel averaged $3.41 an hour, compared with $4.87 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 $3.03 in plants that made hats, caps, and millinery to $4.18 in those that made men's and boys' suits and coats. Earnings of apparel workers also varied by occupation and geographic area. Table 1 gives estimated average hourly earnings in 1976 for selected occupations and areas 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.

Table 1. Average hourly earnings of production workers in the men's and boys' suits and coats industry, selected occupations and areas, 1976

Men's and boys' suits and coats	Estimated average hourly earnings		
	New York, N.Y.—N.J. metropolitan area	Baltimore	Philadelphia
All production workers	$4.51	$4.23	$4.47
Cutters and markers	6.95	5.06	6.39
Finishers, hand, coat fabrication	3.81	3.88	3.89
Pressers, finish, machine, coat fabrication	4.99	5.20	5.98
Sewing machine operators, coat fabrication	4.60	4.12	4.47
Sewing machine operators, trouser fabrication	4.50	3.69	3.95

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.

While many plants are housed in old buildings, others are located in modern buildings that have ample work space, 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.

Working conditions 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, pattern making, and cutting jobs are more interesting and less monotonous than most other apparel jobs.

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 office of State employment service. 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 information on schools that offer degrees in apparel management, engineering technology for apparel, design, and related professional and vocational fields, write to:

American Apparel Manufacturers Association, Suite 800, 1611 N. Kent St., Arlington, Va. 22209.

Amalgamated Clothing and Textile Workers' Union, 15 Union Square, 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.

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OCCUPATIONS IN THE BAKING INDUSTRY

The baking industry—one of the Nation's largest food-processing employers—provides steady, year-round employment for thousands of workers throughout the country. Jobs exist to suit a wide variety of interests, skills, and talents. Bakery workers make, wrap, pack, sell, and deliver products. Mechanics maintain and repair plant machinery and service delivery trucks. Managers and sales specialists direct operations and clerical workers perform regular office duties.

Nature and Location of the Industry

About 240,000 persons worked in the Nation's 3,500 industrial bakeries in 1976. More than 4 out of 5 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 workers. They do the baking, handle raw materials, maintain equipment, wrap and pack products, and keep the bakeries clean. Nearly 1 out of 4 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. The remaining 20 percent of the work force are in administrative, professional, technical, and clerical jobs.

Production Occupations. Although not all baked goods are made in exactly the same way, most bakery production jobs are similar. 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 primary product of the industry, 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. *Mixers* (D.O.T. 520.885) load blending machines with the exact amounts of flour, water, and yeast needed for the bread. Using instruments, they carefully control the temperature, timing, and mixing speed of the machines to insure a uniform, well-blended dough. The mixed dough is dropped into a trough and pushed 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.

Divider machine operators (D.O.T. 520.885) run machines that divide, round, proof, and shape dough into loaf-size balls. A conveyor carries these balls of dough to *dough molders* or *molding machine operators* (D.O.T. 520.885) who 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. 520.884) 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. 526.885) load



Divider machine operator runs machine that divides and shapes dough into loaves.

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Oven tender loading pans of dough into oven.

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, *all-round bakers* (D.O.T. 526.781) assisted by helpers, usually handle all the steps needed to turn out finished baked products. In large bakeries, all-round 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 *helpers* (D.O.T. 526.886) are employed in baking operations to grease pans, remove bread from pans, push troughs and racks, and wash pans. They may assist all-round bakers and other workers. They have job titles such as doughmixer helper, and oven tender helper.

After baked goods are cooled, several types of workers prepare them for delivery to customers. *Slicing-and-wrapping machine operators* (D.O.T. 521.885) feed loaves of bread onto conveyors leading to the machines, watch the slicing and wrapping operations, adjust the machines, and keep them supplied with bags and labels. A conveyor then 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. 520.885) 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. 524.884) 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. 524.885).

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.

Route drivers (D.O.T. 292.358) 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 more products are major parts of their job. 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 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.

Chain grocery store bakeries and multioutlet retail bakeries employ truckdrivers 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

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owners of small bakeries coordinate all 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 discussion of the duties, training, and employment outlook for maintenance, sales, driving, administrative, clerical, and technical personnel appear elsewhere in the *Handbook*.)

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 and wrapping machine operators can learn their job in a few days, but skilled workers, such as all-round 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 all-round bakers begin as baker's helpers. They learn more advanced baking skills while working alongside experienced bakers, and may be selected to enter an apprenticeship program. Employers usually require an apprentice to be at least 18 years old and have a high school or vocational school diploma. Apprenticeship programs last 3 or 4 years, and include on-the-job training in all baking operations and classroom instruction in related subjects.

Some workers take courses in vocational school or learn baking in the Armed Forces. Such training may not qualify a person as a skilled baker, but it may help in getting a job as an apprentice or shorten the apprenticeship training period.

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. All-round 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. Good health also is important because of the high temperature in bakeries.

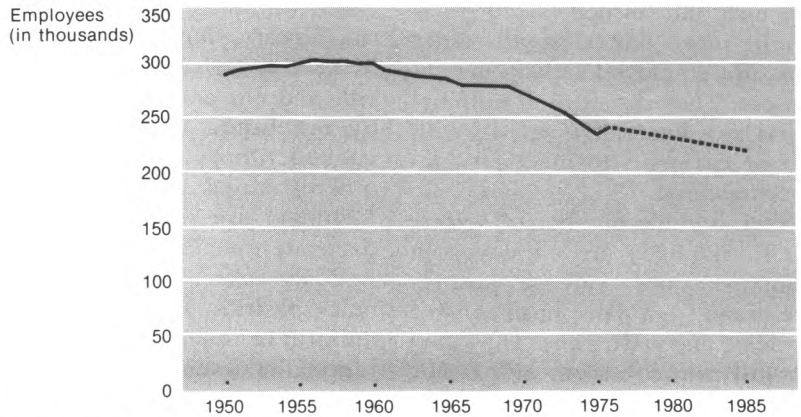
Some bakeries have apprenticeship programs for maintenance workers such as machinists, electricians, and mechanics. Others train maintenance workers informally on the job. Some bakeries hire only maintenance workers who are already skilled.

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 sometimes 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.

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. In recent years, large baking firms have required 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 diplo-

Technological innovations enable bakeries to meet increased demand with fewer employees

Wage and salary workers in the baking industry, 1950-76 and projected 1985



Source: Bureau of Labor Statistics

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ma 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 mid-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.

Population growth will increase the demand for bakery products. However, laborsaving technological innovations will enable many bakeries, particularly large industrial ones, to 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. In addition, some bakeries can prepare a week's baked goods at one time and store them in the freezer until needed.

Earnings and Working Conditions

In 1976, earnings of production workers in the baking industry averaged $202.27 a week, or $5.16 an hour, which is 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 1976 were as follows:

Baking supervisors	$5.84–7.49
All-round bakers and mixers	4.81–7.04
Molders and dividers and molding and dividing machine operators	4.62–7.04
Oven tenders	4.81–7.04
Baker's helpers	4.44–6.95
Wrapping machine operators	4.81–6.29

Some plant employees work night shifts and weekends because many bakeries operate around the clock. Some bakeries are eliminating the night shift since baked goods can be frozen and stored until needed. 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, route drivers for wholesale bakeries had minimum weekly salaries of from $123 to $283 in 1976. By selling more baked products to more customers, route drivers can increase their earnings. Companies generally pay for uniforms and their maintenance.

Working conditions in bakeries are generally good. However, many jobs involve some strenuous physical work, despite the considerable mechanization of baking processes. Work near ovens can be uncomfortably hot.

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 Confectionary Workers' International Union of America, and route drivers and truck drivers 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.

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.

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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 full and 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 6f existing produt s. 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).

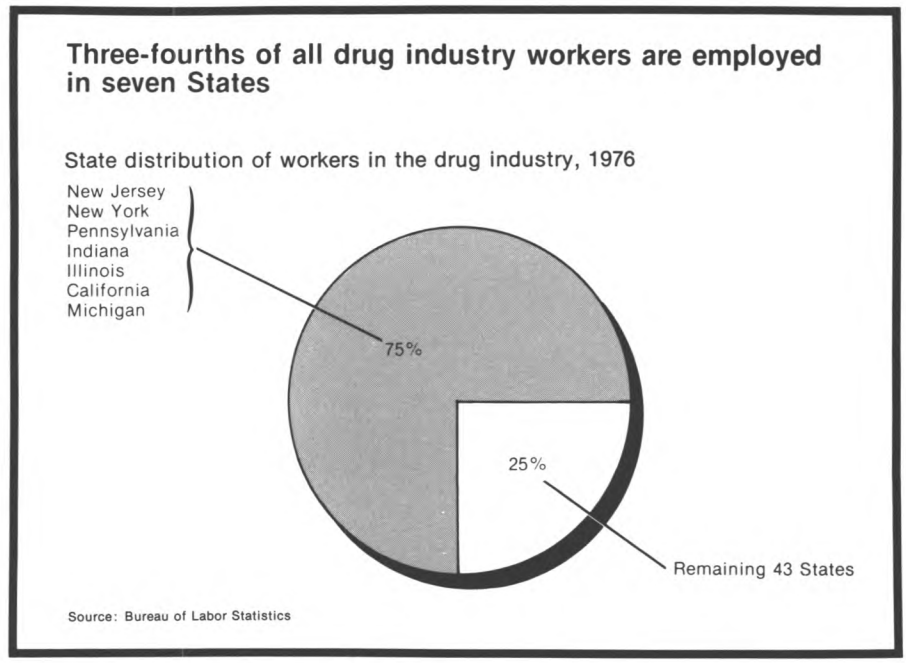
Drug firms also are involved in research and the development of other types of products and chemicals. Closely related to drugs as important adjuncts to modern medical care are medical devices and diagnostic products. Many pharmaceutical as well as other manufacturers in the past few years have entered the fast growing production of radiological equipment, radio-pharmaceuticals, heart pacemakers, dialysis machines, and numerous other products. These are used to diagnose disease on one hand or, like drugs, help alleviate symptoms and restore health and well-being. Many firms also are involved in the agricultural chemical market. Many of the same types 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 1976, about 165,000 persons worked in the drug industry. Over 130,000 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 large numbers of 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, Pennsylvania, Indiana, Illinois, California,



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and Michigan. Large drug manufacturing installations are located in Indianapolis, Ind.; Chicago, Ill.; Nutley and Rahway, N.J.; Philadelphia, Pa.; 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 sa-



About 1 out of every 6 employees in the drug industry is a scientist, engineer, or technician.

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 6r 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 one of every six 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.

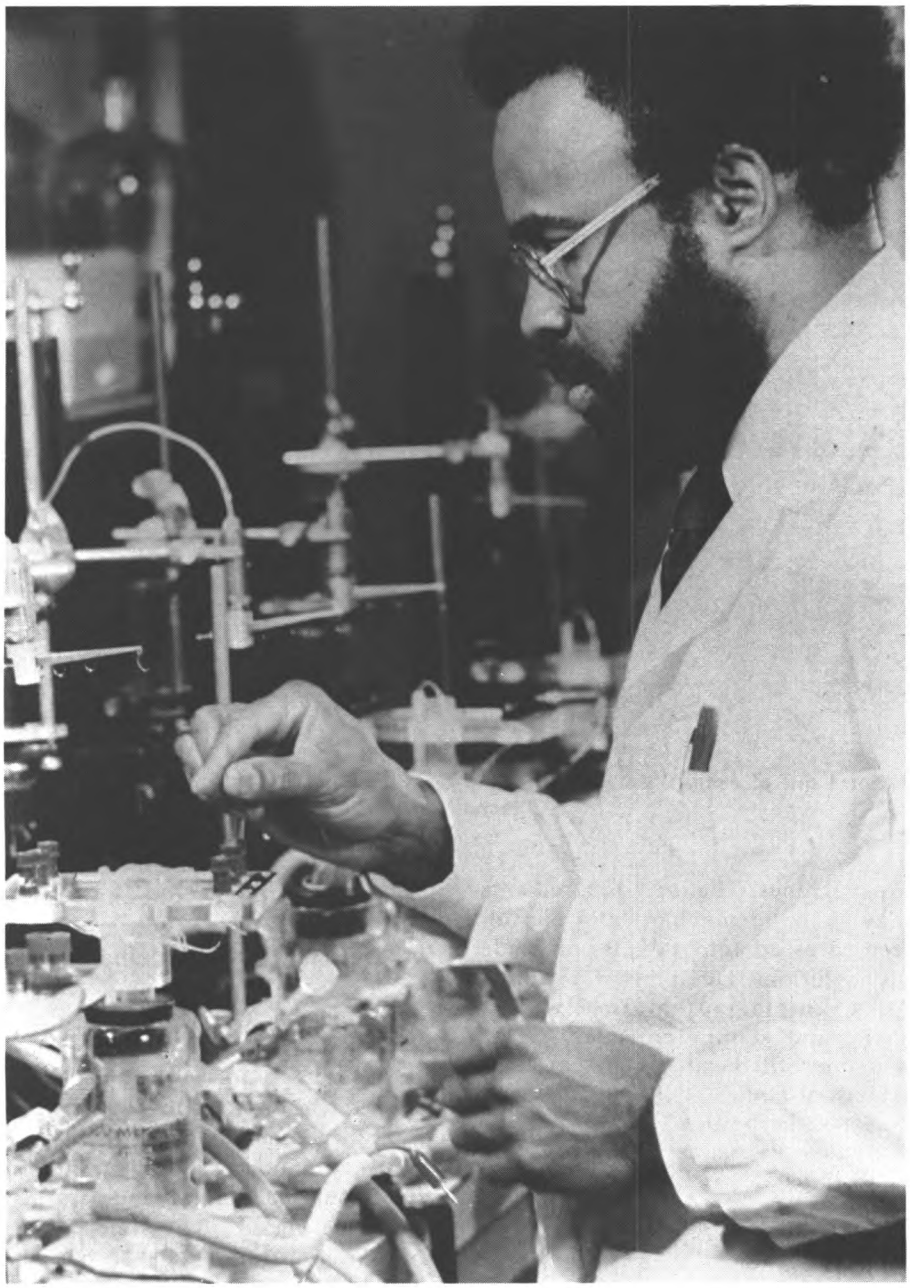
A drug may undergo hundreds of complex, time-consuming quality control checks at various stages during the manufacturing process to insure that it conforms to spe ifications. Although some inspection operations are mechanized, many are performed manually.

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 half are in white-collar jobs (scientific, technical, administrative, clerical, and sales), a much higher proportion than in most other manufacturing industries; the other half are in plant jobs (processing or production,

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Biologist conducts tests that monitor the effect of different compounds on heart muscle.

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 one out of every six employees in the industry is a scientist, engineer, or technician—a far greater proportion than in most other industries. The majority do research to develop new drug products. Others work to streamline production methods and improve environmental and quality control.

Chemists (D.O.T. 022.081) 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.

Several thousand *biological scientists* (D.O.T. 041.081, .181) work in the drug industry. Biologists and bacteriologists study the effect of chemical agents on infected animals. Microbiologists grow strains of microorganisms which 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 the 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. 008.081) design equipment and devise manufacturing processes. *Industrial engineers* (D.O.T. 012.081, .168, .187, .188, and .281) plan equipment layout and workflow to maintain efficient use of plant facilities. *Mechanical engineers* (D.O.T. 007.081, .151, .181, and .187) coor-

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dinate the installation and maintenance of sterilizing, heating, cooling, humidifying, and ventilating equipment.

Technicians (D.O.T. 073.381, 078.128, .168, .281, .381, and .687) represent about one-third of the drug industry's scientific and technical workers. 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 (the study of viruses), and cytology (analysis of cells).

Administrative, Clerical, and Related Occupations. About 1 out of every 3 workers in drug manufacturing is in an administrative, clerical, or other office 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. 266.158), 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. Nearly half 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. 559.782) control machines that produce tablets, capsules, ointments, and medicinal solutions. *Granulator machine operators* (D.O.T. 559.782) tend milling and grinding machines that reduce mixtures to particles of designated sizes. *Compounders* (D.O.T. 550.885) tend tanks and kettles in which solutions are mixed and compounded to make up creams, ointments, liquid medications, and powders. *Compressors* (D.O.T. 556.782) operate machines that compress ingredients into tablets. *Pill and tablet coaters* (D.O.T. 554.782), 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. 559.687) inspect tablets for hardness, chippage, and weight to assure conformity with specifications.

Ampoule fillers (D.O.T. 559.885) 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.

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.

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For technicians in the drug industry, methods of qualifying for jobs vary in many ways. 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.

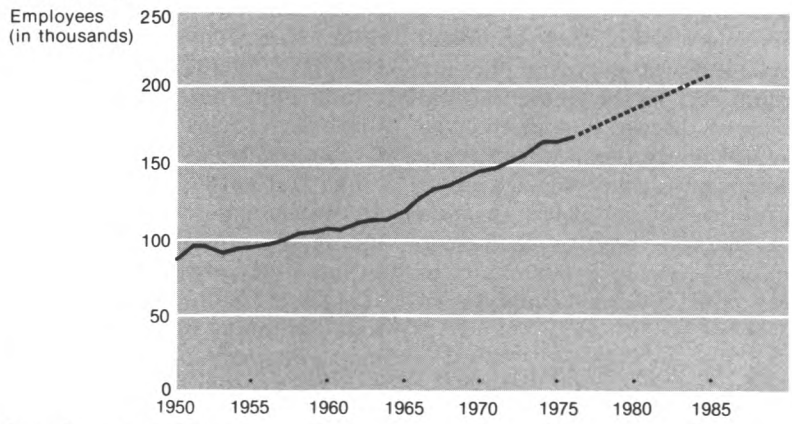
The experience required for higher levels of technician jobs varies from company to company. Generally, employees advance over a number of years from assistant technician, to technician, to senior technician, to technical associate. Some companies require senior technicians and technical associates to 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.

Drug industry employment has shown fairly steady growth

Wage and salary workers in the drug industry, 1950-76 and projected 1985



Source: Bureau of Labor Statistics

Employment Outlook

Drug manufacturing employment is expected to grow about as fast as the average for all industries through the mid-1980's. In addition to employment growth, many job openings will result from deaths, retirements, and other separations from the labor force.

The demand for drug products is expected to grow very rapidly. 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 that are 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 with mounting health care requirements, 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. Increas-

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ingly restrictive government regulations have reduced the rate of return on investment in research and development, and, as a result, drug manufacturers are expected to limit future expansion in this area. 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. For example, in 1976, production workers in the drug industry averaged $5.50 an hour, while those in manufacturing as a whole averaged $5.19 an hour.

According to a 1973 Bureau of Labor Statistics Survey, earnings of office employees in the drug manufacturing industry were 68 percent 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.

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 6f 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 has been about half the average for all manufacturing industries.

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 United Steel Workers 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.

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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. We would never have reached the moon without the thousands of people working in electronics research and production. Nor would doctors be able to diagnose and treat many diseases without modern electronic machines. Mechanics use electronic testing equipment to locate malfunctioning parts in numerous types of machines and engines. Business executives also owe a lot to electronics. Electronic computers, for example, provide them with better and more information, speed up payroll and building 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 widely different 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 1.4 million persons were employed in the development, pro-



Most electronics products are assembled by hand with small tools, soldering irons, and light welding machines.

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duction, and sales of these products in 1976. Nearly three-quarters of them worked in plants that produce 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 the jobs in 1976 were in eight States: California, New York, Illinois, Massachusetts, Pennsylvania, Indiana, New Jersey, 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

A wide variety of jobs exists in the electronics manufacturing industry. 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 one out of every nine 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, especially in 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 of engineers in the industry, work on research and development, production, and quality control problems. Most of these engineers are highly specialized and may work in a specific area such as 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 assist engineers by making calculations, sketches, and drawings, and testing 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.

Administrative, Clerical, and Related Occupations. About one out of four 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. 729.884, 720.884, 726.781 and .884). Assemblers, most of whom are semiskilled workers, make up the largest group of employees. Most end products are assembled by hand with small tools, 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. Color slide projectors flash a picture of an assembly sequence on a screen, while the as-

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About half of electronics manufacturing employees work in plant occupations.

sembler 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. Most components are put together by machines, since their assembly involves simple and repetitive operations. Even some types of miniaturized semiconductors and other components, made with parts small enough to pass through a needle's eye, are assembled by machines.

Hand assembly is needed for some items, such as receiving tubes and some types of resistors and diodes. Hand assemblers may perform only a single operation as components move down the production line, but some put together complete components. Tiny parts often 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. 674.782) make tubes for experimentation and development work.

In electron tube manufacturing, special fabricating workers are employed. For example, *grid lathe operators* (D.O.T. 725.884) 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. 724.781 and .884), *crystal grinders* and *finishers* (D.O.T. 726.884), and *punch press operators* (D.O.T. 617.885).

Processing Occupations. Many electronics workers process or prepare parts for assembly. *Electroplaters* and *tinners* (D.O.T. 501.885) coat parts with metal; *anodizers* (D.O.T. 501.782) 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. 726.887) print patterns on circuit boards and on parts of electronic components. *Etching equipment operators* (D.O.T. 590.885) do chemical etching of copper on circuit boards.

Operators of infrared ovens and hydrogen furnaces (D.O.T. 590.885) remove moisture and foreign deposits from ceramic, metal, and glass parts. In tube manufacturing, *exhaust operators* (D.O.T. 725.884) and *sealers* (D.O.T. 692.885) 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,

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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. 722.281) 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 janitors.

(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.)

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 jobs such as tester or laboratory assistant. A relatively small number of plantworkers 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 diemakers, 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 with 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 mid-1980's, employment in other areas either will grow more slowly or possibly decline. In addition to the jobs resulting from em-

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ployment growth, large numbers of openings will arise in all areas as experienced workers retire, die, or take jobs in other industries.

Production of industrial electronic products will increase as business executives buy more computers and other electronic equipment to automate paper work and production processes. Business spending for electronic communication and testing equipment also will grow. Although the demand for television receivers, 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. As a result, employment in this industry may decline. 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.

The rates of 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 and Working Conditions

As shown in the accompanying table, in 1976 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.

Type of product	*Production workers' average hourly earnings, 1976*
All manufacturing industries	$5.19
Major electronics manufacturing industries:	
Government and industrial electronics end products	6.45
Radio and television receiving sets, and phonographs	4.51
Electron tubes	5.22
Semiconductors and other components, except tubes	3.97

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.

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.

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OCCUPATIONS IN FOUNDRIES

Metal castings produced by foundry workers are essential parts of thousands of products ranging from missiles to cooking utensils. 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 1976, about 300,000 people worked in the foundry industry producing bath tubs, tubing, plumbing fixtures, 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 exactly shaped 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, 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 is packed 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.

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.

Shell molding, a fourth process, is becoming increasingly 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 that, once hardened, 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.

A sixth method, centrifugal casting, is used to make pipe and other products that have cylindrical cav-



Supervisor inspects cores.

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ities. 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 mechanized, they also employ proportionately fewer skilled molders and coremakers than small shops. However, many skilled maintenance workers, such as millwrights and electricians, are employed to service and repair the large amount of machinery.

Though foundries are located in many areas, jobs are concentrated in States that have considerable metalworking activity, such as in Michigan, Ohio, Pennsylvania, Illinois, Indiana, and Wisconsin.



Employees placing cores into molds.

Foundry Occupations

Most of the industry's 300,000 employees in 1976 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 the casting is designed, a *patternmaker* (D.O.T. 600.280 and 661.281), following the design blueprint, makes a wood or metal pattern in the shape of the casting. Next, a *hand molder* (D.O.T. 518.381) makes sand molds by packing and ramming sand, specially prepared by a *sand mixer* (D.O.T. 579.782), around the pattern. A *molder's helper* (D.O.T. 519.887) may assist in these operations. If large numbers of identical castings are to be made, 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. 518.782).

A *coremaker* (D.O.T. 518.381 and .885) shapes sand into cores (bodies of sand that make hollow spaces in castings). *Core-oven tenders* (D.O.T. 518.885) 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 placed in the molds by *core setters* (D.O.T. 518.884) or molders. Now the molds are ready for the molten metal.

A *furnace operator* (D.O.T. 512.782) controls the furnace that melts the metal which a *pourer* (D.O.T. 514.884) lets flow into molds. When the castings have solidified, a *shakeout worker* (D.O.T. 519.887) removes them from the sand and sends them to the cleaning and finishing department.

Dirty and rough surfaces of castings are cleaned and smoothed. A *shotblaster* (D.O.T. 503.887) operates a machine that cleans large castings by blasting them with air mixed with 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. 599.885). Sandblasters and tumbler operators may also operate a machine that both tumbles and blasts the castings. A *chipper* (D.O.T. 809.884) and a *grinder* (D.O.T. 809.884) use pneumatic chisels, power abrasive wheels,

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Grinders finishing castings.

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. 504.782), operates these furnaces. Before the castings are packed for shipment, a *casting inspector* (D.O.T. 514.687) checks them to make sure they are structurally sound and meet specifications. Often, the inspection involves X-raying the casting to check for 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 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*.

Training, Other Qualifications, and Advancement

Most 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, hand coremakers, and patternmakers—learn their jobs through formal apprenticeship. Apprentices receive supervised on-the-job training for 2 to 4 years, usually supplemented by classroom instruction. High school graduates are preferred for most apprenticeship programs, but applicants with less education sometimes are hired. For some apprenticeship programs, especially those for patternmaking, a high school education is the minimum requirement. Management prefers workers who have completed an apprenticeship, because they 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 Foundry Society Cast Metals Institute conduct training programs to update and upgrade the skills of experienced workers.

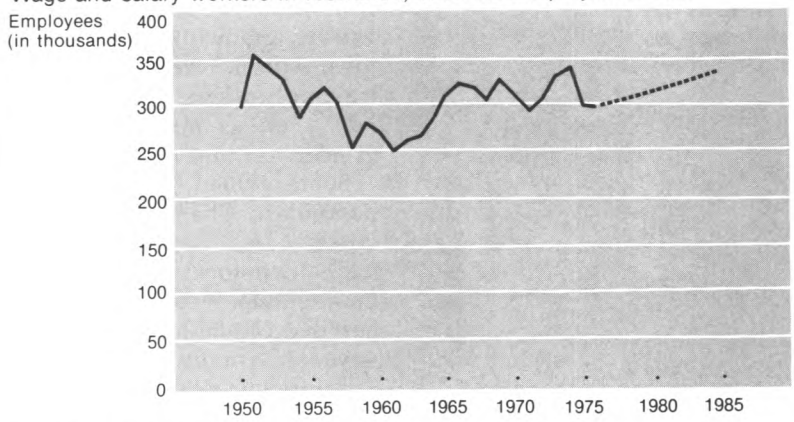
Employment Outlook

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 only about as fast as the average for all industries through the mid-1980's. Technologi-

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Employment in foundries is very sensitive to year-to-year fluctuations in the business cycle

Wage and salary workers in foundries, 1950-76 and projected 1985



Source: Bureau of Labor Statistics

cal developments will enable foundries to meet the increased demand for castings with only a moderate 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 greatly from year to year, since demand for castings is very sensitive to ups and downs in the economy.

Much 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 the industry's growing amount of machinery in working order. 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 and Working Conditions

Production workers in foundries have higher average earnings than those in manufacturing as a whole. In 1976, production workers in iron and steel foundries averaged $6.16 an hour, and those in nonferrous foundries averaged $5.22. By comparison, production workers in all manufacturing industries averaged $5.19 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 shift work and 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.

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 promoting safety training.

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, Golf and Wolf Rds., Des Plaines, Ill. 60016.

Foundry Educational Foundation, 1138 Terminal Tower, Cleveland, Ohio 44113.

International Molders' and Allied Workers' Union, 1225 E. McMillan St., Cincinnati, Ohio 45206.

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OCCUPATIONS IN THE INDUSTRIAL CHEMICAL INDUSTRY

Industrial chemical products are the raw materials for all kinds of everyday items, from nylon stockings to automobile tires. Chemicals also are used to treat drinking water, to propel rockets, and to make steel, glass, explosives, and thousands of other items. The discovery of nylon, plastics, and other new products has helped the industrial chemical industry become one of the Nation's most important.

Making these many, very different kinds of products requires a large number of workers with many different skills. About 540,000 people in many different occupations worked in the industrial chemical industry in 1976. Training varies from a few days on the job for some plantworkers to college degrees for engineers and chemists.

Nature 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, limestone, 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 are moved automatically from one part of the plant to another by conveyors or through pipes. Through the use of such automated equipment, a relatively small number of workers can 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. Over half of the industry's employees, however, are concentrated in large plants with more than 500 workers.

Chemical plants are usually close to manufacturing centers or near the sources of raw material. Many plants that produce chemicals from petroleum, for example, are near the oil fields of Texas and Louisiana. Although industrial chemical workers are employed in almost every State, about half of them work in Tennessee, New Jersey, Texas, Virginia, West Virginia, Ohio, and South Carolina.

Occupations in the Industry

Workers with many different skills and levels of education work in the industrial chemical industry. Research 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; 1 out of 5 of its employees is a scientist, engineer, or technician. An even larger number are administrators or production supervisors. Because the sale of chemical products frequently requires a technical background, scientists and engineers may take jobs as sales representatives.

Chemists are the largest and one of the most important group of scientists in the industry. Through basic and applied research, chemists learn about the properties of chemicals in order to find new and improved products and production methods. Their efforts have led to the discovery of plastics, nylon, and many other items.

Chemists also work in activities other than research and development. A large number supervise plantworkers or analyze and test chemical samples to insure the quality of the final product. Many are administrators, marketing experts, chemical sales workers, and technical writers.

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 and operation. Chemical engineers also fill jobs in sales, customer service, market research, plant management, and technical writing.

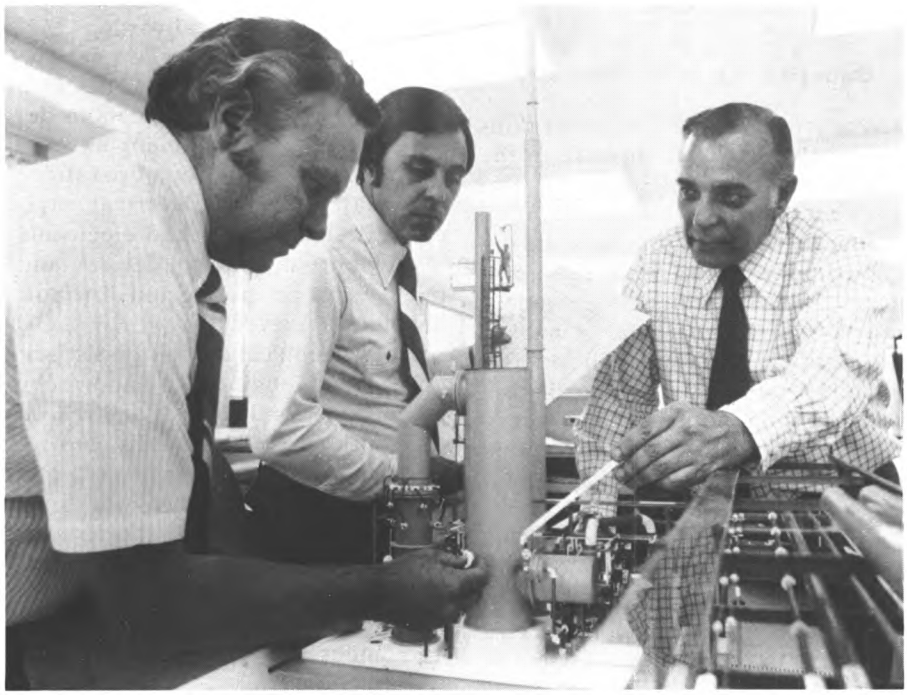
Mechanical engineers design power and heating equipment. They also work with chemical engineers to design processing equipment and supervise its installation, operation, and maintenance. Electrical engineers design electric and electronic instruments and control devices, and facilities for generating 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. Their work may range from simple routine tests to complicated analyses. Drafters provide engineers with specifications and detailed drawings of chemical equipment.

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Chemical engineer monitors process at chemical plant.



Design engineer, drafter, and model builder examine model of new chemical plant layout.

Plant Occupations. About three out of every five industrial chemical workers operate or maintain equipment or do other plant jobs.

Skilled *chemical operators* (D.O.T. 558.885 and 559.782) and their helpers are the largest group of plant workers. They set dials, valves, and other controls on automatic equipment to insure 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 some other title, 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 out of five industrial chemical workers holds an administrative, clerical, or other nonscientific white-collar job. High-level managers generally are trained in chemistry or chemical engineering. These executives decide what products to manufacture, where to build plants, and how to handle the company's finances. Executives depend on

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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.)

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 job openings occur. Thus, a worker may advance from laborer to chemical operator helper, and then to chemical operator. Skilled processing workers are rarely recruited from other plants.

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 must have at 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, and industrial relations, often advance to administrative jobs. Some companies have advanced training programs for new administrative employees. Persons with a technical background in chemistry or engineering will have the best opportunities for sales positions.

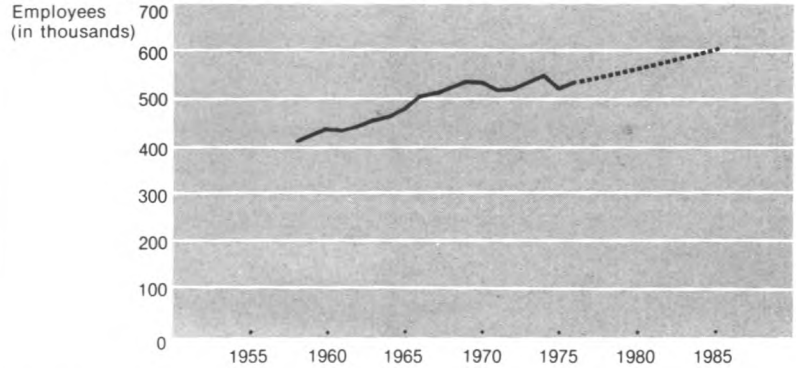
Secretaries, bookkeepers, and other clerical workers generally have had commercial courses in high school or business school.

Employment Outlook

Employment in the industrial chemical industry is expected to grow more slowly than the average for all industries through the mid-1980's. Most job openings will occur

Continued long-term growth is expected in the industrial chemical industry, despite some sensitivity to the business cycle

Wage and salary workers in the industrial chemical industry, 1958-76 and projected 1985



Source: Bureau of Labor Statistics

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from the need to replace experienced workers who retire, die, or transfer to other industries.

However, continued emphasis on research and development is expected to stimulate some 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 synthetics, not only have created new markets but also have competed successfully in markets previously dominated by woods, metals, and natural textiles. Chemical products are expected to continue to make advances in these markets. However, higher production costs may cause the growth rate in the production of industrial chemicals to slow down in the future. Firms are expected to pay more for petroleum and natural gas, which are the raw materials for many industrial chemicals. In addition, more stringent air and water quality standards are forcing chemical companies to spend more money for pollution control equipment.

Employment is expected to grow at a slower rate than production because of laborsaving technological developments and the greater use of automatic processing and control equipment. Although the composition of employment in the industry is expected to change, with more administrative and technical workers needed to handle the increasingly complex production processes, most job openings will be for production workers since they are the largest group of employees.

Earnings and Working Conditions

Production workers in the industrial chemical industry have relatively high earnings because a large proportion of them are in skilled jobs. In 1976 they averaged $6.21 an hour, compared with $4.87 an hour for production workers in all industries.

National wage data are not available for individual occupations in the industrial chemicals industry. However, specified in 1976 hourly wages in a few union-management contracts were as follows:

	Hourly rates
Instrument repairers	$4.93–5.30
Laboratory technicians	4.82–7.07
Chemical operators	4.64–6.90
Pipefitters, boilermakers, and sheet-metal workers	4.98–7.95

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, usually for extra pay. Shift assignments are usually rotated, so an individual may work days 1 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. However, the industrial chemical industry has one of the better safety records in manufacturing. Protective clothing, eyeglasses, showers, eye baths near hazardous work stations, and other safety measures help prevent serious injuries.

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.

Manufacturing Chemists' Association, Inc., 1825 Connecticut Ave. NW., Washington, D.C. 20009.

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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 540,000 persons in 1976. 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, which other rolling mills shape into steel sheets, bars, plates, strips, wire, 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 where the steel is shaped into semifinished and finished products. Following are brief descriptions of the major iron and steelmaking and finishing operations and some of the occupations connected with them.

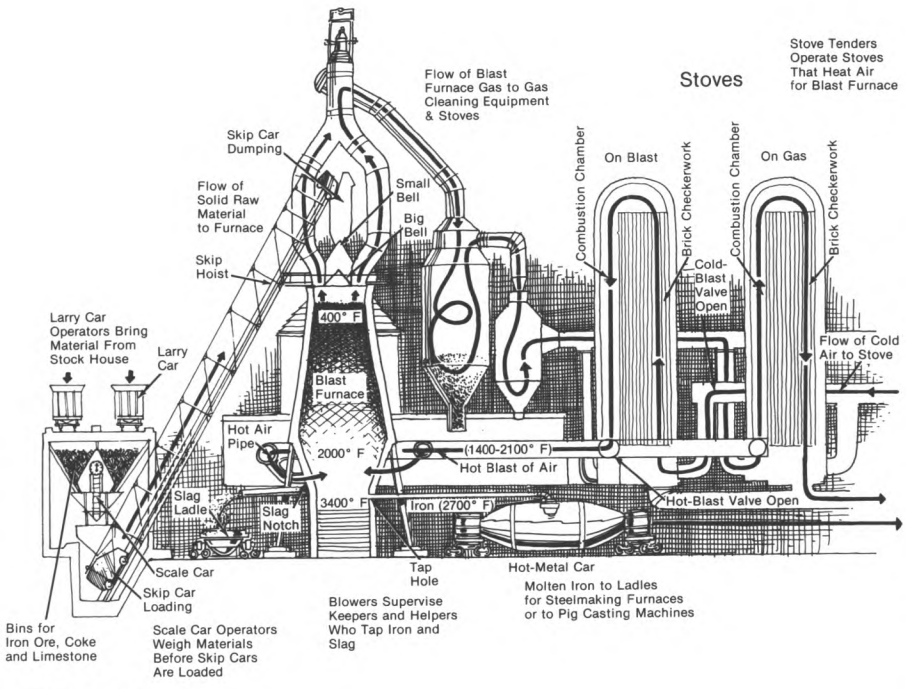
Blast furnaces. The blast furnace, a large steel cylinder lined with heat-resistant (refractory) brick, is used to separate the iron from other elements in the iron ore. A mixture of ore, coke, and limestone (called a "charge") is fed into the top of the furnace. As this material works its way down through 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.

The raw materials used in blast furnaces are transferred from storage areas on railroad cars. Moving on

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Source: American Iron and Steel Institute

elevated tracks to the furnace, the cars are positioned over an open grate. The raw materials are dumped through the grate and into a large funnel-shaped bin called a hopper. *Scale car operators* (D.O.T. 921.883) 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* (D.O.T. 921.883) uses electric and pneumatic controls to operate the cars.

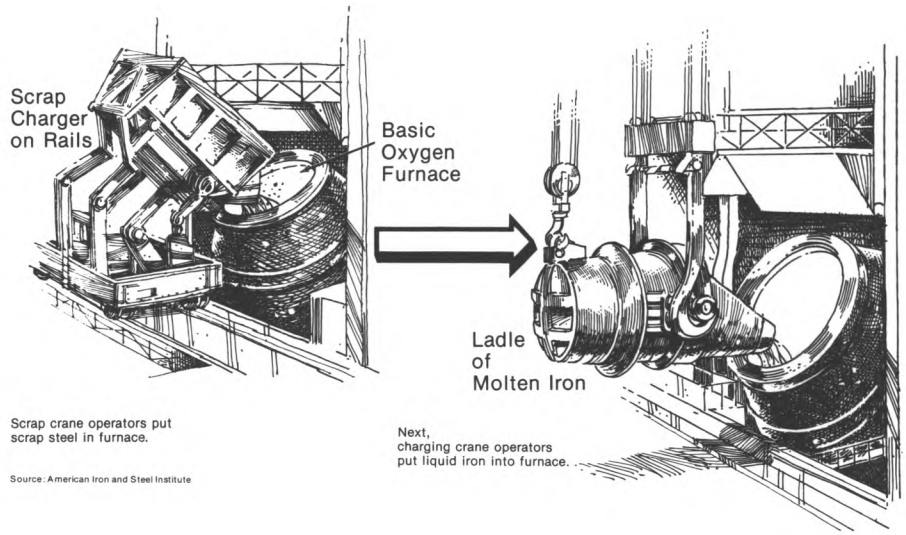
Stove tenders (D.O.T. 512.782) operate the gas-fired stoves that heat air for the blast furnace. They observe controls that show the temperature of the air inside the stove. When air reaches the correct temperature, the tender opens valves on the stove that allow the heated air to pass to the furnaces. Stove tenders also keep the stove flues clean of carbon and dirt.

Blowers (D.O.T. 519.132) 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. 502.884) and their *helpers* (D.O.T. 502.887) 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.



Source: American Iron and Steel Institute

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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 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 heat-resistant and is used in products, which need those qualities such as razor blades.

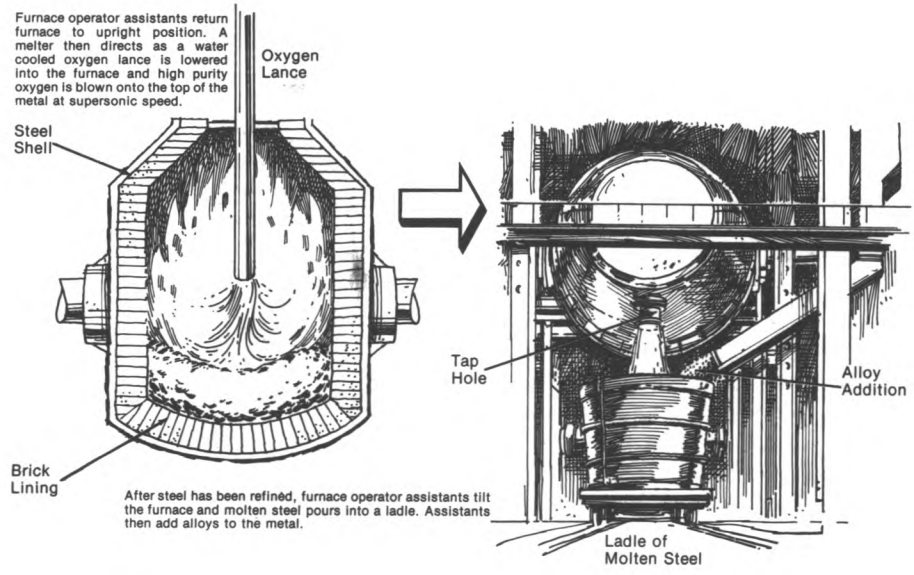
Steel is made in three types of furnaces: basic oxygen, open hearth, and electric. More than 60 percent of all domestic steel is made in basic oxygen furnaces (BOF's) and about 20 percent in open hearth furnaces. Both produce similar kinds of steel, but BOF's do the job faster and are expected to replace many of the open hearths now in operation. 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 20 percent of total U.S. steel output.

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 of those in other steel furnace operations.

A *melter* (D.O.T. 512.132) 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 limestone 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 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. 512.782), 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. 921.883) adds scrap steel and is followed by a *charging crane operator* (D.O.T. 921.883) 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. Thus, the furnace operator must pay close attention to conditions in the furnace, regulate the oxygen flow, and, if the furnace does overheat, direct the rocking of the furnace 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 helpers, working from behind a heat shield, use a long-handled spoon to take a sample. The sample is sent up to the lab where metallurgists 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 first assistant can



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.

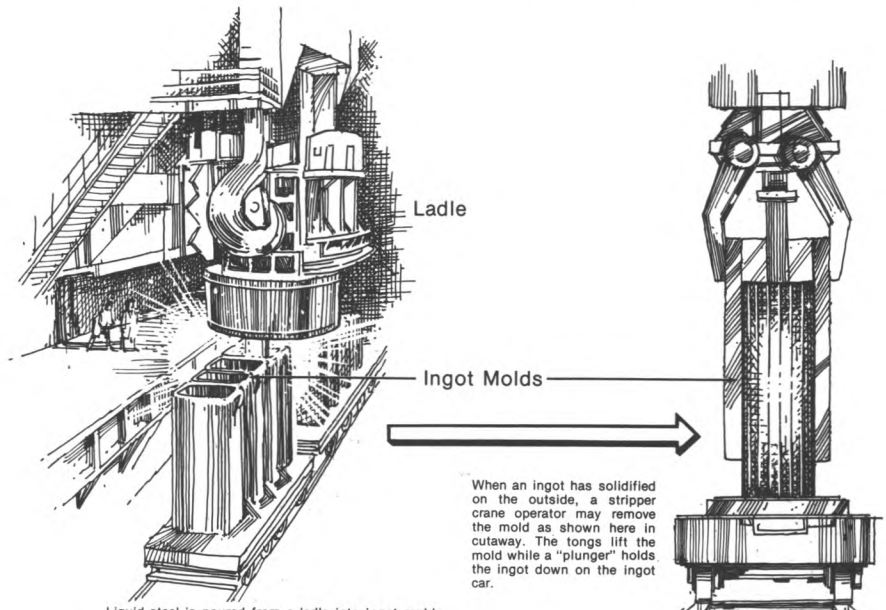
Source: American Iron and Steel Institute

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keep the slag above the taphole, preventing it 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. 921.883) 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. 514.884) 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. 921.883) 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. 921.883) maneuvers an overhead crane to lift the ingots from small railcars and place them in the soaking pit. A *heater* (D.O.T. 613.782) and *helper* (D.O.T. 613.885) 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.



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

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 grooved 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. 613.782), 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, 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. 613.782) 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. 615.782) controls a heavy hydraulic shear that cuts the steel into desired lengths.

In a rolling mill that has automatic

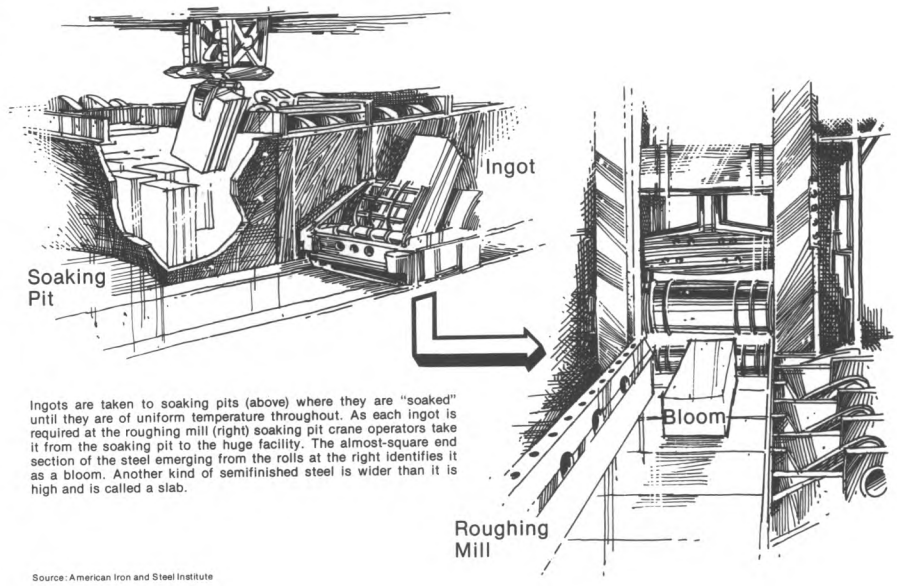
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controls, a rolling mill attendant is given a card that has been punched with a series of holes. The holes represent coded directions as to how the ingot is to be rolled. The attendant inserts the card into a card "reader" and presses a button to start 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 in turn must be reheated and then 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. The steel 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 require.

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 wire and pipe.

Steel sheet is the most important finished product made by the iron and steel industry. To make sheets, a slab is first heated in a furnace similar to the soaking pits described earlier, and then 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.



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

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. 613.782) 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. 613.782) and assistant use handtools to adjust the gauge and edge guides for the first series of rolls (called the roughing mill). A *rougher pulpit operator* (D.O.T. 613.782), 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.

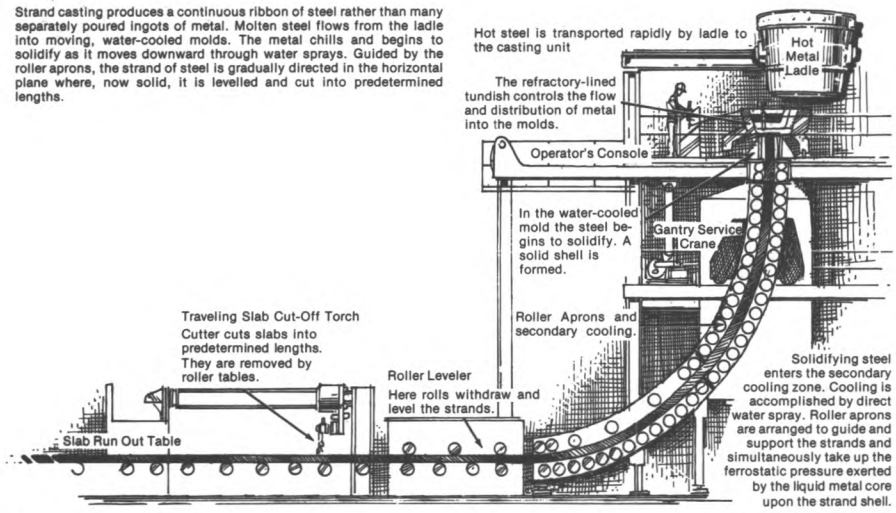
Other important steel mill products include various types of wire and pipe. These products are made from billets. To make drawn wire, the billet is rolled into a long, thin, round product called a rod. A *wire drawer* (D.O.T. 614.782) operates equipment that pulls the steel rod through a die. The die 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.

A *piercing-mill operator* (D.O.T. 613.885) 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 on 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 op-

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Source: American Iron and Steel Institute

erators make and repair metal parts for production equipment. Diemakers use machine tools to form dies, such as those used to make wire. *Roll turners* (D.O.T. 801.884) 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 train crew 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*.)

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 and melter, differ among companies. Some firms determine these promotions solely on seniority while others also consider ability to do the job.

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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 finally 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 eventually to melter. A possible line of job 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.

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.



Employee oversees automatically controlled charging of blast furnace.

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 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 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.

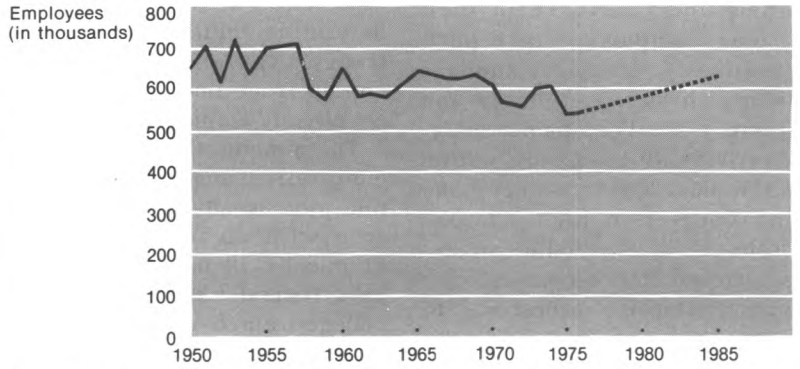
Employment Outlook

Employment in the iron and steel industry is not expected to change significantly through the mid-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 sensitive to changes in

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Technological advances have enabled the iron and steel industry to meet growing demand without long-run increases in employment

Wage and salary workers in the iron and steel industry, 1950-76 and projected 1985



Source: Bureau of Labor Statistics

business conditions and defense needs.

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 laborsaving 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 and Working Conditions

Earnings of production workers in iron and steelmaking are among the highest in manufacturing. In 1976, they averaged $7.68 an hour, while production workers as a whole averaged $4.87. To show how earnings vary by occupation and department, wage rates for employees in some of the principal occupations are presented in table 1. However, most steelworkers are paid on an incentive basis—that is, the more they produce the more they earn—and often earn more than the table would indicate.

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 vacation pay 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 va-

Approximate basic straight-time hourly earnings [1] of workers in selected occupations in basic iron and steel establishments, mid-1976

	Hourly earnings
Blast furnaces:	
Larry or scale car operators	$6.55
Keepers	6.95
Basic oxygen furnaces:	
Second assistants (Second helper)	6.95
Furnace operators	7.80
Open hearth furnaces:	
Charging machine operators	7.20
Furnace operators (First helper)	8.15
Bloom, slab and billet mills:	
Soaking pit crane operators	7.05
Rollers	8.35
Continuous hot-strip mills:	
Roughers	7.20
Rollers	8.90
Maintenance:	
Bricklayers	7.30
Millwrights	7.20

[1] Excludes premium pay for overtime and for work on weekends, holidays, and late shifts and incentive pay.

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cation every 5 years; the remaining workers receive 3 extra weeks of vacation once in a 5-year period. Professional and executive personnel receive similar benefits.

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, and education and scholarship assistance.

Working conditions vary by department. 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 winter. Many plants have developed methods 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. Because certain processes are continuous, many employees are on night shifts or work on weekends.

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.

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OCCUPATIONS IN LOGGING AND LUMBER MILLS

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 Pacific Northwest, the Nation's major timber-producing regions.

Nature and Location of the Industry

In 1976, about 75,000 wage and salary workers were employed in logging—harvesting trees and removing them from forests. A much larger number—about 210,000—worked in sawmills and planing mills where logs are converted into lumber. In addition, there were about 60,000 self-employed workers, most of them in logging.

This statement deals with activities and jobs involved in cutting and removing timber from forests and in the processing of 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 statement elsewhere in the *Handbook*.

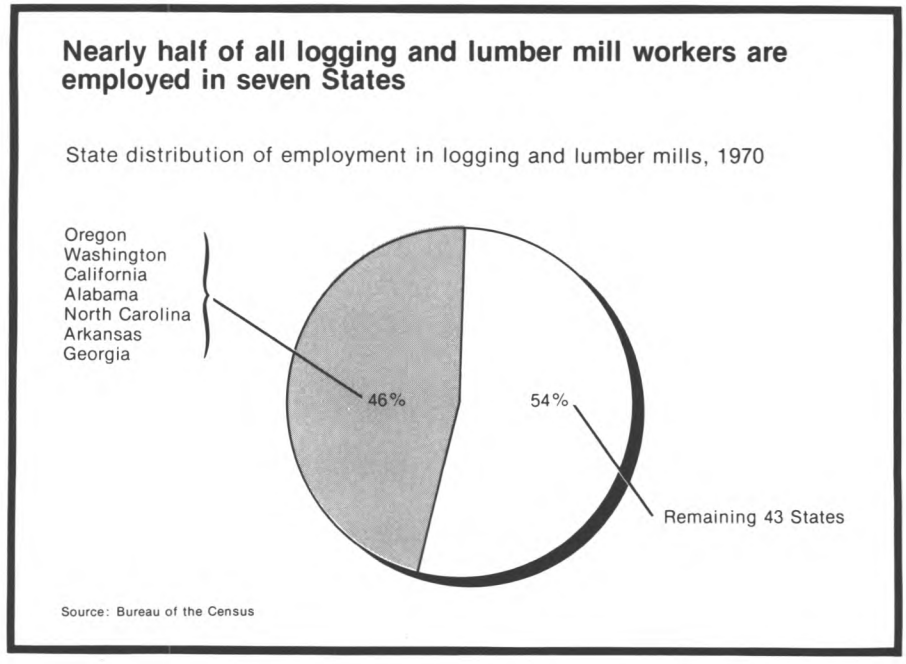
Lumber production has followed the same basic process for many years. A stand of timber is harvested in the forest, moved to a central location or "landing" accessible to transportation, and then carried by truck or rail to a mill for processing. Logging crews typically consist of from 5 to 15 workers. 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, moulding, 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, and Georgia.

Logging. Before a stand of timber is harvested, a *forester* (D.O.T. 040.081) 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. 441.384) assist foresters in performing these duties. *Timber cruisers* (D.O.T. 449.287) 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 further cutting (bucking) it into logs for maximum product value and easier handling. *Fallers* (D.O.T. 940.884), 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



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where they want it, without injuring other trees. As soon as the tree is down, *buckers* (D.O.T. 940.884) 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 *logging-tractor operator* (D.O.T. 929.883).

The next task—"skidding"—is a method of removing logs from the cutting area. A choker (steel cable) is noosed around the log by *choker setters* (D.O.T. 942.887) and then attached to a tractor, which drags or "skids" the log to the landing. A *rigging slinger* (D.O.T. 942.884) supervises and assists choker 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 "high-lead" 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. 942.782) 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. 921.883) operates a machine that picks up logs and places them on the trailer. A *second loader* (D.O.T. 949.884) directs the positioning of logs on the trailer. Although trucks usually are used, logs are sometimes carried by railroad cars.

Sawmills and Planing Mills. At the sawmill incoming logs are stacked on the ground (cold decking) or dumped into a pond to await cutting.



Loader operators take logs from landing area and place them on trucks to go to plants for processing.

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. 941.488) 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. 921.886) sort the logs so that all of one kind or size go into the mill together.

A *bull-chain operator* (D.O.T. 921.885) controls a conveyor that pulls logs up a chute into the sawmill. A *barker operator* (D.O.T 533.782) 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. 667.887) rolls it onto a platform called a "carriage," and a *block setter* (D.O.T. 667.885) aligns 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. 667.782), who is one of the most experienced workers in the mill. The quality and quantity of usable lumber obtained from logs depends 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. 667.782), 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 saw operator* (D.O.T. 667.782), 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. 669.587) examine each board and determine its grade according to set standards of quality and value. After grading, *sorters* (D.O.T. 922.887) 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. 563.381) 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

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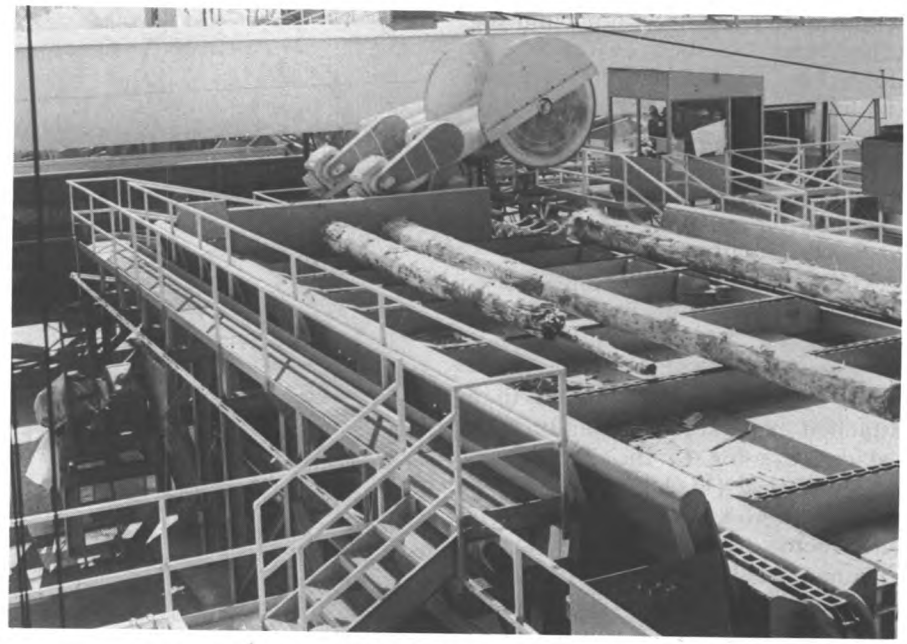
set of rotating knives controlled by a *planer operator* (D.O.T. 665.782). Some knife heads produce smooth surfaces, while others tongue-and-groove the boards for flooring or paneling. Similarly, a wide variety of moulding or other building trim may be cut. The dressed or finished lumber is usually graded again before storage by a *planer mill grader* (D.O.T. 669.587). 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 electronics backgrounds 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, salesworkers, 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, are given elsewhere in the *Handbook* in sections covering individual occupations.)

Training, Other Qualifications, and Advancement

Most loggers and millhands get their first jobs without previous training. Employers prefer high school graduates, but applicants with less education frequently are hired. Entry level jobs usually can be learned in a few weeks by observing and helping experienced workers.



Saw operator cuts logs into 8-foot lengths for plywood.

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 with 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 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 mid-1980's despite anticipated increases in lumber production to meet the Nation's population and industrial growth. Laborsaving machinery will make it possible to harvest more timber and process more lumber with fewer employees.

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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 four times as fast as 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.

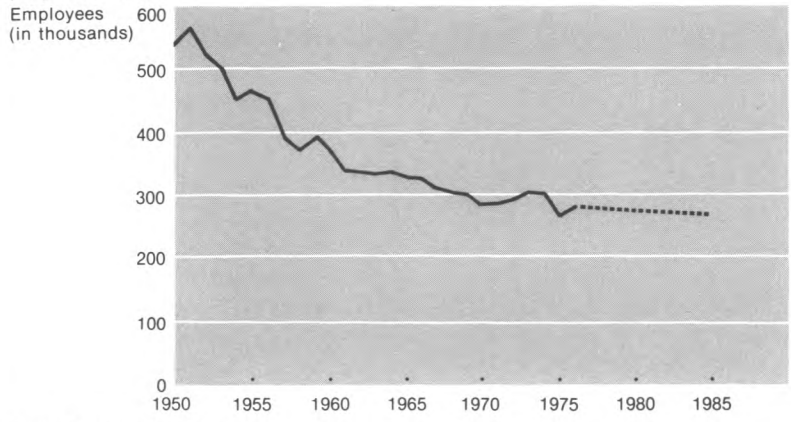
Summer jobs sometimes are available for high school students 17 years of age or older. These jobs are unskilled and include such tasks as working on a survey crew, helping haul logs to landings, clearing brush, and fighting forest fires.

Earnings and Working Conditions

In 1976, production workers in sawmills and planing mills averaged $4.59 an hour. In comparison, production workers in manufacturing industries as a whole averaged $5.17 an hour.

Laborsaving machinery has cut employment in the logging and lumber mills industry in half since 1950

Wage and salary workers in logging and lumber mills, 1950-76 and projected 1985



Source: Bureau of Labor Statistics

Wage rates in logging, sawmills, and planing mills vary considerably by occupation and geographic area. Workers in different 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 1976 are shown in the accompanying tabulation. Workers in the South earned considerably less than those in the West.

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 yot 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 very 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.

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

Logging	*Hourly rates, West Coast*
Deck workers	$6.00
Pond workers	6.00
Sorters	6.25
Trimmers	6.25
Choker setters	6.45
Pony edgers	6.45
Truckdrivers	6.55
Graders	6.65
Lumber stackers	6.80
Planer operators	7.00
Rigging slingers	7.10
Yarder engineers	7.70
Head-saw operators, circular saw	7.80
Head-saw operators, band saw	8.30
Fallers and buckers	9.15

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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.

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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.

A 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 to haul raw materials and heavy equipment, and by other industries such as trucking 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. Automobiles provide people with the ability to go anywhere in the country whenever they desire.

Another measure of an industry's economic importance is the number of people it employs. Motor vehicle manufacturing employs more workers than any other single manufacturing industry, almost 1 out of every 100 workers in the Nation's labor force works in motor vehicle manufacturing.

Still another indicator is the number of jobs an industry creates in other sectors of the economy. Motor vehicle manufacturing is important for two reasons. First, it is a major consumer of steel, rubber, plateglass 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, materials 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.

The industry has about 3,000 plants, ranging from small parts plants with only a few workers to huge assembly plants that employ several thousand. About 85 percent of the industry's employees work in plants with 500 workers or more.

Over two-thirds of the industry's employees work in the Great Lakes region, including Michigan, Ohio, Indiana, Illinois, Wisconsin, and western New York. Michigan alone has almost 40 percent of the total, with half of these workers in the Detroit metropolitan area. Other important industry centers in the Great Lakes area are Flint and Lansing, Michigan; Cleveland and Warren, Ohio; Indianapolis and Fort Wayne, Indiana; Buffalo, New York; and Chicago, Illinois.

Major automobile manufacturing centers are also found in other parts of the country, including Los Angeles, San Francisco, Kansas City, St. Louis, Atlanta, and Philadelphia.

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 automobiles, 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 car.

First, executives decide what type of car to produce—a sports car, compact, or luxury car—based on what their market research shows about consumers' desires. Once this decision has been made, they determine basic specifications for the car's size and cost. Design of the car's body and interior is assigned to stylists. From the sketches and drawings, skilled model makers 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, usually working with drafters who draw up blueprints and specifications, design the car's engine, transmission, suspension, and other parts. Their designs must meet safety and pollution control standards, as well as pass cost, fuel economy, and performance tests. They work with physicists, chemists, metallurgists, and other scientists 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 is 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 must be redesigned before the car can be produced.

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On-the-road testing of fuel economy and tailpipe emissions.

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 to be made, 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 presses stamp 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 processess 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 finally ready for assembly. Each worker on the assembly line has a specific task to perform as the conveyor carries the chassis along the assembly line. 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. A blue sedan, for example, may follow a red station wagon. 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. Semiskilled plant workers, including assemblers and inspectors, make up about one-half of all employees. An additional one-quarter are supervisors, machinists, tool-and-die makers, mechanics,and other skilled craft workers. Clerical workers make up another one-tenth of the total. The rest are professionals, technicians, sales workers, managers, guards, and unskilled workers.

Some of the important 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, chemists, drafters, and other professional and technical workers.

Over 30,000 engineers worked in the automobile industry in 1976. Most of them were 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.

The industry employed over 3,000 mathematicians, physicists, chemists, and other physical scientists in 1976. Most of them 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 produc-

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tion. Metallurgists, for example, supervise melting and heating operations in the casting and forging departments.

Drafters are the largest group of technical workers. They work closely with engineers and stylists to draft blueprints and specifications for each part of the car. Engineering aides, laboratory assistants, and thousands of other technicians also assist engineers and scientists.

Administrative, Clerical, and Related Occupations. Executives 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 plantworkers such as maintenance machinists 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



The largest group of workers in the automobile industry are assemblers.

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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. 806.887). They put together small parts to make subassemblies, and put subassemblies together to build a complete vehicle. 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. 500.885) coat bumpers, grills, hubcaps, and trim with chrome. *Metal finishers* (D.O.T. 705.884) file and polish rough metal surfaces in preparation for painting. *Sprayers* (D.O.T. 741.887) apply primers and paint with power spray guns. *Polishers* (D.O.T. 705.884) 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, *cutters* (D.O.T. 781.884) cut fabric or leather with hand or electric shears. *Sewing machine operators* (D.O.T. 787.782) sew the pieces together into seat covers or headliners. *Cushion builders* (D.O.T. 780.884) fasten springs, padding, and foam rubber to the seats and other upholstered areas and install the covers.

Inspection Occupations. (D.O.T. 806.281, .283, .381, .382, .387, .684, and .687). 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, materials handlers 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, while other parts and materials are moved by power truck operators. Checkers, stock chasers, and stock clerks 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. Skilled 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.

Training, Other Qualifications, and Advancement

Engineers and scientists must have at 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 stylists are graduates of art institutes or have bachelor's degrees in industrial design. They should have a background in practical applications, such as model building, as well as in design theory and techniques.

Most engineering aides, 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 semiskilled 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 coordina-

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tion 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.

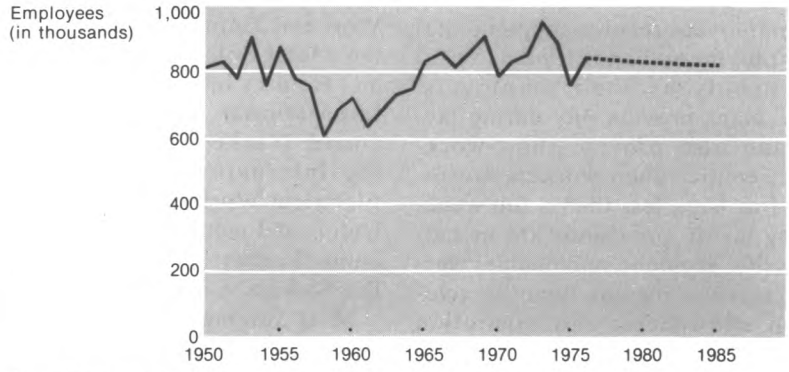
Applicants for apprenticeship usually must be high school, trade, or vocational school graduates, or have equivalent training. Training should include mathematics, science, mechanical drawing, and shop courses. Apprentices must pass physical examinations, mechanical aptitude tests, and other qualifying tests.

Apprenticeship includes both classroom and on-the-job instruction. 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 in motor vehicle manufacturing fluctuates with the economy, consumer preferences, credit availability, and defense activity

Wage and salary workers in motor vehicles and equipment manufacturing industry, 1950-76 and projected 1985



Source: Bureau of Labor Statistics

Employment Outlook

Employment in the automobile industry is not expected to increase significantly through 1985. Nevertheless, thousands of workers will be hired in this large industry each year 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.

The production of motor vehicles is expected to increase during the next decade as population and income increase. Because of laborsaving technology, however, employment in the industry will not keep pace with production. Automobile companies will use more automated and computerized equipment for machining, assembling, and inspecting. A recent example is the versatile "industrial robot" that can be programmed to weld body panels, feed parts into machine tools, and do a variety of other tasks. Also, new or modernized plants will have the latest conveyor equipment for moving parts and materials.

Some of the industry's increased efficiency, however, will be offset by other developments. For example, more workers will be needed to design, test, and build cars with improved safety, exhaust control, and fuel consumption features.

Changes in the kinds of vehicles built and how they are produced will affect the type as well as the number of workers employed in the automobile industry. 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 programmers, but will limit employment 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. Overall, the number of semiskilled workers will decline slightly.

Earnings and Working Conditions

Production workers in the automobile industry are among the highest paid in manufacturing. In 1976 they averaged $7.10 an hour, compared to $5.19 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.

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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.).

Most automobile industry employees work in plants that are relatively clean and free of dust, smoke, and fumes. Some work areas, however, are hot, noisy, and filled with dust and fumes. These conditions have been greatly improved by the introduction of better ventilation and noise control systems.

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.

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OCCUPATIONS IN THE NUCLEAR ENERGY FIELD

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.

In 1976, about 300,000 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 zn research and development of nuclear energy. Most nuclear energy workers are scientists, engineers, technicians, and craftworkers.

Applications of Nuclear Energy

One significant use of nuclear energy is the production of electricity by nuclear reactors. Steam produced by reactors now generates electricity or many communities. These reactors have become competitive with systems that use fossil fuels (such as coal and oil). In early 1977, there were 65 nuclear reactors in commercial operation. About 170 plants were either in the planning stage or were being constructed. Dual-purpose nuclear power desalting plants, which would at the same time provide 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.

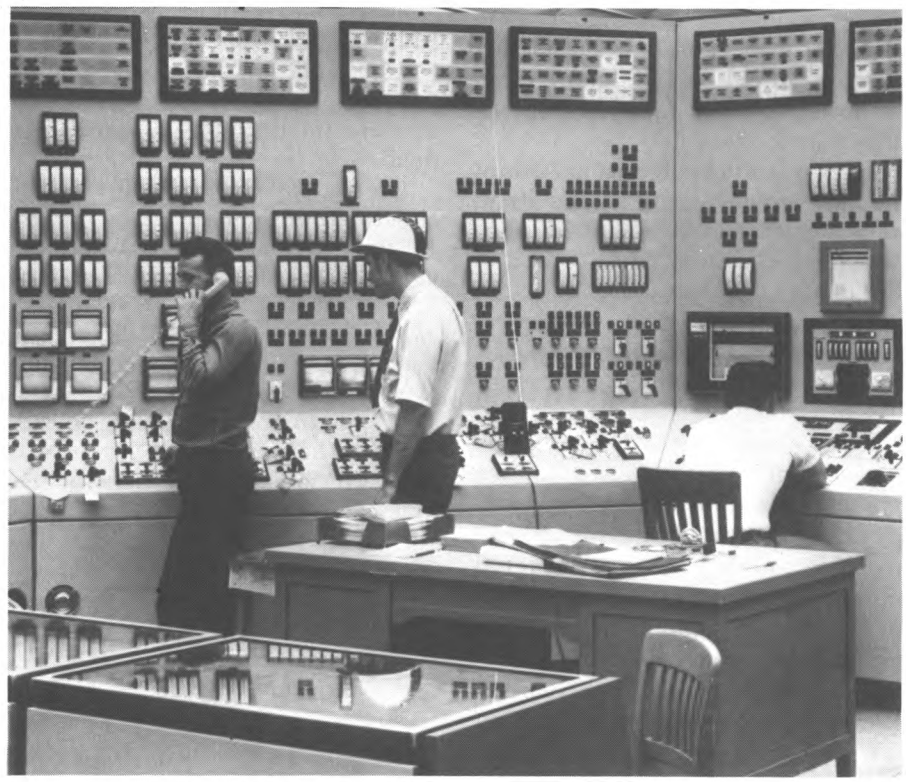
Although existing reactors already generate huge quantities of power from a small amount of uranium, more efficient reactors may be in operation by the mid-1980's. Further in the future, controlled fusion reactors may provide an even more efficient method of producing electricity.

Another significant application of nuclear energy is in 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.

How Nuclear Energy is Produced

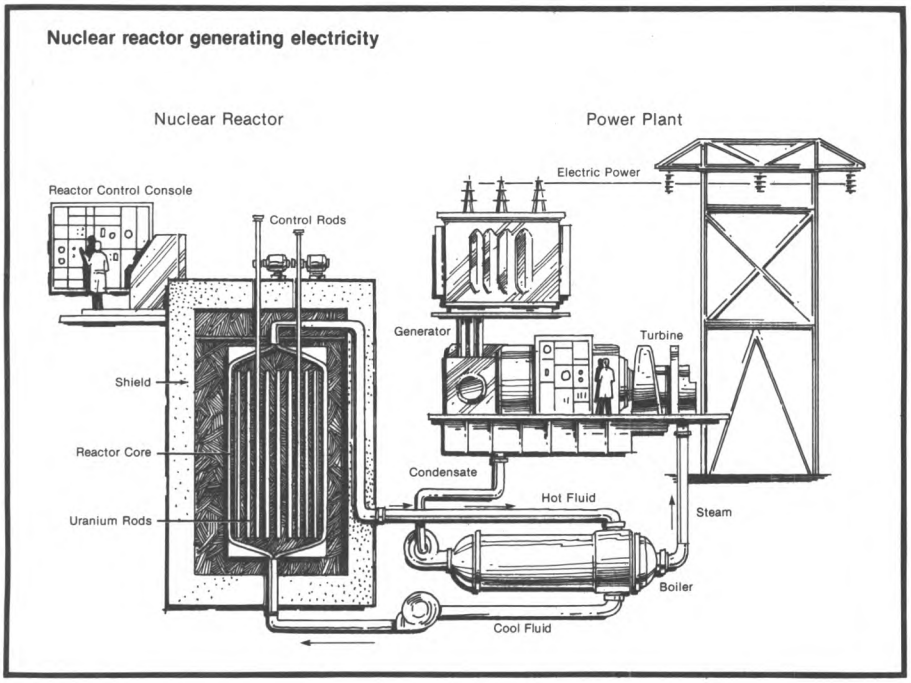
Although there are several processes for producing nuclear energy, the most common method used today is the fission process. It involves splitting uranium or plutonium nuclei by neutron bombardment. When neutrons emitted from this fission process bombard other nuclei, further fission takes place and, under proper conditions, results in a "chain" reaction. This reaction 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 of 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 U-235 isotopes 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."



A section of a control room at a nuclear power plant.

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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.

Nature of the Nuclear Energy Field

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.

The Federal Government supports about half of the basic nuclear energy activities, although private support has been increasing. The U.S. Energy Research and Development Administration (ERDA) 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 ERDA-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 for 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

Engineers, scientists, technicians, and craftworkers account for a higher proportion of total employment in this field than in most others, 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 semiskilled and unskilled 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 and 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, biological scientists, 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 highly skilled 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 oth-

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er craftworkers and chemical-process operators.

Activities in the Nuclear Energy Field

The following sections briefly describe some major nuclear energy activities and their workers.

Uranium Exploration and Mining. The 9,500 people employed in uranium exploration and mining in 1976 had jobs similar to those in mining of other metallic ores. They mainly work in the Colorado Plateau area of the Far West, in the States of 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. Scientists and engineers—mining engineers, 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 1,700 workers in 1976.

These mills employ skilled machinery repairers, millwrights, pipefitters, carpenters, electricians, and chemical-process operators. A small proportion of those working in milling operations are 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 1976 uranium refining and enriching plants employed about 11,800 workers.

Maintenance craftworkers, 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. More than one-third of the engineers and scientists are chemical engineers and chemists.

Reactor Manufacturing. About 27,800 people were employed in the design and manufacture of nuclear reactors and reactor parts in 1976. 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.

Over one-third of the employees in firms that design and manufacture reactors are scientists, engineers, and technicians. Engineers alone represent nearly one-quarter 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.

Reactor Operation and Maintenance. About 13,000 workers operated and maintained nuclear reactors in 1976. 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 ERDA 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 30,000 employed in ERDA research and development facilities are engineers, scientists, and supporting technicians, including radiation monitors.

Although most nuclear energy research is done in ERDA research and development facilities, about 2,600 persons conducted research in privately owned laboratories of educational institutions, other nonprofit institutions, and industrial concerns in 1976. Nearly 3 out of 4 were in scientific, engineering, and technical jobs.

Production of Nuclear Weapons and Other Defense Materials. Establishments producing nuclear weapons, weapon components, and other defense materials employed about 32,700 persons in 1976. 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 1976, about 66,000 persons worked on the construction of nuclear facilities—most were craftworkers. About 18,000 of these were pipe- and steamfitters, 8,100 were electricians, and 11,200 were laborers. Several thousand carpenters, ironworkers, operating engineers, and boilermakers also were required in nuclear construction.

Other Nuclear Energy Activities. About 2,400 workers produced special materials such as beryllium, zirconium, and hafnium for use in reactors in 1976. 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 6,900 people were involved in the design, construction, or operation of particle accelerators used in

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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 1976, the Energy Research and Development Administration (ERDA) employed nearly 7,000 workers who were involved in nuclear energy activities. The Nuclear Regulatory Commission (NRC) employed about 2,500 persons. Since ERDA 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 1976, about 650 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 others 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 1,900 radiation monitors were employed in 1976. 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. About 2,100 people worked as nuclear reactor operators in 1976.

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 scientist 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.

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Employees inspect one of the fuel elements in a nuclear reactor at an electric company plant.

Training and Other Qualifications

Training and education requirements and advancement opportunities for most workers in the nuclear energy field are similar to those doing 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 scientific and engineering positions can be obtained at a college or university or through on-the-job experience. Many colleges and universities have expanded their facilities and curriculums to 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 craftworkers 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 craftworkers generally obtain the required additional specialized skills through apprenticeship training programs of employers and unions.

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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, either through a technical school or through training programs in the military service. Many trainees are selected from conventional power plant personnel with 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 trainee must pass an operating and 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 Energy Research and Development Administration, 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 ERDA 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 ERDA facilities on a rotation basis, and many graduate students do their thesis work at ERDA 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 much faster than the average for all industries through the mid-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 is expected to be several times greater in 1985 than it was in 1976. 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 craftworkers 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 the 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 bio-medical applications of nuclear science.

Earnings and Working Conditions

Hourly earnings of production workers employed by contractors at ERDA laboratories and other installations averaged $6.21 in 1976, compared with $5.19 for those in all manufacturing industries.

Scientists and engineers employed at ERDA installations averaged $21,700 a year in 1976. Clerical personnel earned an average of $5.15 an hour while technicians averaged about $6.55 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*.)

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 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, and ERDA and its

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contractors have maintained an excellent safety record. 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.

Most hourly paid plantworkers 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. Energy Research and Development Administration, Washington, D.C. 20545.

For information about licensing and safety requirements, contact:

U.S. Nuclear Regulatory Commission, Washington, D.C. 20555.

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OFFICE MACHINE AND COMPUTER MANUFACTURING OCCUPATIONS

During the last decade, employment in the office machine and computer industry grew much faster than employment in manufacturing as a whole. Growth was spearheaded by a 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, plants that make computers and related equipment account for about three-fourths of the industry's production.

Nature and Location of the Industry

In 1976, the office machine and computer manufacturing industry employed 290,000 workers in approximately 1,050 plants. About 6 out of every 10 of them worked in plants that produced computer equipment, the remainder in plants that produced conventional office machines and scales and other weighing devices.

Computer equipment manufacturing plants employed about 195,000 workers in 1976. These plants manufacture general purpose computers as well as those used for special applications, such as space exploration and missile guidance. They also manufacture 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 or that rent or lease computers and provide related services.

In 1976, about 95,000 people were employed in factories that produced conventional office machines and scales. Of this total, nearly half 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 10 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, skilled, 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 out 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 office machine and computer manufacturing. Their work is primarily in chemical pro-

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cessing of printed circuits used in computers. Mathematicians make up another large group of scientists. Their work on complex mathematical problems is important in designing computers. Physicists are employed in research and development to 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. In addition, systems analysts and programmers may assist sales personnel in determining data processing needs of customers.

Technical Occupations. More than 1 out 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 by conducting performance tests on components.

Administrative and Sales Occupations. About 1 out of every 13 workers is an administrator. Included are top executives who manage companies and determine policy decisions and middle managers who direct departments such as advertising and industrial relations. Other administrative employees in staff positions include accountants, lawyers, and market researchers.

Sales personnel hold about 1 out 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 out 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, as well as computer personnel such as 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, and plumbers and pipefitters, electricians, carpenters, and other workers maintain production machinery and building facilities.

Assembly Occupations. (D.O.T. 706.884, 726.781 and .884) 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 sub-assemblies 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 for computers, typewriters, accounting machines, calculators, and other products. Numerical control machine operators tend machines that have been programmed 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. Workers who feed or monitor this equipment are called test-set operators or testing machine operators.

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Job titles indicate the work many inspectors do. *Machined parts inspectors* (D.O.T. 609.381) use precision testing instruments to determine whether parts have been machined properly. *Type inspectors* (D.O.T. 706.687) use a magnifying glass to examine typewriter type for defects. *Electronic subassembly inspectors* (D.O.T. 726.384) use microscopes, meters, and various measuring devices to examine circuits and other electronic subassemblies. *Electronic assembly inspectors* (D.O.T. 722.281) use special instruments to test electronic systems such as computer memory units.

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 very complex. Electronic 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 in plants that are air-conditioned and have special refrigerated and dust-free rooms in order to maintain the equipment. Painters, plumbers, pipefitters, carpenters, and 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 trucks and boxcars and do general clean-up work. Some other plant occupations are boiler operator, stationary engineer, guard, and janitor.

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. Most 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 have not completed all of the requirements for a degree. Still other technicians are promoted from lower grade jobs in the plant and 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

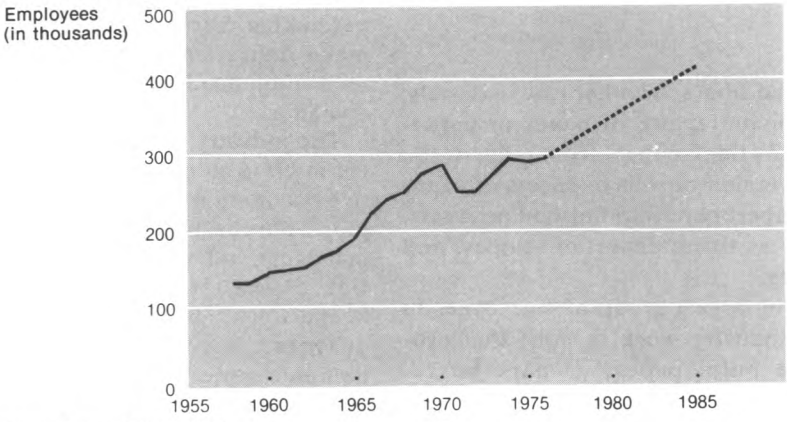
Employment in this industry is expected to increase faster than the average for all industries through the mid-1980's. This growth is projected to occur principally in plants that produce electronic computer equiment; little growth is forseen among manufacturers of conventional office equipment. In addition to the job openings that result from employment growth, 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 make a medical diagnosis, and to help students learn more quickly are just a few of the new computer applications that are likely to come into widespread use over the next few years. In addition to growth generated by new applications, de-

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Very rapid employment growth is expected in plants that produce electronic computer equipment

Wage and salary workers in office and computing machine manufacturing, 1958-76 and projected 1985



Source: Bureau of Labor Statistics

mand will rise as further price reductions bring a computer system 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—input and output, storage, and communication devices—as well as software designed specifically to meet the needs of certain types of organizations.

Although the demand for conventional office machines is expected to remain strong through the mid-1980's, employment in plants that produce this type of 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 formerly done by hand will tend to reduce labor requirements, particularly in plants where products are mass-produced, such as typewriters and calculators.

Some occupational groups in the office machine and computer manufacturing industry are expected to grow faster than 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 and Working Conditions

In 1976, plant workers in the office machine and computer industry had average earnings of $5.29 an hour. Wages in computer manufacturing plants are slight higher than in the industry as a whole, averaging $5.46 an hour in 1976.

National wage data are not available for individual occupations in the office machine and computer industry. However, the following tabulation, based on data obtained from a small number of union contracts, provides an example of the range in hourly wage rates for selected occupations in 1976:

	Hourly rate ranges
Assemblers	$3.00–4.50
Machinists	4.38–5.82
Tool-and-die makers	5.50–6.50
Electricians	5.50–6.50

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.

In general, the work surroundings in office machine and computer plants are more favorable than those in most other types of factories. Work stations usually are well-lighted and clean, and free from dust, fumes, and loud noises. Many computer factories are relatively new and are located in suburban areas.

Some plant jobs are repetitious, but very few require great physical effort. Fewer and less severe injuries take place in office machine and computer manufacturing than the average for all manufacturing.

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.

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OCCUPATIONS IN THE PAPER AND ALLIED PRODUCTS INDUSTRIES

In 1976, the paper and allied products industry employed about 676,000 people to produce many different kinds of paper and paperboard products. The industry employs workers in occupations ranging from unskilled to highly specialized technical and professional jobs, many found only in the paper industry.

Nature and Location of the Industry

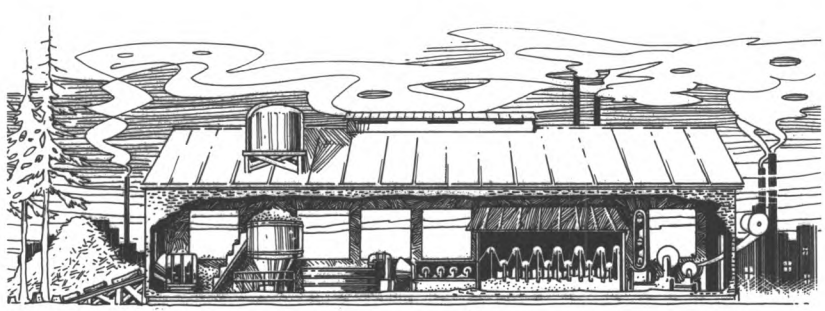
The paper industry is highly mechanized. Pulp, paper, and many finished paper products are manufactured by machines—some as long as a football field—in a series of nearly automatic operations that require very little handling of materials by workers. Manufacturing plants in the paper industry are engaged 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 work in mills that produce pulp, paper, or paperboard. The next largest group works in plants that make boxes and containers; and the remainder work in plants that make 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 eight States: New York, Pennsylvania, Illinois, Ohio, Wisconsin, Massachusetts, California, and New Jersey.

The papermaking process



Tree Farm ■ Pulpwood ■ Chipper ■ Digester ■ Beater ■ Fourdrinier Paper Machine ■ Paper

Occupations in the Industry

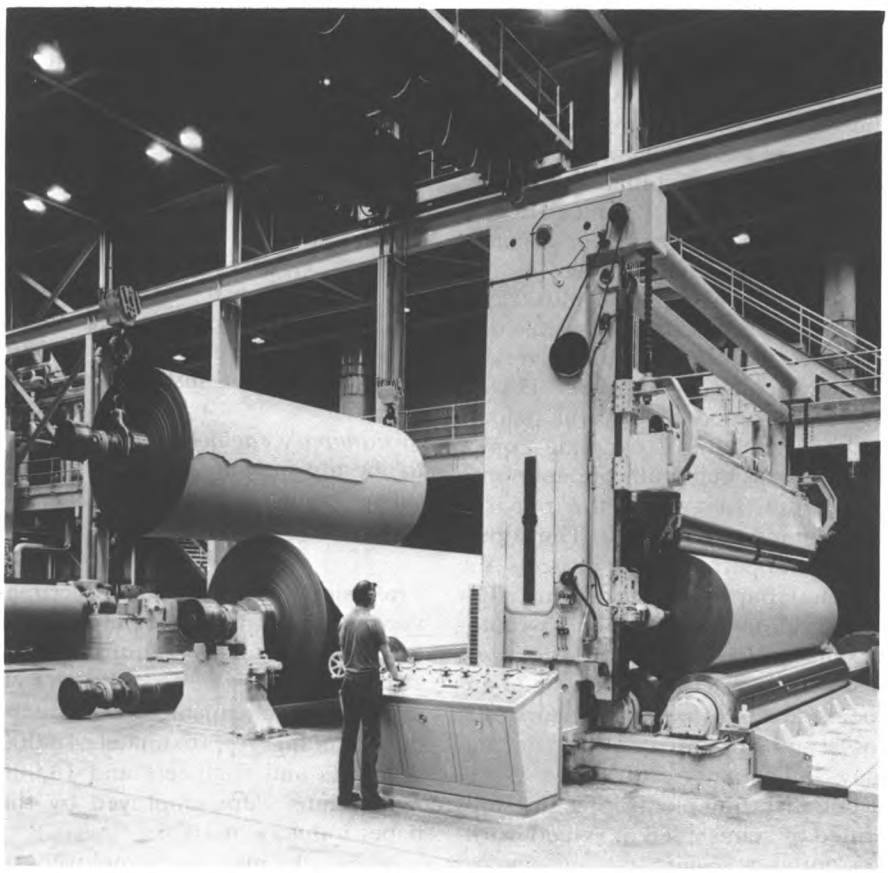
Employees in the paper industry work in a variety of occupations requiring a broad range of training and skills. Many workers operate and control specialized papermaking, finishing, and converting machines. Some workers install and repair papermaking machinery. Truck drivers make deliveries, and other workers load and unload trucks, railroad cars, and ships.

The industry employs many workers in clerical, sales, and administrative occupations. For example, it employs 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* in sections covering individual occupations.)

Production Jobs. In 1976, 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 combines the production of pulp, paper, and finished paper products into one continuous operation. (See accompanying chart.)

After trees are cut down, loggers will 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 cylinder 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. 533.782). 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

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The paper industry is highly mechanized.

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 chemical process, pulpwood is carried on conveyor belts to a chipper machine operated by a *chipper* (D.O.T. 668.885). 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 orginal harvest site, thereby reducing transportation costs and the amount 6f 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. 532.782), 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. By checking an instrument panel, digester operators make certain that proper conditions are being maintained. When the pulp fibers are removed from the digester, they are washed to remove chemicals, partially cooked chips, and other impurities. These fibers, called pulp, resemble wet, brown cotton.

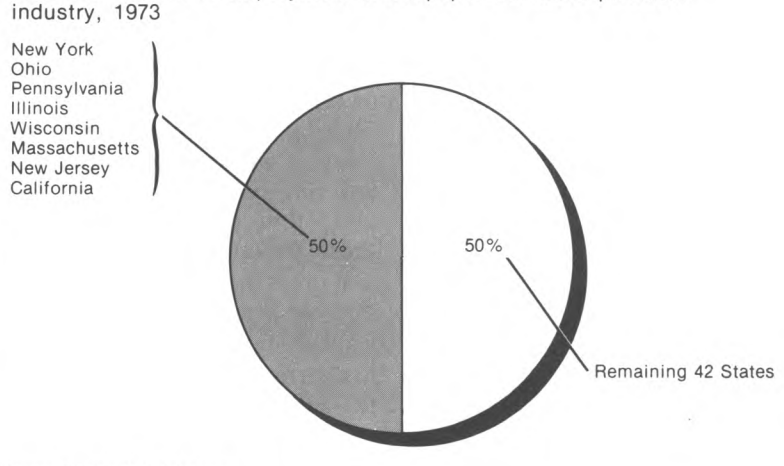
Many modern plants today are making greater use of continuous digesters (equipment that produces pulp continuously rather than in separate batches). Continuous digesters make it practical to use sawdust in pulpmaking, and eliminate the manual starting and stopping of each batch of pulp.

To turn pulp into paper, the pulp is mixed thoroughly with water and further refined in machines operated by skilled workers called *beater engineers* (D.O.T. 530.782). The kind 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

Half of all workers in the paper and allied products industry are employed in eight States

State distribution of employment in the paper and allied products industry, 1973



Source: Department of Commerce

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pulp solution pours into a continuously moving and vibrating belt of fine wire screen. As the 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 passes through the dryer section of the papermaking machine to evaporate remaining water.

The quality of the paper produced largely depends on the skills of *paper machine operators* (D.O.T. 539.782), 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 make sure the flow of pulp and the speed of the machine are coordinated. Paper machine operators also determine whether the paper meets required specifications by interpreting laboratory tests or, in some instances, by visually checking or feeling the paper. They supervise the less skilled workers of the machine crew and, with their help, keep the paper moving smoothly through the machine.

Many modern papermills have papermaking machines that use computers and advanced instrumentation to help the operator control the quality of the paper. For example, beta-ray sensors measure the weight of the paper and electromagnetic sensors measure the thickness. Measurements from these devices are put into a computer that compares them to programmed specifications. The computer then adjusts the papermaking machine's operations to eliminate any differences. Computer process control also has brought about changes in job duties for some operator positions. Generally this has involved a reduction in manual manipulation of control devices and an increase in monitoring functions. For example, the computer sets production variables such as temperature, pressure, and flow rates whereas, before computer control, they were set by the machine operator.

Backtenders (D.O.T. 532.885), who are supervised by paper machine operators, control the pressure and temperature of machinery that dries and finishes the paper and gives it the correct thickness. Backtenders inspect the paper for imperfections and make sure that it is being 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 stationary usually have finishing departments. Most workers in these departments are either semiskilled or unskilled. One semiskilled worker, the *supercalender operator* (D.O.T. 534.782), 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), inspects sheets of paper for tears, dirt spots, and wrinkles; counts them; 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. Occupations in converting plants differ widely, depending largely on the product being manufactured. An example of a semiskilled worker is the *envelope machine operator* (D.O.T. 641.885), 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. 651.782) who controls a machine that cuts and creases paperboard sheets and prints designs or lettering on them.

Converting plants employ thousands of workers to 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 when they 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. Approximately 16,000 scientists and engineers and 13,000 technicians were employed by the paper industry in 1976.

Many chemists are employed to control the quality of the product by supervising the testing of pulp and paper. In research laboratories, chemists 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 woodbuying operations of pulp and paper companies. They map forest areas, plan and supervise the harvesting,

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and seed or plant new trees to assure continuous production of timber.

Systems analysts and *computer programmers* are becoming increasingly important to this industry due to the greater use of computerized controls in the production process. They also analyze business and production problems and convert them to a form suitable for solution by computer.

Frequent tests are performed during the manufacture of pulp or paper to determine whether size, weight, strength, color, and other properties meet standards. Some testing is done by machine operators, but in many mills *testing technicians* are employed. These technicians, who have job titles such as laboratory technician, pulp tester, and chemical analyst, also assist engineers and chemists in research and development activities.

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 information 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.

Training, 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 apprenticeship programs for maintenance workers. Under these programs, which usually last 3 to 4 years, people are trained for jobs such as machinist, electrician, millwright, and pipefitter. Generally, an applicant is given a physical examination, mechanical aptitude tests, and similar qualifying tests. Apprenticeship includes both on-the-job training and classroom instruction related to the occupation. The machinist apprentice, for example, receives classroom instructions in mathematics, blueprint reading, and shop theory.

In newer mills, many experienced maintenance workers are being retrained to become multi or four-skilled craftworkers. The workers are given 18 months to become competent in each individual craft or a total of 4 1/2 years. For example, a pipefitter would learn the skills of a millwright, 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 companies have summer jobs for college students specializing in papermaking, and upon graduation frequently hire them on a permanent basis. Some associations, colleges and individual companies offer scholarships in pulp and papermaking technology.

Some companies have formal training programs for college graduates with engineering or scientific backgrounds. These employees may work for brief periods in various parts of the plant 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 occupations. This is true especially for sales representatives who give customers technical assistance. Most pulp and paper companies employ clerks, bookkeepers, stenographers, and typists who have had commercial courses in high school or business school.

For 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. In some plants, qualified workers may be promoted directly to supervisory positions. In others, workers are given additional training before they are eligible for promotion. This training often is continued after the worker is promoted—through conferences, special plant training sessions, and courses at universities or trade schools. Most firms provide some financial assistance for employees who take courses outside the plant.

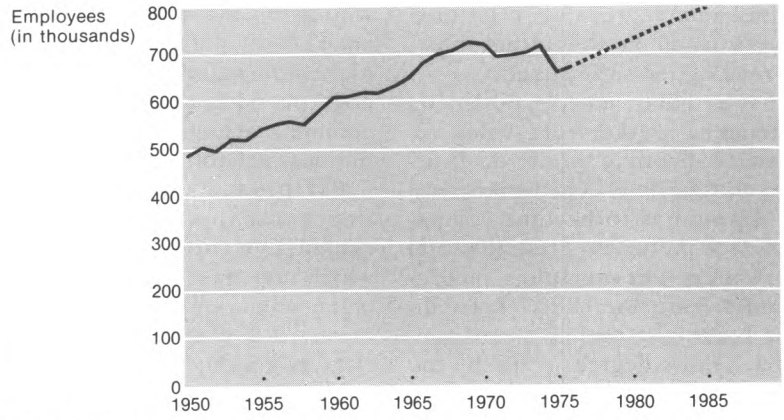
Employment Outlook

Employment in the paper and allied products industry is expected to increase more slowly than the average for all industries through the mid-1980's. Although a significant number of job openings are expected due to growth, most openings will stem from the need to replace workers who 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.

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Employment in paper manufacturing is expected to continue growing over the long run

Wage and salary workers in paper and allied products manufacturing, 1950-76 and projected 1985



Source: Bureau of Labor Statistics

Paper production is expected to increase over the long run as population and business activity grow and new uses for paper are developed. Employment will grow at a slower rate than production, however, because of the greater use of laborsaving machinery. Most of the employment growth will occur in plants that make finished products such as napkins, envelopes, boxes, and wrapping paper. These plants are not as suited for laborsaving machinery as plants that produce pulp and unfinished paper products.

Occupational groups within the industry are expected to grow at different rates. 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 and Working Conditions

Production workers in the paper industry had average earnings of $5.43 an hour in 1976. In the same year, production workers in private industry, except farming, averaged $4.87 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 1976. Local rates within these ranges depend on geographic location, type and size of mill, kinds of machines used, and other factors.

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. Maintenance workers usually are employed on the regular day shift. Multi-craft maintenance mechanics generally earn about $1.50 an hour more than a single-craft mechanic.

	Hourly rate ranges
Production occupations:	
Paper machine operator	$5.34–10.41
Backtender	4.87– 9.91
Head stock preparer (beater engineer)	4.93– 7.01
Digester operator (cook)	5.07– 7.30
Supercalendar operator	5.18– 6.36
Barker operator, drum	4.69– 6.80
Chipper	4.40– 6.70
Maintenance occupations:	
Pipefitter	5.58– 7.76
Electrician	5.74– 7.76
Machinist	5.58– 7.76

In most plants the standard workweek is 40 hours; in a few it is 36 hours or less. Workers normally have year-round employment because paper production is not subject to seasonal variation.

Most pulp and papermaking jobs do not require strenuous physical effort. However, some employees 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.

A majority of the production workers are members of trade unions. The largest union in the industry is the United Paperworkers International Union. Many osher 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, 224 S. Michigan Ave., Chicago, Ill. 60604.

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 representatives, write to:

National Paper Trade Association, Inc., 420 Lexington Ave., New York, N.Y. 10017.

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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 for the generation of over one-third of our electric power. In addition, basic petroleum compounds are used to manufacture hundreds of everyday products such as synthetic rubber, fertilizers, and plastics.

In 1976 about 160,000 workers, who had a wide range of educational backgrounds and skills, were employed in the petroleum refining industry. This industry covers occupations and activities involved in refining oil. Occupations in petroleum and natural gas production and processing are discussed in a separate chapter elsewhere in 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 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 vapors from the heated oil pass into a tower where the various "fractions," or parts, of the oil are condensed. 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 are used to remove water, sulfur compounds, and other impurities.

About 280 refineries were in operation in 1976. They ranged in size from plants with fewer than ten employees to those with several thousand. Although many States have refineries, about 85 percent of the workers were employed 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.

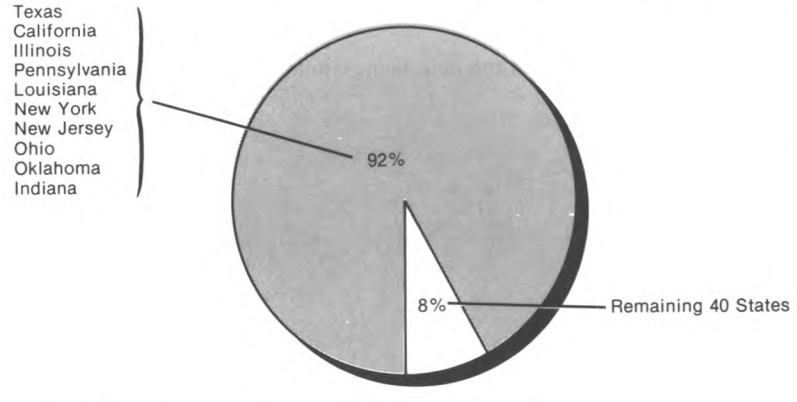
Occupations in the Industry

About 1 out of every 2 workers in a refinery is 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. 542.280), or chief operator, who is responsible for one or more processing units. The refinery operator, with help from assistant operators, 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 plantworkers may include *still pump operators* (D.O.T. 549.782), also known as pumpers, and their *helpers* (D.O.T. 549.884), who maintain and operate pumps that control all production throughout the refinery; and *treaters* (D.O.T. 549.782), 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

Over 90 percent of all workers in the petroleum refining industry are employed in ten States

State distribution of workers in the petroleum refining industry, 1974



Source: Bureau of Labor Statistics

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Operator observes refinery controls.

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, carpenters, instrument repairers, machinists, pipefitters, sheetmetal 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.

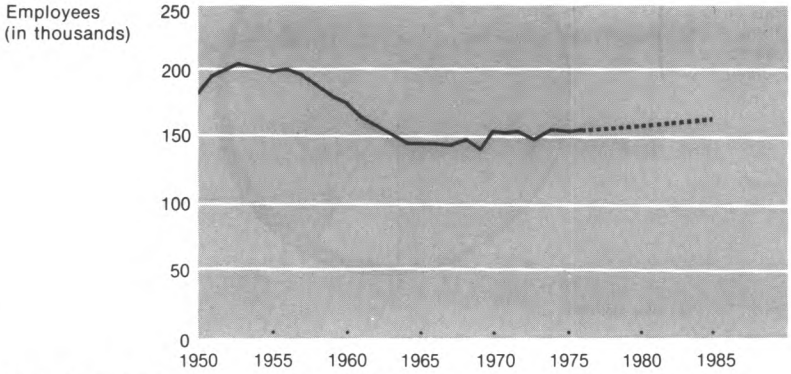
Plantworkers who do not operate, monitor, or maintain equipment do many other tasks. Some workers drive delivery trucks; some load and unload materials on trucks, trains, or ships; and others keep stock and tool inventory records. The industry also employs service workers such as guards and janitors.

About 12 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 many administrative, clerical, and other white-collar personnel. Administrative workers include managers, accountants, purchasing agents, lawyers, computer programmers, computer analysts, and personnel and training specialists. Typists, secretaries, bookkeepers, keypunch op-

Employment in petroleum refining is expected to show little change through the mid-1980's due to productivity improvements

Wage and salary workers in the petroleum refining industry, 1950-76 and projected 1985



Source: Bureau of Labor Statistics

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erators, and business machine operators assist administrative workers. (Detailed discussions of professional, technical, mechanical, and other occupations found not only in petroleum refining but also in other industries are presented elsewhere in the *Handbook*.)

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 plantworkers 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 department or the 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.

Administrative 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. For occupations associated with computers, educational requirements range from a high school level for keypunch operators to a college degree in the physical science field for analysts.

Employment Outlook

Employment in petroleum refining is expected to show little change through the mid-1980's. Refinery output is expected to increase to meet the Nation's growing demand for petroleum products, but 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, administrators, and technicians. More maintenance workers, such as electricians, pipefitters, and instrument repairers, will be needed to take care of the increasing amount of automated



Most refinery jobs require only moderate physical effort.

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equipment and complex control instruments.

Earnings and Working Conditions

Refinery workers are among the highest paid employees in manufacturing. In 1976 production workers in petroleum refining averaged $7.72 an hour, compared with an average of $4.83 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 they may be 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.

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.

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, Suite 802, 1725 DeSales St. NW., Washington, D.C. 20036.

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OCCUPATIONS IN THE PRINTING AND PUBLISHING INDUSTRY

Printing is both an art and one of our chief means of communication. In 1976, the printing and publishing industry employed almost 1.1 million workers. Government agencies and private firms that do their own printing, such as banks and insurance companies, also employed thousands of printing workers.

Nature and Location of the Industry

Included in the industry are 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 1976, the largest division in terms of employment was newspaper printing and publishing, with over 380,000 employees. Most daily and many weekly newspapers throughout the Nation do their own printing. 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 359,000 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 five States—New York, Illinois, California, Pennsylvania, and Ohio. Within these States, most printing activities are in or near manufacturing, commercial, or financial areas such as New York, Chicago, Los Angeles, San Francisco-Oakland, Philadelphia and Cincinnati. 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.

In letterpress printing, the letters and images are raised from the rest of the printing plate. Printing is achieved by covering the printing surface with ink and pressing it directly against paper, thus transferring 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 wa-



The printing and publishing industry employed almost 1.1 million workers in 1976.

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ter do not mix. The plate's image areas are coated with a substance to make the greasy printing ink stick to the plate and then moistened with water so that only the image areas take up the ink. 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 1976, almost 40 percent of all printing craft workers—152,000—were employed in composing room occupations. This group includes *compositors* (D.O.T. 973.381) who set type by hand or machine; *typesetter perforator operators* (D.O.T. 208.588) who punch tapes used to operate some typesetting machines; *make-up arrangers* (D.O.T. 973.381) who assemble type in shallow trays called "galleys" and make trial copy of this type; and *proofreaders* (D.O.T. 209.688) who check the trial copy with the original copy for errors.

Electrotypers and stereotypers (D.O.T. 974.381 and 975.782) 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. Electrotypes are used mainly in book and magazine work. Stereotypes, which are less durable, are used chiefly in newspaper work.

Photoengravers (D.O.T. 971.381) make metal printing plates of illustrations and other copy that cannot be set up in type. 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* (D.O.T. 971.381), 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. 651.782, .885 and .886) 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), *artists and letterers* (D.O.T. 971.281), *strippers* (D.O.T. 971.381), *platemakers* (D.O.T. 972.381), and *press operators* (D.O.T. 651.885).

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* (D.O.T. 019.281) 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 tying 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*.

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

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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 6f 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 apprenticeships 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 more slowly than the average for all industries through the mid-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.

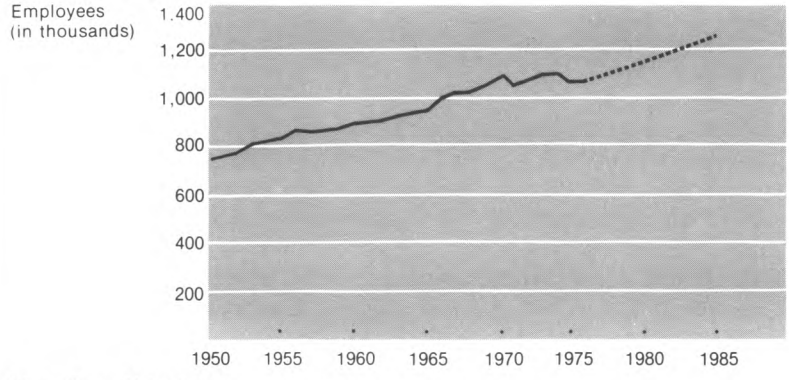
Occupational groups in the industry are expected to increase at different rates. Employment of technical, maintenance, and clerical workers will increase at a faster pace than total employment. Employment growth will vary among the printing crafts. The number of lithographic craft workers, for example, 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 while creating a demand for more computer typesetters. More mechanics will be hired to maintain the industry's increasingly complex machinery.

Earnings and Working Conditions

Earnings of production workers in the printing and publishing industry are among the highest in manufacturing. In 1976, they averaged $5.67 an

Employment in the printing and publishing industry has grown steadily, responding only slightly to economic downturns

Wage and salary workers in printing and publishing, 1950-76 and projected 1985



Source: Bureau of Labor Statistics

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	Estimated average minimum hourly rate, 1976	
	Newspapers	*Book and job shops*
Bookbinders	—	$7.47
Compositors:		
Hand	$7.91	8.38
Machine operators	8.18	8.20
Electrotypers	—	7.23
Photoengravers	8.47	8.90
Press operators	7.65	—
Press (cylinder) operators	—	7.72
Press (platen) operators	—	6.63
Stereotypers	7.49	7.88

hour, while those in manufacturing industries as a whole averaged $5.19.

The accompaying tabulation shows average estimated union minimum hourly rates for selected printing occupations in 1976 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 a 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 Communications 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, 11600 Sunrise Valley Dr., Reston, Va. 20041.

American Photoplatemakers Association, 105 West Adams St., Suite 950, Chicago, Ill. 606043.

Graphic Arts Technical Foundation, 4615 Forbes Ave., Pittsburgh, Pa. 15213.

Gravure Technical Institute, 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 N. 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.)

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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 7,200 mills and factories, produces enough fabric each year to wrap around the earth 250 times, and provides jobs for about 1 million people.

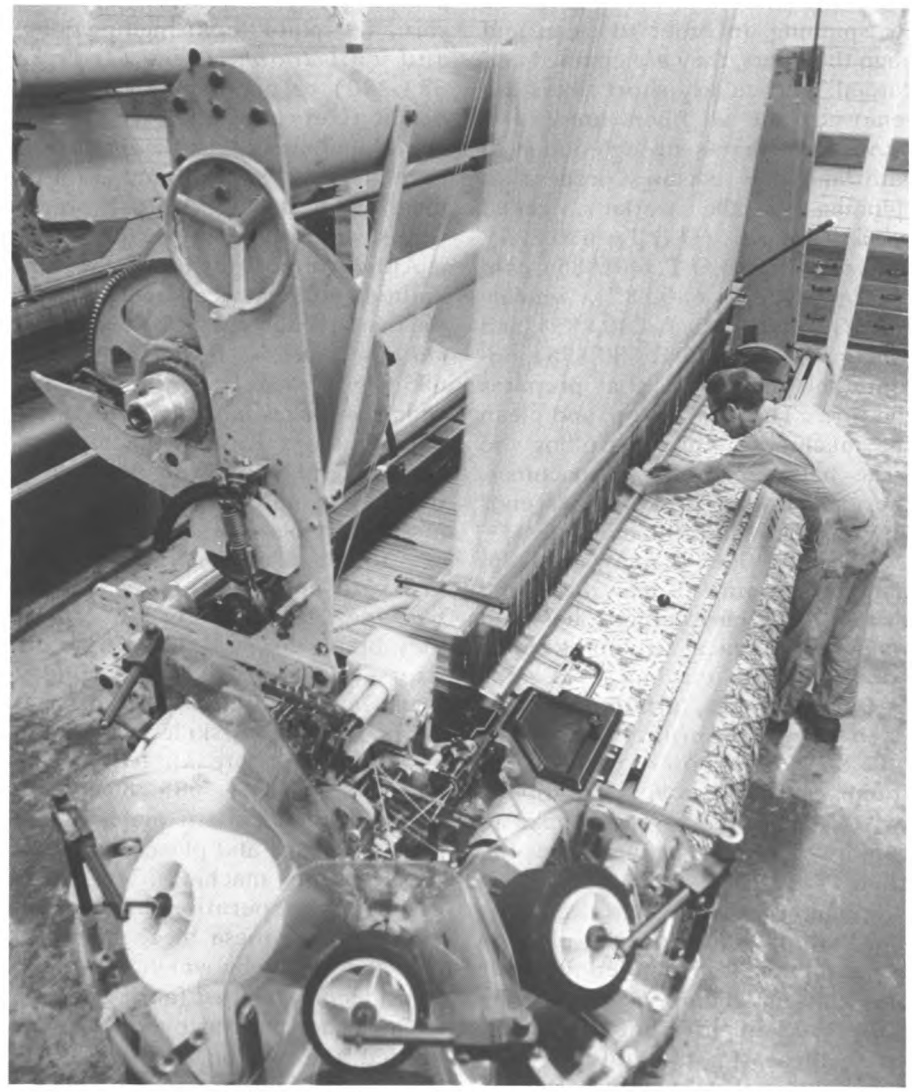
Nature and Location of The Industry

About one-half of all employees in the industry work in mills that weave or knit fabrics that will be made into clothing or household furnishings. Another one-third of the employees produce knit goods for use in making stockings and underwear, while most of the remainder work in mills that color or put patterns on the cloth, or that manufacture carpets and other products such as thread, lace, and cord for tires. About 9 out of 10 textile workers are employed in plants having 100 workers or more, although the majority of plants are small.

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 enjoyed 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 of the country in manufacturing narrow fabrics such as lace, ribbon, and fabric tape; in weaving and finishing wool; and in the production of 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 a little 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, ei-



About one-half of all employees in the textile industry work in mills that weave or knit fabric.

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ther working with their hands or operating machinery.

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 for the industry 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 the fiber into yarn, weaving or knitting the yarn into fabric, and dyeing and finishing the fabric.

First the fibers must be prepared for spinning. In order to clean and align the fibers, they are combed and carded. Particularly short fibers are removed, and all fibers are drawn into a form that is strong enough to withstand the twisting process of spinning. Textile workers, called *opener tenders* (D.O.T. 680.885), *picker tenders* (D.O.T. 680.885), *card tenders* (D.O.T. 680.885), *drawing frame tenders* (D.O.T. 680.885), and *roving tenders* (D.O.T. 680.885), 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.

When the fiber is ready for spinning, a spinning frame draws and twists it 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. 682.885) 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 operations usually are performed in different plants because these two methods of cloth manufacture and the machinery used to accomplish them are quite different. To prepare the yarn for weaving, *loom winder tenders* (D.O.T. 689.885), *spooler tenders* (D.O.T. 689.886), *warper tenders* (D.O.T. 681.885), *slasher tenders* (D.O.T. 582.782), and *warp tying machine tenders* (D.O.T. 681.885) position it 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.

Fabric is produced on looms which interlace—weave—the yarn. There may be as many as 2,000 looms in the weaving room. *Weavers* (D.O.T 683.782) constitute about 10 percent of all textile machine operatives. They are skilled workers who monitor and operate as many as 200 looms at a time. They observe fabric being woven to detect and remove defects. They also repair breaks in yarn, fix minor loom malfunctions, and call *loom fixers* (D.O.T. 683.280) to make major repairs. Loom fixers not only repair machines, but also adjust them and prepare them for operation. Each of these highly skilled operatives works with several weavers.

Although most textiles are woven, knitted cloth claims a larger share of the market each year. To knit yarn, a *knitting machine operator* (D.O.T. 685.885) places it on a machine which produces fabric by intermeshing yarn loops. Knitting machine operators tend several machines at a time. They start the machines, feed in the yarn, observe the knitting process to detect malfunctions, tie broken yarn ends, and notify *knitting machine fixers* (D.O.T. 689.280) if they break down. Knitting machine fixers and loom fixers do similar work, but on different machines.

The most highly skilled workers in a knitting mill are *knitter-machine mechanics* (D.O.T. 685.380). They arrange metal pattern plates in the form of chains and place the chains in the knitting machines. The chains control the operation of the machines. Thus, these mechanics provide the means by which textile designs become knitted fabrics.

Once the yarn has been woven or knitted, the resulting fabric is ready to be dyed and finished either by textile mills that also weave or knit the fabric, or by independent businesses. *Dyers* (D.O.T. 582.138) develop dye formulas that are used to create a desired color. They also supervise the dyeing. *Dye weighers* (D.O.T. 550.884) mix the dyes and chemicals used in dyeing. *Dye range operators* (D.O.T. 582.782) run the machines that dye and dry the cloth.

Manufacturers print textiles in thousands of different colors and designs in order 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 as the cylinder rolls over the cloth, leaving the print.

However, before the fabric can receive a print, the design must be created, and *colorists* (D.O.T. 022.181) must develop the colors for printing. *Screen printing artists* (D.O.T. 970.381) then use these colors to make color separations of designs on transparent paper. For each color, *screen makers* (D.O.T. 971.381) prepare a screen, treating it with emulsion and exposing it photographically to the appropriate transparency. *Screen printers* (D.O.T. 652.782) 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, strengthening it, or providing it with a silky luster. Each step offers job opportunities for textile machine operatives and general maintenance workers. People in several other occupations are important to the industry, although they are not directly involved in production. Among these are *textile designers* (D.O.T. 142.081), *textile engineers* (D.O.T. 183.118), and *textile technicians* (D.O.T. 689.384). These occupations 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 fabrics or printed on them. Most designers work in New York City, where the designing and styling departments of most textile companies are located.

Textile engineers usually hold supervisory or managerial positions.

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They may be plant managers who supervise entire plants, or plant engineers, responsible for the heating, air conditioning, electrical, materials handling, or other systems in textile establishments.

Textile technicians translate fiber properties into useful end products. They may work in research, developing new fiber processing techniques; in quality control and production, measuring major characteristics of raw textiles; or in customer sales and service, selling directly to customers or serving them. Many technicians work in the dyeing and finishing areas of textile plants.

In addition to occupations that are unique to the manufacture of textiles, many others are found in this industry. There are managers such as plant and department managers in all areas of the textile industry. Personnel specialists hire employees, and make sure that pay and benefits are received. There are jobs for bookkeepers, accountants, and computer programmers. The industry employs a wide assortment of clerical workers as well, including secretaries, computer console operators, and shipping and receiving clerks. There also are jobs for janitors, guards, and food service workers. Mechanics and repairers, besides those already mentioned, keep machinery and equipment operating properly. Laborers, such as freight and material handlers, often using mechanical devices, lift and move heavy loads to various textile machines.

Training, Other Qualifications and Advancement

Most occupations in the textile industry are machine operative jobs that can be learned on the job. Other occupations require additional training and special skills. A small share of jobs is held by workers trained in professional fields.

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 pro-



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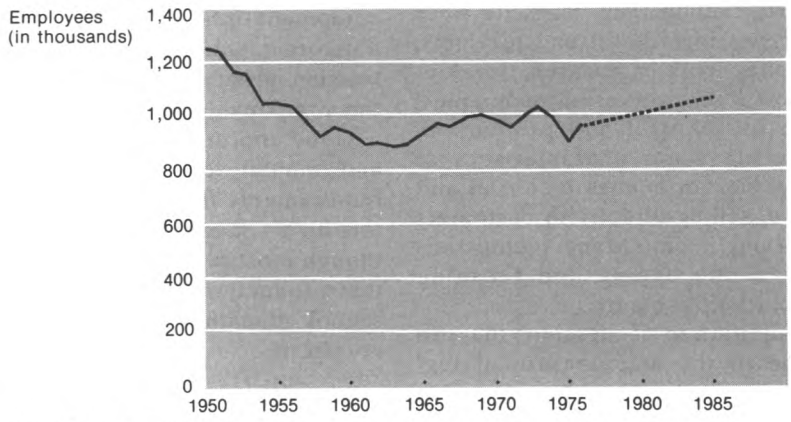
grams to help an employee advance in skilled occupations; many pay all or part of the tuition for courses taken at private and public schools and colleges which the company determines would help the employee advance to positions of increased responsibility.

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 in these fields 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 well, both 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.

Graduates of 4-year colleges hold the majority of management jobs in textile companies. Textile manufacturers are particularly interested in those 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 phases of the manufacturing process or in the operation of the industry, such as textile engineering, textile chemistry, or textile management. Ten colleges in the United States offer 4-year undergraduate degrees in textiles; most of these institutions are located in the northeastern and southeastern parts of the country. High school courses in mathematics and the physical sciences are good preparation for pursuing degrees in textile engineering or chemistry, while courses in business and economics provide a good basis for pursuing a degree in textile management.

Employment in textile manufacturing, which declined in the 1950's, is expected to continue at recent levels

Wage and salary workers in textile mill products manufacturing, 1950-76 and projected 1985



Source: Bureau of Labor Statistics

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. Having completed their training, many of them move into manufacturing supervisory jobs, from which they often advance 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 frequently have degrees in textile engineering or textile management, as well as the demonstrated ability to lead and motivate people.

Employment Outlook

Textile industry employment growth is expected to be slower than the average for all industries through the mid-1980's. Many more job openings will result from persons leaving the industry because of death, retirement, or for other reasons than from employment growth. The demand for textile employees, particularly skilled and semiskilled workers, will be greatest in the Southeast.

Textile output is expected to expand over the next decade in response to demand from the apparel and home furnishings industries which are spurred by growth in population and incomes. An anticipated increase in the variety of textile products also should contribute to growth in output. In addition, although competition from imports has diminished the demand for domestic products of some sectors of this industry, recent negotiation of a new international trade agreement limiting textile imports probably will 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. Electronic instrumentation, which reduces the need for maintenance

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Table 1. Average Hourly Earnings of Production Workers in Weaving Mills and Yarn and Thread Mills Industries, Selected Occupations and Areas, 1975

Weaving mills and yarn and thread mills	Estimated Average Hourly Earnings		
	New England	Middle Atlantic	Southeast
All production workers	$3.17	$3.33	$3.07
Card tenders	3.01	[1]	2.85
Frame spinners	3.08	[1]	2.93
Slasher tenders	3.53	3.53	3.35
Warper tenders	3.08	3.70	3.02
Loom fixers	3.82	4.68	4.05
Weavers	3.62	4.07	3.55

[1] Not available.

workers, is expected to become increasingly important. Also, the coming decade will see the greater use of computers as a management tool and as a means of controlling parts of the production process.

Although the adoption of technologically advanced machinery will diminish the need for semiskilled and unskilled workers, the demand for skilled workers and professional and managerial personnel will increase. Skilled production 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 and Working Conditions

Average hourly earnings of production workers in the textile industry in 1976 were below those of production workers in all manufacturing industries—$3.67 versus $5.19.

In 1976, production workers' average wages ranged from $3.44 an hour in yarn and thread mills to $3.97 an hour in textile finishing plants. There also is some variation in wages by geographic area. A 1975 Bureau of Labor Statistics survey of weaving mills and yarn and thread mills indicated average earnings of production workers in the Southeast were $3.07 an hour; in New England $3.17 an hour; and in the Middle Atlantic region, $3.33 an hour. Table 1 gives estimated average hourly earnings in 1975 for selected occupations and regions in one segment of the industry. According to limited information, starting salaries for professional workers in the textile industry ranged from $10,000 to $12,000 a year in 1976.

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.

Although the average workweek for textile production workers is close to 40 hours, about the same for production workers in all manufacturing industries, many textile employees, particularly in the Southeast, work 46 to 48 hours a week. Most textile mills operate 24 hours a day, each day divided into three shifts. A shift differential is usually paid to those who work the 3d, or late, shift.

There are few seasonal influences on textile plant operation. When there is a lack of work due to recession or for some other reason, the textile industry usually chooses to reduce operations by 1 or 2 days a week rather than close down the plants altogether.

Although most textile employees work with or near machinery, the accident rate for the industry is slightly lower than the average for all manufacturing industries. Some workers, however, are subjected to noise from machinery. Most employees work in newer buildings where temperature and humidity controls are common, although lint-laden air and poor lighting are problems in some older plants.

Benefits for textile employees in both unionized and nonunionized plants usually include paid holidays and vacations, pensions or retirement plans, hospitalization insurance, and sick pay. Additional benefits provided by 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, whereas about half of all manufacturing workers are union members. 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, Wachovia Center, 400 S. Tryon St., Charlotte, North Carolina 28285.

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.

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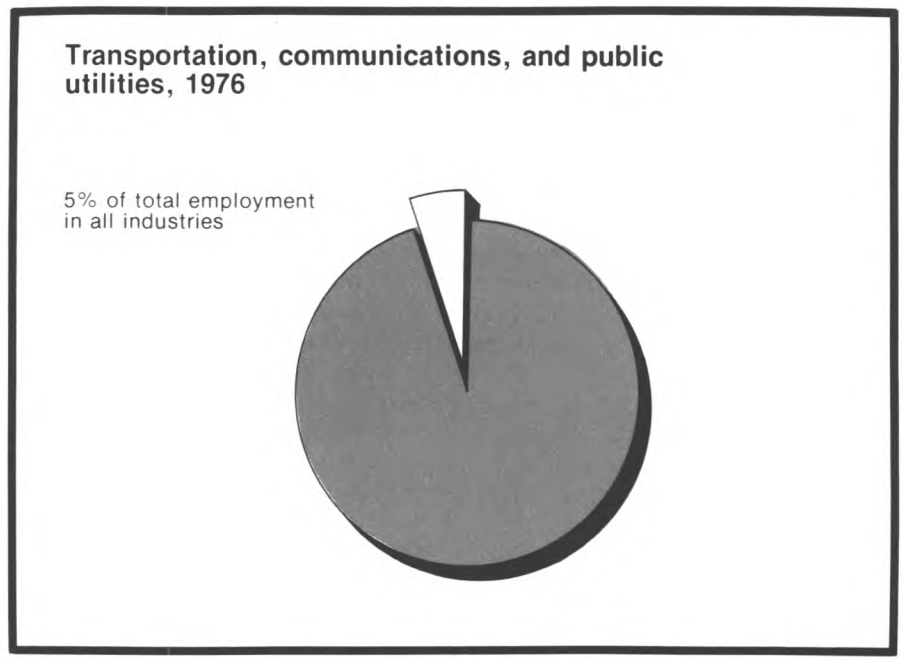
TRANSPORTATION, COMMUNICATIONS, AND PUBLIC UTILITIES

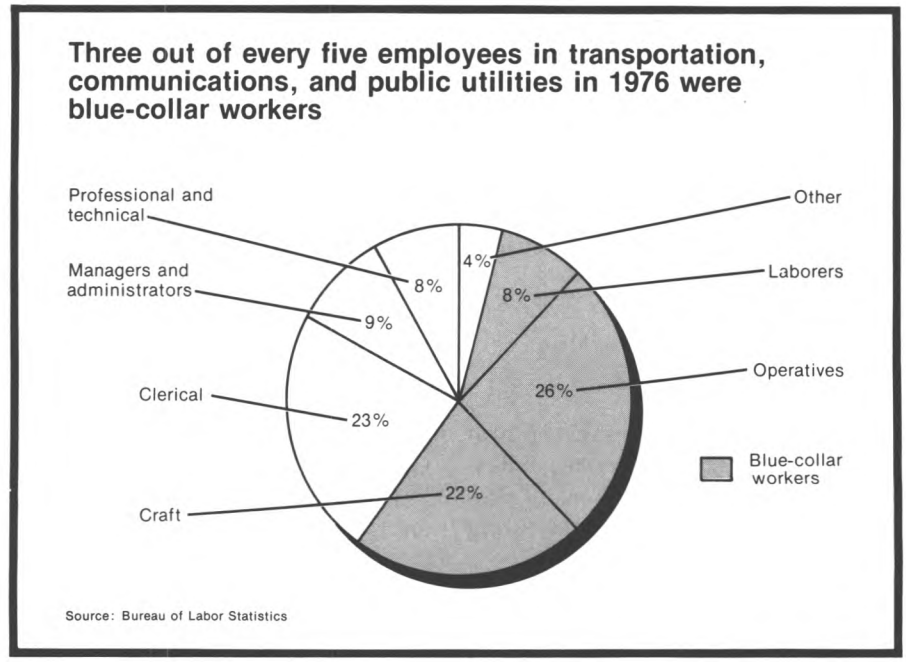
Transportation, communications and public utility firms are commonly grouped together because they provide a public service and are owned or regulated by government or other public agencies. The purpose of this regulation varies from industry to industry, but in general the goals have been to ensure fair prices and to see that the public interest is served.

In 1976, almost 5.7 million people worked in this group of industries, almost one million of them in Federal, State, and local governments owning or regulating part of the industry. The two largest industries were communications, which employed 1.2 million workers, and motor freight transportation and warehousing (including local and long-distance trucking), which employed over 1 million workers. Close behind were electric, gas, and sanitary services with 750,000 workers, and railroads with 525,000.

As shown in the accompanying tabulation, blue-collar workers (craft workers, operatives, and laborers) accounted for three-fifths of the total employment in these industries in 1976. The remaining two-fifths were white-collar workers (professional, managerial, clerical, and sales). However, the occupational pattern differed among the various industries.

In the transportation industries, blue-collar operatives constitute the largest group of workers, almost three 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 truck drivers who move goods throughout the country. Other operative workers include rail-





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road brake operators and sailors. Many craft workers also are needed in the transportation industries, 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 the telephone, 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, and 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 industries is expected to increase about as fast as the average for all industries through the mid-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 business expansion will stimulate growth in interurban transit at a faster than average rate. Average growth is expected in air transportation, trucking, and some local passenger transportation (subways and local buses). On the other hand, taxicab service employment is expected to remain about the same. The long-run decline in railroad employment is expected to continue, but at a decreasing rate.

Employment in communications is expected to grow at about the same rate as the average for all industries through the mid-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 communications. 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 statements 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*.

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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 1976 over 425,000 people were employed in a variety of interesting and responsible occupations in this industry.

Characteristics 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 almost 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 1976, about 303,000 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 1976, the FAA employed about 58,000 people, the CAB less 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. Most other civil aviation employees work at airports near large cities.

Civil Aviation Occupations

Over two-thirds of all civil aviation employees work in ground occupations. Many of these are mechanics and aircraft maintenance personnel who refuel, clean, inspect, and repair the planes between flights. Other large groups make reservations and sell tickets for the airline companies. Some are air traffic controllers and flight service specialists for the FAA. Flight service specialists assist pilots before the flight by suggesting routes and altitudes and providing them with information on their particular area, such as terrain and weather peculiarities. Other groundworkers include cargo and freight handlers, dispatchers, and clerical, administrative, and professional personnel.

Flight crewmembers make up the remaining one-third of civil aviation employment. They include the pilots who fly the planes and the flight



Over two-thirds of all civil aviation employees work in ground occupations.



Reservation agents use computer terminals to make reservations.

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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.

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. Advancement 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 mechanics, inspectors, and in a few cases, to supervisory and executive positions. Some jobs require aircraft mechanics to be certified by the FAA.

New reservation, ticket, 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 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. All workers must be certified by FAA examiners before they can work as controllers. Controllers can advance to supervisory positions and to higher management jobs in air traffic control.

Completion of commercial courses in high school or business school is usually 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.



Controllers at an air traffic control center coordinating flights to prevent collisions.

Employment Outlook

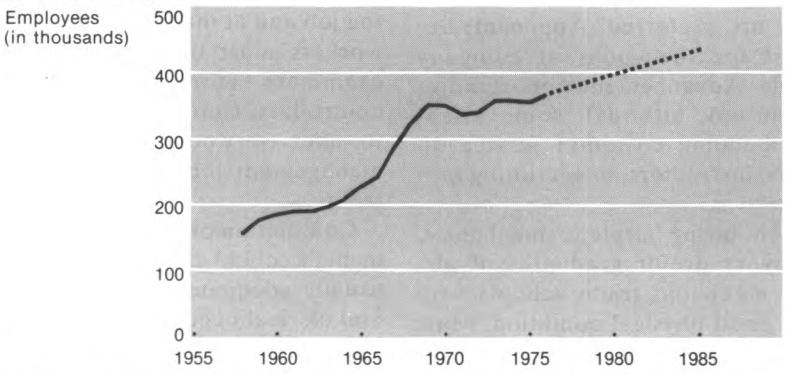
The total number of workers in civil aviation occupations is expected to increase about as fast as the average for all occupations through the mid-1980's. Besides the job openings that will be created by employment growth, many openings will arise as experienced workers retire, die, or transfer to other 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.

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Employment in civil aviation is expected to experience moderate long-term growth, following a rapid increase during the late 1960's

Wage and salary workers in transportation by air, 1958-76 and projected 1985



Source: Bureau of Labor Statistics

Earnings and Working Conditions

Airline employees earned an average of $20,900 a year in 1976, over twice the average for all nonsupervisory workers in private industry, except farming. Among the major occupations, salaries ranged from $800 a month for new reservation agents to $6,500 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.

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 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.

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:

Research and Inquiry Division, Office of Information Service AIS-230, Federal Aviation Administration, Washington, D.C. 20591.

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OCCUPATIONS IN THE ELECTRIC POWER INDUSTRY

Electricity has become so much a part of our daily lives that most people take it for granted. But just imagine not being able to ride the elevator to your apartment and instead having to walk up all those flights of stairs. Or think about having no lights, television set, or radio in your home. Today, it would be difficult to get used to living without electricity.

Bringing electricity into our homes and places of work and recreation is not as simple as just turning on a switch. There are thousands of employees working in the electric power industry to make all this possible.

Nature and Location of the Industry

The delivery of electricity to users at the instant they need it is the unique feature of the electric power systems. Electricity cannot be stored efficiently but must be used as it is produced. Because a customer can begin or increase the use of electric power at any time by merely flicking a switch, 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 chapter 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 the users.

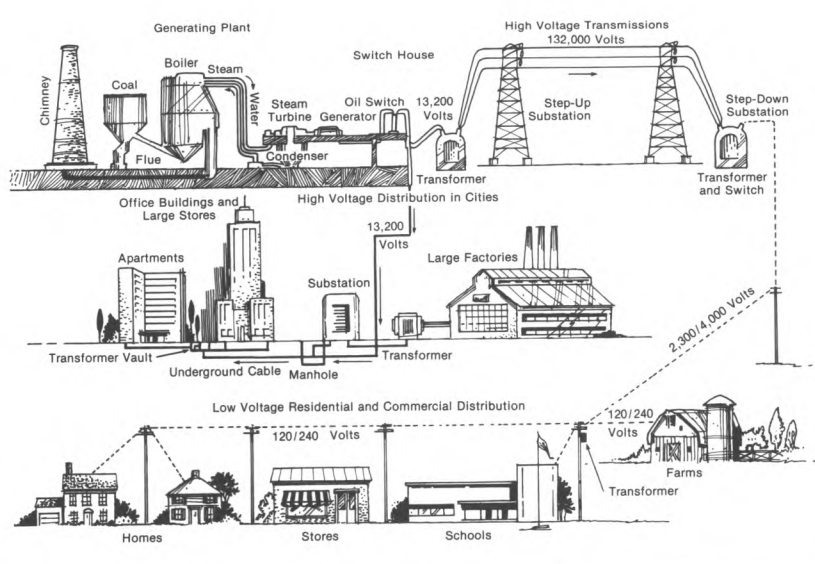
The first step in providing electrical energy occurs in a generating station or plant, where huge generators convert mechanical energy into electricity. Electricity is produced primarily in steam-powered generating plants that use coal, gas, oil, or nuclear energy for fuel. In addition, a considerable 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 service or to provide electricity for special purposes, are powered by diesel engines or gas turbines.

After electricity is generated, it passes through a "switchyard," 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.

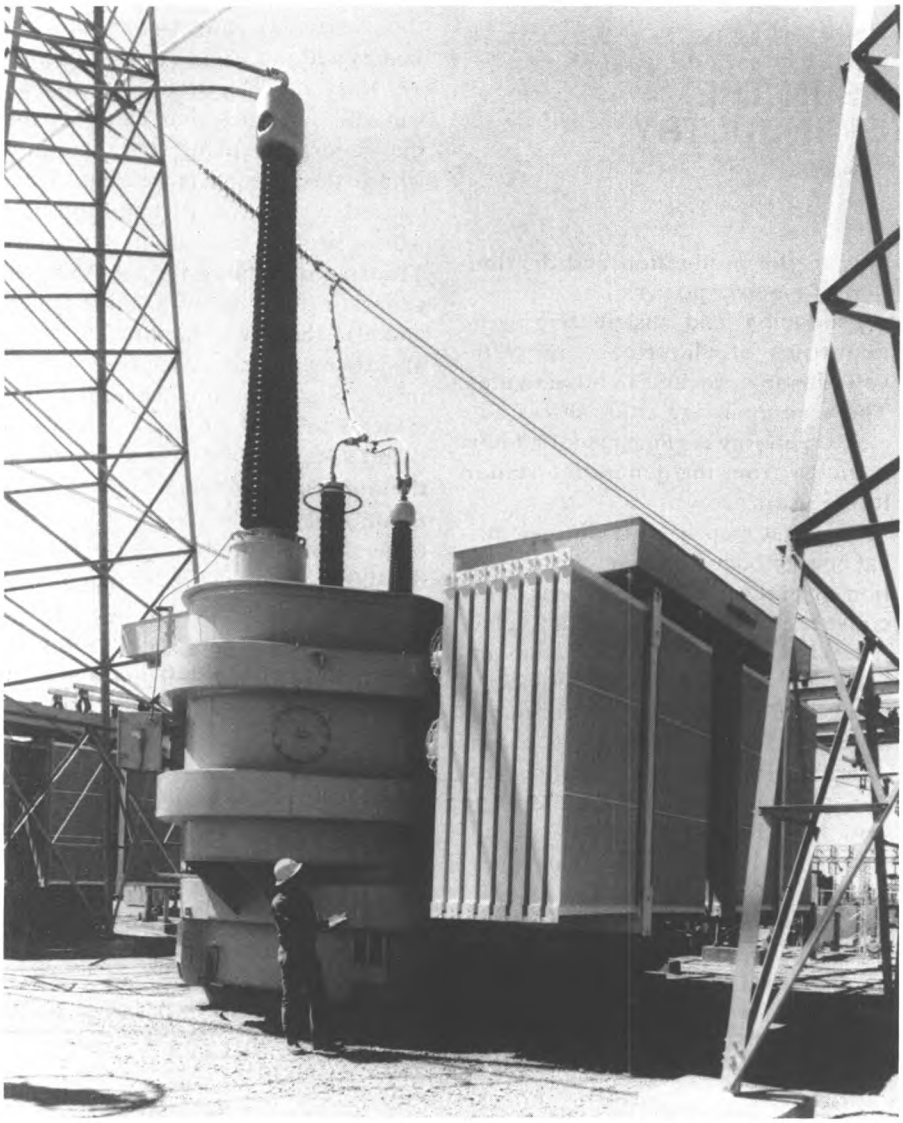
In 1976, 544,000 people worked in the electric power industry. Most of them, 461,000, worked in investor-owned utilities and cooperatives and 80,400 worked in Federal and municipal government utilities. A few large manufacturing establishments, which produce electric power for their own use, also employ 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.

How electricity is made and brought to the users



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Jobs in the electric power industry are found throughout the country.

Electric Utility Occupations. 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 chapter.) The industry also employs large numbers of workers in engineering, scientific, administrative, sales, clerical, and maintenance occupations. A brief discussion on 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 plantsites, 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, 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.

Employment Outlook

Employment in the electric power industry is expected to increase about as fast as the average for all industries through the mid-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 an 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, en-

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gineering, and technical employees is expected to increase sharply as construction of power generating plants increases and as research into developing more efficient energy usage to combat shortages and higher prices of fossil fuels becomes necessary. Much of this increase in employment will be in the development and construction of new nuclear power facilities.

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 job 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 and Working Conditions

Earnings in the electric utility industry are relatively high. In 1976, nonsupervisory employees in private electric power companies averaged $6.60 an hour. By comparison, the average for all nonsupervisory workers in private industry, except farming was $4.87 an hour.

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 10 years, and 3 weeks for 10 to 20 years. Some 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 6 to 12 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.

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 on linecrews, are more subject to accidents than others.

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, from industry trade associations, or from the local offices of unions that represent electric utility workers. Additional information also may be obtained from:

Edison Electric Institute, 90 Park Ave., New York, N.Y. 10016.

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 to detect any trouble that may arise. In this way, operators ensure that power production will not be interrupted.

Switchboard operators (D.O.T 952.782) 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

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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. 950.782)—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 using control valves, meters, and other instruments which are mounted on panel boards. The size of the generating unit determines the number of boilers used; thus a boiler operator may be responsible for operating one or several boilers.

Turbine operators (D.O.T. 952.138) 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 turbogenerator 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. 952.782) 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 directly related to 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. 950.782) 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) 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.



Operators check and record the readings of instruments.

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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 the 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. While licensing requirements often vary from place to place, the National Institute for the Uniform Licensing of Power Engineers (NIULPE) is attempting to standardize these requirements.

Some powerplant workers employed in atomic-powered electric plants must have special training to work with nuclear fuel, 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 mid-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.

Earnings and Working Conditions

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 1976.

	Average hourly earnings
Auxiliary equipment operator	$5.66
Boiler operator	7.44
Control room operator	8.26
Switchboard operator:	
Switchboard operator, Class A	7.56
Switchboard operator, Class B	7.03
Turbine operator	7.26
Watch engineer	8.67

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. Since generating stations operate 24 hours a day, 7 days a week, some powerplant employees must work nights and weekends, usually on rotating shifts.

Sources of Additional Information

For information concerning licensing of powerplant employees, contact State and local occupational licensing agencies in your area or write to:

National Institute for Uniform Licensing of Power Engineers, 176 W. Adam St., Suite 1914, Chicago, Ill. 60603.

TRANSMISSION AND DISTRIBUTION OCCUPATIONS

Nature of the Work

One-fourth of the workers in the electric power industry are in transmission and distribution jobs. This phase of the utility system links the electric power produced in generating plants to individual customers according to their needs. The principal workers in these jobs are those who

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control the flow of electricity—load dispatchers and substation operators—and employees who construct and maintain powerlines—line installers and repairers, cable splicers, troubles ground helpers, and laborers.

Load dispatchers (D.O.T. 950.168), 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 interconnecting their utility system with other systems and directing transfers of current between systems as the need arises.

Substation operators (D.O.T. 952.782) 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 lines, 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 commerical or governmental installations.

Line installers and repairers (D.O.T. 821.381) 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 particu-



Line installers constructing underground electric power lines.

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lar types of work. Those in one crew may work on new construction only, and others may do only repair work.

Trouble shooters (D.O.T. 821.281) 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. 821.887) 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. 829.381) 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.

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 because climbing poles and lifting lines and equipment is strenuous. 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 mid-1980's. Most of these opportunities 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 employment 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 and Working Conditions

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 1976.

	Average hourly earnings
Ground helper	$5.37
Line installer and repairer	7.97
Load dispatcher	8.38
Substation operator	7.14
Trouble shooter	9.15

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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.



Meter readers go to customers' homes to record electricity used.

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) 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. 821.381) who put in and take out meters, and *meter testers* (D.O.T. 729.281).

Meter readers (D.O.T. 239.588) 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 chapter elsewhere in the *Handbook*.

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. Beginners accompany the experienced meter reader on the rounds until they have learned the job.

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 mid-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 and Working Conditions

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 1976.

	Average hourly earnings
District representative	$8.14
Meter repairer A	7.26
Meter repairer B	6.43
Meter reader	5.78

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OCCUPATIONS IN THE MERCHANT MARINE INDUSTRY

In 1976, the merchant marine industry employed about 100,000 people in a variety of occupations that require different levels of skill and education. Many of these jobs are found only in the merchant marine industry.

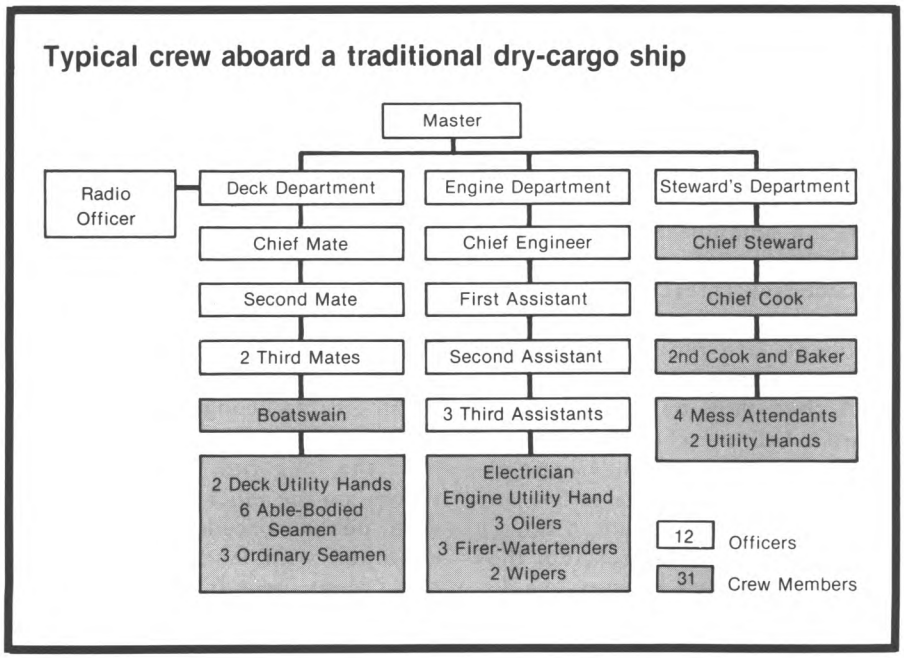
Nature and Location of the Industry

The merchant marine consists mainly of private firms that carry foreign and domestic commerce aboard oceangoing vessels. In late 1976, nearly all of the 521 ships in the active fleet were privately owned. The small number of government-owned ships in the merchant marine are operated by the Navy's Military Sealift Command (MSC) and have civilian crews.

Nearly three-fifths of the ships in our merchant fleet are freighters. These include general cargo ships and special vessels, such as roll-on-roll-off container ships. About two-fifths of the ships are tankers that carry liquid products, such as oil, mostly between the Nation's Gulf and Atlantic Coast ports. Several ships are combination passenger-cargo carriers.

Many ships operate on a regular schedule to specific ports. Others sail for any port promising cargo. The size of a crew depends on the type of vessel. Cargo ships and tankers have crews varying from 13 to 65 persons; passenger ships may have crews of 300 or more.

Most shoreside employees in the industry work in the country's major port cities, and most officers and sailors have home bases in these cities. The Nation's largest port is New York. Other major Atlantic ports are Boston, Philadelphia, Baltimore, Norfolk, Charleston, Savannah, and Jacksonville. Gulf ports that handle large volumes of cargo include New Orleans, Houston, Galveston, and Tampa. Shipping on the West Coast is concentrated in the areas of San Francisco, Los Angeles, Seattle, and Portland.



Occupations in the Industry

Almost half of the merchant marine industry's employees are officers and sailors who make up ship crews. Most of the industry's shoreside employees are dockworkers who load and unload ships. A small number of workers have administrative and clerical jobs.

Ship Crews. The *captain* (D.O.T. 197.168) or master, has complete authority and responsibility for the ship's operation, and the safety of the crew, passengers, and cargo. Under the supervision of the captain, the work aboard ship is divided among the deck, engine, and steward departments.

Deck officers (D.O.T. 197.133), under orders from the captain, direct movement of the ship and the maintenance of the deck and hull. *Boatswains* (D.O.T. 911.131) supervise deck crews and see that deck officers' orders are carried out. *Able seamen* (D.O.T. 911.884) steer the ship and report sightings to the deck officer. *Ordinary seamen* (D.O.T. 911.887), the entry rating in the deck department, do general maintenance work such as chipping rust, painting, and splicing and coiling ropes. *Deck utility hands* (D.O.T. 911. 884) and *ship's carpenters* (D.O.T. 860.281) also are employed on some vessels to maintain the ship's deck and hull.

Marine engineers (D.O.T. 197.136) are responsible for starting, stopping, and controlling the speed of the main engines and the operation of all other machinery aboard ship. They also direct sailors, such as oilers and wipers, in the lubrication and maintenance of engines, pumps, and other equipment. *Oilers* (D.O.T. 911.884) lubricate moving parts of mechanical equipment. *Wipers* (D.O.T. 699.887) keep the engineroom and machinery clean. *Firers-watertenders* (D.O.T. 951.885) regulate fuel gauges and the amount of water in the boilers. The *ship's electrician* (D.O.T. 825.281) repairs and

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maintains electrical equipment, such as generators and motors.

The *chief steward* (D.O.T. 350.138) supervises the preparation of meals and the upkeep of living quarters aboard ship. The *chief cook* (D.O.T. 315.131) and assistant cooks prepare meals. *Utility hands* (D.O.T. 318.887) carry food supplies from the storeroom, prepare vegetables, and wash cooking utensils. *Mess attendants* (D.O.T. 350.878) set tables, serve meals, wash dishes, and care for living quarters.

Most ships employ *radio officers* (D.O.T. 193.282), who keep contact with the shore and other ships and maintain the radio equipment. Some cargo ships and all passenger vessels carry *pursers* (D.O.T. 197.168), who prepare the necessary papers to allow ships to enter or leave port.

Occupations aboard ship are discussed in detail elsewhere in the *Handbook* in the statements on merchant marine officers and merchant marine sailors.

Dock Workers. Many workers are needed to load and unload ships. Terminal managers are responsible for hiring dockworkers called *stevedores* (D.O.T. 911.883). Gang bosses supervise crews of stevedores who load and unload ships and move cargo in and out of warehouses. Some operate materials handling equipment, such as lift trucks and cranes. Stevedores also position and fasten hose lines to the ship's tanks when loading or unloading liquid cargo, such as chemicals and oil.

Clerical Occupations. The merchant marine industry employs workers in general clerical jobs, such as payroll clerk, secretary, and typist. Other clerical workers have specialized jobs. *Billing clerks* (D.O.T. 219.388) type invoices that list items shipped and dates of shipment. *Clerks and dispatchers, pilot station*, (D.O.T. 911.368) keep records of ships entering ports. *Manifest clerks* (D.O.T. 219.388) compile and type the ship's manifest (a list of passengers and cargo) for use at customhouses or terminals. *Receipt and report clerks* (D.O.T. 911.388) prepare reports on labor and equipment costs for loading and unloading cargoes.

Administrative and Professional Occupations. The merchant marine industry employs a small number of administrative and other office personnel. Executives plan and administer company policy. The industry also employs accountants, lawyers, and labor relations and personnel workers. Some *marine architects* (D.O.T. 001.081) are employed to oversee the construction and repair of ships.

Training, Other Qualifications, and Advancement

Inexperienced workers may be hired as stevedores to load and unload cargo. Applicants must be in good physical condition. A high school education is preferred but not required. Under the guidance of experienced workers, stevedores can learn their jobs in a few weeks. As vacancies occur, they can advance to jobs such as lift truck operator and crane operator. Workers who have supervisory ability may become gang bosses.

No educational requirements are established for jobs aboard ship, but a good education is an advantage. Formal training for officers is conducted at the U.S. Merchant Marine Academy, at five State merchant marine academies, and through programs operated by trade unions. Unions also conduct training programs to upgrade the ratings of sailors.

To obtain an officer's license, a candidate must be a U.S. citizen, be physically fit, and pass a written examination administered by the U.S. Coast Guard. Sailors also must obtain licenses (merchant mariner's documents) from the Coast Guard. Applicants are required to pass a physical examination and present proof that they have a job offer aboard a U.S. merchant vessel.

Persons who are considering a career at sea must be able to live and work with others as a team. Although peace time service is relaxed, they must adjust to some military-like discipline that is essential because of the nature of shipboard life.

Most general clerical occupations, such as secretary or bookkeeper, usually require the completion of basic commercial courses in high school or business school. Additional on-the-job training is necessary for specialized clerical occupations, such as manifest clerk and receipt and report clerk.

Administrative positions usually are filled by college graduates who have degrees in business administration, marketing, accounting, industrial relations, or other specialized fields. A knowledge of the merchant marine industry is helpful. Marine architects must be licensed professionals. Requirements for licensing are set by the individual States and generally include graduation from an accredited professional school followed by 3 years of practical experience in an architect's office.

Employment Outlook

Little or no change in employment in the merchant marine industry is expected through the mid-1980's. Nevertheless, some openings will arise each year from the need to replace experienced workers who retire, die, or transfer to other fields.

Because of substantially higher shipbuilding and labor costs, our merchant fleet finds it difficult to compete in the world shipping market. To insure that our country has a merchant fleet operating in regular or essential trade routes, the Government subsidizes many ships. In 1970, the Government also passed a law which would subsidize the construction of 30 new ships annually over a 10-year period and to improve tax incentives for firms to buy new ships. Despite this support, the size of our merchant fleet probably will not grow significantly, since the number of ships to be built is expected to only slightly exceed the number of older vessels taken out of service.

Little or no change in the employment of ship's officers is expected over the long run. Employment of sailors, on the other hand, is expected to decline because new ships are equipped with laborsaving innovations, such as automated enginerooms, which reduce the need for these workers.

Employment trends also will vary among shoreside occupations. The greater use of containerized cargo

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ships and improvements in materials handling equipment will reduce the need for stevedores. Employment in administrative and clerical occupations, on the other hand, is not expected to change significantly.

Earnings and Working Conditions

Stevedores working along the Atlantic and Gulf Coasts earned $8 an hour in 1976, and those on the Pacific Coast earned $7.52 an hour. Stevedores also earn extra pay for handling hazardous cargo.

Earnings aboard ships are relatively high; all officers earned a base pay of over $1,000 a month in 1976. Sailors who have advanced a rung or two in rating could receive a base pay of over $700 a month. In addition, both officers' and sailors' earnings are supplemented by premium pay for overtime or for assuming extra responsibilities. On the average, additional payments for assuming extra work or responsibility add about 50 percent to base pay. Shipboard workers also receive free meals and lodging while at sea.

Since ship's crewmembers and stevedores are subject to occasional layoff, however, their annual earnings usually are not as high as the hourly rates and monthly salaries would imply.

Most shoreside workers in the industry work a 5-day, 40-hour week. The workweek for people aboard ships is considerably different. Most officers and sailors are required to stand watch, working split shifts around the clock. Generally, they work two 4-hour shifts during every 24-hour period and have 8 hours off between each shift. Other officers and sailors are on duty 8 hours a day, Monday through Friday.

The merchant marine industry provides excellent fringe benefits. Most employers provide paid vacations and holidays. Vacations for sailors and officers range from 90 to 180 days a year. Many firms also provide other benefits such as life, health, and accident insurance. Officers and sailors may retire on full pension after 20 years of service, regardless of age. Stevedores are eligible for pension at age 65.

Working and living conditions aboard ship have improved over the years. Mechanization has reduced the physical demands, and newer vessels have private rooms, air-conditioning, television, and better recreational facilities. However, life aboard ship is confining, and since voyages last several weeks or months, officers and sailors are away from their homes and families much of the time. Some tire of the lengthy separations and choose shoreside employment. However, for many people, the spirit and adventure of the sea, good wages, and fringe benefits more than compensate for the disadvantages.

The duties aboard ship are hazardous compared with other industries. At sea, there is always the possibility of injury from falls or the danger of fire, collision, or sinking. Most shoreside jobs are not hazardous, but stevedores may do heavy lifting and risk injury from falling boxes and other freight when loading and unloading ships.

Most employees are union members. All stevedores are represented by either the International Longshoremen's Association or the International Longshoremen's and Warehousemen's Union. Most officers aboard ships are represented by the International Organization of Masters, Mates and Pilots; and the National Marine Engineers Beneficial Association. Sailors are members of the National Maritime Union of America and the Seafarers' Union.

Sources of Additional Information

For general information about jobs in the merchant marine, write to:

Office of Maritime Manpower, Maritime Administration, U.S. Department of Commerce, Washington, D.C. 20235.

Information about job openings and wages aboard ships can be obtained from local maritime unions. If such a union is not listed in the local telephone directory, contact:

National Maritime Union of America, 36 Seventh Ave., New York, N.Y. 10011.

Seafarers' International Union of North America, 675 Fourth Ave., Brooklyn, N.Y. 11232.

National Marine Engineers, Beneficial Association, 17 Battery Pl., New York, N.Y. 10004.

Further information about stevedore jobs is available from:

International Longshoremen's Association (AFL-CIO), 17 Battery Pl., New York, N.Y. 10004.

International Longshoremen's and Warehousemen's Union (AFL-CIO), 150 Golden Gate Ave., San Francisco, Calif. 94102.

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OCCUPATIONS IN RADIO AND TELEVISION BROADCASTING

The glamour and excitement of radio and television make broadcasting careers attractive to many people. In 1976 about 130,000 full-time and 30,000 part-time workers were employed in broadcasting; slightly more than half were in radio and the rest were in television. In addition, several thousand freelance artists, mostly writers, performers, and musicians, work on a contract basis for stations, networks, and other producers. Several thousand other employees work for independent producers in activities closely related to broadcasting, such as the preparation of filmed and taped programs and commercials.

Broadcasting stations offer a variety of interesting jobs in all parts of the country. Opportunities for entry jobs are best at stations in small communities, although the highest paying jobs are in large cities, especially those with national network stations.

Nature and Location of the Industry

Commercial broadcasting. In 1976 about 7,250 commercial radio stations and 720 commercial television stations were in operation in the United States. Most commercial radio broadcasting stations are small, independent businesses. The average station employs about 11 full-time and 4 part-time workers. The smallest radio stations employ only four or five people while radio stations in large cities may have 100 employees or more. Television stations average about 75 full-time and 10 part-time employees. However, many television stations are smaller than this, while some are much larger. A television station in a small market may employ only 30 people, while a station in a major metropolitan area may employ up to 250 people. 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 1,000 workers in 1975.

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. As many as 200 stations across the country may carry a network television show. In 1975 the three national networks employed about 13,000 workers. Most network programs originate in New York City or Los Angeles.

Public broadcasting. There were about 850 noncommercial radio stations (mainly FM) and 270 educational television stations in 1976. 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 employed more than 9,000 full-time and over 4,000 part-time workers in 1976.

Cable television. There were also about 3,570 cable TV systems (CATV) employing about 25,000 workers in 1976.



Station personnel preparing for a newscast.

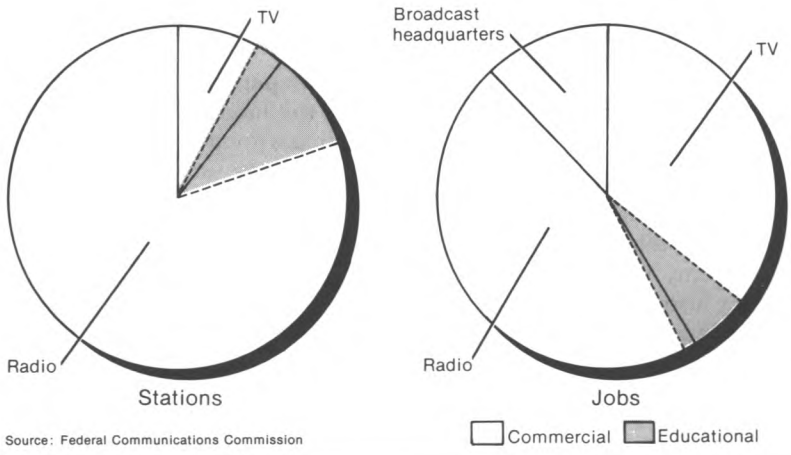
Broadcasting Occupations

Nearly half of all employees in the broadcasting industry hold professional and technical jobs, such as announcers, anchors and news persons, writers, or broadcast technicians. Clerical and sales workers make up an additional 30 percent, and managerial personnel make up about one-fifth. Many of the remaining employees are craft workers, such as electricians and carpenters.

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. An-

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Although television accounted for only 11 percent of all broadcast stations and systems, it provided 41 percent of all broadcast jobs in 1976



Source: Federal Communications Commission

nouncers in small stations may do their own writing, operate the studio control board, and do sales work. The engineering staff may consist of only one full-time broadcast technician assisted by workers from the other departments. In large radio and television stations, jobs are 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 are responsible for the overall program schedules of large stations. They arrange for a combination of programs that will be attractive and interesting to the audience and at the same time effectively meet the needs of advertisers.

Traffic managers prepare daily schedules of programs and keep records of broadcasting time available for advertising. *Continuity directors* are responsible for the writing and editing of all scripts. They may be assisted by *continuity writers*, who prepare announcers' books ("copy") that contain each programs script and commercials along with their sequence and length.

Directors 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*, 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. Some stations employ *program assistants* to aid directors and associate directors. Assistants help assemble and coordinate the various parts of the show. They arrange for props, makeup service, artwork, and film slides and assist in timing. They cue the performers, using cue cards prepared from scripts.

Community and public affairs directors are a link between the station and schools, churches, citizen groups, and civic organizations. They supervise, write, and host public affairs programs.

In large stations, directors may work under the supervision of a *producer*, who selects scripts, controls finances, and handles other production problems. Many times these functions are combined in the job of *producer-director*.

Announcers are the best known group of program workers. 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. Broadcast announcers are discussed in detail elsewhere in the *Handbook*.

Music is an important part of radio programming. Both small and large stations use recordings and transcriptions to provide musical programs and background music for other shows. Large stations, which have extensive music libraries, sometimes employ *music librarians* to maintain music files and answer requests for any particular selection of music. The networks have specialized personnel who plan and arrange for musical services. *Musical directors* 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 is a key aspect of radio and television programming. *News directors* plan and supervise all news and special events coverage. *News reporters* broadcast daily news programs and report special news events on the scene. *News writers* select and write

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copy for newscasters to read on the air. In small stations, the jobs of news reporter and news writer often are combined.

Stations that originate live television shows must have staff members who take care of staging the programs. *Studio supervisors* plan and supervise the setting up of scenery and props. *Floor managers* plan and direct the performers' positions and movements on the set according to directors' instructions. The jobs of studio supervisor and floor manager often are combined. *Property handlers* set up props, hold cue cards, and do other unskilled chores. *Make-up artists* prepare personnel for broadcasts by applying cosmetics. *Scenic designers* plan and design settings and backgrounds for programs. They select furniture, draperies, pictures, and other props to help convey the desired visual impressions. *Sound effects technicians* 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 filmed program material. *Film editors* edit and prepare all film for on-the-air presentation. They screen all films received, cut and splice films to insert commercials, and edit locally produced film. *Film librarians* catalog and maintain files of motion picture film.

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*, 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 *development engineers* to design and develop new electronic apparatus to meet special problems.

Broadcast technicians have many jobs. For example, 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. (Further information on broadcast technicians is given elsewhere in the *Handbook*.)

Sales Department. *Sales representatives*, the largest group of workers in this department, sell advertising time to sponsors, advertising agencies, and other buyers. They 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 do only sales work. The sales manager supervises them, and also may handle a few of the largest accounts personally. Some large stations employ statistical and research personnel to help analyze and report market information on the community served.

General administration. 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 accountants, lawyers, personnel workers, and others. They are assisted by office workers, such as secretaries, typists, bookkeepers, clerks, and messengers.



Broadcast technician in control room monitoring telecast.

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

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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.

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 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 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 (the FCC also issues second and third class licenses) is required by law for the chief engineer, and usually is required by stations for other members of a radio or television station's engineering staff. 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 some metropolitan areas, where competition for jobs is keen, 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 first class or third class license.

Entry jobs as announcers in small stations usually do not require specific training or experience, but an applicant must have a pleasant voice, a good command of the language, and other characteristics that make a dramatic or attractive 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. Qualifications for administrative and sales jobs in broadcasting are similar to those required by other employers; a business course program of study in high school or a college degree in business or management is good preparation for such jobs.

Most beginners start out in small educational and public broadcasting stations. Although these stations cannot pay high salaries, they offer opportunities to learn the different phases of broadcasting work because they generally use personnel in combination jobs. For example, an announcer may perform some of the duties of a broadcast technician.

People in the engineering department tend to remain in this area of work, where thorough training in electronics is essential. Program employees usually remain in programming work, although sometimes transfers to and from the sales and business departments are made. Transfers are easier between sales and general administrative departments because of their close working relationship; in fact, in small stations, they are often merged into one department. 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 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

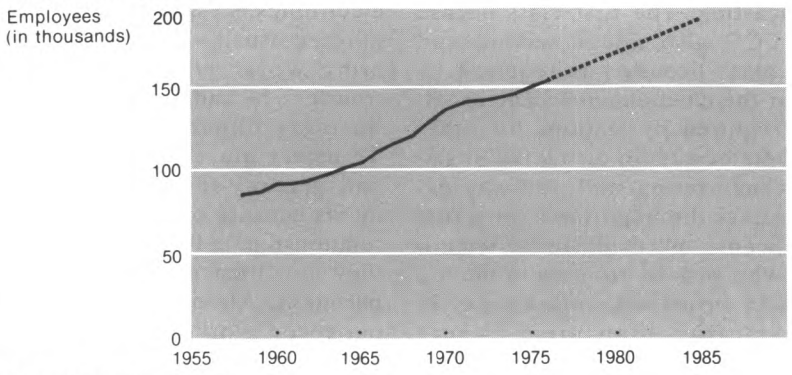
Employment in the broadcasting industry is expected to grow about as fast as the average for all industries through the mid-1980's. Besides the job openings from growth, many openings will result from the need to replace experienced workers who retire, die, or leave the industry for other reasons. Competition will be very keen for entry jobs, especially in metropolitan areas, because this field traditionally attracts large numbers of jobseekers.

New radio stations can be expected to go on the air, particularly in small communities, and will offer opportunities for additional workers. Technological developments are likely to limit employment growth in

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The steady employment growth in radio and television broadcasting is expected to continue through 1985, with many of the new jobs in educational and cable television

Wage and salary workers in radio and television broadcasting, 1958-76 and projected 1985



Source: Bureau of Labor Statistics

some broadcasting occupations. For example, automatic programming equipment that permits radio stations to provide virtually unattended programming reduces requirements for announcers.

The number of educational television stations is expected to increase as private and government groups continue to expand in this area. The growth of educational stations will increase job opportunities, especially in programming, community relations, and station management. However, such technological advances as remotely controlled transmitter and automatic programming equipment may limit employment growth in engineering and technician jobs.

Cable television (CATV) has emerged as a powerful new force in communications, and some additional job opportunities for professional, technical, and maintenance workers will be created as CATV systems increasingly originate and transmit programs. Many of these new jobs will be in small cities where most CATV systems are located to improve television reception in rural areas. By using cables instead of airwaves, CATV can offer customers a larger selection of stations plus many additional programs produced specifically for cable television.

Earnings and Working Conditions

In 1976 earnings of nonsupervisory broadcasting workers averaged $5.78 an hour, nearly one-fifth more than the average for nonsupervisory workers in private industry, except farming. Salaries vary widely among occupations and locations in the broadcasting industry. Employees in large cities generally earn much more than those in the same kinds of jobs in small towns. Salaries also 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 longer hours. Sales and business 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. To meet a broadcast deadline, program and technical employees in the networks may have to work continuously for many hours under great pressure.

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 technicans, 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, associate directors, 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:

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

For information on careers in public radio and television broadcasting, write to:

Corporation for Public Broadcasting, 1111 16th St. NW., Washington, D.C. 20036.

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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 1976, the railroads hauled 1.4 billion tons of freight, and carried 271 million passengers as well.

With 531,000 workers in 1976, 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.



Trains are one of the most efficient methods of transporting large amounts of freight.

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 comes 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 the 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 at the major railroad operations centered near New York, Los Angeles, Philadelphia, Minneapolis, Pittsburgh, and Detroit.

Railroad Occupations

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.

One-fourth of all railroad workers are *station and office employees* who direct train movements and handle the railroads' business affairs. Profes-

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Operating employees make up almost one-third of all railroad workers.

sionals 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 the 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-sixth 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 1976 distribution of railroad employment among the four occupational groups. Detailed information about some occupations within these groups is given elsewhere in the *Handbook*.

Training, Other Qualifications, and Advancement

Most beginning railroad workers are trained on the job by experienced employees. 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 those 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.

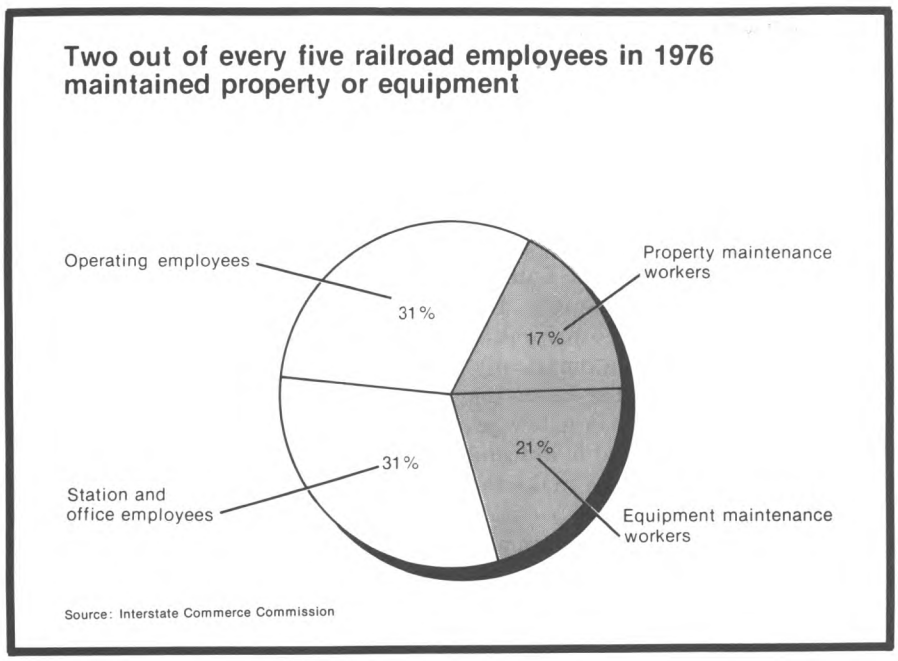
Extra board workers with enough seniority move to regular assignments as they become available. The length of time a new worker spends on the extra board varies according to the number of available openings. Some workers do not receive regular assignments for many years.

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 apprenticeships that last 3 to 4 years, depending on how much previous work experience the apprentice has.

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 be promoted, however, workers

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may have to qualify by passing 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 procedures, 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 mid-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 automatic classification systems are installed in more yards, 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 working in passenger service may eventually work for AMTRAK, the National Railroad Passenger Corporation, created in 1971 to revive train passenger service.

Earnings and Working Conditions

Nonsupervisory railroad employees averaged $6.88 an hour in 1976, 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 1976 average hourly earnings for locomotive engineers in passenger service were $12.71; for freight service brake operators $7.96; for railway clerks, $6.39; and for track gang members, $5.89. Regional wage differences are much less in railroading than in 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. Extra board workers may be called to duty on short notice and at any time. Bridge and building workers, signal installers, and track workers may work away from home for days at a time.

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.

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