occupational outlook handbook

Career Information
for Use in Guidance

1966-67 EDITION

UNITED STATES DEPARTMENT of LABOR, W. Willard Wirtz, Secretary

Bureau of Labor Statistics • Arthur M. Ross, Commissioner

Bulletin No. 1450

Pointers on Using the Handbook

To find out what is in this *Handbook* and how it is arranged, see Guide to the Handbook, page 3.

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For a general view of work and jobs in the United States, read the chapter on A Look at Tomorrow's Jobs, page 10.

Forecasts of the future are precarious! In interpreting the statements on the outlook in each occupation, keep in mind the points made on page 4, as well as the methodology presented in the Technical Appendix, page 834.

The job picture is constantly changing. To find out how you can keep your information up to date, see the chapter on Where To Go for More Information or Assistance, page 6.

You may need local information too. The *Handbook* gives facts about each occupation for the United States as a whole. For suggestions on where to get information for your own locality, see page 7.

OCCUPATIONAL OUTLOOK HANDBOOK

EMPLOYMENT INFORMATION ON OCCUPATIONS FOR USE IN GUIDANCE

1966–67 Edition

A Revised Edition of the *Handbook* is Published Every 2 Years

Bulletin No. 1450
(Revision of Bulletin 1375)
UNITED STATES DEPARTMENT OF LABOR
W. Willard Wirtz, Secretary
BUREAU OF LABOR STATISTICS
Arthur M. Ross, Commissioner

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This volume was prepared by the Bureau of Labor Statistics, U.S. Department of Labor, with the cooperation of the following offices of the Department—

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Office of Manpower, Automation, and Training
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Bureau of Employment Security
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Nelson M. Bortz, Director

and the—

U.S. Department of Agriculture
and
U.S. Department of Health, Education, and Welfare

Foreword

Never before in our history has the individual American devoted so much time and thought to the selection of a work career. Several factors are responsible for this, but perhaps the most significant of these is the knowledge that today's youthful members of the work force can anticipate changing jobs three to four times over the course of a career.

This development affects not only these younger workers, but every American with an interest in today's job market. Once, the prospect of an individual obtaining and holding a job for a lifetime was a realistic one for almost all of us. Today, however, modern technology and the new skill demands it has brought about have introduced on the American work scene an unprecedented era of change. It is change so sweeping that it requires the continuing attention of all of us; as workers, as parents, as young people still in school.

In line with these facts, the Department of Labor's *Occupational Outlook Handbook* for 1966–67 offers a broadly ranging consideration of almost all of the principal occupational categories in the American economy. In terms of the work our people actually perform, the *Handbook* covers 90 percent of all 16 million individuals employed in professional, technical, and managerial occupations; nearly all of the 4½ million sales workers; about half of the 10.7 million clerical workers; and about 40 percent of the 9.3 million service workers.

The new volume also reevaluates the effects of automation, the new technology, and recent economic developments upon the occupations the *Handbook* covers. It examines new jobs which have been developing as a direct result of automation.

In short, the *Handbook* represents an effort to define the modern world of work in America. It seeks to provide a compendium of the Nation's job opportunities for the use of parents and their youngsters, for guidance and counseling experts, and for all others in our Nation who have a deep interest in the effective matching of jobs and people.

W. Willard Wirtz, *Secretary of Labor*

Prefatory Note

Occupational guidance in career planning and training has always been important, but today when the unemployment rate for teenagers in our country is about triple the rate for adults, this guidance has become critical. In the face of the current revolution in science and technology as well as in economic and social patterns, the occupational needs of our Nation are changing rapidly. The rate of change seems to accelerate with each new scientific and social development, making a biennial publication of the *Occupational Outlook Handbook* imperative.

The information provided in the 1966–67 edition of the *Occupational Outlook Handbook* includes descriptions of the nature of work; places of employment; educational and training requirements; the employment outlook for about the next 10 years, including, in most cases, estimates of annual requirements for growth and replacement needs; and earnings and working conditions. In developing the employment outlook, consideration was given to the present and future demand that might arise from growth and turnover for workers in particular occupations, and to the potential supply of workers, including supply sources such as schools and other training institutions, transfers from other occupations, and reentries to the labor force. The balance between the outlook for supply and demand, in those occupations where such an assessment is possible, gives an indication of the nature of the job competition facing young people in the years ahead.

The first *Handbook* originated with a report in 1938 from the Advisory Committee on Education appointed by President Franklin D. Roosevelt. The Committee recommended that an occupational outlook service be set up in the Bureau of Labor Statistics to provide information for the use of individuals in choosing a career, and for the use of counselors in planning educational and training programs. The first occupational outlook publication, entitled "Employment Outlook for Automobile Mechanics," was issued in 1945 and the first *Handbook*, in 1949, followed thereafter by several editions. Since 1957, the *Handbook* has been issued every 2 years.

Two related publications also issued regularly by the Bureau of Labor Statistics are the *Occupational Outlook Quarterly*, a periodical which provides a continuous flow of current information between editions of the *Handbook*; and the *Occupational Outlook Report Series*, a set of over 100 reprints of the *Handbook* statements on different fields of work. Both of these publications offer aid to young people choosing a vocation.

The Bureau of Labor Statistics wishes to acknowledge with gratitude the cooperation received from hundreds of officials in industry, labor organizations, trade associations, professional societies, government agencies, educational institutions, and other organizations in preparing the *Handbook*. Without their help the quality of the *Handbook* could not be maintained.

ARTHUR M. ROSS, *Commissioner of Labor Statistics*

Letter From the American Personnel and Guidance Association

Both the occupational structure of our society and the process of vocational counseling are becoming more complex. Consequently, any tool or reference which helps both counselor and counselee to grasp current occupational requirements, trends, and characteristics should be a most welcome resource. The 1966–67 edition of the *Occupational Outlook Handbook*, following a series of successful predecessors, fulfills the unique demands of counselors for such a comprehensive, accurate, and factual volume.

Among the many sources of career information currently available, the *Occupational Outlook Handbook* has several distinguishing features not found in other comparable publications. A singular advantage held by this reference book is the rich experience and wide research efforts of Bureau of Labor Statistics staff members who have compiled the material. As one of a number of editions it has been constantly improved to meet the exacting requirements of professionally trained educational and vocational counselors. The recency, accuracy, and factual nature of the content separates this reference from many similar publications. The straightforward style enhances the readability for both counselor and counselee and permits wide use of the volume by parents and lay citizens with minimum danger of misinterpretation. It is gratifying to note that editors of the *Occupational Outlook Handbook* seem to be well aware of the standards for occupational literature as developed by the Career Information Review Service committee of the National Vocational Guidance Association, a division of the American Personnel and Guidance Association.

The difficult process of effective vocational counseling requires a periodic careful balance between characteristics and needs of the individual in relation to vocational opportunities and requirements. The professionally qualified vocational counselor must be aware not only of the basic research and theory undergirding sound career decisionmaking but of the many difficult-to-measure variables which impinge on the choice process. Such factors as the need patterns of the individual, his attitudes, and his value structure are difficult to assess but of great significance. On the information side, the perceived status of the occupation, regional variations in working conditions, and the social value of the job outcomes are important elements to recognize. Finally, the developmental character of career planning, involving a continuous review of these variables, is a basic assumption of vocational guidance. Thus, for sound counseling the skill and professional competency of the user of any compendium such as the *Handbook* is as important as the quality of the publication itself.

The availability of the 1966–67 edition of the *Occupational Outlook Handbook* and its companion periodical the *Occupational Outlook Quarterly* can help counselors keep abreast of occupational developments both current and future. The American Personnel and Guidance Association congratulates the Bureau of Labor Statistics and the editorial staff of the *Occupational Outlook Handbook* for the excellence of this significant publication.

HAROLD F. COTTINGHAM, *President*
American Personnel and Guidance Association

Letter From the Veterans Administration

When, in 1943, the Veterans Administration became responsible for providing counseling and training services to disabled veterans of World War II, an immediate need for current and reliable occupational information was recognized. The *Occupational Outlook Handbook* was developed from a project designed to meet this need. In these days, when technological and other changes are rapidly bringing about a manpower revolution, the vocational counselor must have available the most effective means for analyzing occupations in terms of probable job requirements and the relationship between training, skills, and employment.

For more than 20 years, vocational counselors in programs of the Veterans Administration have rated the *Handbook* a prime source of occupational information. Because of its consistently high quality, the continuation of this publication is welcomed as a useful reference for all counselors.

W. J. Driver
Administrator of Veterans Affairs

Letter From the Bureau of Employment Security

The Bureau of Employment Security welcomes the seventh edition of the *Occupational Outlook Handbook*, the most comprehensive yet published. This *Handbook* is a necessary tool in carrying out the counseling functions of the Employment Service, and will be in even greater use in the future. A copy of the *Handbook* is available for reference in each of the 1,900 local employment service offices.

Many people who come to the Public Employment Service for help in finding a job need counseling; this resulted in more than 2 million interviews in 1964. Nearly 10.8 million job seekers came to the local employment service offices, and some 6.3 million placements in nonagricultural jobs were made. One of the major difficulties people face in choosing a vocation is their insufficient exposure to the variety of opportunities available to them. Usually, they measure themselves only against the kind of work done by others with whom they come in close contact, and as a result may choose their job without considering other possibilities. An orderly and comprehensive comparison of one field with another is desirable, and the *Occupational Outlook Handbook* makes this possible with a minimum of effort for the counselor.

Robert C. Goodwin, *Administrator*
Bureau of Employment Security
U.S. Department of Labor

Letter From Vocational Rehabilitation Administration

In view of the many new challenging developments in our changing economy, the information contained in this new edition of the *Occupational Outlook Handbook* is particularly useful in helping the 90 State rehabilitation agencies in the State-Federal vocational rehabilitation program to prepare disabled persons for suitable employment. The data provided in this publication will continue to be especially valuable in meeting the needs of the steadily expanding professionalized staff of vocational rehabilitation counselors. The work of the counselors will be greatly facilitated in their efforts to find jobs for the increasing numbers of hard-to-place handicapped people. I congratulate the Bureau of Labor Statistics for its part in providing such invaluable information through the pages of its *Handbook*.

MARY E. SWITZER, *Commissioner of Vocational Rehabilitation*
Vocational Rehabilitation Administration
U.S. Department of Health, Education, and Welfare

Letter From the United States Office of Education

The individual realizes his highest occupational potential when he develops a career suitable for him and useful to society. He must be cognizant of his abilities, aptitudes, interests, and personality traits and he must also learn about a world of work characterized by changes. Accurate knowledge of both sets of facts greatly increases the probability that an individual will be able to find and maintain his proper place in this vast and evolving occupational complex.

The *Occupational Outlook Handbook* properly used by the student and his counselor becomes a very effective tool in gaining a knowledge of the world of work. The other six editions of the *Handbook* have been very helpful to school counselors. They have come to regard it as the basic publication on occupational information. With a constantly increasing number of counselors in the schools, I am sure that there will be a greater demand than ever before for this seventh and improved edition of the *Handbook*.

On behalf of the United States Office of Education, I congratulate the Bureau of Labor Statistics and the *Occupational Outlook Handbook* staff for continuing to provide this most useful *Handbook*.

FRANCIS KEPPEL
U.S. Commissioner of Education
U.S. Department of Health, Education, and Welfare

Contributors

This *Handbook* was prepared in the Bureau of Labor Statistics, Division of Manpower and Occupational Outlook, Sol Swerdloff, Chief, under the general direction of Harold Goldstein, Assistant Commissioner for Manpower and Employment Statistics.

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Some photographs were furnished by various Government agencies, and are so indicated by the credit lines accompanying these pictures.

Note

A great many trade associations, professional societies, unions, and other organizations in industry are in a position to supply valuable information to counselors or young people seeking information about careers. For the convenience of users of this *Handbook*, the statements on separate occupations or industries list some of the organizations or other sources which may be able to provide further information. Although these references were assembled with care, the Bureau of Labor Statistics has no authority or facilities for investigating organizations. Also, since the Bureau has no way of knowing in advance what information or publications each organization may send in answer to a request, the Bureau cannot evaluate the accuracy of such information. *The listing of an organization, therefore, does not in any way constitute an endorsement or recommendation by the Bureau or the U.S. Department of Labor, either of the organization and its activities or of the information it may supply.* Such information as each organization may issue is, of course, sent out on its own responsibility.

The occupational statements in this Handbook are not intended, and should not be used, as standards for the determination of wages, hours, jurisdictional matters, appropriate bargaining units, or formal job evaluation systems. These descriptive statements are presented in a general, composite form and, therefore, cannot be expected to apply exactly to specific jobs in a particular industry, establishment, or locality.

Contents

OCCUPATIONAL OUTLOOK HANDBOOK

Using the Handbook in Guidance Services

The *Occupational Outlook Handbook*, now in its seventh edition, has become an invaluable tool in school guidance and placement programs. Over the years, as both the *Handbook* and guidance services have matured, they have become mutually dependent on each other.

In the guidance field, the *Handbook* is used by several groups. At the college level, the counselor educator explains its contents to counselor trainees to help them understand specific job patterns, characteristics of related occupations, and trends affecting the nature and number of jobs. More important, the counselor educator teaches the future counselors to use this reference in everyday guidance activities.

At the secondary school level, the teacher of occupations finds this volume organized and written in such readable language that his students can use it as a reference book in understanding different kinds and levels of work, and in discovering information about careers of personal interest.

However, at both secondary and collegiate levels, the *Handbook* is most valued by the counselor on the job, and the student who seeks help in choosing a career. The counselor utilizes all available facts about the youth sitting across the desk, and about the jobs that might be suitable for him.

In recent years, scientific knowledge has been multiplying at an ever increasing rate. Predictions are that it will increase in geometric proportions in the near future. Consequently, most occupations which are affected by scientific knowledge—and what job is not?—will be subject to change. As work patterns move with the times, worker functions, too, will shift.

Since many occupations which will be important a decade hence have not yet evolved, a student with some years of preparation before him may be encouraged to elect a broad program of courses and perhaps identify a general area of interest such as science, social studies, or art. Specialization may be delayed until a later date. The further he goes in school, the more time he will have to select his major field. The more familiar he is with areas of work as described in the *Handbook*, the better prepared he will be to plan his own future as he goes along.

Most of the career information in the *Handbook* follows a uniform outline: Nature of Work; Where Employed; Training and Other Qualifications; Employment Outlook; Earnings and Working Conditions; and Where To Go for More Information. The comprehensive coverage includes basic information from which the counselor can deduce values that contribute to job satisfaction. Planning for the future requires interpretation of economic facts, anticipation of the effect of science and invention on various vocational fields, and estimates of changing occupational emphasis. Counselors need this information and the ability to correlate it for use in the guidance program. The *Handbook* does part of the job and also enables the counselor to assist the student in considering vocational goals or areas which will utilize his strongest potentials—intelligence, special talents, personality, interests, and values.

School counselors all over the country use the *Handbook* as one of their essential tools. It is

among the few volumes they keep on their desks for constant reference. One counselor-trainer reports that she always cautions her counselors-in-training: "Don't rely on your memories for facts about occupations. Consult the *Handbook*." Surely the counselor who fails to avail himself of this and other materials published by the Occupational Outlook Service lacks some of the most authentic and current data about occupations.

The *Occupational Outlook Handbook* is frequently used by counselors in conferring with students who have completed a vocational interest test and find certain occupational areas indicated by test results. The use of the reference makes it easy to refer a pupil to a number of occupations related to his vocational goals. For many counselors, this book is their first reference, and from this as a start they encourage the use of other materials.

The various descriptions of occupations included in the *Handbook* are also available as reprints. Counselors may place these under specific occupational headings in their reference file and make them available to individual students who express interest in particular occupations.

Counselors use the *Handbook* and related materials not only with students but also in helping parents to counsel their children. Here the reprints are especially valuable, as they may be borrowed easily for home reading.

The *Handbook* should broaden each student's background of occupational information and understanding of the important factors influencing occupations, thus helping him to develop desirable and satisfying plans for the future. Careful study of it by counselors, parents, and pupils should help them to realize the many ways in which occupations are changing, growing, and declining. Such realization will emphasize the need for flexible planning for the choice of a major interest area as well as related occupations to which these interests and abilities may lead.

Guidance services are permissive in nature and should always be available in career planning. A student matures and jobs evolve, making the counselor's function, in the present, one of effecting a compatible union of worker and work at some time in the future. Intelligent use of this book can give a counselor the assurance that after he understands what the counselee brings to his potential vocation, he can suggest the various areas of work which will meet these qualifications. A wise counselor, an inquiring student and the *Handbook* make a good team.

FRANK L. SIEVERS, *Director*
Guidance and Counseling Programs Branch
and
DOLPH CAMP, *Chief*
Occupational and Career Guidance Section
Office of Education, U.S. Department of Health, Education, and Welfare

Guide to the Handbook

This book answers many questions young people ask when they are interested in choosing an occupation. It provides many types of information on occupations—the employment outlook in each field, the nature of the work, training and other qualifications needed for entry, lines of advancement, where jobs are located, and earnings and working conditions.

How the Handbook Is Organized

The *Handbook* starts with three introductory chapters designed to help counselors and students make effective use of the book and to give them a general view of the world of work.

This chapter, the Guide to the Handbook, describes the contents and organization of the book. It tells how the information was assembled and discusses a number of points which need to be kept in mind in interpreting the statements. The second introductory chapter gives suggestions regarding supplementary sources of occupational information and tells how readers can keep up to date on developments affecting the employment outlook in different occupations. This introductory chapter also contains a brief description of the counseling, placement, and other services available to jobseekers at local offices of State employment services affiliated with the U.S. Employment Service. The final introductory chapter describes some of the most important trends in population and employment, both past and prospective, and provides a background for interpreting the reports on particular occupations.

Occupational Reports

The reports on different fields of work make up the main body of the book. The eight major divisions of the book are: Professional, managerial, and related occupations; clerical and related occupations; sales occupations; service occupations; skilled and other manual occupations; some major industries and their occupations; occupations in agriculture; and occupations in government. Within each of these major divisions, occupations are grouped into related fields.

Indexes and Appendix

To help the readers locate information on the occupations in which they are interested, a detailed list of the occupational reports, by field of work, is included in the table of contents at the front of the book. The index at the back of the book lists occupations and industries alphabetically.

The technical appendix contains a discussion of the sources and methods used in analyzing the occupational outlook in different fields of work. It is designed for readers wishing more information on this subject than is included in this chapter. The appendix also contains an explanation of the D.O.T. numbers given in the occupational reports, to indicate where each occupation fits into the classification system of the *Dictionary of Occupational Titles.*

D.O.T. Numbers: The occupations covered in the *Occupational Outlook Handbook* are organized according to the occupational classification system developed by the Bureau of Employment Security of the U.S. Department of Labor and published in the *Dictionary of Occupational Titles.* This *Dictionary* provides a code number (the so-called D.O.T. number) for each occupation included in it. The code numbers of both editions of the D.O.T. are listed, where possible, in parenthesis immediately below the main occupational group headings in the *Handbook.* In the body of the text in the *Handbook,* code numbers only of the new third edition are shown. A table converting the code numbers of the second edition (the one in use at the time of the publication of the *Handbook*) to the code numbers of the third edition will be made available by the Bureau of Employment Security at the time the new D.O.T. is published.

Some Important Facts About the Occupational Reports

Occupations Covered

The more then 700 occupations discussed in this *Handbook* generally are those of greatest interest to young people. Most of the large ones requiring long periods of education or training are discussed, as are a number of small but rapidly growing fields and other occupations of special interest. Altogether, the occupations covered account for about 90 percent of all workers in professional and related and in sales occupations; nearly as high a proportion in skilled occupations; about half in clerical and about 40 percent in service occupations; and smaller proportions in semiskilled occupations. The main types of farming occupations are also discussed.

General information on many fields of work not covered in the occupational reports is contained in the introductions to the major divisions of the book. These introductions are also designed to aid the reader in interpreting the reports on individual occupations.

Sources of Information

Information on employment trends and outlook and the many related topics discussed in the occupational reports was drawn from a great variety of sources. It is based in part on extensive field investigation carried out by the Bureau of Labor Statistics professional staff. Interviews with hundreds of persons in industry, unions, trade associations, and public agencies provided a wealth of up-to-date information. In addition, the Bureau's other research programs supplied data on employment in different industries, productivity and technological developments, wages and working conditions, trade union agreements, industrial hazards, and a number of other topics. Additional data regarding the nature of the work in various occupations, training and licensing requirements, wages, and employment trends were provided by other agencies of the Federal Government—among them, the Bureau of Apprenticeship and Training and Bureau of Employment Security in the Department of Labor; the Bureau of the Census of the Department of Commerce; the Office of Education and the Vocational Rehabilitation Administration of the Department of Health, Education, and Welfare; the Veterans Administration; the Civil Service Commission; the Interstate Commerce Commission; the Civil Aeronautics Administration; and the Federal Communications Commission. Many other public and private organizations—including State licensing boards, educational institutions, business firms, professional societies, trade associations, and trade unions—also made available published and unpublished data and supplied much helpful information through interviews.

After the information from these many sources was brought together and analyzed, conclusions were reached as to prospective employment trends in the occupations. In addition, estimates were made of the numbers of job openings that will be created by retirements and deaths and transfers out of the occupation. The supply of new workers likely to be available in particular fields was also analyzed, by studying statistics on high school and college enrollments and graduations, data on the number of apprentices in skilled trades, reentries to an occupation, and transfers into an occupation.

Preliminary drafts of the occupational reports were reviewed by officials of leading companies, trade associations, trade unions, and professional societies, and by other experts. The information and conclusions presented in each report thus reflect the knowledge and judgment not only of the Bureau of Labor Statistics staff but also of leaders in the field discussed, although the Bureau, of course, takes full responsibility for all statements made.

Points To Bear in Mind in Using the Reports

In using the information on employment prospects which this book contains, it is important to keep in mind that all conclusions about the economic future necessarily rest on certain assumptions. Among the assumptions which underlie the statements on employment outlook in this *Handbook*, are that high employment levels will be maintained and that no cataclysmic events will occur, such as a war or a severe and prolonged economic depression. Such catastrophes would, of

course, create an entirely different employment situation from that likely to develop under the assumed conditions. But young people would find it impossible to build their lifetime plans in expectation of such unpredictable catastrophes, though, on the basis of historical experience, they must be prepared to weather economic ups and downs during their working lives. The assumptions and methodology used in employment outlook analysis are discussed in detail in the technical appendix, page 834.

To avoid constant repetition, the assumptions are seldom mentioned in the reports on the many fields of work where the impact of a general decline in business or a change in the scale of mobilization would probably be about the same as in the economy as a whole. On the other hand, in the statements on occupations where employment tends to be either unusually stable or especially subject to ups and downs, the factors affecting employment are delineated. Even in the latter occupations, however, long-term trends in employment are more important than short-run fluctuations when appraising the prospects of an individual in a career occupation.

The picture of employment opportunities given in this book applies to the country as a whole unless otherwise indicated. People who want supplementary information on job opportunities in their communities should consult local sources of information, as suggested in the next chapter.

The information presented on earnings and working conditions, as on other subjects, represents the most recent available when the *Handbook* was prepared early in 1965. Much of the information came from Bureau of Labor Statistics surveys, but many other sources were also utilized. For this reason, the earnings data presented in the various occupational reports often refer to different periods of time, cover varying geographic areas, and represent different kinds of statistical measures. Comparisons between the earnings data for different occupations should, therefore, be made with great caution.

Reference has been made in several occupational statements to training programs established under the Manpower Development and Training Act (MDTA), to equip unemployed and underemployed persons with skills needed in today's world of work. However, the absence of a reference to MDTA training for a particular occupation does not necessarily mean that programs are not in operation. In 1964, training programs (which last from several weeks to 2 years) covered some 700 occupations—technical and semiprofessional, skilled and semiskilled, clerical and sales, service and nonagricultural. To obtain information about MDTA training offered in your area, contact the local office of the State employment service.

Finally, it should be kept in mind that information on occupations and the employment opportunities they offer is only part of that needed in making a career decision, which means matching a person and an occupation. The other part relates, of course, to the aptitudes and interests of the potential worker himself. In assessing their own abilities and interests and in selecting the occupation for which they are best suited, people can obtain help from vocational counselors in schools and colleges, State employment service offices, Veterans Administration regional offices and guidance centers, and many community agencies.

Where To Go for More Information or Assistance

Persons using this *Handbook* may want more detail on the occupations discussed in the occupational reports, or information on fields of work which are not covered in this publication.

Suggestions as to sources of additional information on the occupations discussed are given in most of the occupational reports. In addition, several types of publications of the U.S. Department of Labor, including periodicals described on pages 855–858, provide further information on topics such as earnings, hours of work, and working conditions. Other sources likely to be helpful include public libraries; schools; State employment services; business establishments; and trade unions, employers' associations, and professional societies. A brief description of each follows.

Public Libraries

These libraries usually have many books, pamphlets, and magazine articles giving information about different occupations. They may also have several books and current indexes which list the great numbers of publications on occupations, and the librarians may be of assistance in finding the best ones on a particular field of work.

Schools

School libraries and guidances offices also often have extensive reading materials on occupations. In addition, school counselors and teachers usually know of any local occupational information which has been assembled through special surveys made by schools or other community agencies. Teachers of special subjects such as music, printing, and shorthand can often give information about occupations related to the subjects they teach.

State Employment Services

Counselors in local public employment offices are in a particularly good position to supply information about job opportunities, hiring standards, and wages in their localities. (The services available through the public employment offices are described in the concluding section of this chapter.)

Business Establishments

Employers and personnel officers can usually supply information about the nature of the work performed by employees in their industry or business and the qualifications needed for various jobs, as well as other facts about employment conditions and opportunities. The names of local firms in a particular industry can be found in the classified sections of telephone directories or can be obtained from local chambers of commerce.

Trade Unions, Employers' Associations, and Professional Societies

Frequently, these organizations have local branches, with officials who can supply information relating to the occupations with which they are concerned.

Occupational Outlook Service Publications

The Bureau of Labor Statistics has recently published a *Counselor's Guide to Occupational and Other Manpower Information, An Annotated Bibliography of Selected Government Publications.* The bibliography, as the title suggests, lists the major occupational and other manpower publications of Federal and State government agencies that will be useful to counselors and others interested in trends and developments that have implications for career decisions. This bulletin, No.

1421, is available from the Superintendent of Documents, Government Printing Office, Washington, D.C., 20402, at 50 cents a copy.

The Bureau of Labor Statistics also issues a periodical, the *Occupational Outlook Quarterly*, to keep readers up to date between editions of the *Handbook*, on developments affecting employment opportunities and on the findings of new occupational outlook research. In addition, the Bureau issues at irregular intervals occupational outlook bulletins which give much more detailed information on various fields of work than can be included either in the *Handbook* or in the *Occupational Outlook Quarterly*. Further information about these publications, and directions for ordering them, will be found on page 855.

The Bureau will be glad to place the name of any user of this *Handbook* on its mailing list to receive announcements of new publications and releases summarizing the results of new studies. Anyone wishing to receive such materials should send the request, with his address, to the Bureau of Labor Statistics, U.S. Department of Labor, Washington, D.C., 20212.

Services to Jobseekers at Public Employment Offices

Many of the readers of the *Handbook* want assistance in choosing suitable work and in finding the right job. The U.S. Employment Service and affiliated State employment services form a nationwide organization which, through trained employment counselors in 1,900 local offices throughout the United States, finds jobs for workers and workers for jobs.

A nationwide network of Youth Opportunity Centers in 142 presently designated metropolitan areas will eventually be established as part of the Employment Service System. They will operate in conjunction with the local community action programs established under the Economic Opportunity Act. The goal of such centers will be to develop an organized and coordinated community effort toward helping young people, particularly school dropouts and others who cannot compete successfully in today's job market, prepare for and attain jobs. Outreach techniques will be utilized to recruit and motivate youths who do not come freely to the employment service for help.

The centers will provide any youth under 22 with services that prepare him for employment, develop his job opportunities, and place him in a suitable job. These services will include exploratory interviewing, testing, counseling, referral to training services, followup, and job placement.

Although the Employment Service is a Federal-State system, each employment office is basically a local community organization. It is concerned with facilitating suitable and stable employment for the community's working population and with meeting adequately the manpower needs of employers. The local office tries to do more than just refer a worker to a job—it tries to match the worker with the job so that the requirements of each are satisfied. To do this, the public employment office has developed a number of services that are available to all jobseekers.

Counseling Services

Employment service counseling assists young people who are starting their careers, as well as experienced workers who wish or need to change their occupation. The major purposes of employment counseling are to help people gain insight into their actual and potential abilities, their interests, and their personal traits; to understand the nature of occupations; and to make the best use of their capacities and preferences in the light of available job opportunities.

In the employment service, the counselor has a great store of resources, including testing facilities and labor area and occupational information.

Testing. Most local offices provide testing services, including the General Aptitude Test Battery which measures basic abilities for many and varied broad fields of work and specific jobs. These tests help the applicant appraise his abilities and may reveal aptitudes the jobseeker did not know he had.

Job Information. The State employment office counselor has information about jobs in the community. He knows what kinds of jobs prevail in local industry, which jobs are more plentiful, what the hiring requirements and the opportunities for advancement are, and what the jobs pay. In many labor areas, the counselor has information about future occupational opportunities based on area skill surveys, which usually cover employers' forecasts of their requirements for periods up to 5 years; and on training needs surveys, which include a 1- or 2-year forecast of the labor supply and demand for a single or closely related group of occupations. He may also have detailed occupational guides covering specific jobs in the community. Since his office is a part of the nationwide employment service, the counselor also has information regarding employment opportunities in other areas throughout the country.

The Job Guide for Young Workers and the *Health Careers Guidebook* are two publications which the employment service counselor also uses. The former provides job information for over 100 occupations specifically directed to the needs and interests of young workers. The latter includes information on approximately 200 occupations in the rapidly growing health services field.

Occupational Information. The employment service office has occupational information to help the job applicant decide whether he is suited for a particular kind of work. The *Dictionary of Occupational Titles* and other compilations describe the work performed in various occupations, the training required, lines of advancement, physical demands, and working conditions for most occupations.

Cooperative Arrangements With Other Community Groups. Local employment office counselors work closely with other public and private agencies and organizations which provide special services that the jobseeker may need in order to be better prepared for employment. These groups include educational, training, vocational rehabilitation, and health and welfare agencies.

Placement Services

The primary objectives of the placement service in the local employment office are to fill employers' job openings with occupationally qualified workers, and to locate for workers employment suited to their skills, knowledge, and abilities. The employment office placement service is designed to eliminate the waste of "hit-or-miss" job hunting.

The public employment offices provide jobseekers not only with assistance in finding employment, but also with information on the basic elements for getting and holding a job. The employment service personnel explain what to look for in a job; what the sources are for job leads; how to plan for job hunting; how to prepare for an interview with an employer; what information and papers to have ready; and what the proper attitude and dress should be.

Local Openings. State employment office personnel maintain regular contacts with local employers and know their hiring needs and their job openings. Placement interviewers receive requests from employers for many different kinds of workers. Through the local office, therefore, the job applicant has access to a variety of job vacancies with many employers, just as the employer has access to many applicants. When no suitable job exists for an individual worker, the employment service may attempt to find an opening for him from likely employers.

Jobs Throughout the Country. The job clearance system of the nationwide network of State employment offices offers the applicant an opportunity to apply for jobs outside his area, elsewhere in the State and the Nation, and even in foreign countries. Each State employment service prepares frequent inventories of hard-to-fill jobs, which are distributed to all other State employment services. This makes it possible for them to refer local workers to out-of-area jobs for which they qualify. In addition, a national network of highly specialized professional placement offices has been established in the State employment service to speed the matching of jobs and applicants in professional fields.

Placement Aids. As in counseling, the information which is available in the employment offices, on local job opportunities for industries, occupations, and areas, and on occupational requirements, contributes greatly to getting the right job for the worker, and the right worker for the job.

Also available to the jobseeker are aptitude and proficiency tests which help determine whether an applicant is qualified to perform satisfactorily on specific jobs.

Services to Special Worker Groups

The Employment Service has developed techniques and procedures for particular applicant groups who may encounter special problems in their search for suitable jobs.

For young people, special services include counseling future high school graduates, and school dropouts, and intensive efforts to promote employment opportunities. In many cities, employment service offices have long had cooperative arrangements with high schools to provide counseling, testing, occupational information, and placement services to seniors prior to their graduation, as well as to those who leave school earlier. About 10,500 high schools had such arrangements in the school year 1963–64. A nationwide network of Youth Opportunity Centers is being established as part of the Employment Service System.

The State employment offices have long maintained an active program for helping applicants with vocational handicaps. In each local office, a person is responsible for counseling and placement of the handicapped. In addition to matching the vocational qualifications, he also matches the physical and mental capacities of the individual with job requirements so that the handicap will not affect job performance.

Special services for veterans are provided by the employment service. Each local office has a veterans' representative who is fully informed about veterans' rights and benefits, and who carries on job promotion for veterans. In addition, he assists veterans in making use of the usual counseling, placement, and other services of the local office staff.

The Employment Service also has developed techniques to deal with job problems of middle-age and older workers. Special attention is given to assist them in making realistic job choices and to overcome problems related to getting and holding a job. Employers have been encouraged to remove age restrictions on hiring and to hire only according to the qualifications of the individual.

Similar attention is given to the employment problems of minority group members, and others facing special difficulties in obtaining suitable employment. The Civil Rights Act of 1964 specifically requires the Employment Service to assist all jobseekers without regard to their race, color, religion, sex, or national origin. In carrying out this mandate for equal employment opportunity, the service assists jobseekers in obtaining employment consistent with their highest qualifications, and conducts an active program to encourage merit employment practices.

How To Locate the Local Employment Office

The addresses and telephone numbers of local offices of State employment services affiliated with the U.S. Employment Service may be found in local telephone directories. Jobseekers, employers, schools, and public and private agencies helping clients to find employment are invited to utilize the services of the public employment offices in their communities, and to avail themselves of the job information maintained in these offices.

A Look at Tomorrow's Jobs

Choosing a vocation is one of the most important decisions a person will make in his lifetime. Charting a career calls for not only an appraisal by the counselor, teacher, parent, or student himself of an individual's abilities and interests, but also for an assessment of the fields of work for which there will be employment opportunities in the future, the qualifications that will be in demand, and the competition to expect from other workers. The *Handbook* seeks to provide some of this latter information, and this chapter will furnish a background for understanding the outlook and requirements in a particular occupation.

Ask a young boy or girl "What are you going to do for a living?" and the reply, most likely, will be in terms of a specific occupation that intrigues him or her most. Although youths should be encouraged to consider more than one occupation as their lifework—for reasons given later in this chapter—getting all the facts about occupations is a good way to start exploring what it takes to make one's way in the world. Here, parents, teachers, counselors, as well as the people employed in a particular line of work, can help the young clarify their impressions of a given occupation. But a career exploration should cover more than a mere handful of the more popular fields.

New ways of making things, new things to make, and new patterns of living are continuously causing changes in the kinds of jobs available. Awareness of the dynamic changes going on in our economy is important for both young and old. For the young because they must adjust to what will happen next in the world around them. For the old because they advise and guide the young. An attitude of continuing curiosity, alertness, and critical evaluation is essential to all who look for ways to prepare for the future.

Occupational Profile

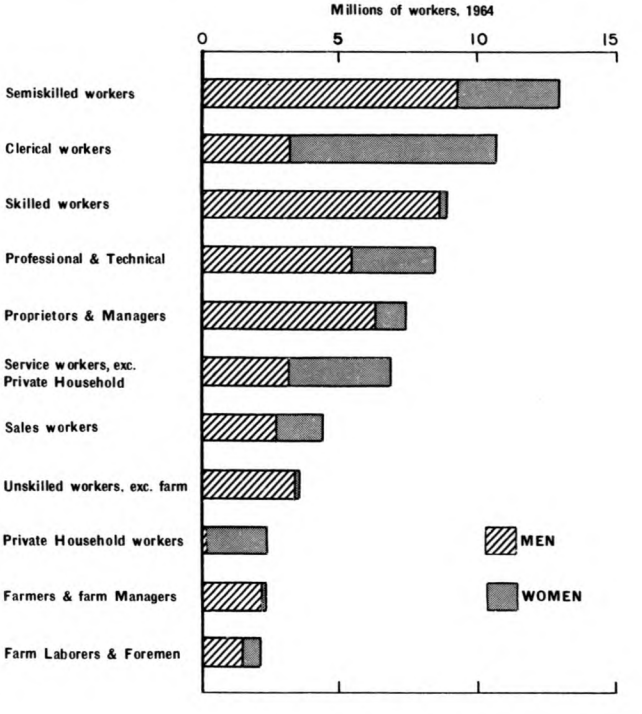
As our industrial society grows bigger, more complex, and more specialized, the occupations reflect these changes; and the occupations in turn become more complex and specialized, thus providing an imposing and often confusing number of choices.

How does one find the way through this growing forest of jobs? A first step is to stand back and look at jobs in terms of broad groupings—jobs which have similar broad characteristics, such as entrance requirements or potential earnings, and offer a similar way of life and labor.

Our civilian labor force of over 70 million persons can be separated into 11 different occupational groups. (See chart 1.) *Semiskilled workers* make up the largest occupational category. About 13 million people today are engaged in assembling goods in factories; driving trucks, buses, cabs; and operating machinery. There are almost 11 million *clerical workers*, people who operate computers and office machines, keep records,

CHART 1

EMPLOYMENT IN MAJOR OCCUPATIONAL GROUPS



take dictation and type. *Skilled workers*, numbering about 9 million, include carpenters, tool and die makers, instrument makers, all-around machinists, electricians, and typesetters.

Professional and technical workers, the fourth largest occupational group, include among their 8½ million such highly trained personnel as teachers, engineers, physicians, lawyers, and clergymen. *Proprietors and managers*, people who are in business for themselves or manage the operations of commercial, industrial, or public employers, total about 7½ million. There are almost 7 million *service workers*, men and women who maintain law and order, assist professional nurses in hospitals, give haircuts and beauty treatments, serve food and beverages, and see to it that the public is satisfactorily accommodated in hotels and restaurants, airplanes, ships, and railroad trains. *Sales workers*, about 4½ million strong, are found in retail stores, wholesale firms, insurance companies, real estate agencies, as well as offering wares door-to-door.

Unskilled workers (excluding those in farming and mining) amount to a little over 3½ million, and for the most part, they are busy moving, lifting, and carrying materials and tools in the Nation's workplaces. *Private household workers*—maids, governesses, laundresses, caretakers, butlers—total about 5.3 million. *Farmers and farm managers*, numbering about 2.3 million, get their chores done with the help of a little over 2 million *farm laborers and foremen.*

Industrial Profile

Learning about work means knowing the place where the work is done. The "where" is quite important, for any skill may be sought by a wide variety of employers. A clear view of the "where" comes from a look at the industries which are the source of jobs. To help understand our industries, they too can be grouped into major divisions, the industries in each usually representing roughly similar lines of economic activity.

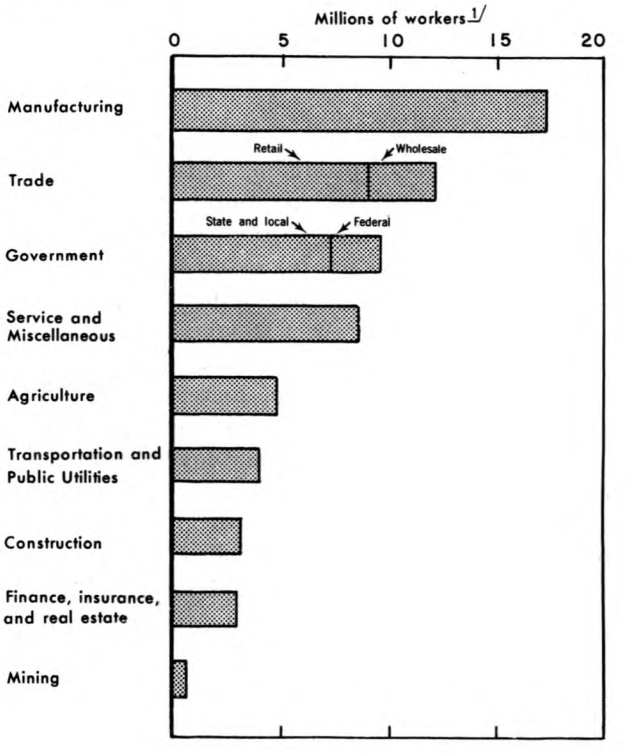
Industries may be viewed in terms of whether they produce goods or whether they produce services. Production of goods—raising food crops, building houses, extracting minerals, and manufacturing articles no longer occupies most of the Nation's workforce. Today's employment emphasis is on providing services. The efforts of most American workers are claimed by such activities as teaching; caring for the personal health and well-being of other people; selling; repairing and maintaining all kinds of equipment; providing recreation, transportation, delivery service and utilities; and providing banking services and meeting insurance needs.

This fairly general grouping of industries into goods and service producers, may be subdivided into nine major groups, according to their product or service. (See chart 2.)

We can get an idea of how the major industry groups have been changing by looking at some employment figures by industry that were collected by the Bureau of Labor Statistics. Although the total number of employees in all groups has increased by nearly a third since the end of World War II, the same degree of growth did not occur in each industry group. (See chart 3.)

CHART 2

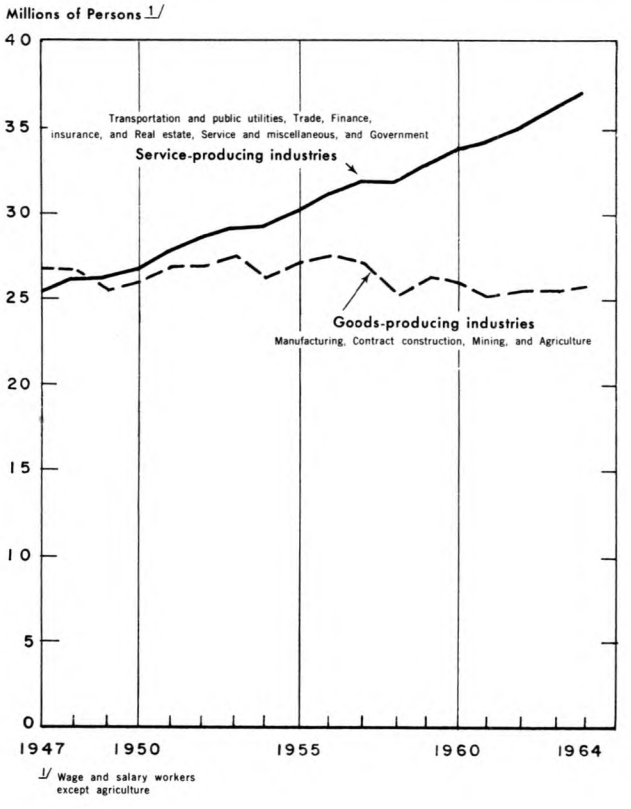
EMPLOYMENT IN MAJOR INDUSTRY GROUPS, 1964 ....



1/ Wage and salary workers except agriculture

CHART 3

INDUSTRIES PROVIDING SERVICES OFFER MORE JOBS THAN THOSE PROVIDING GOODS....



Among the goods-producing industries—manufacturing, construction, and mining—which employed nearly 26 million workers on their payrolls in 1964, employment has increased slowly in recent years. Significant gains in productivity, resulting from automation and other technological developments, as well as the growing skills of the work force have permitted large increases in output without corresponding increases in employment.

Agriculture, which once employed more than half of all workers, employed only 6 percent, or 5 million workers in 1964, a drop of nearly 42 percent since 1947. Decreases in the number of farms, rapid mechanization and improved fertilizers, feeds, and pesticides have permitted large increases in output at the same time that employment has fallen sharply.

Manufacturing—still the largest group with about 17 million workers—had an employment increase of about 11 percent between 1947 and 1964. New products for industrial and consumer markets and the rapid growth of the defense-space market have spearheaded the post World War II employment growth.

Contract construction employment, now at 3 million, has increased 57 percent between 1947 and 1964. The Nation's rapidly growing need for homes, offices, stores, highways, bridges, dams, and other physical facilities resulted in a sharp increase in construction employment.

Mining, which had fewer than 1 million workers in 1964 has declined considerably in importance since 1947. Between 1947 and 1964, mining employment fell by more than 33 percent, primarily because of laborsaving technological changes and a shift to sources of power other than coal.

There were 37 million workers on the payrolls of the service-producing industries in 1964, and employment has increased markedly since 1947. The major reasons have been (1) population growth; (2) increasing urbanization, with its accompanying need for more city services; (3) rising income and living standards with coincident demand for improved services such as health, education, and security. Except for the transportation and utilities group, all service industries have grown in both size and importance as a source of jobs in the past decade and a half.

Trade has expanded sharply since 1947. Wholesale and retail outlets have multiplied in large and small cities to satisfy the needs of our increasingly urban society. Employment in trade totaled 12 million in 1964, an increase of more than 36 percent since 1947.

Government employment has grown faster than any other industry—an increase of nearly 74 percent between 1947 and 1964. This growth has been mostly in State and local governments, which accounted for three-quarters of all government employment in 1964. Employment increases have been greatest in education, health and hospitals, sanitation, and police services. Overall total government employment rose from 5.5 million in 1947 to 9.5 million in 1964.

Services and miscellaneous industries. Our rapidly growing needs for maintenance and repairs, advertising, domestic service, laundry, hotel service, and other services have resulted in rapid employment increases in these industries. Over

the 1947–64 period, total service employment rose from slightly more than 5.0 million workers to more than 8.5 million.

Transportation and other utilities. The tremendous jump in air and bus travel has been more than offset by declines in the railroad industry, resulting in an overall drop of nearly 5 percent in employment in this industry group since 1947. Employment fell from 4.2 million in 1947 to 4.0 million in 1964.

Finance, insurance, and real estate, though relatively small in employment, has grown rapidly since 1947. During the 1947–64 period, employment in this industry grew from 1.8 million to 2.9 million, an increase of nearly 68 percent.

The Forces of Change

What people do for a living and how they do it depends on the size and needs of the population to be served, the educational and skill levels of workers, scientific discoveries and their application in industrial technology, changes in the organization of business functions and tasks, and the shifts in demand for goods and services.

Recent years have seen dramatic technological breakthroughs. Molecular miracles have been performed in research laboratories to produce the materials that can withstand the rigors of the nuclear and space age, materials that are also extremely useful in earthbound endeavors. The quest for perfection in measuring instruments and sensing devices to explore the outer space as well as the inner space—secrets now locked in the heavens above and the earth and ocean below—pays off even in improving ways of refining oil, producing steel, making television sets and appliances, or processing food.

We are also in the midst of a revolution in management techniques. The electronic computer—hallmark of automation—has been accompanied on the business and industrial scene by the trend toward a "systems" approach. This means that all activities in an enterprise—such as production, warehousing, sales, finance, personnel, and purchasing—are ever more closely coordinated so that an organization can reach its goals with least effort at least cost. In many places of business, this means drastic changes.

The Outlook for Industrial Change

As industries change, so do their manpower needs: A new machine or a newly automated process may require new ways of working, different worker skills and characteristics, or perhaps may even create an entirely new occupation; a change in the amount produced may affect the number of workers needed; an invention may all but eliminate an industry. Having looked at what has happened in the past and where we stand now, those about to choose a career will want to know what can be expected to happen next. This is where projections come in—estimates of future requirements based on the best available information.

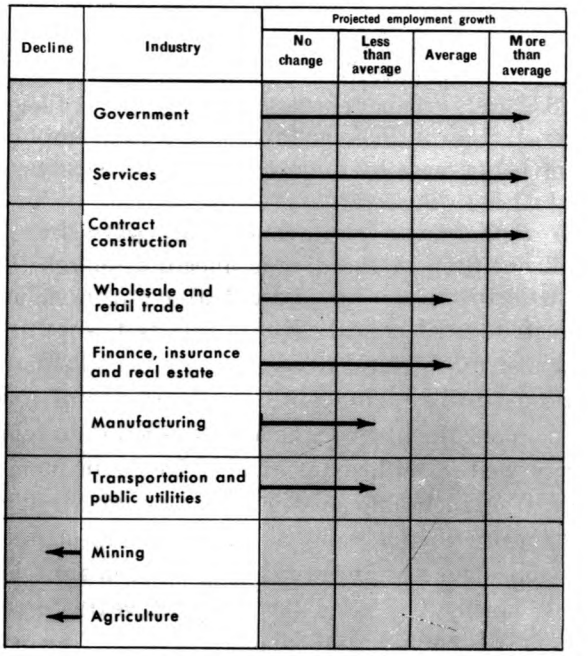
In general, job growth will continue to be faster in the service-producing industries than in the goods-producing industries. However, the industry divisions within the goods-producing sector are expected to show an inconsistent pattern, as shown in chart 4.

One of the major industry groups facing a continuing decline in manpower needs is *agriculture*. Continuation of the factors resulting in past declines—rapid mechanization, improved fertilizer

CHART 4

WHILE TOTAL EMPLOYMENT WILL GO UP BY ONE-FOURTH BY 1975 . . . .

Industry Growth Rates Will Vary Widely



and feeds, and a decrease in the number of farms, particularly the small low-income-producing units—is likely to continue. The outlook is for a 1975 farm work force one-fifth lower than in 1964.

Mining is the only major nonagricultural industry division in which no increase in manpower requirements is expected. In bituminous coal mining, where the number of production workers has dropped sharply in recent years—from 425,600 in 1947 to 133,300 in 1964—employment by 1975 may drop somewhat below the 1964 level. Minor employment increases may occur in quarrying and other nonmetallic mining. In total, the job level in the entire mining group, which fell by one-third from 955,000 in 1947 to 635,000 in 1964, will probably experience little change in the next decade.

Contract construction is expected to grow at a more rapid rate than the average for all nonfarm industries, if general business conditions remain good. (See qualifiers at end of this chapter for discussion of assumptions underlying these projections.) A healthy and expanding economy will spur the construction of industrial plants and commercial establishments such as office buildings, stores, and banks. The volume of construction maintenance and repair, which now is about one-third of new construction activity, is also expected to grow significantly in the next 10 years. Home and apartment building will be stimulated by the increase in population and new family formation, by higher income levels, and by continuing shifts of families from cities to the suburbs. Large government expenditures for school construction, roads, and urban renewal are also very likely. Overall, the outlook is for construction employment to increase by more than one-third between 1964 and 1975.

Manufacturing employment may grow by almost one-fifth in the decade ahead, although the growth will vary for individual manufacturing industries. Electrical equipment and supplies, and instruments and related products makers are expected to be hiring the largest number of new personnel. Machinery makers, too, should do relatively well in additional hiring. In the ordnance industry (including missiles), the rapid employment growth of recent years is not expected to continue, and manpower needs should remain relatively unchanged over the next 10 years. Producers of rubber and plastic products, paper, chemicals, and printing will be among the other growth industries. In some manufacturing industries, however, manpower needs may actually decline, as in the petroleum refining, tobacco, leather, and textile mill products industries.

Government—mostly State and local—will be a major source of new jobs in the coming decade. The employment level in government may be as much as one-half higher in 1975 than in 1964. The great bulk of the openings in government will be for people who work for State and local government—teachers, policemen, firemen, and public health service personnel. Local governments—cities, counties, townships, school districts—and State governments employed about 7.2 million workers in 1964, and their manpower needs may increase by nearly two-thirds over the 1964–75 period. The Federal Government has fewer than 2½ million civilian workers and its employment needs are expected to change little during this period.

Service industries will be among the fastest growing industries during the next 10 years. About one-half more workers will be employed in this industry division in 1975 than in 1964. As our population becomes increasingly needful of health services due to the increases in the numbers of both the young and old, medical and health services will have to be expanded substantially. Business services—advertising, accounting, auditing, and data processing; collection agencies; and maintenance firms—are also certain to grow.

Manpower requirements in educational services (public and private) are expected to grow especially fast, as more young people attend schools at all levels. Manpower requirements in education are also expected to be affected sharply by expanded government programs to provide vocational and adult education and training and education for youth, the poverty-stricken, and the unemployed.

Employment in *wholesale and retail trade* may grow by nearly one-fourth between 1964 and 1975, somewhat more slowly than nonfarm employment as a whole. Although an ever-increasing volume of merchandise will be distributed to a growing market, the rate of increase in manpower needs will be slowed down by the growing use of self-service, vending machines, electronic data-processing, and automated warehousing techniques.

A substantial part of the job growth in retail trade will come from the need for part-time workers, especially women, as suburban shopping centers multiply and stay open during evening hours.

Job growth in *finance, insurance, and real estate* will keep in step with the overall employment advance in the nonfarm economy. The finance, insurance, and real estate group by 1975 may expand their payrolls by one-fourth over the 3 million employed in 1964. That is a slower growth rate than the industry division registered in the past.

The most rapid employment advance in the division will be made by banking. An industry that now employs every fourth worker in the group—banking—may employ about 50 percent more workers 10 years from now. Half of the finance, insurance, and real estate work force now consists of women, a pattern that is not likely to change materially in the years ahead. Thus, this industry division will continue to provide a promising field of job opportunities for women.

The number of jobs in *transportation and public utilities* is expected to show little or no change by 1975. Widely differing employment trends—increases in air and motor freight transportation; little or no change in communication, electric, gas, and sanitary services; and decline in railroad employment—may just about offset one another.

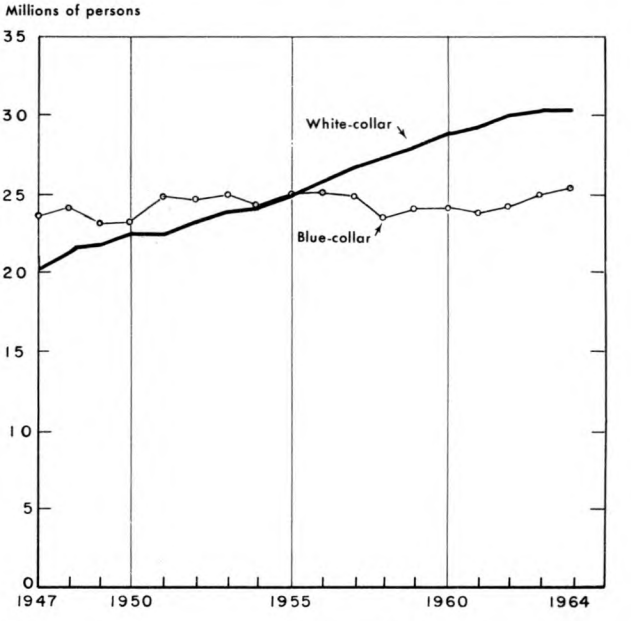
The Outlook for Occupational Change

Increased mechanization and streamlining of work have led to fundamental changes in the Nation's occupational structure. White-collar workers—professional, managerial, office, and sales workers—on the increase since the beginning of this century, outnumbered blue-collar or manual workers—craftsmen, operatives, and laborers—for the first time in 1956. (See chart 5.) We may expect a continuation of the more rapid growth of the white-collar occupations; a slower growth in the blue-collar occupations; a faster-than-average growth among service workers; and a further decline among farmers and farm laborers.

Compared with the expected growth of about one-quarter in total employment between 1964 and 1975, an increase of nearly one-third is anticipated for white-collar jobs, and nearly a fifth for blue-collar occupations. By 1975, white-collar jobs may make up nearly one-half of all employed workers, compared with slightly more than two-fifths in 1964.

CHART 5

EMPLOYMENT HAS SHIFTED TOWARD WHITE-COLLAR OCCUPATIONS . . . . .



The greater growth expectation for white-collar jobs reflects the continued expansion anticipated for the service-producing industries that employ a high proportion of white-collar workers; (see chart 6) also important are the growing demands for personnel capable of performing research and applying scientific findings in industry; the increasing needs for educational and health services; and a continuing growth in the amount of paperwork necessary in all types of enterprises. Although the number of blue-collar workers as a group will increase at a much slower rate than that of white-collar workers, the number of craftsmen will grow at about the same rate as total employment. The following section describes in somewhat greater detail the changes expected to occur in the broad occupational groups over the next decade.

The fastest growing occupation during the next 10 years (see chart 7) will continue to be the *professional, technical, and kindred occupations.* Personnel in these areas will be in sharp demand as the Nation explores new approaches to educa-

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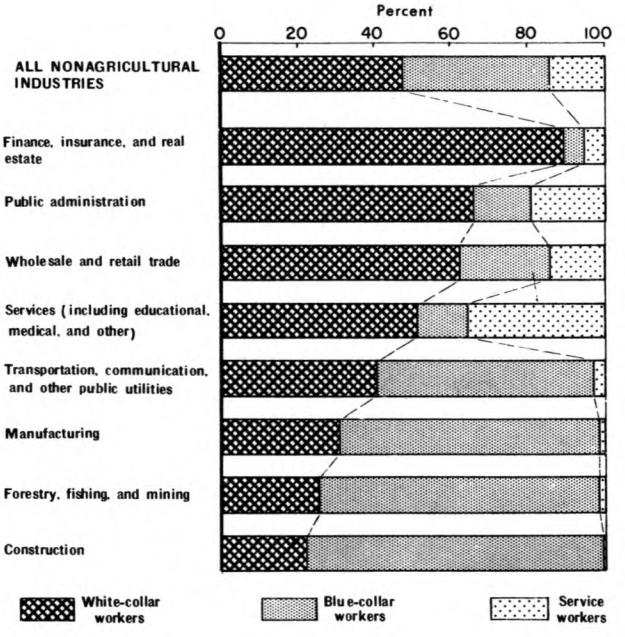
CHART 6

PROPORTION OF WHITE-COLLAR, BLUE-COLLAR, AND SERVICE WORKERS IN MAJOR NONAGRICULTURAL INDUSTRY GROUPS, 1964. . . .



tion, bends greater effort towards America's socioeconomic progress, urban renewal, transportation, harnessing the ocean, enhancing the beauty of the land, and conquering outer space. Today, thousands of men and women are working in fields that were little known only a decade ago—cryogenics, bionics, ultrasonics, microelectronics. The quest for scientific and technological knowledge is bound to grow, thus sharply boosting the demand for both specialists and those who can function effectively in several fields. The next decade will see a new emphasis on the social sciences, and educational and medical services. Overall, by 1975 the requirements for those workers may be more than two-fifths higher than in 1964.

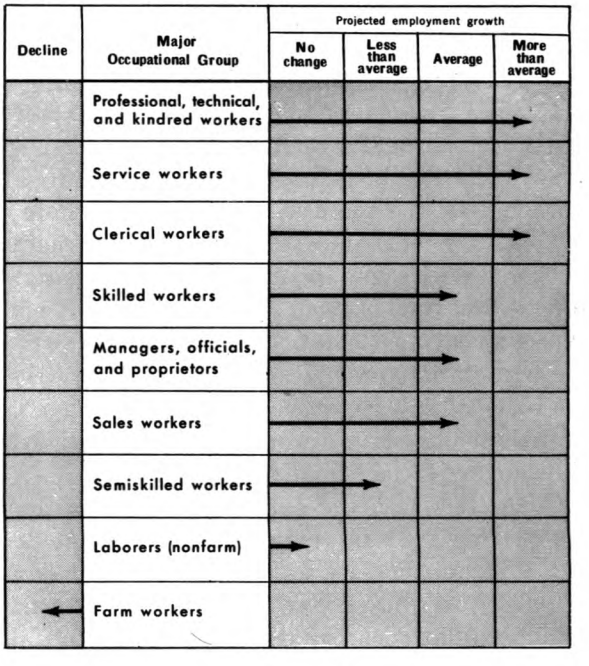
Service workers, a diverse group, may also increase by as much as two-fifths by 1975, or nearly as rapidly as professional workers. A relatively rapid rise in demand for protective service workers such as policemen and firemen is to be expected as the population increases in urban and suburban communities. A very substantial increase in the demand for attendants and other service workers in hospitals and other institutions is also anticipated. Other categories of service workers for which requirements are expected to increase rapidly include waiters and waitresses, cooks, counter and fountain workers, and charwomen and cleaners. The chief reason for anticipating growth in these latter occupations is the expected expansion in the food service business and in hospitals and other types of public buildings and institutions. The group may see their rapid growth facilitated by the new Federal programs to train workers in these occupations.

Clerical workers will be in strong demand, particularly those qualified to handle jobs created by the change to electronic data processing, and those skilled in work involving public contacts. The demand is expected to be slow for file clerks, calculator operators, pen-and-pencil recordkeepers. The need for clerical workers as a group is expected to increase by more than one-third between 1964 and 1975.

While the demand for *skilled workers* is spurred by the growing needs for mechanics and repair-

CHART 7

JOB OPPORTUNITIES GENERALLY WILL INCREASE FASTEST IN OCCUPATIONS REQUIRING THE MOST EDUCATION AND TRAINING. . . .



men, building trades craftsmen, and foremen, there are technological changes underway in the manufacturing industries which tend to limit the expansion of the group. About average growth is expected between 1964 and 1975.

Managers, officials, and proprietors as a group also will increase at about the average rate for all occupations. The demand for salaried managers and other officials in business organizations and government is expected to continue to increase at a fairly rapid rate. Although the number of independent businessmen declined substantially during the post war period, this trend is expected to level off in the years ahead.

Although the activity at both retail and wholesale level will rise considerably in the coming decade, the number of *sales workers* will increase more slowly than other white-collar groups. Changes in distribution methods, such as self-service, automated vending, and allied techniques are likely to have a restrictive influence on employment growth. Nevertheless, the overall increase in the needs for sales workers will be about average for all workers—about a one-fourth increase between 1964 and 1975.

A Word About Job Openings

Job opportunities spring from two sources; net growth and replacement needs. The next decade will see at least as many job openings created through the need to replace workers who retire, die, or leave the work force for other reasons, as from the net growth in employment. Replacement needs will be particularly acute in occupations with a large proportion of older workers who have relatively few years of working life left; and in those occupations with a large proportion of women, because many women leave the labor force to take care of family responsibilities. On the other hand, in rapidly growing occupations made up mainly of young men with a long working life ahead of them, growth in the occupation will be the principal source of new jobs. (See chart 8.)

Future Working Population

Turning from the types of workers likely to be in demand in the coming decade, the next question is whether our manpower resources will match job requirements.

First, there is the matter of numbers. Just as our population provides the market for most of the goods and services the Nation produces, it also provides the men and women who will work to produce these goods and services. Not all of the 195 million people in the Nation work today; neither will all of the 226 million people the country will have in 1975. (See chart 9.) The

CHART 8

JOB OPPORTUNITIES ARE DETERMINED BY GROWTH PLUS REPLACEMENT . . . .

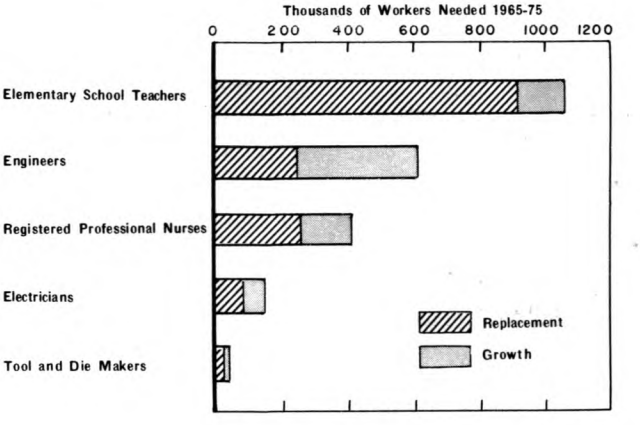
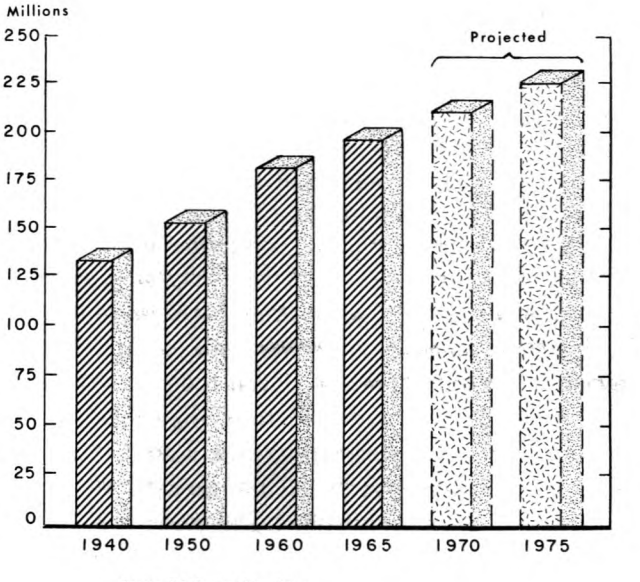


CHART 9

POPULATION WILL REACH 226 MILLION IN 1975 16 PERCENT MORE THAN IN 1965 . . . .



Source: U.S. Bureau of the Census

labor force—men and women age 14 and over, who are working or looking for work—now numbers about 78 million and is likely to grow almost 20 percent over the next 10 years, reaching nearly 94 million in 1975.

Although the number of all workers and jobseekers will increase by about 20 percent from 1965 to 1975, as shown in table 1, the growth in the labor force is really a story of young people. Young men and women between the ages of 25 and 34 will increase in number at a rate double that for the labor force as a whole. The people who will be in the 25 to 34 age group in 1975 are today in the 14 to 24 age bracket—an age group whose primary concern now would ordinarily be with education and training.

What happens if a young person lacks the qualifications, education, and training that are the raw materials necessary to build a career? Present experience shows that the less education and training, the less chance a worker has for a good, steady job. (See charts 10 and 11.) Unemployment falls heaviest on workers with the least education. Young workers having completed less than 8 years of school will have 7 times the unemployment rate of college graduates. Similarly, workers in the least skilled group—laborers—are 7 times as likely to be unemployed as professional workers.

Education and Training for Occupational Change

The developments in every broad occupational group seem to call for ever more education and training. And the need for educational and skill upgrading will not be confined to the rapidly growing professional and technical fields, nor even to white-collar employment generally. The demand for better educated and trained workers appears to be all-inclusive.

The need for education is further underscored by the likelihood that a person may face several job changes during his working career. No longer can a boy or girl expect just one occupation to cover a lifetime of work. Even today, a 20-year-old man could be expected to change jobs 6 or 7 times, during his work life expectancy of 43 years. Being able to adjust to changing ways of work applies to women as well, because little is likely to remain the same over the 40 years a single woman can, on the average, plan on working. Even married women, on the average, can count on rather lengthy work life expectancies—about 30 years for those without children, and about 25 years for those with children. To be able to switch from one specific job to another, a person must

TABLE 1. CHANGES IN THE LABOR FORCE, 1965–75

Labor force group	Number of persons (in millions)		Percent change, 1965–75
	Estimated, 1965	Projected, 1975	
Age 14 and over, both sexes	78.4	93.6	19.4
In the formal education age range, 14–24:			
Men	10.5	13.9	32.0
Women	6.3	8.6	36.3
In the career commitment age range, 25–34:			
Men	10.7	15.0	40.4
Women	4.2	6.1	45.0
In the career peak age range, 35–54:			
Men	21.7	21.5	−.8
Women	11.5	12.6	9.7
In the advanced career age range, 55 and over:			
Men	9.0	9.9	10.3
Women	4.6	6.0	32.4

NOTE: Because of rounding; sums of individual items may not equal totals. Percentages computed from unrounded figures.

CHART 10

UNEMPLOYMENT RATES ARE HIGHEST FOR YOUNG WORKERS AND FOR THOSE WITH THE LEAST SCHOOLING

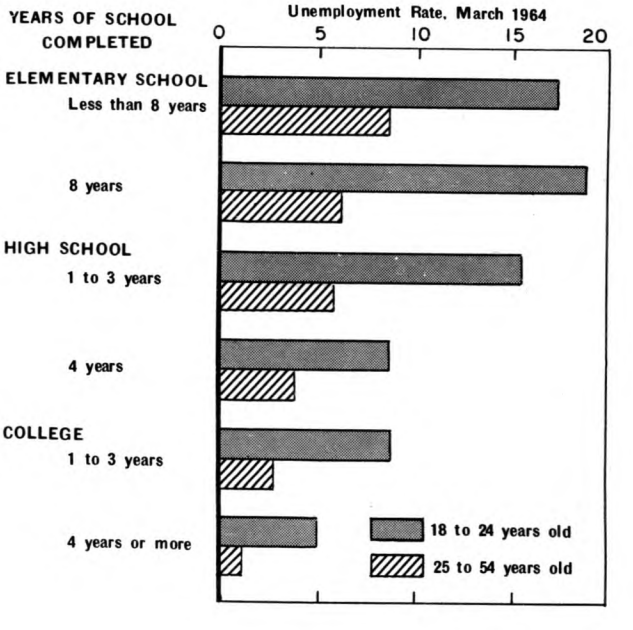
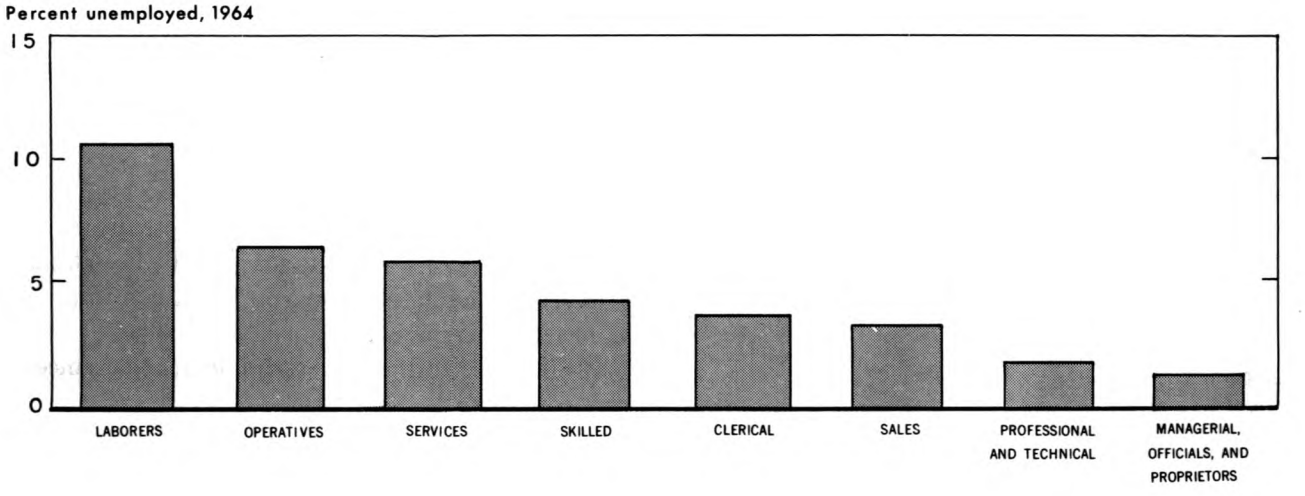


CHART 11

UNEMPLOYMENT HITS HARDEST AMONG THOSE IN THE LEAST SKILLED JOBS



have an educational background broad enough to enable him to absorb the training and retraining that will be necessary to permit him to switch.

"Stay in school" is indeed the motto for the decade ahead. Today, just about 2 out of 3 workers in the 25 to 34 age group—people who have more or less obtained the education and training necessary for beginning a career—have a high school education or better. By 1975, 3 out of 4 workers in this age group will be similarly equipped. Thus, those without a high school education are likely to face tough sledding in finding satisfactory and rewarding work. There was a time when experience alone carried a lot of weight on an application form. Experience, to be sure, remains an important consideration, but an effective formula for advancement today calls for another important ingredient—education. Experience carries must less weight these days than, say, 20 years ago. Much of it can become obsolete overnight due to technological change.

The monetary advantages of education, depicted in tables 2 and 3, are significant. The value of an education—besides the many intangible yet important ways it enhances a person's life—

TABLE 2. ESTIMATED AVERAGE LIFETIME EARNINGS OF ELEMENTARY AND HIGH SCHOOL MALE GRADUATES, SELECTED OCCUPATIONS

Occupation	Lifetime earnings from age 18 to 64		
	Elementary school graduates	High school graduates	Differential
CRAFTSMEN, FOREMEN, AND KINDRED WORKERS			
Average	$207,000	$243,000	$36,000
Brickmasons, stonemasons, and tile setters	204,000	233,000	29,000
Carpenters	178,000	209,000	31,000
Compositors and typesetters	229,000	254,000	25,000
Electricians	236,000	257,000	21,000
Linemen and servicemen, telegraph, telephone, power	228,000	263,000	35,000
Machinists	215,000	239,000	24,000
Mechanics and repairmen	191,000	216,000	25,000
Painters, construction and maintenance	167,000	189,000	22,000
Plasterers	197,000	239,000	42,000
Plumbers and pipefitters	222,000	252,000	30,000
Toolmakers, and diemakers and setters	264,000	282,000	18,000
OPERATIVES AND KINDRED WORKERS			
Average	186,000	210,000	24,000
Busdrivers	172,000	196,000	24,000
Mine operatives and laborers	173,000	212,000	39,000
Truck and tractor drivers	189,000	212,000	23,000
Operatives and kindred workers	188,000	212,000	24,000
SERVICE WORKERS, INCLUDING PRIVATE HOUSEHOLD			
Average	147,000	181,000	34,000
Barbers	184,000	189,000	5,000
Firemen, fire protection	215,000	244,000	29,000
Policemen and detectives	192,000	230,000	38,000

SOURCE: Basic data from the 1960 Census of Population, U.S. Department of Commerce.

is also demonstrated in chart 12. People with a better education are not only likely to earn more, but they are likely to see their earnings rise for a longer period than those with limited schooling.

These facts point out that education and occupation are together an index to probable future income and chances for steady employment. Young people who have acquired a skill or good basic education will have a better chance at interesting work, good wages, and steady employment. Getting as much education and training as one's abilities and circumstances permit should therefore be top priority for today's youth.

Qualifiers

No one can accurately forecast the future, but the estimates presented in the *Handbook* are based on the best information available. Of course, some aspects of the future are easier to predict and can be predicted more accurately than others. For example, the number of young people who will be 18 years old in 1975 can be estimated with a very high degree of accuracy, because these are the same individuals whom the census counted as 3-year olds in 1960. On the other hand, forecasting employment of automobile assemblers in 1975 is extremely difficult. The first estimate of 18 year-olds will be affected only by the death rate among boys and girls who were 3 years old in 1960, and this rate, extremely low, stays about the same from year to year. Employment of automobile assemblers, however, can be affected by the changing demand for American-made automobiles, shifts in buyers' preferences (toward the "compact" car, for instance), changes in the ways cars are made (more automation or greater use of turbine engines) and economic developments outside the automobile industry that are almost impossible to foresee. Nevertheless, using the wealth of information available and the best judgment of informed experts, it is possible to describe at least in broad terms, what the work future will be like.

To forecast the demand for certain kinds of workers, specific assumptions have to be made about general economic movements and broad national policy. The picture of the future as reflected in the *Handbook* is based on four fundamental assumptions:

(1) that high levels of economic activity and employment will be maintained over the long run, even though there may be temporary recessions;

(2) that there will be no major war, but at the same time, the defense program will continue at about the current level;

(3) that scientific and technological advances will continue;

(4) that the institutions and fundamental economic structure of the United States will not change significantly.

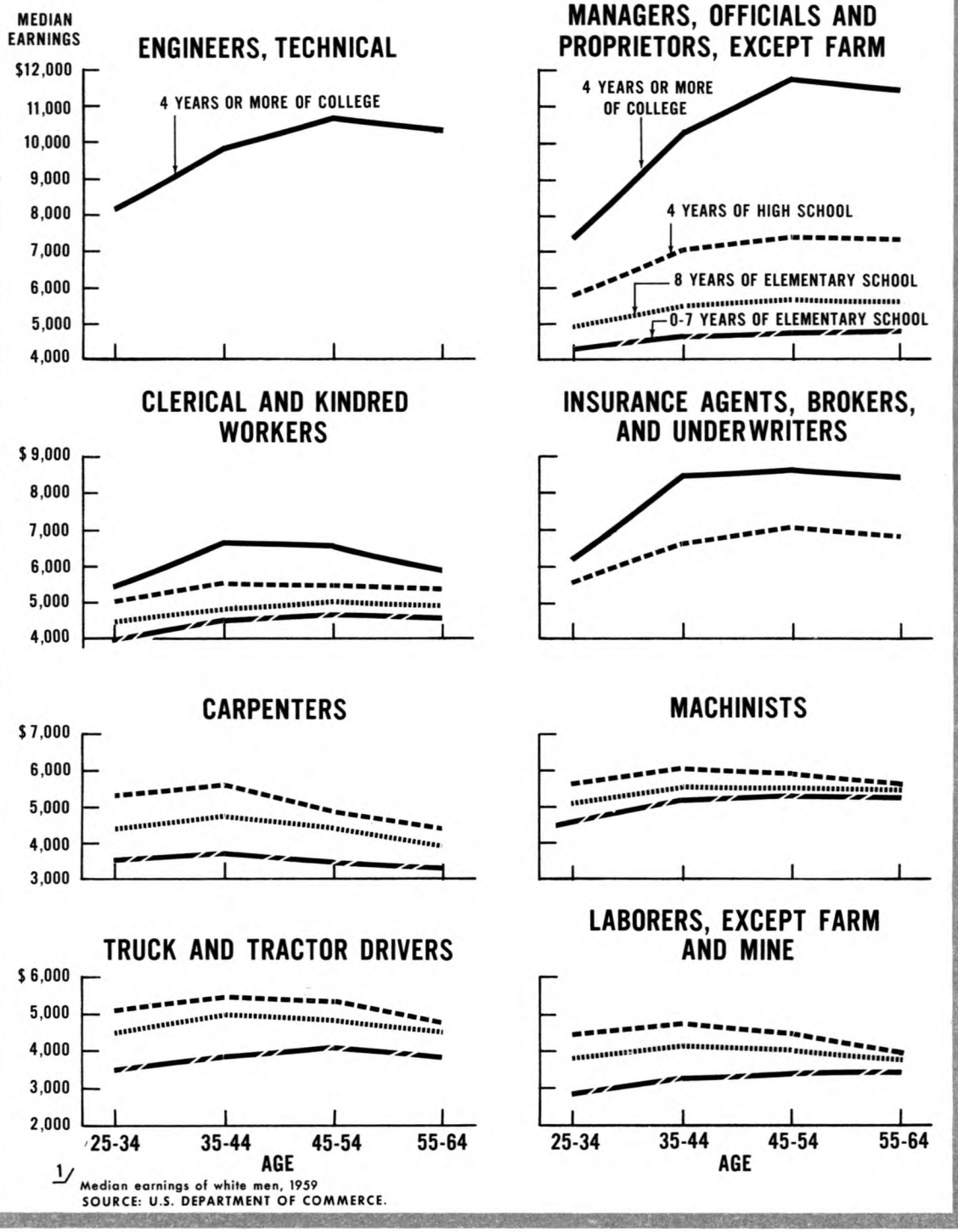
TABLE 3. ESTIMATED AVERAGE LIFETIME EARNINGS OF PROFESSIONAL MEN, BY LEVEL OF EDUCATION

Occupation	Lifetime earnings from age 18 to 64		
	Average	4 years of high school	4 or more years of college
Doctors	$717,000	----------	$721,000
Dentists	589,000	----------	594,000
Lawyers	621,000	----------	642,000
Engineers:			
Aeronautical	395,000	$378,000	418,000
Electrical	372,000	327,000	406,000
Mechanical	360,000	339,000	399,000
Civil	335,000	285,000	380,000
Natural scientists:			
Geologists	446,000	----------	470,000
Physicists	415,000	----------	431,000
Chemists	327,000	274,000	351,000
Biologists	310,000	----------	322,000
Social scientists:			
Economists	413,000	----------	432,000
Psychologists	335,000	----------	345,000
Statisticians	335,000	----------	387,000
Teachers:			
Elementary school	232,000	----------	241,000
High school	261,000	----------	265,000
College	324,000	----------	328,000
Accountants	313,000	286,000	362,000
Clergymen	175,000	156,000	184,000

SOURCE: Basic data from the 1960 Census of Population, U.S. Department of Commerce.

CHART 12

EARNINGS OF MEN, 1/ BY AGE, FOR SELECTED OCCUPATIONS AND LEVELS OF EDUCATION



1/ Median earnings of white men, 1959

SOURCE: U.S. DEPARTMENT OF COMMERCE.

Professional, Managerial, and Related Occupations

Professional and administrative occupations have many attractions for young people choosing a career. These occupations offer opportunities for interesting and responsible work and, in many cases, lead to high earnings. As a rule, however, they can be entered only after long periods of specialized education or other preparation, because a broad knowledge of one's field is an essential requirement for success in these types of work.

Nearly one-fourth of all workers in 1965 were in professional, administrative, and related occupations. These occupations—employing more than 16½ million people—accounted for more than half of all white-collar employment.

The professions generally require either college graduation—often with an advanced degree—or experience of such kind and amount as to provide comparable knowledge. Professional occupations are of two main types. Most professional occupations, including those of engineer, architect, physician, lawyer, and teacher, require specialized, theoretical knowledge of a specific field. The other group, including occupations such as editor and actor does not require as much specialized, theoretical knowledge, but demands a great deal of creative talent and, also, skill acquired chiefly through experience. Licenses are required for practice in many professions—medicine, dentistry, and pharmacy, for example—with licensing authorities determining the minimum qualifications which members must have. In addition, professional societies set up membership standards, which tend to define their respective fields.

The professions provide many employment opportunities for women. They represented about one-third of all professional, technical, and kindred employment in 1964. In several very large professional occupations — teaching, nursing, library work, and social work—women predominate.

It is not easy to prepare for and enter professional work. Often, institutions providing professional training do not accept applicants for professional training unless their school grades are high, and employers generally give preference in hiring to graduates whose grades put them high in their class.

Closely related to the professions is a wide variety of technical occupations. People in these occupations work hand-in-hand with engineers, scientists, mathematicians, physicians, and other professional personnel. Their job titles include those of draftsmen; engineering aid; programer; and electronics, laboratory, or X-ray technician. Employment in these technical occupations usually requires a combination of basic scientific knowledge and specialized education or training in some particular aspect of technology or science. Such training may be obtained in technical institutes, junior colleges, and other schools, or through equivalent on-the-job training. Many of the duties of technicians may be performed also by beginning professional workers. However, because of their more limited educational background, technicians generally find it difficult to advance to professional level jobs.

The major professional, technical, and related occupations are shown in chart 13.

People in administrative and related occupations run the Nation's businesses and manage a wide variety of other organizations, both private and governmental. The problems they deal with are as varied as the affairs they manage. Whether their organizations are small or large, employing only a few people or many thousands, the decisions they reach and their effectiveness in getting these decisions carried out contribute greatly to the success or failure of the enterprise.

About 6.5 million men and 1.1 million women were managers, officials, or proprietors in 1965. Of these more than 7½ million people, managers

and officials in salaried positions accounted for almost 60 percent. Executives and other managerial personnel in business firms make up the largest part of this salaried manager group. In addition, several hundred thousand more people in this category are officials of Federal, State, and local government agencies and nonprofit organizations of many kinds. Also grouped with managerial workers are persons in a variety of official and administrative positions; for example, members of Congress, ship captains, railroad conductors, and trade union officials.

Employment Trends

Employment in professional, technical, and related occupations has risen rapidly over the years. From less than half a million in 1870, the number of these workers has grown to about 8.9 million in 1965. (See chart 14.) Moreover, during the 1950 decade, the rate of growth in the professions was more than twice that for clerical workers, the second fastest growing occupational group at that time. Moreover, thus far in the 1960's, growth in the professional, technical, and related worker group continues to exceed that of any other broad occupational group.

A major reason for the increase in the total number of workers in professional and related occupations has been the development of various fields, some unknown until recent years. Engineering, mathematics, and other closely related scientific professions have had a spectacular growth over the past 60 years. Other major fields, which have developed wholly or largely during the present century include social work, accountancy, personnel work, programing, other data-processing specialties, and electronics. Some of this growth has accompanied the expansion in scientific and engineering professions. As scientific and technical work has become more highly organized, particularly in the laboratories and engineering departments of large firms and in government agencies, more technical assistance has been provided for the professional worker.

CHART 13

TEACHING AND ENGINEERING ARE THE LARGEST PROFESSIONAL OCCUPATIONS . . . .

Employment in selected professional, technical and kindred occupations

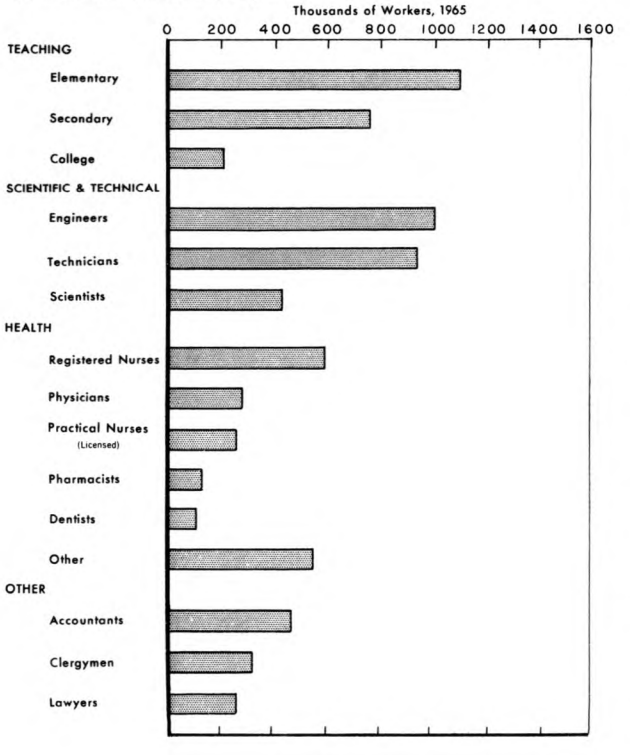
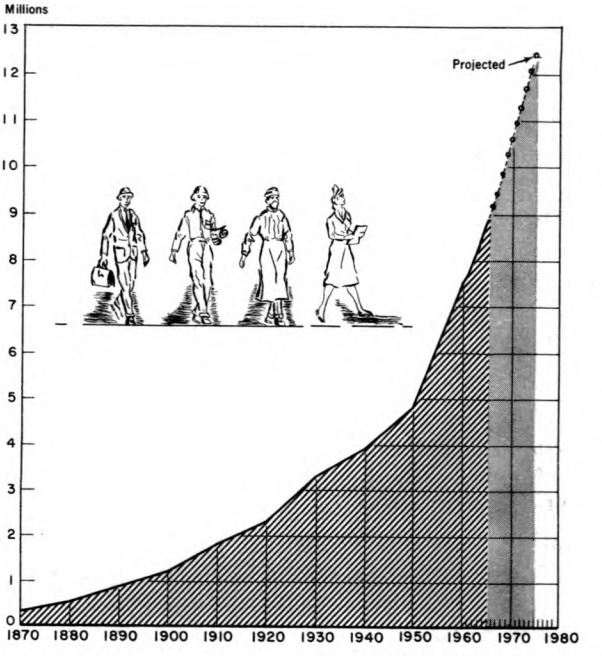


CHART 14

GROWTH OF PROFESSIONAL, TECHNICAL, AND KINDRED OCCUPATIONS . . . .



Data prior to 1950 are decennial census figures and are not strictly comparable to later years.

Similarly, large numbers of technicians and assistants work in the health fields, thereby freeing the professional personnel for work requiring more training.

Between 1965 and 1975, employment in the professional and technical group is expected to rise by nearly 40 percent—almost twice the rate for total employment. However, there will naturally continue to be differences in the rates of growth among the professions.

The number of people in administrative and managerial positions in the United States is growing, although by no means as fast as the number of professional workers. Employment in this field as a whole is expected to continue increasing moderately. By 1975, the total number of people in managerial, administrative, and related positions may be almost 9.5 million, nearly one-fourth more than in 1965.

Most of this increase in employment will be in salaried positions. Growth in the number of self-employed proprietors will be relatively slow in the years ahead, in part because of the trend toward the formation of larger businesses. In the retail field, for example, supermarkets are replacing the small general store, the separate meat market, and the corner grocery store. On the other hand, the number of managers and salaried officials in larger business organizations and government agencies is mounting rapidly.

Educational Trends

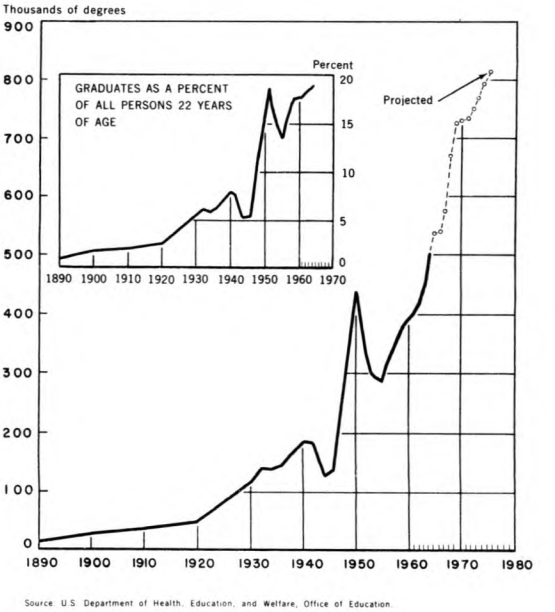
The professional and managerial occupational groups engaged 8 in every 10 workers with a college education in 1964, and the concentration of college graduates among these occupations is steadily increasing. In addition to the many professional occupations for which college graduation has long been an entry requirement, demand for college graduates is increasing at the entry level in other professional fields, and in many administrative and related occupations. Graduates are sought for many positions which either did not exist a few decades ago or which were formerly filled by employees selected primarily on the basis of their experience and personal characteristics. This emphasis on a college education will be reinforced in the years ahead, in view of the growing complexity of modern industry and technology, which is constantly increasing the amount of technical knowledge required for effective performance in many professional and administrative jobs.

The growth in the professional, administrative, and related occupations has been accompanied by a great increase in the numbers of young men and women graduating from college, who are the chief source of professionally trained workers. The proportion of young people completing college (represented as a percent of all persons 22 years of age) rose from 2.5 percent in 1920 to 8 percent in 1940, and 19 percent in 1964, as shown in the inset in chart 15. (The level reached in 1950 is artificially high, reflecting the large number of veterans who went to college under the veterans' education program and who, in many cases, would have completed college earlier if it had not been for the war.)

The recent rapid increase in the proportion of young people graduating from college (chart 15) reflects a number of basic social trends. Because family incomes are higher, more people can afford to put off going to work and to pay the costs of education. More families want a college education for their children. Scholarships and loans are available for more students; part-time work opportunities are also available. Finally, a college

CHART 15

NUMBER OF BACHELOR'S DEGREES GRANTED . . .



Source: U.S. Department of Health, Education, and Welfare, Office of Education.

education is becoming necessary for an increasing proportion of jobs, and in many professions the amount of education needed is increasing. Since these factors will probably continue to be influential in the future, the proportion of young people who are being graduated from college is expected to go on increasing for many years. The college-age population is also growing. The number of people age 18 to 21 is expected to increase by nearly 4 million between 1965 and 1975. These factors, considered together, point to a great increase in college graduations, assuming that the Nation's colleges and universities build the classrooms, laboratories, dormitories, and other facilities and hire the faculty members needed to provide for the greatly increased numbers of students. It is likely that the number of bachelor's degrees awarded annually will be more than 60 percent greater by 1975 than in 1964. Projections prepared by the U.S. Office of Education in 1964 indicate an increase from the 502,104 bachelor's degrees granted in 1964 to 731,000 in 1970 and 815,000 in 1975.

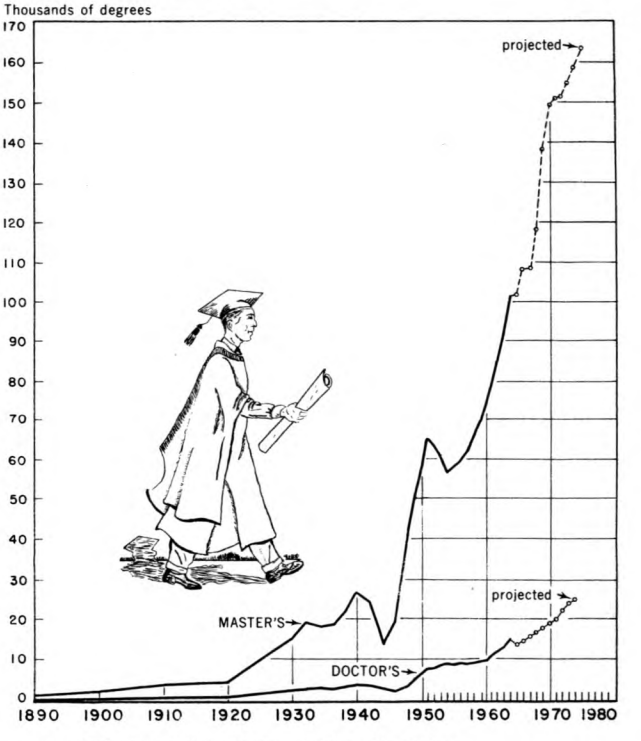
The number of students taking graduate training has also risen very rapidly during the last few decades, and will probably continue to mount in the years ahead. A master's degree is usually earned through 1 or 2 years of study beyond the bachelor's degree. To earn the Ph.D. degree usually requires 3 years or more beyond the bachelor's degree. As a rule, graduate study is concentrated in the major subject field of the student's interest, whereas undergraduate study is broader in content.

Chart 16 shows the vast increase in graduate degrees awarded since 1920 in all fields taken together. The numbers of master's and doctor's degrees granted reached unprecedented heights in the early 1950's, following the record number of bachelor's degrees granted a few years before. After a slight decline in the mid-1950's, master's degrees rose to about 101,000 in 1964 and are expected to approach 150,000 in 1970, if past trends continue. The number of doctorates awarded (about 14,500 in 1964) may reach 18,000 by 1970. According to projections made by the U.S. Office of Education, the number of master's degrees conferred may exceed 160,000 and doctorates may approach 25,000 in 1975.

These projections obviously imply a great increase in the supply of personnel which will be available for professional employment. Since the demand for personnel is also expected to show continued growth, there is promise of expanding employment opportunities for the increasing numbers of college graduates. The anticipated increases in college-trained personnel raise the possibility, however, of increasing competition during the late 1960's and early 1970's for the better professional positions in at least some fields of work.

CHART 16

NUMBER OF MASTER'S AND DOCTOR'S DEGREES GRANTED . . . .



Source: U.S. Department of Health, Education, and Welfare, Office of Education

BUSINESS ADMINISTRATION AND RELATED PROFESSIONS

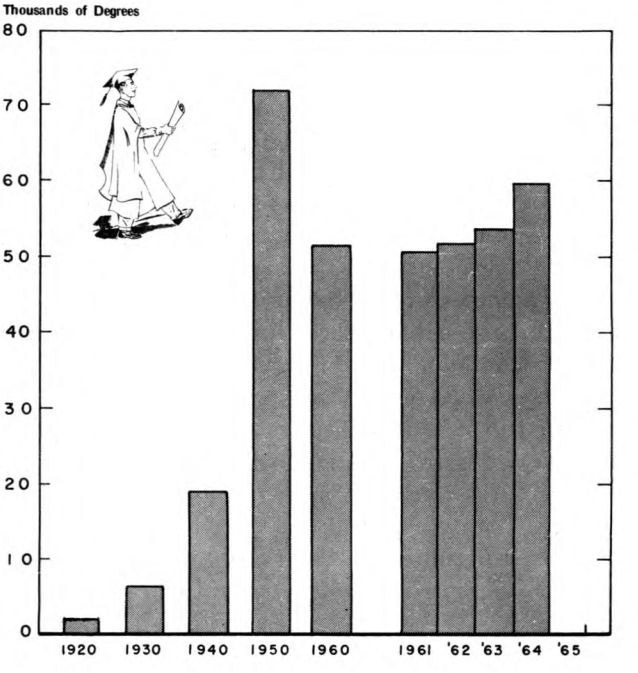
The success or failure of a business enterprise probably depends more on how well its managers do their job than it does on anything else. Close to 4½ million salaried workers—85 percent of them men—were employed in 1964 to manage the business activities of our Nation's enterprises. Many others are self-employed managers who carry on all or a part of the activities necessary for the management of their own businesses. In addition, many professional workers also have managerial responsibilities. Business managers are one of the fastest growing occupational groups in the country. Between 1958 and 1964, the number of salaried management workers increased more than twice as fast as the number of workers in all nonagricultural occupations combined.

Many management workers are college graduates who have taken their major course work in the field of business and commerce. This field of training is second only to teacher training and the social sciences in the numbers of degrees awarded. Degrees in business and commerce exceed those granted in such large fields as engineering, law, and medicine. In recent years, the graduates in this field have exceeded 50,000 annually and have accounted for more than 10 percent of all bachelor's degrees awarded. In 1920, 1,559 degrees in business administration were awarded, representing only about 3 percent of all degrees. Chart 17 shows the number of bachelor's degrees awarded in business and commerce since 1920.

Company management workers are involved in work similar to that of a small business owner, but on a much larger scale. The man who runs a small television repair service, for example, may attempt to attract new customers through advertisements in local papers. The workers in charge of advertising the household appliances produced by a large manufacturing company may use newspaper advertisements also, but these advertisements are likely to be bigger, more elaborate, and published in newspapers throughout the country. The company's products will probably be advertised also through radio, television, and other channels. Similarly, the small businessman has, at most, only a few employees to direct, whereas the personnel workers in a large corporation must consider the welfare and productiveness of thousands of employees.

CHART 17

BACHELOR'S DEGREES GRANTED IN BUSINESS AND COMMERCE



Source: U.S. Department of Health, Education, and Welfare, Office of Education

At the top of the management ladder are the corporation presidents, vice presidents, and other company officials. These people set company goals, coordinate company activities, and make

the major decisions which establish companywide policies. In small companies, they may also carry through with the plans they develop, taking direct charge of the work done in connection with store displays, financial reports, employee recreational activities, or other projects. In large corporations, however, the plans and policies developed by officials at the top are more likely to be carried out with the assistance of management workers in subordinate positions—the middle-level managers who direct the work of sales, accounting, personnel, engineering, and other departments. (See chart 18, illustrating how management functions might be organized within a large company.) Companies with branch plants and chain stores have managers in charge of these operations. Some companies also have many supervisory positions which involve management responsibilities. Persons in positions of this kind are responsible for keeping the units under their direction operating efficiently and in accordance with the broad policies established for the company as a whole.

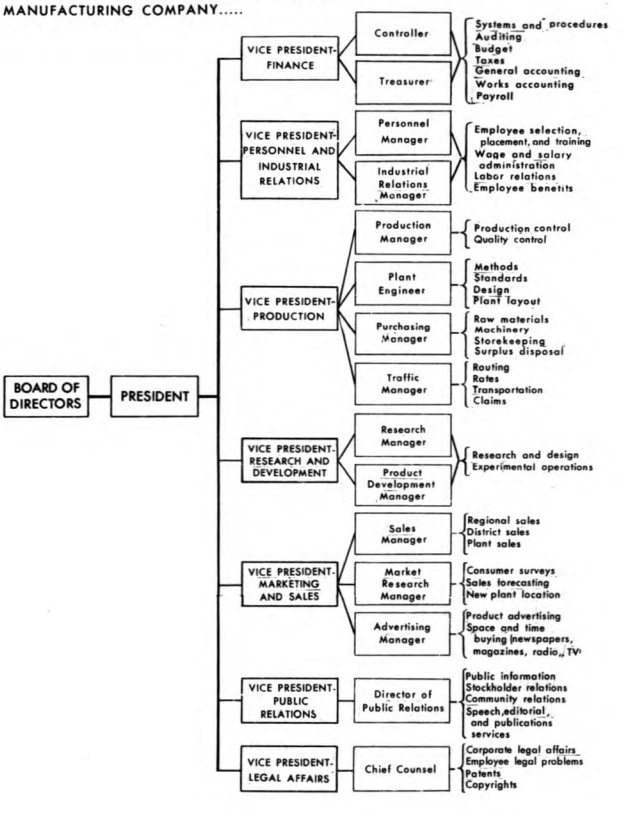
At the bottom of the management ladder are the beginners who are gaining experience which may later qualify them for management positions. Many are college graduates who have been recruited because their ability, personality traits, and training make them promising candidates for managerial work. Such trainees are usually placed in jobs where they have particularly good opportunities to become acquainted with the firm's business activities and policies. Some work as assistants to people in management positions, while others are given job assignments which are changed periodically so that they may have an opportunity to learn all phases of their employer's business operations. A limited number are offered formal executive trainee programs.

Although many people enter administrative jobs only after several years of work experience, often in work unrelated to management, an increasing number of employers are now seeking to develop the qualities which make for successful management through company-sponsored training programs open to selected groups of employees.

Employment in this field of work is expected to expand considerably through the mid-1970's because of the increasing dependence on trained management specialists and the general industrial expansion in our country. About 260,000 new salaried workers or more per year are expected to be needed through the mid-1970's to take care of growth needs. Additional openings will arise also because of the need to replace management workers who retire or leave their jobs for other reasons. Many positions will be filled by people who have already acquired a substantial amount of experience in other phases of their employer's operations, or by outsiders with work experience related to the positions to be filled. Opportunities for many young people to start on the road to a career in business management will also be provided as the entry jobs farther down on the ladder are vacated by people who move up to better positions.

CHART 18

SAMPLE ORGANIZATION CHART OF A LARGE MANUFACTURING COMPANY.....



Accountants

(2d ed. D.O.T. 0–01.)
(3d ed. D.O.T. 160.188)

Nature of Work

Keeping track of where the money goes in the maze of financial transactions in today's business and government requires the services of experts. These experts — called accountants — numbered about 450,000 in 1965, of whom more than 80,000 were certified public accountants (CPA's).

Accounting is one of the largest fields of professional employment for men. Only about 2 percent of the CPA's, and less than 10 percent of all accountants are women. However, the proportion of women may grow in the future as an increasingly complex and expanding economy demands more accounting services.

Accountants compile and analyze business records and prepare financial reports, such as profit and loss statements, balance sheets, cost studies, and tax reports. The major fields of employment are public, private, and government accounting. Public accountants are independent practitioners who work on a fee basis for business enterprises or for individuals wishing to use their services, or as a member or employee of an accountancy firm. Private accountants, often referred to as industrial or management accountants, handle the financial records of the particular business firm for which they work on a salary basis. Government accountants work on the financial records of government agencies and often audit the records of private business organizations and individuals whose dealings are subject to government regulations.

Accountants in any field of employment may specialize in such areas as auditing, tax work, cost accounting, budgeting and control, or systems and procedures. Public accountants are likely to specialize in auditing—that is, in reviewing financial records and reports and giving opinions as to their reliability. They also advise clients on tax matters and other financial and accounting problems. Most private accountants do cost or other management accounting. Sometimes they specialize in tax work, or in internal auditing—that is, examining and appraising financial systems and management control procedures in their company. Many accountants in the Federal Government are employed as Internal Revenue agents, investigators, and bank examiners, as well as in regular accounting positions.

Where Employed

More than half of all accountants do private accounting work for the business and industrial firms that employ them. Perhaps an additional third are engaged in public accounting as proprietors, partners, or employees of independent accounting firms. About 10 percent work for Federal, State, and local government agencies. A smaller number teach in colleges and universities.

Accountants are employed wherever business, industrial, or governmental organizations are located. The majority, however, work in large metropolitan centers where there is a particularly heavy concentration of public accounting firms and central offices of large business organizations.

Auditor verifies inventory to validate company's financial statement.

Training, Other Qualifications, and Advancement

Training in accounting can be obtained in universities, 4-year colleges, junior colleges, accounting and private business schools, and correspondence schools. Graduates of all these institutions are included in the ranks of successful accountants; however, a bachelor's degree with a major in accounting or a closely related field is increasingly an asset, and for better positions it may be required. Candidates with a master's degree in accounting, as well as college training in other business and liberal arts subjects, are preferred by many firms. Previous work experience can be of great value also, in qualifying for private employment. A number of colleges offer students an opportunity to get such experience through internship programs conducted in cooperation with public accounting or business firms. For beginning accounting positions, the Federal Government requires 4 years of college training (including 24 semester hours in accounting) or an equivalent combination of education and experience. Most universities require the master's degree or the doctorate with the Certified Public Accountancy Certificate.

All States require that anyone practicing in the State as a "certified public accountant" hold a certificate issued by the State board of accountancy. Well over half the States also restrict the title "public accountant" to those who are licensed or registered. Requirements for licensing and registration vary considerably from one State to another, and information on these requirements may be obtained directly from the board of accountancy in the State where the student plans to practice. Almost half the States have laws that will, by 1970, require CPA candidates to be college graduates. All States use the CPA examination provided by the American Institute of Certified Public Accountants. In recent years, more than 9 out of 10 successful CPA candidates have been college graduates. Before the CPA certificate is issued, at least 2 years of public accounting experience, or its equivalent, is required in nearly all States.

Inexperienced accountants usually begin with fairly routine work. Junior public accountants may be assigned to counting cash, verifying additions, or performing other detailed work. They usually advance to semisenior positions in 1 or 2 years and to senior positions within another 1 or 2 years. In the larger firms, those successful in dealing with top executives in industry often become supervisors, managers, or partners, or transfer to executive positions in private accounting. Many become independent practitioners. Beginners in private accounting may start as ledger or cost clerks, timekeepers, junior internal auditors, or, occasionally, as trainees for technical and executive positions. They may rise to chief plant accountant, chief cost accountant, senior internal auditor, or manager of internal auditing, depending on their specialty, and some become controllers, treasurers, and even corporation presidents. In the Federal Government, beginners are hired as trainees and are usually promoted in a year or so. Although advancement may be rapid for able accountants, those with inadequate academic preparation are likely to be assigned to routine jobs and find themselves handicapped in obtaining promotion. In colleges and universities, those with minimum training and experience may receive the rank of instructor without tenure, with advancement and permanent faculty status dependent upon further education.

Accountants who want to get to the top in their profession usually find it necessary to continue their study of accountancy and related problems—even though they may have already obtained college degrees or CPA certificates. Even experienced accountants may spend many hours in study and research in order to keep abreast of legal and business developments that affect their work. For example, more and more accountants are studying computer operation and programing methods so as to adapt accounting procedures to new methods of processing business data.

Employment Outlook

Employment opportunities for accountants were very good in 1965 and are expected to remain so into the mid-1970's. As many as 10,000 accountants may be needed annually during this period to replace those who retire, die, or transfer to other occupations. Provided no major setback occurs in the general level of business activity, at least as many more accountants will be needed each year for growth in the occupation. Demand for college-trained accountants will rise faster than demand for people without this broad

background of training, because of the growing complexity of business and its accounting requirements. However, graduates of business and other schools offering thorough training in accounting should also have good job prospects during this period.

Over the long run, accounting employment is expected to expand rapidly because of such factors as the greater use of accounting information in business management; complex and changing tax systems; the growth in size and number of business corporations required to provide financial reports to stockholders; and the increasing use of accounting services by small business organizations. Highly trained accountants will be in even greater demand as consultants to business managers in planning new recordkeeping systems and accounting procedures for use with electronic data-processing equipment.

Increasing numbers of women will be engaged in professional accounting, though most public accounting firms will probably remain reluctant to employ them—because of tradition, and preferences expressed by individual clients, and because some types of travel and factory assignments are considered better suited to men than to women. However, those women who rank high among college graduates with accounting majors and who secure the CPA certificate will, in time, undoubtedly break down these barriers.

Earnings and Working Conditions

Starting salaries for new college graduates averaged about $6,400 a year in 1964, according to a private survey of over 100 large business organizations recruiting college seniors for accounting positions. Smaller firms, especially the small CPA firms, generally pay somewhat lower rates. Salaries of senior accountants with about 5 years' experience are generally about 50 percent higher than salaries of beginners; salaries of those with 10 years' experience are about twice as high as the rate for beginners.

Chief accountants in other than public accounting firms averaged between $10,000 and $16,000 a year in 1964. Chief internal auditors in large industrial organizations earned from $18,000 to $28,000 a year, according to the limited data available. Accountants in managerial accounting positions, such as controllers and financial vice presidents, earned much more.

Self-employed certified public accountants in 1963 who were working as individual practitioners averaged $11,000 a year. Individually, those who were partners in small firms averaged almost $17,500, and those in medium-size firms averaged nearly $24,000, according to the American Institute of Certified Public Accountants. Top partners in very large accounting firms may have earned individually more than $100,000 a year.

In the Federal Civil Service, the entrance salary for junior accountants and auditors was $5,000 in early 1965. Some candidates with superior academic records could qualify for a starting salary of $6,050. Many experienced accountants in the Federal Government made between $10,000 and $11,000 a year, and some, with administrative responsibilities, earned more than $14,000 in 1964.

Public accountants are likely to work especially long hours under heavy pressure during the tax season. They do most of their work in their clients' offices, and sometimes do considerable traveling to serve distant clients. A few private and government accountants also do a great deal of traveling and work irregular hours, but the majority remain in one office and work between 35 and 40 hours a week, under the same general conditions as their fellow office workers.

Where To Go for More Information

Information, particularly on CPA's and on the aptitude and achievement tests now given in many high schools and colleges and by many public accounting firms, may be obtained from:

American Institute of Certified Public Accountants,
666 Fifth Ave., New York, N.Y. 10019.

Further information on specialized fields of accounting may be obtained from:

National Association of Accountants,
505 Park Ave., New York, N.Y. 10022.
Financial Executives Institute,
50 West 44th St., New York, N.Y. 10036.
The Institute of Internal Auditors, Inc.,
60 Wall St., New York, N.Y. 10005.

A leaflet describing accounting as a career may be obtained free from:

The American Accounting Association, College of Business Administration,
State University of Iowa, Iowa City, Iowa 52240.

Advertising Workers

(2d ed. D.O.T. 0–81. and 0–06.94)
(3d ed. D.O.T. 162.158; 164.068 through .168; and 132.088)

Nature of Work

Through advertisements published in newspapers and magazines, broadcast on the radio, shown on television, displayed on billboards, sent through the mail, or even written in smoke in the sky, businessmen try to reach potential customers and persuade them to buy their products or services. Advertising workers plan and prepare these advertisements and get them before the public. They include executives responsible for planning and overall supervision, copywriters who write the text, artists who prepare the illustrations, layout specialists who put copy and illustrations into the most attractive arrangement possible, administrative and technical workers who are responsible for the satisfactory reproduction of the "ads," and salesmen who sell advertising space in publications or time on radio or television programs. In a very small advertising organization, one person may do all these things. Large organizations employ specialists for research, copywriting, and layout work, and sometimes have staff members who specialize in writing copy for particular kinds of products or for one type of advertising media such as radio, popular magazines, or direct mail. The following are the specialized occupations most commonly found in advertising work.

Advertising managers head the advertising departments of manufacturing companies and other advertisers and of newspapers and other media. Since most businesses use the services of advertising agencies to handle all or part of their advertising programs, the company's advertising manager works mostly on policy questions—for example, the type of advertising, the size of the advertising budget, and the agency to be employed. He then works with the agency in planning and carrying through the program. He may also supervise the preparation of special sales brochures, display cards, and other promotional materials.

The advertising manager of a newspaper, radio station, or other advertising medium is chiefly concerned with selling advertising time or space; his functions are similar to those of the sales manager in other businesses.

Account executives are employed in advertising agencies to handle relations between the agency and its clients. An account executive studies the client's sales and advertising problems, develops a plan to meet the client's needs, and seeks his approval of the proposed program. Account executives must be able to sell ideas and maintain good relations with clients. They must know how to write copy and use artwork, even though they usually call on copywriters and artists to carry out their ideas and suggestions.

Some advertising agencies have account supervisors who oversee the work of the account executives. In others, account executives are directly responsible to agency heads.

Advertising copywriters create the headlines, slogans, and text that attract buyers. They collect information about the products and the people who might use them. They use their knowledge of psychology and writing techniques to prepare copy especially suited for readers or listeners and

Account executive shows advertising layout to client representatives.

778–316 O—65——4

for the type of advertising medium to be used. Copywriters may specialize in copy that appeals to certain groups—housewives, businessmen, scientists, or engineers—or even in copy that deals with specific products such as lipsticks or washing machines. In advertising agencies, copywriters work closely with account executives, though they may be under the supervision of a copy chief.

Media directors (or space buyers and time buyers) are employed by advertisers and advertising agencies to determine where and when advertising should be carried in order to reach the largest group of prospective buyers at the least cost. They must have a vast amount of information about the cost of advertising in all media and the relative size and characteristics of the reading or listening audience which can be reached in various parts of the country by specific publications, broadcasting stations, and other media.

Production managers and their assistants arrange to have the final copy and art work converted into printed form. They deal with printing, engraving, and other firms involved in the reproduction of advertisements. The production manager must have a thorough knowledge of various printing processes, typography, photography, paper, inks, and related technical materials and processes.

Research directors and their assistants assemble and analyze information needed for effective advertising programs. They study the possible uses of the product, its advantages and disadvantages compared with competing products, and the best ways of reaching potential purchasers. Such workers may make special surveys of the buying habits and motives of customers, or may try out sample advertisements to find the most convincing selling theme or most efficient media for carrying the advertising message. The research director is an important executive in advertising organizations. More information on this occupation is contained in the statement on Marketing Research Workers.

Artists and layout men are part of a key creative group in advertising work. They work closely with advertising managers, copwriters, and other advertising personnel in planning advertisements. More information about this group appears in the separate statements on Commercial Artists and on Photographers.

Where Employed

In 1964, about 125,000 men and women were employed in professional or other positions requiring considerable knowledge of advertising, according to an estimate by the Advertising Federation of America. Perhaps a third of these workers are employed in advertising agencies, and more than half of the agency workers are employed in the New York City and Chicago metropolitan areas. However, there are many independent agencies in other cities, and many leading agencies operate branch offices outside the major centers.

Advertising workers not employed in advertising agencies work for manufacturing companies, stores, and other organizations having products or services to sell; for advertising media, such as newspapers and magazines; and for printers, engravers, art studios, product and package designers, and others who provide services to advertisers and advertising agencies. Large numbers of advertising workers—especially those employed by advertising service and media firms—are located in the New York and Chicago metropolitan areas, but many are found in smaller cities throughout the country.

Training, Other Qualifications, and Advancement

Most employers, in hiring advertising trainees, prefer college graduates with liberal arts training or majors in marketing, journalism, or business administration. However, there is no typical educational background for success in advertising. Some successful advertising people have had no college training; others started in such varied occupations as engineer, teacher, chemist, artist, or salesman.

Most advertising jobs require a flair for language, both spoken and written. Since every assignment requires individual handling, a liking for problem-solving is also very important. Advertising personnel should have a great interest in people and things, to help them sell their ideas to their superiors, to advertisers, and to the public. They must be able to accept criticism and to gain important points with tact.

Young people planning to enter the avertising field should get experience in copywriting or other

work for their school publications and, if possible, through summer jobs in selling, interviewing, or other work connected with marketing research services. Some large advertising organizations recruit outstanding college graduates and train them through programs which cover all aspects of advertising work. Most beginners, however, have to locate their own jobs by applying directly to possible employers. Young men sometimes begin as mail clerks, or as messengers and runners who pick up and deliver messages and proofs for departments and agency clients. Some start as assistants in research or production work or as space or time salesmen. A few begin as junior copywriters. In most advertising organizations, women begin as secretaries or, if they have the required education, as research assistants. The best avenue of entrance to advertising work for women is through advertising departments in retail stores.

Employees with initiative, drive, and talent may progress from beginning jobs to creative, research, or managerial work. For management positions, they should have experience in all phases of the advertising business including some work with advertising agencies, media, and advertisers.

Copywriters and account executives can usually look forward to rapid advancement if they demonstrate exceptional ability in dealing with clients, since the success of an advertising organization depends upon satisfied advertisers. Many of these workers prefer to remain in their own specialties and for them advancement can be to more responsible work at increased pay. Some topflight copywriters and account executives set up their own agencies.

Employment Outlook

Many young people are attracted to the advertising field, and those seeking entry will face stiff competition through the mid-1970's. Good opportunities, however, will continue to exist for those who are very well qualified by background and aptitude.

Employment in advertising is expected to increase moderately during the next 10 years. Among the factors that will contribute to the demand for advertising workers are the overall growth of industry, the development of new products and services, and the increase in competition among producers of industrial and consumer goods. In addition to those needed to fill new positions, several thousand advertising workers will be needed each year to replace those who transfer to other types of work, or who retire, die, or leave the field for other reasons. The greatest demand is likely to occur in advertising agencies, since the present trend is for advertisers to turn over more and more of their advertising work to agencies.

Earnings and Working Conditions

Starting salaries for beginning advertising workers ranged from $60 to $150 a week in 1964, according to the limited information available. The higher salaries were most frequently paid in very large firms recruiting outstanding college graduates, and the lower salaries in stores and small advertising agencies.

Salaries of workers above the trainee level are also likely to be highest in the very large firms, according to a private survey. In advertising agencies doing a yearly business of $2 million or less, the annual salaries of copywriters ranged from $3,200 to $12,800 in early 1962; account executives' salaries ranged from $4,500 to $16,500 a year. In agencies doing an annual business of $10 million or more, salaries ranged from $4,500 to $24,000 for copywriters and from $12,500 to $25,000 for account executives. Salaries reported for copy chiefs, account supervisors, and other top executive personnel were usually, but not always, substantially higher. According to another private survey, earnings of advertising managers in firms other than advertising agencies generally ranged from $7,000 to $21,000 annually. The wide spread in salaries reflects the great difference in experience, function, talent, and degree of responsibility among workers with the same job title.

Advertising workers frequently work under great pressure. Working hours are extremely irregular, because publication deadlines must be met and last minute changes are not uncommon. People in creative jobs often work evenings and weekends to finish important assignments.

At the same time, advertising offers a satisfying career to people who enjoy variety, excitement, and a constant challenge to their creative ability,

and who can meet the competition. The copywriter and the artist have the satisfaction of seeing their work in print or hearing it over the radio, even though they remain unknown to the public at large.

Where To Go for More Information

Advertising Federation of America,
655 Madison Ave., New York, N.Y. 10021.
American Association of Advertising Agencies,
200 Park Ave., New York, N.Y. 10017.

Industrial Traffic Managers

(2d ed. D.O.T. 0–97.66)
(3d ed. D.O.T. 184.168)

Nature of Work

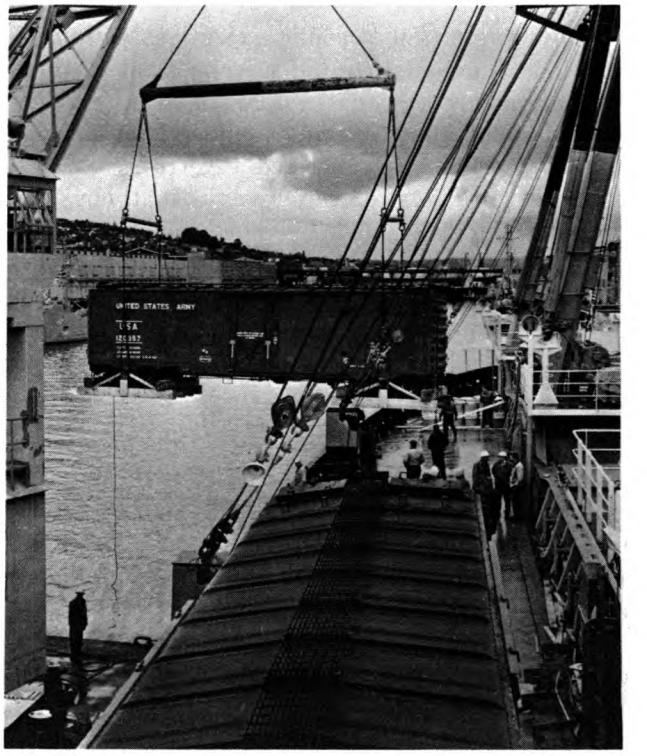
Determining the best way to move freight about the country or around the world can be a complicated matter. There is piggyback and air freight, as well as regular rail, truck, and steamship; and there are thousands of freight classifications, rates, routes, and regulations. Trained specialists called industrial traffic managers are responsible for handling this job.

Industrial traffic managers and their assistants arrange for transportation of raw materials and finished products to and from industrial and commercial firms. They see that goods are shipped in a way that will ensure prompt and safe delivery at the lowest possible cost.

After taking into consideration the kind and amount of goods to be shipped, the time when delivery is needed, and other factors, they choose the type of transportation, the route, and finally the particular carrier, or transportation company. (Traffic managers employed by railroads, airlines, trucking firms, and other transportation companies, who are chiefly concerned with attracting business to their firms, are not covered by this statement.)

The duties of industrial traffic managers and their assistants range from routine tasks, such as checking freight bills, to major planning and policymaking matters, such as deciding whether the company should buy and operate its own fleet of trucks. Other duties include ascertaining the freight classifications and rates that apply to goods shipped, routing and tracing shipments, arranging with carriers for transportation services, preparing bills of lading and other shipping documents, and handling claims for lost or damaged goods. In addition, traffic managers are responsible for maintaining records not only of shipments but also of freight rates, commodity classifications, and applicable government regulations. Sometimes traffic managers are responsible for the packaging of shipments and for their companies' warehouse facilities and transportation equipment.

In small companies, or in firms without separate traffic departments, transportation arrangements for incoming goods may be made by the purchasing department, and for outgoing goods, by the sales department. Employees who handle transportation arrangements in such firms must have a broad knowledge of the transportation field, but



Industrial traffic managers arrange combinations of transportation facilities for shipments.

usually they do not have the title "traffic manager."

Since many aspects of transportation are subject to Federal, State, and local government regulations, traffic managers and their assistants must know about these and any other legal matters that apply to their companies' shipping operations. Many traffic managers represent their companies before ratemaking and regulatory bodies—such as the Interstate Commerce Commission, State Commissions, and local traffic bureaus—to request or oppose changes in rates, commodity classifications, or types of service provided by carriers.

Where Employed

About 15,000 people held jobs as industrial traffic managers in 1965. The majority were employed by manufacturing firms, although some worked for stores and other types of establishments. A few traffic managers are in business for themselves, acting as consultants on transportation problems for various clients. Most traffic managers are men.

Training, Other Qualifications, and Advancement

Although it is still possible for those with a high school education to qualify for traffic manager positions on the basis of previous experience in traffic departments, a college education is becoming increasingly important for a career in this field. For some kinds of work, college training may be required. For example, in order to argue cases before the U.S. Government's Interstate Commerce Commission, a traffic manager must meet certain "qualification standards" which generally include at least 2 years of college training. In selecting college graduates for trainee positions, some employers prefer to hire graduates of schools of business administration who have majored in transportation; other prefer holders of degrees in liberal arts who have had courses in transportation, management, economics, statistics, marketing, or commercial law.

The first jobs of new traffic department employees are often in shipping rooms, where they gain experience in routing shipments and preparing bills of lading and other shipping forms, or in general traffic offices, where they may do clerical work such as filing schedules of freight rates and calculating freight charges. After gaining experience in various routine tasks, employees may be advanced to more technical work such as analyzing rates and transportation statistics. After further experience, a competent worker may advance to a supervisory position, such as supervisor of rates and routes. For the most competent, promotion to assistant manager, and eventually to manager, is possible.

Workers in traffic departments may prepare themselves for advancement by participating in company-sponsored training programs, by taking courses in colleges, universities, and vocational schools, or by attending seminars sponsored by various private organizations. A mark of professional status and recognition in traffic management work is "certified" membership in the American Society of Traffic and Transportation, Inc., which can be acquired by successfully completing the Society's examinations and meeting certain experience requirements.

Employment Outlook

A steady increase in employment in this occupation can be expected through the mid-1970's. Some large companies will probably follow the example already set by many corporations and reorganize their shipping and receiving activities into separate traffic departments with traffic managers in charge. In other companies, new transportation jobs will probably be located in purchasing or sales departments and thus have different job titles.

Among the factors expected to contribute to the growth in this field are the increasing emphasis in many industries on efficient management of transportation activities and the trend toward procuring raw materials and finished products from more and more remote places and distributing them to increasingly wider markets. Since transportation costs are a major factor in the price of many items, companies are becoming increasingly concerned with economies in shipping. Undoubtedly, there will be strong demand for specialists who know how to classify products so as to obtain the lowest possible freight rates, choose the carriers that are best able to handle each shipment, and otherwise protect their companies from excessive shipping expenses.

Although college training will probably be emphasized increasingly for entry jobs, experience and demonstrated ability in the fields just indicated will remain the most important factors in qualifying for promotion, especially to high-level traffic management positions.

Earnings and Working Conditions

Young men with college degrees who started as business trainees in the traffic departments of large industrial firms often received annual salaries of about $6,200 in 1965 according to the limited data available. Beginners with less schooling, however, usually received lower salaries.

Earnings of experienced traffic managers are related generally to their companies' sales volume and transportation costs. The average (median) salary of traffic managers in companies with transportation costs totaling less than $1 million annually was about $9,000 in 1964 according to the limited information available. In companies where transportation costs ranged between $4 million and $10 million, the average was approximately $17,500. In firms where these costs were still higher, some traffic executives earned considerably more than $25,000.

Traffic department employees usually work the standard workweek of their companies—generally from 35 to 40 hours. Those in particularly responsible jobs may have to spend some time outside regular working hours preparing reports, attending meetings, and traveling to hearings before State and Federal regulatory agencies.

Where To Go for More Information

Young people interested in careers in industrial traffic management may consult members of local traffic and transportation associations or they may write to:

Associated Traffic Clubs,
207 Pine St., Seaford, Del. 19973.

For information on the requirements for certification by the American Society of Traffic and Transportation, Inc., write to:

American Society of Traffic and Transportation, Inc.,
22 West Madison St., Chicago, Ill. 60602.

Marketing Research Workers

(2d ed. D.O.T. 0-36.11)
(3d ed. D.O.T. 050.088)

Nature of Work

Businessmen make decisions daily regarding the marketing of their goods and services. Marketing research workers help to increase the fund of information upon which these basic business decisions are made. They act as factfinders—seeking out, analyzing, and interpreting many different kinds of information. They prepare reports and recommendations to help management make decisions on such widely differing problems as forecasting sales; selecting a brand name, package, or design; choosing a new plant location; deciding whether to move goods by rail, truck, or other method; and determining the kinds of advertising likely to attract the most business. In investigating these and other problems, they consider expected changes in population, income levels, and consumer credit policies, or other subjects relevant to marketing policies.

Most marketing research starts with the collection of facts from published materials, from the firm's own records, and from specialists on the subject under investigation. For example, research workers analyzing the fluctuations in a company's sales, may first study sales records in a number of different cities to determine periodical changes in sales volume. They may then compare these changes with changes in population, income levels, the size of the company's sales force, and the amounts spent by the company for advertising in each city and, from these comparisons, discover the reasons for changes in the volume of sales. Other marketing research workers may study changes in the quantity of company goods on store shelves, or make door-to-door surveys to learn how many company products are already used in households.

Marketing research is often concerned with the personal opinions of the people who are using

company products or who might use them in the future. For example, a survey intended to help management decide on the design and pricing of a new line of television sets may involve the use of a questionnaire to learn from a limited number of consumers the price they would be willing to pay and their preferences in such things as the color and size of the set.

A survey of this kind is usually carried on under the supervision of marketing research workers who specialize in research on consumer goods—that is, merchandise sold to the general public. In planning the survey, the marketing research worker may get help from a statistician in selecting a group (or "sample") of individuals to be interviewed, in order to be confident that the opinions obtained from them represent those held by the many other potential customers. He may also consult a specialist in "motivational research"—an expert in framing questions that will produce reliable information about the motives that lead people to make the purchases they do. When the investigation gets underway, the marketing research worker may supervise a number of interviewers who call on consumers to obtain answers to the questions. He also may direct the work of the office employees who tabulate and analyze the information collected. His report summarizing the survey findings may also include other information that company officials need in making decisions about the new line.

Marketing research surveys concerned with products used by business and industrial firms may be conducted somewhat differently from consumer goods surveys. Because research on some industrial products requires interviewers with a technical knowledge of the product involved, the interviews are often conducted by the marketing research worker himself (or by several research workers, if the survey is a particularly extensive one). In his interviews, the worker not only tries to get opinions about the proposed product, but keeps on the lookout for possible new ways of adapting it to industrial needs. He must, therefore, be a specialist both in marketing research and in the industrial uses of the product involved.

Where Employed

More than 15,000 people were employed full time as marketing research workers in 1965. This number included research assistants and others in junior positions, who helped experienced analysts collect information and prepare reports, as well as research supervisors and directors. The majority of these workers were men; positions held by women were most frequently at the junior professional levels.

In addition to these marketing research workers, a limited number of other professional employees (statisticians, economists, psychologists, and sociologists) and several thousand clerical workers (clerks who code and tabulate survey returns, typists, and others) were employed full time in this field. Thousands of other workers, many of them women, were employed on a part-time or temporary basis as survey interviewers.

Among the principal employers of marketing research workers are manufacturing companies and independent advertising and marketing research organizations which do this kind of work for clients on a contract basis. Marketing research workers also are employed by very large stores, radio and television firms, and newspapers; others work for university research centers, government agencies, and other organizations which provide information for businessmen. Marketing research organizations range in size from one-man enterprises to large firms with a hundred employees or more.

The largest number of marketing research workers are in New York City, where many major advertising and independent marketing research organizations are located and where many large manufacturers have their central offices. The second largest concentration is in Chicago. However, marketing research workers are employed in many other cities—wherever there are central offices of large manufacturing and sales organizations.

Training, Other Qualifications, and Advancement

Many people go into marketing research after having worked in other kinds of research jobs or having been employed in work related to the field of marketing. University teachers with experience in teaching marketing research or statistics sometimes are chosen by employers to head new marketing research departments.

A college degree is usually required of people hired as trainees in marketing research. Market-

ing, statistics, English composition, speech, psychology, and economics are among the courses considered most valuable as preparation for this field of work. Candidates for some marketing research positions need specialized training in engineering or other technical subjects, or a substantial amount of sales experience and a thorough knowledge of the company's products. A knowledge of electronic data-processing procedures is becoming important because of the growing use of electronic computers in sales forecasting, distribution, cost analysis, and other aspects of marketing research. Graduate training may be necessary for some kinds of work—for example, motivational research or sampling and other statistical work connected with large-scale surveys.

Trainees in marketing research usually start as research assistants or junior analysts. At first, they are likely to do considerable clerical work, such as copying information from published sources, editing and coding questionnaires, and tabulating results of questionnaires returned in surveys. They also learn how to conduct interviews and how to write reports on survey findings.

After a few years of experience, assistants and junior analysts may advance to higher level positions, with responsibility for specific marketing research projects, or to supervisory positions. An exceptionally able individual may eventually become marketing research director or vice president in charge of marketing and sales.

Marketing research workers must have exceptional ability in recognizing and defining problems, and imagination and ingenuity in applying marketing research techniques to their solution. Above all, this work calls for the ability to analyze information and to write reports which will convince management of the significance of the information.

Employment Outlook

College graduates well prepared in marketing research methods and statistics are likely to find very good job opportunities in this growing occupation through the mid-1970's. In addition to growth needs, many openings will occur each year as persons retire, die, or leave the field for other reasons. However, competition for top jobs is expected to be keen as the number of experienced marketing research workers continues to grow.

The demand for marketing research services is expected to increase during the next 10 years as the constant stream of new products heightens competition for customers. Business managers will find it increasingly important to obtain the best information possible for appraising marketing situations and planning marketing policies. As marketing research techniques improve and more statistical data accumulate, company officials are likely to turn to marketing research workers for information and advice with increasing frequency. It is anticipated, therefore, that existing marketing research organizations will expand and that many new marketing research departments and new independent research firms will be set up.

Earnings and Working Conditions

Starting salaries for market research trainees averaged about $525 a month in 1965, according to the limited data available. People with master's degrees in related fields usually started at higher salaries.

Earnings are substantially higher for experienced marketing research workers who attain positions with considerable responsibility. For example, in 1962 earnings of marketing research directors averaged about $14,000, while senior analysts averaged $9,600.

Marketing research workers usually work in modern, centrally located offices. Some, especially those employed by independent research firms, do a considerable amount of traveling in connection with their work. Also they may frequently work under pressure and for long hours to meet deadlines.

Where To Go for More Information

Information about specialized types of marketing research is contained in a report entitled "Selecting Marketing Research Services" which may be obtained from:

Small Business Administration,
Washington, D.C. 20416.

Additional information on marketing research may be obtained from:

American Marketing Association,
230 North Michigan Ave., Chicago, Ill. 60601.

Personnel Workers

(2d ed. D.O.T. 0–39.81 through .88 and 0–68.70 through .78)
(3d ed. D.O.T. 166.088 through .268 and 169.118 and .168)

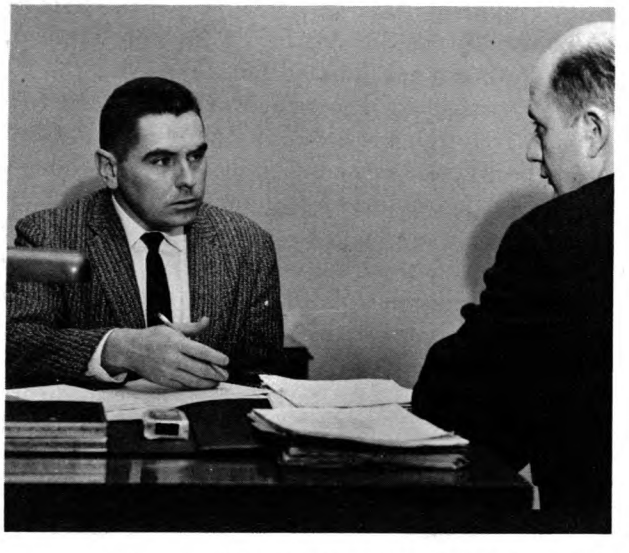
Nature of Work

Attracting and keeping the best employees available, and matching them to jobs they can do effectively are important for the successful operation of business and government. Personnel workers are responsible for helping their employers attain these objectives. They develop recruiting and hiring procedures, interview job applicants, and select and recommend the ones they consider best qualified for the openings to be filled. In addition, personnel workers counsel employees, deal with disciplinary problems, classify jobs, plan wage and salary scales, develop safety programs, and conduct research in personnel methods. Employee training, the administration of retirement and other employee benefit plans, and labor-management relations—including the negotiation of agreements with unions—are also important aspects of their work.

Many personnel jobs require only limited contact with people; others involve frequent contact with employees, union representatives, job applicants, and other people in and outside the company.

Business organizations with large personnel departments employ personnel workers in many different levels of responsibility. Usually, the department is headed by an executive with the title of Personnel Director; other titles sometimes used are Industrial Relations Director, Labor Relations Director, or Employee Relations Director. The director formulates personnel policy, advises other company officials on personnel matters, and administers his department. Within the department, supervisors and various personnel specialists—in labor relations, wage administration, training, safety, job classification, and other aspects of the personnel program—may be responsible for the work of staff assistants and clerical employees. Small business organizations employ relatively few personnel workers. Sometimes one person may be responsible for all the personnel activities and may have other duties as well.

Personnel workers in Federal, State, and local government agencies do much the same kind of work in about the same kind of departmental organization as do those employed in large business firms. Government personnel workers, however, spend considerably more time in activities related to classifying jobs, and in devising, administering, and scoring the competitive examinations given to job applicants.



Interviewing job applicants is important in personnel work.

Where Employed

Personnel workers are employed in nearly all kinds of business enterprises and government agencies. The total number employed in 1965 was estimated to be nearly 100,000. Well over half of all personnel workers were employed by private firms. The next largest number was employed by Federal, State, and local government agencies. A considerably smaller group of personnel workers were in business for themselves, often as management consultants or labor relations experts. In addition, colleges and universities employed a number of professionally trained personnel workers as teachers of courses in personnel administration, industrial relations, and similar subjects.

Most personnel workers are employed in large cities and in the highly industrialized sections of

the country. More than three-fourths of all personnel workers are men. Many women, however, occupy personnel positions in organizations that employ large numbers of women workers—for example, in department stores, telephone companies, insurance companies, banks, and government agencies.

Training, Other Qualifications, and Advancement

A college education is becoming increasingly important for entrance into personnel work. Some employers hire new graduates for junior personnel positions, and then provide training programs to acquaint them with their operations, policies, and problems.

Other employers prefer to fill their personnel positions by transferring people who already have first hand knowledge of operations, such as employees in administrative and sales positions. A large number of the people now in personnel work who are not college graduates entered the field in this way.

College courses that provide good preparation for personnel work include personnel management, business management, applied psychology, statistics, labor economics, political science, sociology, English, and public speaking. Many employers in private industry prefer college graduates with a major in personnel administration, while some prefer graduates with a general business administration background. Other employers consider a liberal arts education the most desirable preparation for personnel work. Young people interested in personnel work in government are often advised to major in public administration, political science, or personnel administration; however, those with other college majors are also eligible for personnel positions in government.

For some positions, more specialized training may be necessary. Jobs involving testing or employee counseling often require a bachelor's degree with a major in psychology and sometimes a graduate degree in this field. An engineering degree may be desirable for work dealing with time studies or safety standards, and a degree with a major in industrial relations may be helpful for work involving labor relations. A background in accounting may be useful for positions concerned with wages, or pension and other employee benefit plans.

After the initial period of orientation, through formal or on-the-job training programs, college graduates may progress to classifying jobs, interviewing applicants, or handling other personnel functions. Eventually, after they have gained experience, those with exceptional ability may be promoted to executive positions such as that of personnel director. Personnel workers sometimes advance by transferring to other organizations with larger personnel programs or from a middle-rank position in a big corporation to the top job in a smaller one.

Personal qualities regarded as important for success in personnel work include the ability to speak and write effectively and a better-than-average skill in working with people of all levels of intelligence and experience. In addition, the prospective personnel worker should be the kind of person who can see the employee's point of view as well as the employer's, and should be able to give advice in the best interests of both. A liking for detail, a high degree of persuasiveness, and a pleasing personality are also important.

Employment Outlook

College graduates are expected to find many opportunities to enter personnel work through the mid-1970's. However, competition for beginning professional positions is likely to be keen in many parts of the country, and employment prospects will probably be best for college graduates who have specialized training in personnel administration. Opportunities for young people to advance to personnel positions from production, clerical, or subprofessional jobs will be limited.

Employment in personnel work is expected to expand rapidly as the Nation's employment rises. More personnel workers will be needed to carry on recruiting, interviewing, and related activities. Also, many employers are recognizing the importance of good employee relations, and are depending more heavily on the services of trained personnel workers to achieve this.

Employment in some specialized areas of personnel work will rise faster than others. More people will probably be engaged in psychological testing; the need for labor relations experts to handle relations with unions will probably continue to increase; and the growth of employee services, safety programs, pension and other bene-

fit plans, and personnel research is also likely to continue.

Earnings and Working Conditions

A national survey indicated that the average annual salary of job-analyst trainees employed in private industry was about $6,600 in early 1964; experienced job analysts averaged $10,200; directors of personnel who worked in companies employing between 250 and 750 workers averaged $9,700; directors of personnel in very large companies averaged $16,500, and some top personnel and industrial relations executives in very large corporations earned considerably more.

In the Federal Government, inexperienced graduates with bachelor's degrees started at $5,000 a year in early 1965; those with exceptionally good academic records or master's degrees began at $6,050; a few especially well-qualified master's degree holders received $7,220. Federal Government personnel workers with higher levels of administrative responsibility and several years of experience in the field were paid about $12,000; some in charge of personnel for major departments of the Federal Government earned $17,000 or more a year.

Employees in personnel offices generally work 35 to 40 hours a week. During a period of intensive recruitment or emergency, they may work much longer. As a rule, personnel workers are paid for holidays and vacations, and share in the same retirement plans and other employee benefits available to all professional employees in the organizations where they work.

Where To Go for More Information

General information on personnel work as a career may be obtained by writing to:

American Society for Personnel Administration,
52 East Bridge St., Berea, Ohio 44017.

Information about government careers in personnel work may be obtained from:

Public Personnel Association,
1313 East 60th St., Chicago, Ill. 60637.

Public Relations Workers

(2d ed. D.O.T. 0-06.97)
(3d ed. D.O.T. 165.068)

Nature of Work

All organizations—both profit and nonprofit—want the public to view them in a favorable light. Public relations workers help their employers build and maintain such a public image by keeping themselves informed about the attitudes and opinions of customers, employees, and other groups important to the interests of their employers.

Public relations workers often provide information about their employers' business to newspapers and magazines, radio and television, and other channels of communication. They plan the kind of publicity which they believe will be most effective, contact the people who may be interested in using it, and prepare and assemble the needed material. Many items in the daily papers, human interest stories in popular magazines, and pamphlets giving information about a company, the product it makes and job opportunities with it, have their start at public relations workers' desks. These workers also may play an important part in arranging speaking engagements for company officials, and sometimes write speeches for them to deliver. Often they participate in community affairs, serving as their employers' representatives during safety campaigns and other community projects. Showing a film at a school assembly, staging a beauty contest, calling a press conference, and planning a convention may all be part of a public relations worker's job.

Public relations workers tailor their programs to their employers' particular needs. In a business firm, the public relations worker is usually concerned with his employer's relationships with employees, government agencies, civic organizations, and other community groups.

Some public relations workers—for example, the press agent who handles publicity for an individual and the man who is in charge of a limited public relations program for a university, fraternal organization, or small business firm—may handle all aspects of the work. They make their

own contacts with outsiders, do the necessary planning and research, prepare material for publication, and otherwise carry out plans previously made. Such public relations workers may be top-level officials or they may occupy positions farther down the management ladder. They may combine public relations duties with advertising or other managerial work.

In large firms with extensive public relations programs, staffs assigned to this work sometimes number 100 or more. Responsibility for developing overall plans and policies may be shared between a vice president or other top executive who is responsible for final decisions, and the director of a public relations department. In addition to the public relations department's writers and research workers, there may be specialists in different kinds of public relations work—in preparing material for publication in the daily press, for example, or in writing reports sent to stockholders.

Where Employed

In 1965, there were an estimated 50,000 public relations workers according to the limited data available. About one-fourth were women. In recent years, an increasing number of women have entered public relations work, particularly in department stores, hospitals, hotels, and restaurants.

The majority of public relations workers are employed by manufacturing firms, stores, public utilities, trade and professional associations, and labor unions. Others are in consulting firms which provide counsel and other kinds of public relations services to clients on a fee basis. In 1964, there were about 2,000 public relations consulting firms, as well as a number of advertising agencies which offered public relations services; and there were about 5,000 corporations which either used services of consulting firms or had public relations staffs of their own.

Employment in public relations work tends to be concentrated in big cities where press services and other communications facilities are readily available and where large corporations and trade, professional, and other associations have their headquarters. More than half of the consulting firms are either in New York City or in Los Angeles, Chicago, and Washington, D.C.

Training, Other Qualifications, and Advancement

A college education is generally regarded as the best preparation for public relations work; however, employers differ in the specific type of college background they require of applicants. Some prefer graduates with majors in English, journalism, or public relations; others prefer candidates with a background in science or some other field related to the firm's business activities. In 1964, 14 colleges offered a bachelor's degree in public relations and 5 offered the master's degree. In addition, over 200 colleges offered at least one course in public relations.

Among the college subjects considered desirable as preparation for a career in public relation are journalism, economics and other social sciences, business administration, psychology, public speaking, literature, and physical sciences. Extracurricular activities, which may provide students with some valuable experience, include writing or other work connected with school publications, participation in student government activities, and part-time or summer employment in selling, public relations, or related fields of work.

Among the personal qualifications usually considered important for work in this field are creativity, initiative, drive, the ability to express thoughts clearly and simply. Fresh ideas are so important to effective public relations work that some experts in this field spend all of their time providing ideas and planning programs but take no active part in carrying out the programs. In selecting new employees, many employers prefer people who have had some previous work experience, particularly in journalism or some related field.

Some companies—particularly those with large public relations programs for which they recruit young men with excellent college records as public relations trainees—have formal training programs for new employees. In other companies, new employees learn on the job by working under the guidance of experienced staff members. Beginners often start out maintaining files of material about the company and its activities, scanning newspapers and magazines for appropriate articles to clip, and doing the research needed to assemble information for speeches and pamphlets. After gaining experience, they may be given progressively more difficult assignments, such as

writing press releases, speeches, and articles for publication. Promotion to supervisory and managerial positions may come as the worker demonstrates ability to handle more difficult and creative assignments. The most skilled public relations work—initiating and developing plans and maintaining the outside contacts which are so important in a successful program—is usually in the hands of the director of the department and his most experienced staff members. Some experienced public relations workers eventually open their own consulting firms, while others move on to better positions with other employers.

Employment Outlook

Employment in this field is expected to expand rapidly through the mid-1970's. In addition to the new jobs created, as expanding business firms require the services of more public relations specialists, other openings will occur because of the need to replace workers who retire or leave the field for other reasons. However, the number of jobs at the top is limited and competition for them will remain keen.

The demand for public relations workers is expected to grow during the next 10 years and over the longer run as population increases and the general level of business activity rises. In recent years there has been an increase in the amount of funds spent on public relations, and many companies have newly organized public relations departments. This development will continue in future years.

Earnings and Working Conditions

Most trainees in public relations work in 1964 received starting salaries of about $5,000 a year, according to the limited data available. The highest starting salaries were paid chiefly to beginners who were employed by consulting firms in major cities and who were very well qualified from the standpoint of educational background and previous work experience. Many public relations workers, after a few years of experience, earn between $8,000 and $12,000 a year.

The salaries of experienced public relations workers are generally highest in large companies, where public relations programs are likely to be more extensive than elsewhere. A director of public relations employed by a medium-size firm may earn $12,000 or more annually, and those employed by large corporations may have salaries in the $15,000 to $25,000 range, according to the Public Relations Society of America. Top officials, such as vice presidents in charge of public relations, may earn from $25,000 to $50,000 a year or more. Many consulting firms employ fairly large staffs of experienced public relations specialists and often pay salaries which are somewhat higher than the salaries paid public relations workers in other business organizations. In social welfare agencies, nonprofit organizations, and universities, salary levels tend to be somewhat lower.

The workweek for public relations workers is usually the same as for other officials in their organizations—35 to 40 hours. Irregular hours and overtime may often be necessary, however, to meet deadlines, prepare or deliver speeches, attend meetings and community functions, and make trips out of town. Sometimes, because of the nature of their regular assignments or because of special events, they may be on call on a round-the-clock basis with the workweek stretching to 6 or 7 days instead of the usual 5.

Where To Go for More Information

The Information Center, Public Relations Society of America, Inc.,
845 Third Ave., New York, N.Y. 10022.

Purchasing Agents

(2d ed. D.O.T. 0-91.60)
(3d ed. D.O.T. 162.158)

Nature of Work

In order for a company or other organization to function, it has to purchase materials, supplies, and equipment. Such necessities often represent a large part of total costs of operation and can significantly affect a company's profits. Because of its importance, purchasing has been designated as a separate responsibility to be handled by one

Before buying parts, purchasing agent discusses a new product's design with other staff members.

of the management team—the purchasing agent.

What purchasing agents and their assistants buy depends upon the kinds of organizations employing them. For a manufacturer, it may be largely machinery, raw materials, and product components; for a government agency, it may be office supplies, office furniture, and business machines. Whatever the organization, purchasing agents are responsible for obtaining goods and services at the lowest cost consistent with required quality and for seeing that adequate supplies are on hand.

Although the head of the purchasing department is usually called a purchasing agent, he may have the title of vice president–purchasing, procurement or purchasing officer, director or manager of purchasing, or buyer. ("Buyers" in retail stores, and others who are engaged in buying merchandise for resale in its original form are not included in this report.) In a large firm, the head of the purchasing department directs the work of a staff including assistant purchasing agents and clerical workers. Each purchasing assistant may be assigned to a broad area. One person may be responsible for buying raw materials; another, factory machinery; and another, office supplies. Others may specialize in buying certain items—for example, steel, lumber, cotton, or oil.

The purchasing agent receives order forms or requisitions from the various departments of the company. These requisitions list and describe needed items and include such information as required quantities and delivery dates. Since the agent can usually purchase from many sources, his main job is to select the seller who offers the best value. To do this, the agent or his staff members must consider many factors, such as the exact specifications for the required items, price, quality, quantity discounts, transportation cost, and delivery time. Much of the information is obtained by comparing listings in catalogs and trade journals and by telephoning various suppliers, but the purchasing agent also meets with salesmen to examine sample goods, watch demonstrations of equipment, and discuss items to be purchased. Sometimes, suppliers are invited to bid on large orders, and the purchasing agent selects the lowest bidder who meets requirements with respect to the specifications set up for the goods and date of delivery.

It is important for purchasing agents to develop good working relations with their suppliers. Such relations can result in savings on purchases, favorable terms of payment, and quick delivery on rush orders or material in short supply. They also work closely with personnel in various departments of their own company. For example, they frequently discuss product specifications with company engineers or discuss shipment handling problems with employees in the shipping and receiving, storage, or traffic departments.

Where Employed

More than half of the over 125,000 purchasing agents and closely related types of buyers employed in 1965 were in manufacturing industries. Large numbers were employed in government agencies—Federal, State, and local—and in wholesale and retail trade. Public utilities, transportation companies, and service institutions, such as schools and hospitals, employed substantial numbers of purchasing agents and assistants. Even the smallest industries employed some purchasing personnel.

Most purchasing agents work in firms that have fewer than 10 employees in the purchasing department. Some large firms, however, may have a hundred or more specialized buyers. Probably fewer than 10 percent of all purchasing agents and closely related types of buyers are women.

Training, Other Qualifications, and Advancement

Although employers differ greatly in the qualifications required for purchasing personnel, it is evident that a college degree is becoming increasingly important for promotion to a high-level purchasing position. Many employers prefer graduates of schools of business administration or engineering who have had courses in accounting, economics, and purchasing. A few require graduate training in business administration. On the other hand, many firms give great weight to experience with the company and select purchasing workers from among their own personnel, whether or not they have a college education.

Regardless of previous training and experience, the beginner in the purchasing field must spend considerable time learning about his company's operations and purchasing procedures. Some companies provide classroom-type instruction and on-the-job training. The beginner may be assigned to the storekeeper's section to learn about operations such as keeping inventory records, filling out forms to initiate purchases of additional stock, or providing proper storage facilities. He may then work with an experienced buyer to learn about types of goods purchased, prices, and sources of supply. Following the initial training period, the trainee may become a junior buyer of standard catalog items. After he gains experience in the various aspects of purchasing and demonstrates ability to exercise good judgment and accept responsibility, he may be promoted to assistant purchasing agent, and then to full-fledged purchasing agent. In large companies, purchasing agents or heads of purchasing departments may become vice presidents with overall responsibility for purchasing, warehousing, traffic, and related functions.

Employment Outlook

Opportunities are expected to be good through the mid-1970's for well-qualified young people to enter and advance in purchasing occupations. Demand is expected to be strong for graduates of schools of business administration who have had courses in purchasing. Demand is also expected to be above average for graduates whose background in engineering and science qualifies them for jobs in purchasing departments of firms that manufacture complex machinery, chemicals, and other technical products. Liberal arts college graduates should be able to obtain trainee positions in many types of firms. Outstanding persons who do not have a college education will continue to be promoted from clerical, sales, and other types of jobs, but their opportunities for advancement to high-level purchasing jobs will tend to decrease.

Employment of purchasing agents and their assistants is expected to grow rapidly through 1975. Some of the major factors underlying this expected growth are the continuing increase in the size of business and manufacturing firms, the development of new products and new sources of supply (including foreign markets), and the ever-increasing complexity and specialization of business functions. Competition among manufacturers for new, improved, and less costly goods, raw materials, and services will further direct the attention of top management to the importance of the purchasing function. Many job opportunities are expected to result from the need to replace personnel who retire, transfer to other jobs, or leave the field for other reasons.

Earnings and Working Conditions

Beginning annual salaries of male college graduates hired as trainees in purchasing departments of large private firms averaged about $6,200 in 1965. In the Federal Government, beginning purchasing agents who had college degrees usually started at $5,000 or $6,050 in early 1965, depending on the individual's college record.

According to limited data available, in 1965 the earnings of buyers in private firms ranged from $7,000 to $8,500 a year; assistant purchasing agents ranged from $8,500 to $12,000; and purchasing agents, from $12,000 to $20,000. Some top purchasing executives earned from $25,000 to $50,000.

Employees in purchasing departments usually work the standard workweek of the company—generally from 35 to 40 hours a week. In addition, purchasing agents may spend time outside the regular hours to attend meetings, prepare reports, visit suppliers' plants, or travel.

Where To Go for More Information

Young people interested in a career in purchasing may consult members of local purchasing associations, or they may write to:

National Association of Purchasing Agents,
11 Park Pl., New York, N.Y. 10007.

THE CLERGY

The choice of the ministry, priesthood, or rabbinate as one's lifework involves considerations that do not influence to the same degree the selection of a career in most other occupations. When young people decide to become clergymen, they do so primarily because of their religious faith and their desire to help others. Nevertheless, it is important for them 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. They should understand also that the civic, social, and recreational activities of clergymen are often influenced, and sometimes restricted, by the customs and attitudes of their community.

The number of clergymen needed is broadly related to the size and geographic distribution of the Nation's inhabitants and their participation in organized religious groups. These factors affect the number of churches and synagogues that are established and, thus, the number of pulpits to be filled. A sharp rise in church and synagogue membership has occurred since 1940. Over 118 million people were members of organized religious groups in 1963—representing more than 63 percent of the total population, whereas in 1940, slightly less than half the population belonged to religious groups. In addition to those who serve congregations, many clergymen teach in seminaries and other educational institutions, serve as missionaries, and perform various other duties in meeting their religious responsibilities.

Young people considering a career as a clergyman should seek the counsel of a religious leader of their faith to aid them in evaluating their qualifications for the profession. Besides a desire to serve the spiritual needs of others and to lead them in religious activities, they need a broad background of knowledge and the ability to speak and write clearly. Emotional stability is necessary, since a clergyman must be able to help others in times of stress. Furthermore, young people should know that clergymen are expected to be examples of high moral character.

The amount of income clergymen receive depends, to a great extent, on the size and financial status of the congregation they serve and usually is highest in large cities or in prosperous suburban areas. Earnings of clergymen, as of most other professional groups, usually rise with increased experience and responsibility. Most Protestant churches and a number of Jewish congregations provide their spiritual leaders with housing. Roman Catholic priests ordinarily live in the rectory of a parish church or are provided lodgings by the religious order to which they belong. Many clergymen receive allowances for transportation and other expenses necessary in their work. Clergymen often receive gifts or fees for officiating at special ceremonies such as weddings and funerals. In some cases, these gifts or fees are an important source of additional income; however, they are frequently donated to charity by the clergymen. Some churches establish a uniform fee for these services, which goes directly into the church treasury.

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 which were 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. Numerous other church-related occupations—those of the missionary, teacher, director of youth organizations, director of religious education, editor of religious publications, music director, church secretary, recreation leader, and many others—offer interesting and satisfying careers. In addition, opportunities to work in connection with religious activities are present in many other occupations. Clergymen or educational directors of local churches or synagogues can provide information on the church-related occupations and other areas offering opportunities for religious service.

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Protestant Clergymen

(2d ed. D.O.T. 0–08.)

(3d ed. D.O.T. 120.108)

Nature of Work

Protestant clergymen lead their congregations in worship services and may administer the rites of baptism, confirmation, and Holy Communion. They prepare and deliver sermons and give other talks, instruct people who are to be received into membership of the church, perform marriages, and conduct funerals. They counsel individuals who seek guidance, visit the sick and shut-in, comfort those who are bereaved, and serve their church members in many other ways. Protestant ministers may also write articles for publication and engage in interfaith, community, civic, educational, and recreational activities sponsored by or related to the interests of the church. A few clergymen teach in seminaries, colleges, and universities.

The types of worship services which ministers conduct differ among Protestant denominations and also among congregations within a denomination; in some denominations, ministers follow a traditional order of worship, whereas in others they adapt the services to different occasions. Most of these services include Bible reading, hymn singing, prayers, and a sermon. Bible reading by a member of the congregation and individual testimonials may constitute a large part of the service in some denominations.

Ministers serving small congregations generally work on a close personal basis with their parishioners. Those serving large congregations usually 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.

Where Employed

In 1965, about 240,000 people were serving as ministers of churches, composing over 225 Protestant denominations or other groups. In addition, thousands of ordained clergymen were in other occupations—many closely related to the ministry. The greatest number of clergymen are affiliated with the four largest groups of churches—Baptist, Methodist, Lutheran, and Presbyterian—to which about 7 out of every 10 of the 65 million Protestant church members belong. Most ministers serve individual congregations; some are engaged in missionary activities in the United States and in foreign countries; others serve as chaplains in the Armed Forces, in hospitals, and in other institutions; still others teach in educational institutions, engage in other religious educational work, or are employed in social welfare and related agencies. Less than 5 percent of all ministers are women; however, about 80 denominations ordain women. In addition, in some denominations an increasing number of women who have not been ordained are serving as pastors' assistants. Also, in a growing number of denominations certain orders of women workers are referred to as deaconesses.

All cities and most towns have one or more Protestant churches with a full-time minister. The majority of ministers are located in cities and towns. Many others live in less densely populated areas where each may serve the religious needs of two or more congregations in different communities. A larger proportion of Protestants than members of other faiths live in rural areas.

Training and Other Qualifications

The educational preparation required for entry into the ministry has a wider range than that for most professions. Some religious groups have no formal educational requirements, and others ordain persons who have received varying amounts of training in liberal arts colleges, Bible colleges, or Bible institutes. An increasingly large number of denominations, however, require a 3-year course of professional study in theology following college graduation. After completion of such a course in a theological school, the degree of bachelor of divinity or sacred theology is awarded.

Ninety of the theological institutions in the Nation in early 1965 were accredited by the American Association of Theological Schools. Accredited institutions admit only students who have received the bachelor's degree, or its equivalent, from an approved college. In addition, certain character and personality qualifications must be met, and endorsement by the religious group to which the applicant belongs is required. The American Association of Theological Schools recommends that preseminary studies be concentrated in the liberal arts. Although courses in English, philosophy, and history are considered especially important, the pretheological student should take courses also in the natural and social sciences, religion, and foreign languages. The standard curriculum recommended for accredited theological schools divides the course of studies into four major fields: Biblical, historical, theological, and practical. There is a trend toward adding more courses in psychology, pastoral counseling, sociology, religious education, administration, and other studies of a practical nature. Many accredited schools require that students gain experience in church work under the supervision of a faculty member or experienced minister. Some institutions offer the master of theology and the doctor of theology degrees to students completing 1 year or more of additional study.

In general, each large denomination has its own school or schools of theology which reflect its particular interests and needs; however, many of these schools are open to students from various denominations. Several interdenominational schools associated with universities give both undergraduate and graduate training covering a wide range of theological points of view.

Among the personal qualifications which most denominations seek in a candidate for the ministry are a deep religious conviction, a sense of dedication to Christian service, a genuine concern for and love of people, a wholesome personality and high moral and ethical standards, and a vigorous and creative mind. Because of the demands of the ministry, good health is a valuable asset.

Persons who have met denominational qualifications for the ministry are usually ordained following graduation from a seminary. In denominations which do not require seminary training, clergymen are ordained at various appointed times. Clergymen often begin their careers as pastors of small congregations or as assistant pastors in large churches. Protestant clergymen in many of the larger denominations—especially those groups which have a well-defined church organization—often are requested to serve in positions of great administrative and denominational responsibility.

Outlook

A shortage of well-qualified Protestant ministers exists, and probably will continue through the mid-1970's, especially among those denominations where the extent of formal training requires many years of preparation for the ministry. Although the number of students graduating from theological schools has increased over the past 10 years, the gains have not been great enough to replace the thousands of ministers who retire, die, or leave the profession each year and at the same time to meet the needs of newly established congregations and to supply assistant ministers where needed.

Many congregations—mainly those in rural areas—did not have a full-time ordained minister in 1965. Some had to rely on the services of theological students or lay persons or shared the services of a pastor with another congregation. Some large congregations were unable to fill openings for assistant ministers with specialized skills. In addition, ordained ministers were being sought for teaching positions; to serve in foreign missions, in relief work, and in religious educational activities; as chaplains in the Armed Forces; and in universities, hospitals, penitentiaries, and other institutions.

Over the long run, the total number of ministers needed by Protestant churches will probably increase as a result of the expected growth in population and in the number of congregations. The greatest expansion is anticipated in the suburbs of large cities. The increasing opportunities for ministers in fields such as youth and family relations work, the campus ministry, and religious ac-

tivities including chaplaincies in institutions and industry, also point toward a need for additional clergymen. Replacement of those who retire, die, or leave the ministry for other causes also will require an ever-increasing number of newly trained ministers. In addition, there is a growing demand for clergymen to serve as faculty members in departments of religion in public and private universities.

Where To Go for More Information

Young people who wish to enter the Protestant ministry should seek the counsel of a minister or church guidance worker. Additional information on both the ministry and other church-related occupations are also available from many denominational offices. Information on admission requirements may be obtained directly from each theological school.

Rabbis

(2d ed. D.O.T. 0–08.)
(3d ed. D.O.T. 120.108)

Nature of Work

Rabbis are the spiritual leaders of their congregations and teachers and interpreters of Jewish law and tradition. They conduct daily services and hold special services on the Sabbath and on holidays. Rabbis are customarily available at all times for counsel to members of their congregations, other followers of Judaism, and the community at large. Many of the rabbis' functions—preparing and delivering sermons, performing wedding ceremonies, visiting the sick, conducting funeral services, comforting the bereaved, helping the poor, supervising religious education programs, engaging in interfaith activities, assuming community responsibilities, and counseling individuals—are similar to those performed by clergymen of other faiths. Rabbis may also write for religious and lay publications, and teach in theological seminaries, colleges, and universities.

Rabbis serve congregations affiliated with 1 of the 3 branches of American Judaism—Orthodox (traditional), Conservative, or Reform (liberal). Regardless of their particular point of view, all Hebrew 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 or in the use of Hebrew as the language of prayer, or in the use of music. Because of these differences, 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.

Where Employed

About 4,500 rabbis served over 5½ million followers of the Jewish faith in this country in 1965. Most are Orthodox rabbis; the rest are about equally divided between the Conservative and Reform branches of Judaism. Most rabbis act as the spiritual leaders of individual congregations; some serve as chaplains in the Armed Forces, in hospitals, and in other institutions; others teach in educational institutions; and others are employed in social welfare agencies and in religious education work for such organizations as the Hillel Foundation.

Although rabbis serve Jewish communities throughout the Nation, they are concentrated in those States which have sizable Jewish populations, particularly New York, California, Pennsylvania, New Jersey, Illinois, and Massachusetts.

Training and Other Qualifications

To become eligible for ordination as a rabbi, a student must complete the prescribed course of study at a Jewish theological seminary.

Entrance and training requirements depend upon the branch of Judaism with which the seminary is associated. The Hebrew Union College—Jewish Institute of Religion (Reform) and The Jewish Theological Seminary of America (Conservative) are the only seminaries that train rabbis for their respective branches of Judaism. Both schools require the completion of a 4-year college course, as well as prior preparation in Jewish studies, for admission to the rabbinic pro-

gram leading to ordination. Although 5 years are normally required to complete the rabbinic course at the Reform seminary, exceptionally well-prepared students can shorten this period of study to a minimum of 3 years. The course at the Conservative seminary can be completed in 4 years if the student has a strong background in Jewish studies; otherwise, the course may take as long as 6 years.

About 15 seminaries train Orthodox rabbis. These schools have programs of various lengths, all leading to ordination. At one of the larger Orthodox seminaries, well-qualified students who are college graduates may complete the rabbinic program in 3 years; however, students who are not college graduates may spend a longer period at this seminary and complete the requirements for the bachelor's degree at the same time they are pursuing the rabbinic course. Orthodox seminaries do not require a college degree to qualify for ordination; however, in most cases students qualifying for ordination have completed 4 years of college.

In general, the curriculums of Jewish theological seminaries provide students with a comprehensive grasp of all aspects of Jewish knowledge, Bible, Rabbinic literature, Talmud, Jewish history, theology, and other courses such as pastoral psychology and public speaking. The Reform seminary places less emphasis on the study of Talmud and Rabbinic literature and offers a broad course of study that includes such subjects as human relations and Jewish religious education. Some seminaries grant advanced academic degrees in such fields as Biblical and Talmudic research. All Jewish theological seminaries make scholarships and loans available to students.

Newly ordained rabbis usually begin as leaders of small congregations, as assistants to experienced rabbis, or as chaplains in the Armed Forces. As a rule, the pulpits of large and well-established synagogues and temples are filled by experienced rabbis.

The choice of a career as a rabbi should, of course, be made on the basis of a fervent belief in the religious teachings and practices of Judaism and of a desire to serve the religious needs of others. In addition to having high moral and ethical values, the prospective rabbi should have good judgment and be able to write and speak effectively.

Outlook

At present, the number of rabbis in this country is inadequate to meet the expanding needs of Jewish congregations and other organizations desiring their services. This situation is likely to persist through the mid-1970's. In recent years, many congregations—especially those located in States where there are relatively few persons of the Jewish faith—were unable to secure the spiritual leadership of a full-time ordained rabbi and had to rely on the services of senior theological students and lay readers. Rabbis also have been sought to lead the many new congregations which had been organized in and around New York, Chicago, Los Angeles, Philadelphia, and Boston—where the majority of the Jewish population is concentrated.

The recent increases in Jewish religious affiliation and in the number of synagogues and temples seem likely to continue. Furthermore, an increasing demand for rabbis to work with social welfare and other organizations connected with the Jewish faith is anticipated.

Although the number of students graduating annually from the Jewish theological seminaries is expected to increase also, there will probably not be enough new graduates to replace the rabbis who retire or die, and to fill the openings which will be created by the expanding work of the large congregations and by the formation of new congregations. Immigration, once an important source of supply of rabbis, is no longer significant. In fact, graduates of American seminaries are now in demand for Jewish congregations in other countries.

Where To Go for More Information

Young people who are interested in entering the rabbinate should seek the guidance of a rabbi. Additional information on how to prepare for service in the rabbinate of a particular branch of Judaism, including school admission requirements, may be obtained from each theological school.

Roman Catholic Priests

(2d ed. D.O.T. 0–08.)
(3d ed. D.O.T. 120.108)

Nature of Work

Roman Catholic priests attend the spiritual, moral, and educational needs of the members of their Church. Their duties include offering the Sacrifice of the Mass; hearing confessions; administering the Sacraments (including the sacrament of marriage); visiting and comforting the sick; conducting funeral services and consoling survivors; counseling those in need of guidance; and assisting the poor. Priests give religious instruction at Mass in the form of a sermon. They have numerous other responsibilities to assure that all laws of the Church are fulfilled.

Priests spend long hours performing services for the Church and the community. Their day usually begins with morning meditation and Mass and may end with an evening visit to the local hospital or the hearing of confessions. In addition, each day priests spend several hours in prayer and reading their breviaries. Many of them serve on Church committees or in civic organizations and assist in community projects. Various societies that carry on charitable and social programs also depend upon priests for direction.

Although all priests have the same powers acquired through ordination by a bishop, they are classified in two main categories—diocesan and religious—by reason of their way of life and the type of work to which they are assigned. Diocesan priests (sometimes called secular priests) generally work as individuals in the parishes to which they are assigned by the bishop of their diocese. Religious priests are members of religious orders—for example Jesuits, Dominicans, or Franciscans—and generally work as members of a community in specialized activities, such as teaching or missionary work, assigned to them by the superiors of the orders to which they belong.

Both religious and secular priests hold teaching and administrative posts in the Catholic seminaries, universities and colleges, and high schools. Priests attached to religious orders staff a large proportion of the institutions of higher education and many high schools, whereas secular priests are primarily 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 in the foreign field.

Where Employed

About 58,000 priests served over 44 million Catholics in the United States in 1965. There are priests in nearly every city and town and in many rural communities; however, the majority are in heavily populated metropolitan areas, where most of the Catholic population is located. Catholics are concentrated in the Northeast and the Great Lakes regions, with smaller concentrations in California, Texas, and Louisiana. A large number of priests are located in communities near Catholic educational and other institutions. Many are stationed throughout the world as missionaries. Others travel constantly on missions to local parishes throughout the country. Some priests serve as chaplains with the Armed Forces or in hospitals or other institutions.

Training and Other Qualifications

The course of study for the priesthood takes at least 8 years after graduation from high school. Most students take this training in theological seminaries—first, in a minor seminary (usually for 2 years), then in a major seminary which offers 6 years of advanced training. In 1964, over 48,000 students, known as seminarians were enrolled in 459 seminaries in the United States. High school graduates with the desired scholastic background—an academic course, including Latin—can complete the minor seminary in 2 years and then advance to the major seminary. Elementary school graduates may enter the minor seminary where they complete their high school work before taking the 2 years of college level work. Courses include Christian doctrine, Latin, Greek, English, at least one other modern language, rhetoric and elocution, history, geography, bookkeeping, mathematics, natural sciences, and Gregorian chant.

At the major seminary, the first 2 years are devoted to the study of philosophy, scripture, church history, and the natural sciences as related to religion. During the remaining 4 years, the course of study includes sacred scripture; apologetics; dogmatic, moral, and pastoral theology; homiletics; church history; liturgy; and canon law. 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. During the later years of his seminary course, the candidate receives from his bishop a succession of orders culminating in his ordination to the priesthood.

Most postgraduate work in theology is taken either at Catholic University of America (Washington, D.C.) or at the ecclesiastical universities in Rome. Many priests also do graduate work at other universities in fields unrelated to theology. Priests are commanded by the law of the Catholic Church to continue their studies, at least informally, after ordination.

Young men are never denied entry into seminaries because of lack of funds. In seminaries for secular priests, the bishop may make arrangements for loans to the students. Those in religious seminaries are often financed by contributions of benefactors.

Among the qualities considered most desirable in candidates for the Catholic priesthood are a love of and concern for people, a deep religious conviction, a desire to spread the Gospel of Christ, at least average intellectual ability, capacity to speak and write correctly, and more than average skill in working with people. Candidates for the priesthood must understand that priests are not permitted to marry and are dedicated to a life of chastity.

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.

Outlook

A growing number of priests will be needed in the years ahead to provide for the spiritual, educational, and social needs of the rising number of Catholics in the Nation. Although the number of seminarians has increased steadily in recent years, the number of ordained priests is not sufficient to fill the needs of newly established parishes and expanding colleges and other Catholic institutions, and to replace priests who die. Priests usually continue at their work longer than persons in other professions, but 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 serving in many diverse areas—for example, in religious radio, newspaper, and television work, labor-management mediation and in foreign posts, particularly in countries with a shortage of priests. Continued expansion of such activities, in addition to the expected further growth in Catholic population, will require a steady increase in the number of priests, at least through the mid-1970's.

Where To Go for More Information

Young men interested in entering the priesthood should seek the guidance and counsel of their parish priest. Additional information regarding different religious orders and the secular priesthood, as well as a list of the various seminaries which prepare students for the priesthood, may be obtained from Diocesan Directors of Vocations, or from the diocesan chancery office.

CONSERVATION OCCUPATIONS

Forests, rangelands, wildlife, and water are part of our country's great wealth of natural resources. Conservationists protect, develop, and manage natural resources to assure that they are not needlessly exhausted, destroyed, or damaged, and that future needs for the resources will be met.

Specialized training is generally required to work in conservation occupations. Many positions can be filled only by those having a bachelor's degree. For other positions, the desired training may be obtained on the job.

This chapter includes descriptions of three conservation occupations—forester, forestry aid, and range manager. Other conservation workers include soil conservationists, whose work is discussed elsewhere in this *Handbook*.

Foresters

(2d ed. D.O.T. 0–35.07)
(3d ed. D.O.T. 040.081)

Nature of Work

Forests are one of America's greatest natural resources, covering more than one-third of the land area of the country. Foresters manage, develop, and protect these valuable lands and their resources—timber, water, wildlife, forage, and recreation areas. They estimate the amount and value of these resources. They plan and supervise the harvesting and cutting of trees, purchase and sale of trees and timber, and reforestation activities (renewing the forest cover by seeding or planting). Foresters also safeguard forests from fire, destructive animals and insects, and diseases. Some foresters are responsible for wildlife protection and watershed management, as well as for the management of camps, parks, and grazing land.

Foresters usually specialize in one area of work such as timber management, fire control, forest economics, outdoor recreation, watershed management, wildlife management, or range management. Some of these areas are becoming recognized as distinct professions. The profession of range managers, for example, is discussed in a separate statement in this chapter. Foresters may also specialize in such activities as research, writing and editing, extension work (providing forestry information to farmers, logging companies, and the public), forest marketing, and college and university teaching.

Where Employed

An estimated 21,000 persons were employed as foresters in the United States in 1965. The largest group, more than 7,500, were employed by the Federal Government mainly in the Forest Service of the Department of Agriculture. Other Federal agencies employing significant numbers of foresters were the Departments of the Interior and Defense. State governments employed several thousand foresters, and a few hundred were employed by local governments.

About 8,000 foresters were employed in private industry in 1965, mainly by pulp and paper, lumber, logging, and milling companies. Some foresters were managers of their own land, were in business for themselves as consultants, or were employed by consulting firms. Colleges and universities employed more than 1,000 foresters.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in forestry is the usual minimum educational requirement for

Courtesy of the U.S. Forest Service

Forester inspects young tree.

young persons seeking professional careers in forestry. An advanced degree is generally required for teaching and research positions.

Training in forestry leading to a bachelor's or higher degree was offered in 1964 by about 45 colleges and universities. The curriculums in most of these schools include specialized forestry courses in five essential areas: (1) Silviculture (methods of growing and improving forest crops); (2) forest protection (primarily against fire, insects, and disease); (3) forest management (the application of business methods and technical forestry principles to the operation of a forest property); (4) forest economics (study of the factors affecting the supply of and the demand for forest products); and (5) forest utilization (the harvesting, processing, and marketing of the forest crop and other forest resources). The curriculums also include related courses in the management of recreational lands, watershed management, and wildlife management, as well as courses in mathematics, science, engineering, economics, and the humanities. In addition, the great majority of colleges require that students spend one summer in a field camp operated by the college. Forestry students are also encouraged to work other summers in jobs that will give them firsthand experience in forest or conservation work.

Beginning positions for forestry graduates often involve performing routine duties under the supervision of experienced foresters. As they gain experience and are given more responsibility, foresters may advance to positions such as that of branch forester, district ranger, forest supervisor, and managing forester.

Qualifications for success in forestry include an enthusiasm for outdoor work and the ability to meet and deal effectively with people. Many jobs also require physical stamina and a willingness to work in remote areas.

Employment Outlook

Employment opportunities for forestry graduates are expected to be favorable through the mid-1970's. There will be a strong demand for well-qualified personnel with advanced degrees for college teaching positions and for research in areas such as forest genetics, forest diseases and insects, forest products utilization, and fire behavior and control. Among the major factors underlying this anticipated demand are the country's growing population and rising living standards, which will tend to increase the demand for forest products, and the use of forests for recreation areas.

Private owners of timberland are expected to offer increasing numbers of employment opportunities to foresters, because they are becoming increasingly aware of the profitability of improved forestry and logging practices. The forest products industries also will require additional foresters to apply new techniques for utilizing the entire forest crop, and for cutting trees once regarded as unprofitable for timber operations. In addition, competition from metal, plastics, and other materials is expected to stimulate further research to develop new and improved wood products.

The Federal Government is likely to offer increasing employment opportunities for foresters in the years ahead, mainly in the Forest Service of the Department of Agriculture. Among the factors expected to contribute to this expansion are the demands for the use of national forest resources, the trend toward more scientific management of these lands, and expanding research

programs in areas such as outdoor recreation, watershed management, wildlife protection, and range management.

State government agencies should also offer additional employment opportunities for foresters. Forest fire control, protection against insects and diseases, provision of technical assistance to owners of private forest lands, and other Federal-State cooperative programs are usually channeled through State forestry organizations. Growing demands for recreation facilities in forest lands are likely to result in expansion of State parks and other recreational areas.

In addition to new positions created by the rising demand for foresters, a few hundred openings will arise each year owing to retirements, deaths, and transfers out of the profession.

Opportunities for women in outdoor forestry work will probably continue to be limited, largely because of the strenuous physical requirements of much of the work. The few women presently employed in forestry are engaged chiefly in research, administration, and educational work, and future opportunities for women are also likely to be primarily in these fields.

Earnings and Working Conditions

In the Federal Government in early 1965, beginning foresters with the bachelor's degree could start at either $5,000 or $6,050 a year, depending on their college record. Those with the bachelor's degree and 1 or 2 years of graduate work could begin at $6,050 or $7,220; those with the Ph.D. degree, at $8,650 or $10,250.

Beginning salaries of foresters employed by State governments vary widely. However, in 1964, the average starting salary for State government foresters was estimated to be $5,100.

Annual salaries of beginning foresters with bachelor's degrees employed by private industry were generally between $5,200 and $6,500 in 1964, according to the limited information available. Starting salaries of new graduates with master's degrees were usually between $6,500 and $7,500 a year. Those with doctor's degrees usually received starting salaries of more than $7,500.

In colleges and universities, salaries of forestry teachers were generally the same as those paid other faculty members. (See statement on College and University Teachers.) Foresters in educational institutions sometimes supplement their regular salaries with income from part-time consulting, lecturing, and writing books and articles.

As part of his regular duties, the forester—particularly in beginning positions—spends considerable time outdoors under all kinds of weather conditions. Many foresters put in extra hours in emergency duty such as firefighting.

Where To Go for More Information

Society of American Foresters,
1010 16th St. NW., Washington, D.C. 20036.

Forest Service, U.S. Department of Agriculture
Washington, D.C. 20250.

American Forest Products Industries, Inc.,
1816 N St. NW., Washington, D.C. 20036.

Forestry Aids

(2d ed. D.O.T. 0–68.24)
(3d ed. D.O.T. 441.384)

Nature of Work

Forestry aids, sometimes called *forestry technicians*, assist foresters in managing and caring for both public and private forest lands. (See statement on Foresters earlier in this chapter.) Some of their duties include estimating the amount, growth, and value of timber in a forest by sampling techniques; marking timber for harvest; pruning trees to improve the quality of the timber; spraying trees with pesticides to protect them from insects and diseases; collecting information on the condition of watershed projects; and investigating the causes of stream and lake pollution. Forestry aids also conduct road surveys and maintain forest trails. They may supervise timber sale operations and manage recreation facilities.

Forestry aids may be engaged in all phases of fire prevention and control. If a fire occurs, they may lead fire fighting crews. After the fire has

been suppressed, they take inventory of the burned out area and plant new trees and shrubs. Fire precautions are also stressed by the aids as they instruct persons using the forest for recreation purposes to assure that no harm will come to them or to the forest.

Some aids employed in laboratories assist scientists in tests and experiments to discover ways to expand the utilization of forest products.

Where Employed

An estimated 10,000 persons were employed as forestry aids or technicians in the United States in 1965. The largest group, more than 4,000, were employed by the Federal Government, mainly by the Forest Service of the U.S. Department of Agriculture. Approximately 1,800 were working for State governments. About 4,000 forestry technicians were employed in private industry in 1965, primarily by lumber, logging, and paper milling companies. Other forestry aids worked in tree nurseries or in forestation projects of mining, railroad, or oil companies.

Forestry aids are located chiefly in the heavily forested States of Washington, California, Oregon, Idaho, Utah, and Montana.

Courtesy of the U.S. Forest Service

Forestry aids use special rulers and compasses to estimate timber volume.

Training, Other Qualifications, and Advancement

Young persons qualify for beginning positions as forestry aids either by completing a specialized 1- or 2-year post-secondary school curriculum or through work experience. Curriculums designed to train forestry aids are offered in technical institutes, junior colleges, and ranger schools (schools that specialize in training forestry aids). Among the specialized courses are forest mensuration (measurement of the number and size of trees in the forest), forest protection, dendrology (identification of trees and shurbs), wood utilization, and silviculture (methods of growing and improving forest crops). In addition, the student takes courses, such as drafting, surveying, report writing, and first aid and spends time in a forest or camp operated by the school, where he obtains experience in forestry work.

Persons who have not had post-secondary school training must usually have had experience in forest work, such as felling or planting trees and fighting fires, to qualify for beginning forestry aid Jobs. In the Federal Government, the minimum experience requirement is two seasons of related work. Those who have had some technical experience such as estimating timber resources may qualify for more responsible positions.

Qualifications considered essential for success in this field are an enthusiasm for outdoor work, physical stamina, and the ability to carry out tasks without direct supervision. Many jobs also require a willingness to work in remote areas.

Employment Outlook

Employment opportunities for forestry aids are expected to be good through the mid-1970's. Prospects will be especially good for those with post-high school training in a forestry curriculum. As

the employment of foresters continues to grow, increasing numbers of forestry aids will be needed to assist them. Also, it is expected that forestry aids will assume some of the more routine jobs being done by foresters.

Private industry is expected to provide many additional employment opportunities for forestry aids. Forest products industries are becoming increasingly aware of the profitability of employing technical persons knowledgeable in the practical application of scientific forest practices.

The Federal Government is also likely to offer increasing employment opportunities for forestry aids through the mid-1970's, mainly in the Forest Service of the Department of Agriculture. Similarly, State governments will probably increase their employment of forestry aids. Growth in Government employment will stem from factors such as increasing demand for recreational facilities, the trend toward more scientific management of forest land and water supplies, and an increasing amount of timber cutting on Federal forest land.

Earnings and Working Conditions

In the Federal Government, beginning forestry aids and technicians earned $4,005, $4,480 or $5,000 a year in early 1965, depending on the applicants' education and experience. Beginning salaries for forestry aids employed in private industry also ranged between $4,000 and $5,000 a year, according to fragmentary data.

As part of their regular duties, forestry aids must spend considerable time outdoors under all weather conditions. In emergencies, such as firefighting, forestry aids work many extra hours without rest.

Where To Go for More Information

Forest Service, U.S. Department of Agriculture, Washington, D.C. 20250.

Range Managers

(2d ed. D.O.T. 0-35.10)
(3d ed. D.O.T. 040.081)

Nature of Work

Rangelands cover more than 700 million acres in the United States, mostly in the Western and Southern States. Range managers, also called *range conservationists* or *range scientists*, are responsible for the management, development, and protection of these rangelands and their resources. They establish systems and plans for grazing that will yield the highest production of livestock while preserving conditions of soil and vegetation necessary to meet other land-use requirements—wildlife grazing, recreation, growing timber, and watersheds. Range managers evaluate forage resources; estimate the amount of forage that can be properly utilized; decide on the number and appropriate type of livestock to be grazed and the best season for grazing; restore deteriorated rangelands through seeding or plant control; and determine other range conservation and development needs. Range fire protection, pest control, and grazing trespass control are also important areas of work.

The range managers' activities may include research in range maintenance and improvement, report writing, teaching, extension work (providing information about range management to holders of privately owned grazing lands), or performing technical assignments in foreign countries.

Where Employed

In 1965, an estimated 3,500 professional range managers were employed in the United States. Approximately 1,500 were employed by Federal Government agencies, primarily in the Forest Service of the Department of Agriculture and in the Bureau of Land Management of the Department of the Interior. State governments also employed significant numbers of range managers.

In private industry, many range managers are employed by privately owned range livestock ranches. Some are in business for themselves as consultants, or are employed by consulting firms. Others are employed in manufacturing, sales, and service enterprises. Colleges and universities also

Courtesy of the U.S. Bureau of Land Management

Range manager outlines summer grazing plans.

employ range managers in teaching and research positions.

Training, Other Qualifications, and Advancement

The bachelor's degree with a major in range management or range conservation is the usual requirement for persons seeking employment as range managers in the Federal Government. A bachelor's degree in a closely related subject-matter field, such as agronomy, animal husbandry, botany, forestry, soil conservation, or wildlife management, with courses in range management and range conservation, is also accepted as adequate preparation. Graduate degrees are generally required for teaching and research work.

Training leading to a bachelor's degree with a major in range management was offered in 1964 by 18 colleges and universities, mainly in Western and Southwestern States. Most schools conferring the bachelor's degree in range management also grant the master's degree, and a few such schools award the doctorate.

The essential courses for a degree in range management are botany, plant ecology, and plant physiology; zoology; animal husbandry; soils; chemistry; mathematics; and special courses in range management, such as identification and characteristics of range plants, range management principles and practices, and range management methods and techniques. Desirable elective courses include economics, statistical methods, physics, geology, watershed management, wildlife management, surveying, and forage crops.

Federal Government agencies—primarily the Forest Service and the Bureau of Land Management—hire many college juniors and seniors for summer jobs in range management. This experience helps students qualify for permanent positions as range managers when they complete college.

Because most range managers must meet and deal with other people, individually or in groups, they should be able to communicate their ideas effectively, both in writing and speaking. Many jobs require the stamina to perform vigorous physical activity, and a willingness to work in arid and sparsely populated areas.

Employment Outlook

Employment opportunities for graduates with degrees in range management are expected to be favorable through the mid-1970's. The demand will be especially good for well-qualified persons with advanced degrees to fill research and teaching positions.

Opportunities will probably be best in Federal agencies. Favorable opportunities are also expected in private industry, since range livestock producers and private timber operators are hiring increasing numbers of range managers to improve their range holdings. Some openings are expected for range managers to give technical assistance overseas, particularly in developing countries of the Middle East, Africa, and South America.

Among the major factors underlying the anticipated growth in demand for range managers are population growth, increasing per capita consumption of animal products, and the growing use of rangelands for hunting and other recreational pursuits. Many openings are expected because of

the more intensive management of range resources with increasing emphasis on multiple uses of rangelands. Range managers will also be needed to help rehabilitate deteriorated rangelands, improve semiarid lands, and deal with watershed problems.

Along with growing demand for range managers, an increase is expected in the number of range management graduates. In the past, however, the annual number of graduates with degrees in range management was small. For example, according to the Range Management Education Council, in 1964 only 157 bachelor's degrees, 34 master's degrees, and 8 Ph. D. degrees were granted in this field. Therefore, unless the number of graduates should increase substantially, college graduates with degrees in range management should have favorable employment opportunities.

Opportunities for women in this profession are limited because of the rigorous work generally required, and the remote locations of employment. However, a few women, usually with training in botany, work on classification and identification of range plants.

Earnings and Working Conditions

In the Federal Government in early 1965, starting salaries for range managers with the bachelor's degree were either $5,000 or $6,050 a year, depending upon their college record. Beginning salaries for those with the bachelor's degree and 1 or 2 years of graduate work were $6,050 or $7,220; and for those with the Ph. D. degree, $8,650 or $10,250.

Starting salaries for range managers employed by State governments and private industry in mid-1964 were about the same as those paid to range managers employed by the Federal Government. In colleges and universities, starting salaries were generally the same as those paid other faculty members. (See statement on College and University Teachers.) Range managers in educational institutions may augment their regular salaries with income from part-time consulting and lecturing, and writing books and articles.

Range managers may spend considerable time away from home to work in remote parts of the range. They may also spend much time outdoors.

Where To Go for More Information

American Society of Range Management,
Box 5041, Portland, Oreg. 97213.

Forest Service,
U.S. Department of Agriculture,
Washington, D.C. 20250.

Bureau of Land Management,
U.S. Department of Interior,
Washington, D.C. 20240.

COUNSELING

The objective of professional counseling, in its broadest sense, is to help others understand themselves better, and to apply that understanding toward living and working more effectively. Whatever the area of counseling—personal, educational, or vocational—all counselors are concerned with the well-being of the person in relation to his particular need or problem. People who counsel professionally need to have understanding, tolerance, the ability to accept others as they are, and a concern for people combined with a capacity for remaining objective.

This chapter deals in detail only with three counseling areas that are generally recognized as separate specialties in the field: School counseling, rehabilitation counseling, and vocational counseling.

School Counselors are the largest counseling group. They are concerned with the planning and achievement of educational and vocational goals as well as with the day-to-day development of pupils in their school environment.

Rehabilitation Counselors work with the physically or mentally disabled. Although their counseling is, in large part, vocationally oriented, it also involves personal counseling, particularly as it relates to the individual's acceptance of his disability.

Vocational Counselors are concerned primarily with vocational planning and job adjustment. They may work with the young, the old, the able-bodied, and the disabled.

Some people who are identified with other professional occupations also provide counseling services. The most closely related occupation in this category is that of counseling psychologist. Similarly, a great many social workers provide counseling services to families and individuals. These professional occupations and several other groups of professional workers who also do some counseling but whose primary training is in another field (such as teaching, health service, law, religion, or personnel work) are covered elsewhere in the *Handbook*.

Student personnel workers and other staff members of colleges and universities make up another large group that provides counseling services. This chapter does not deal with these workers, nor does it include personnel workers in government and industry who may perform some counseling but whose primary concern is with the efficient use of manpower in their organizations. (See statements on Personnel Workers and College Placement Officers.)

School Counselors

(2d ed. D.O.T. 0–36.40)
(3d ed. D.O.T. 045.108)

Nature of Work

School counselors help students make and carry out plans for their education and work. They also assist them in understanding and adjusting to their school and social environment. Besides working directly with students, counselors consult with classroom teachers, school administrators, and parents to further the development of individual pupils and the objectives of the general educational program. In addition, counselors may lead discussion groups on various topics related to students' interests and problems. Some counsel only part time, and may also teach classes in occupational information, social studies, or other subjects.

Counselors interview students to obtain relevant information that will help these young peo-

ple understand themselves. Additional information about each student may be obtained from tests, administered by a specialist in testing or by the counselor, and from school and medical records. These data are analyzed and interpreted by the counselor who then works with the student and his parents to develop educational and occupational plans that fit the student's interests and abilities. (Schools often have a psychologist who may work with counselors. See statement on Psychologists.)

In the course of such planning, counselors in junior and senior high schools assist students in selecting courses to fit their career or college plans. They make information available on colleges and college admission requirements. They may also aid students in selecting other types of post-high school training and in finding part-time work while in school or full-time employment after leaving school. To aid students and their parents in developing the students' plans, counselors maintain files or libraries of occupational, college, and other information, arrange for showing of educational and vocational films, schedule appointments with college admissions officers, conduct "career day" programs, or arrange trips to factories, business firms, and colleges. Many counselors may also help students with their personal problems.

Courtesy of the U.S. Office of Education

High school counselor and students discuss postgraduation plans.

A sizable number of counselors make followup studies of recent graduates and dropouts, and cooperate in surveys of local job opportunities. They may also conduct or cooperate in research concerning the effectiveness of the educational program.

The methods used in counseling elementary school children necessarily differ in many respects from those used with older students. Special tests and play activity are among the additional techniques used with children in the lower grades. Elementary school counselors spend much of their time consulting with teachers and parents and often serve more than one school.

As with classroom teachers, many full-time counselors perform a variety of other duties, such as supervising school clubs or other extra-class activities (often after regular school hours). In some schools, counselors do their own record-keeping and other paperwork; however, most large schools provide clerical assistance.

Where Employed

Approximately 42,000 persons performed some counseling functions in the public secondary schools during the 1964-65 school year, according to the U.S. Office of Education. More than 20,500 persons were full-time counselors; another 11,000 spent at least half time in counseling activities; and the remainder worked less than half time as counselors. Counseling services in the elementary schools are being steadily expanded, but the number of trained counselors at this level is still small.

The majority of counselors are in large schools. An increasing number of school districts, however, are providing guidance services to their small schools by assigning several schools to a counselor.

About one-third of all high school counselors are women.

Training, Other Qualifications, and Advancement

Most States require counselors to have both a teaching certificate and a counseling certificate (see statement on Elementary and Secondary School Teachers for teaching certificate requirements). A counseling certificate usually requires graduate level work in the guidance field, and from 1 to 5 years of teaching experience. Seventeen States require a master's degree in counsel-

ing; and about half the States require some work experience outside the teaching field. A young person planning to counsel should obtain the specific requirements of the State in which he plans to work, for requirements vary considerably among the States and are changing rapidly.

Undergraduate college students interested in becoming school counselors usually take the regular program of teacher education, preferably with additional courses in psychology and sociology. After graduating from college, they may acquire the needed teaching or other experience, either before or while studying for their advanced degrees. In some school systems, teachers who have completed half of the courses required for the master's degree may counsel under supervision while taking additional courses. The subject areas of the required graduate level courses usually include lectures on the counseling process, understanding the individual, educational and occupational opportunities, and testing and measurement. Some knowledge of statistics is also necessary for interpreting tests. Counselor education programs at the graduate level are available in about 325 colleges and universities, most frequently in the departments of education or psychology. To obtain a master's degree, a student must complete 1 to 2 years of graduate study. Supervised practice in guidance is provided in an increasing number of training programs.

Advancement for school counselors is most frequently to supervisory or other administrative positions within the school system. For those with a doctor's degree, advancement may be to college teaching positions in the guidance field.

Employment Outlook

Employment opportunities for well-trained school counselors are expected to be excellent through the mid-1970's. In early 1965 the supply of qualified counselors was inadequate to meet the existing demand, and this imbalance is expected to persist in the years ahead. Job openings for counselors are expected to increase rapidly through the mid-1970's just to keep pace with the anticipated growth in school enrollments. Thus, a substantial increase in the number of counselors is expected without allowing for any further strengthening of counseling services. The average ratio of counselors to students in the country, as a whole, is still well below generally accepted standards, despite the financial aid which the Federal Government has provided to States for school counseling programs under the National Defense Education Act of 1958, as amended. Furthermore, recent Federal legislation has provided for the extension of counseling services to children in the 7th and 8th grades. At the same time, job-entrance requirements are being steadily increased to include specialized graduate-level training; this rise in hiring standards, at least temporarily, has had the effect of restricting the supply of qualified counselors.

In addition to the number of counselors needed to take care of enrollment growth and strengthening of counseling services, several thousand new counselors will also be required each year to replace those leaving the profession. According to recent data from the U. S. Office of Education, about 10 percent of all counselors leave the field annually because of family responsibilities, retirement, promotion to administrative jobs, or for other reasons.

Among the factors affecting the employment growth of counselors are the great number of young students planning to go to college during a period when admission requirements are being tightened; and the steadily increasing numbers of young people who will be entering the labor force for the first time, and seeking advice on the rising educational requirements for entry jobs, the job changes caused by automation and other technology, and where employment can be found. Also contributing to the increased demand for counseling services is the growing public awareness of the value of guidance services in helping students with personal and social problems which, in turn, may help reduce the number of school dropouts. In addition, there is an increasing recognition of the need to identify and counsel talented children at an early age, so that they may develop their potential to the maximum benefit—both to themselves and to the Nation.

Earnings and Working Conditions

According to the U.S. Office of Education, the average annual salary of school counselors was

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about $7,500 in the 1964–65 school year. Many school counselors had annual earnings higher than those of classroom teachers with comparable educational preparation and experience. (See statements on Kindergarten and Elementary School Teachers and Secondary School Teachers.) Some of these counselors had extra earnings because they work 1 or 2 months longer each year than the classroom teachers. However, some school systems paid counselors an additional amount unrelated to the numbers of months worked.

In most school systems, counselors receive regular salary increases as their counseling experience increases and as they obtain additional education. Some counselors supplement their income by part-time employment in consulting or other work with private or public counseling centers, government agencies, or private industry.

Where To Go for More Information

Information on colleges and universities offering training in guidance and counseling, as well as on the certification requirements of each State, may be obtained from the State department of education at the State capital and from the U.S. Department of Health, Education, and Welfare, Office of Education, Guidance and Counseling Programs Branch, Washington, D.C., 20202.

Additional information on this field of work may be obtained from:

American Personnel and Guidance Association, 1605 New Hampshire Ave. NW., Washington, D.C. 20009.

Rehabilitation Counselors

(2d ed. D.O.T. 0–36.40)
(3d ed. D.O.T. 045.108)

Nature of Work

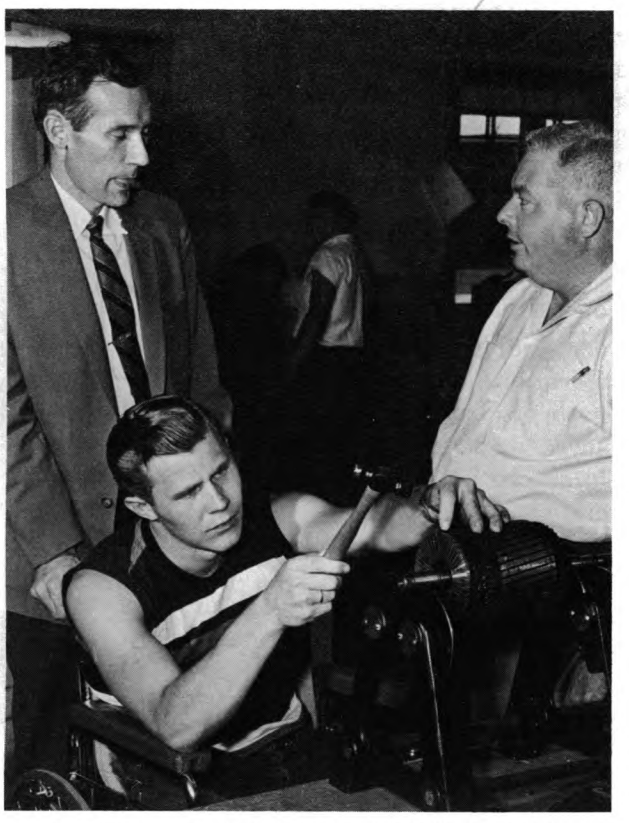
The rehabilitation counselor interviews physically or mentally disabled persons to obtain as much information as possible about them, their emotional problems, and the nature of the disability. During the early interviews, the counselor attempts to establish free and easy communication to ensure a relationship of mutual trust and confidence. Information developed in the interviews is used with other medical, psychological, and social data to help the handicapped person evaluate himself in relation to the kind of work that is suitable to his physical and mental capacity, interests, and talents. A plan of rehabilitation may then be worked out jointly by the counselor, the handicapped person, and those providing medical treatment and other special services. The counselor holds regular interviews with the disabled person to discuss the program, check on the progress made, and help resolve problems. When employment becomes appropriate the counselor assists in finding a suitable job and often makes followup visits to be sure that the placement is satisfactory.

An increasing number of counselors specialize in a particular area of rehabilitation; for example, some work almost exclusively with the blind, some with alcoholics, and others with the mentally ill or retarded. Additional specialties are expected to develop as services for other types of difficulties are included in rehabilitation programs.

The time spent in the direct counseling of each individual depends upon the person and the nature of his disability as well as the counselor's workload. Some rehabilitation counselors may have the responsibility for many persons in various stages of rehabilitation at the same time; on the other hand, those with less experience, or specialized counselors working with the severely handicapped, may handle relatively few cases at a time. In addition to working directly with the handicapped person, the counselor must also maintain close contact with other professional people working with handicapped persons, members of their families, other agencies and civic groups, and private employers who hire the handicapped. The counselor is often responsible for related activities, such as employer education and community publicity for the rehabilitation program.

Where Employed

Every State provides a public rehabilitation program that is financed cooperatively with Federal and State funds. In 1965, about three-fourths



Courtesy of the U.S. Vocational Rehabilitation Administration

Rehabilitation counselor evaluates handicapped worker's job adjustment.

of the estimated 3,600 full-time rehabilitation counselors worked in these State and local rehabilitation agencies. In addition, more than 350, most of whom were counseling psychologists, worked for the Federal Government in the Veterans Administration. The remainder were employed by hospitals, labor unions, insurance companies, special schools, rehabilitation centers, sheltered workshops, and by other public and private agencies that conducted rehabilitation programs and job placement for the disabled.

An estimated 20 percent of all rehabilitation counselors are women.

Training, Other Qualifications, and Advancement

A general requirement for entry into this occupation is graduation from a college or university with course credits in counseling, psychology, and related fields. At present, however, there are no uniform requirements as to the specific kind and amount of education needed to qualify for work in this field. Some employers prefer to hire people with a master's degree who have majored in vocational or rehabilitation counseling; others find the master's degree with a major in a related discipline—social science, psychology, education, or social work—satisfies their needs; a few require the doctorate, with a major in counseling psychology. Employers are placing increasing emphasis on the master's degree as the minimum educational standard for the profession. Work experience in related fields, such as vocational counseling and placement, social work, psychology, education, and other types of counseling, is also given considerable weight by some employers, especially when considering applicants with only the bachelor's degree.

It usually takes from 1½ to 2 years to complete the master's degree in the fields of study preferred for rehabilitation counseling. The curriculum for the master's degree may include a basic foundation in psychology and such courses as: Medical Aspects of Rehabilitation, Cultural and Psycho-Social Aspects of Disability, Survey of Therapeutic Care and Rehabilitation, Legislative Aspects of Rehabilitation, Counseling Techniques, Occupational and Educational Information, Community Resources, and Placement and Follow-Up.

To earn the doctorate in rehabilitation counseling or in counseling psychology may require 4 to 6 years of graduate study. For the doctorate, intensive training in psychology, other social sciences, and the biological sciences as well as research methodology is required.

In 1964, 38 colleges and universities offered financial assistance to a limited number of graduate students specializing in rehabilitation counseling through training grants provided by the U.S. Department of Health, Education, and Welfare, Vocational Rehabilitation Administration. In these graduate programs an internship (supervised work in a rehabilitation setting) is required.

In approximately three-fourths of the State Rehabilitation Agencies, applicants are required to comply with State civil service and merit system rules. In most cases these regulations require the applicants to take a written competitive examination, which is sometimes supplemented by an individual interview and evaluation by a board of examiners. A few States require counselors to be residents of the State in which they work.

Counselors with little experience are usually assigned the least difficult cases; experienced and highly trained counselors are assigned persons with extreme or multiple disabilities that represent difficult rehabilitation problems. After obtaining considerable experience, rehabilitation counselors may be advanced to supervisory positions or to top administrative jobs.

Among the personal qualifications needed for success in this field are an understanding of human behavior, patience, and a capacity for working with people in solving their problems.

Employment Outlook

Employment opportunities for well-qualified rehabilitation counselors are expected to remain excellent through the mid-1970's. Persons with graduate work in rehabilitation counseling or in a related field will have the best opportunities for employment. Opportunities will also be available to applicants with a bachelor's degree and some related work experience.

The supply of qualified rehabilitation counselors was inadequate to meet the counseling needs of the mentally and physically handicapped in early 1965. Most of the disabled war veterans have been rehabilitated, but the number of other people needing rehabilitation counseling is increasing. It is estimated by the Vocational Rehabilitation Administration that over 2 million persons in the Nation needed rehabilitation counseling in early 1965, and at least 800 to 1,200 new counselors will be needed annually through the mid-1970's to staff new and expanding programs and to replace counselors who leave the profession. This annual demand exceeds considerably the number presently being trained at graduate levels and entering the field. Over the next few years, the supply of rehabilitation counselors will probably be augmented to some extent by people from related fields, but the most closely related disciplines (psychology, social work, and education) are those in which the demand for qualified workers with graduate degrees is also expected to exceed the supply for several years to come.

Among the factors contributing substantially to the long-run demand for the services of rehabilitation counselors will be population growth, with related increases in the number of handicapped to be served; the extension of vocational rehabilitation to the more difficult and chronic disabilities including the mentally retarded; increasing support for social welfare in general; and the growing awareness that expenditures for rehabilitation are often returned as savings on the appropriations for programs involving health and custodial care, public assistance, and other types of welfare.

Earnings and Working Conditions

According to the U.S. Department of Health, Education, and Welfare, the beginning average (mean) salary of rehabilitation counselors employed in State agencies in 1964 ranged between $5,790 and $7,270 a year. Counselors with a doctorate in psychology working with the disabled in the Veterans Administration were hired in early 1965 at annual salaries ranging generally from $8,650 to $16,460 depending on the applicant's experience and other qualifications.

Counselors may spend only part of their time counseling in their offices, and the remainder in the field working with prospective employers, training agencies, and the disabled person's family. For field work, it is often necessary to be able to drive a car.

Generally, rehabilitation counselors work a 40-hour week or less with little overtime work required; however, they often attend community and civic meetings in the evenings. They are usually covered by sick and annual leave benefits, and pension and health plans.

Where To Go for More Information

Additional information on rehabilitation counseling as a career may be obtained from:

American Personnel and Guidance Association,
1605 New Hampshire Ave. NW., Washington, D.C. 20009.

American Psychological Association, Inc.,
1200 17th St. NW., Washington, D.C. 20036.

National Rehabilitation Association,
1025 Vermont Ave. NW., Washington, D.C. 20005.

A list of colleges and universities that have received grants to provide rehabilitation traineeships on a graduate level is available from:

U.S. Department of Health, Education, and Welfare,
Vocational Rehabilitation Administration,
Washington, D.C. 20201.

Vocational Counselors

(2d ed. D.O.T. 0–36.40)

(3d ed. D.O.T. 045.108)

Nature of Work

Vocational counselors (including employment counselors) help people develop and accept an adequate career goal that will make use of the individual's potential as well as bring personal satisfaction. They assist clients by planning with them on how to prepare for, enter, and progress in their work. The extent of the counseling assistance available, however, differs among agencies providing such service.

Counselors interview the person seeking their counsel to obtain vocationally significant information about his personal traits, interests, training, work experience, and work attitudes. During or after such sessions, counselors record the applicant's responses to their questions as well as their own general observations about the interview. They may assist the individual in filling out questionnaires concerning his personal history and background, which are then reviewed together. Additional data on the person's general intelligence, aptitudes and abilities, physical capacities, knowledge, skills, interests, and values are also obtained from tests and personal inventories which may be administered or recorded by the counselor or a specialist in testing. Further information may be assembled by the counselor or by the client from sources such as former employers, schools, and health or other agencies.

In subsequent interviews, counselors assist the applicant in evaluating and understanding his own work potential and provide him the information he needs in making plans appropriate to his talents and interests. Job requirements and employment opportunities or training facilities are discussed. An employment plan is jointly developed by the counselor and his client, and a training or work program may be developed. In some agencies a vocational plan may be worked out in a staff conference—which may be attended by supervisors, the psychologist, the testing specialist, and a labor market or occupational analyst.

In many cases the vocational or employment counselor will refer the client to another agency for physical restoration, psychological, or other services before, or concurrent with, counseling. The vocational counselor must be familiar with the services available in the community and be able to recognize what services might be beneficial to a particular client.

Courtesy of the U.S. Bureau of Employment Security

Vocational counselor discusses possible jobs.

Counselors may help the client by suggesting feasible employment sources and appropriate ways of applying for work. In instances where the client needs further support and assistance, the counselor may contact employers, although clients seeking employment are usually sent to placement interviewers following counseling. After job placement or entrance into training, counselors may follow up to determine resolution of the problem or if additional assistance is needed.

Where Employed

In early 1965, the largest number of vocational counselors—1,700 full-time and 1,200 part-time—were employed in State employment service offices, usually located in large cities. The next largest number—probably about 1,000—worked for various private or community agencies offering vocational counseling, primarily in the larger cities. In addition, some worked in institutions such as prisons, mental hospitals, and training schools for delinquent youths. The Federal Government em-

ployed a limited number of vocational counselors, chiefly in the Bureau of Indian Affairs and the Veterans Administration. Some people trained in vocational counseling are engaged in research or graduate teaching in the vocational guidance field. About half of all vocational counselors are women.

Training, Other Qualifications, and Advancement

The generally accepted minimum educational requirement for employment counselors in State employment service offices is a bachelor's degree, preferably with a major in one of the social sciences, plus 15 semester hours in counseling and related courses. An increasing number of States are adopting a 3-level counselor classification system which includes a *counselor intern*, or trainee, requiring a bachelor's degree with 15 hours of undergraduate or graduate work in counseling related courses; a *counselor* requiring a master's degree or 30 graduate hours in counselor related courses; and a *master counselor* requiring a master's degree and 3 years of experience, 1 of which should be in employment service counseling.

Minimum entrance requirements are not standardized among private and community agencies, but most of them prefer, and many require, a master's degree in vocational counseling or in a related field such as psychology, personnel administration, education, or public administration. Most private agencies prefer to have at least one staff member with 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, or teaching.

The public employment service offices in each State provide in-service training programs for their new counselors or trainees; their experienced counselors are often given some additional training in counseling at nearby colleges and universities or, in some cases, at summer institutes. Private and community agencies also often provide in-service training opportunities.

The professional educational curriculum for employment counselors generally includes, at the undergraduate level, a basic foundation in psychology with some emphasis on sociology. At the graduate level, requirements usually include courses such as Techniques of Appraisal and Counseling for Vocational Adjustment, Group Guidance Methods, Counseling Followup Techniques, Psychological Tests in Vocational Counseling, Educational Psychology, Psychology of Occupations, Industrial Psychology, Job Analysis and Theories of Occupational Choice, and some course work in research methods and statistics.

Counselor education programs at the graduate level are available in about 325 colleges and universities, most frequently in the departments of education or psychology. To obtain a master's degree, students must complete 1 to 2 years of graduate study which often includes supervised practice in counseling.

An increasing number of States require counselors in their public employment offices to meet State civil service or merit system requirements that include certain minimum educational and experience standards. They may also require a written or oral examination, or both.

Counselors who demonstrate that they are well qualified may, after considerable experience, 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 become consultants; and others, with the doctorate, may obtain teaching appointments as professors in the guidance field.

Employment Outlook

Vocational counselors with a master's degree and those with recognized related experience in the field will have excellent employment opportunities in both public and private agencies through the mid-1970's. In addition, college graduates with only a bachelor's degree and 15 hours of undergraduate or graduate work in counselor related courses who are interested in becoming counselor interns, aides, and youth advisors, will find many opportunities in State and local employment service offices.

The employment of counselors in State employment service offices is expected to increase rapidly through the mid-1970's. Among the factors contributing to the increasing demand for counseling services in these offices are three recent major Federal laws: the Vocational Education Act of 1963, which provides for vocational guidance and coun-

seling for people who are out of school and seeking employment; the Manpower Development and Training Act of 1965, which provides for counseling in connection with the occupational training or retraining of large numbers of unemployed workers, and the Economic Opportunity Act of 1964, which also provides for counseling to implement such programs as the Job Corps, Work-Training Programs, and the Urban and Rural Community Action Programs. In addition, a sharp increase is expected in the number of young workers entering the labor force during the late 1960's which will be reflected in larger numbers seeking vocational counsel.

Besides the counselors needed to take care of growth in the occupation, many more will be needed to replace workers who retire, die, or leave the profession for other reasons, each year through the mid-1970's.

Earnings and Working Conditions

The annual average (mean) salaries for employment counselors in State employment service offices ranged between $5,346 and $6,727 in mid-1964. Some voluntary agencies in large cities indicate that trainees for vocational counseling positions were being hired at about $5,500 a year; annual salaries reported for experienced counselors ranged up to $15,000 or more in 1964. Trainees in Federal agencies in early 1965 generally started at $6,050 a year; experienced counselors with some administrative and supervisory responsibility earned $10,250 a year.

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.

Where To Go for More Information

General information on employment or vocational counseling may be obtained from:

American Personnel and Guidance Association, Inc.,
1605 New Hampshire Ave. NW., Washington, D.C.
20009.

U.S. Department of Health, Education, and
Welfare, Office of Education,
Guidance and Counseling Programs Branch,
Washington, D.C. 20202.

Information on entrance requirements for positions in the public employment service offices may be obtained from the State civil service or merit system office in each State capital, or from local employment offices.

A list of about 160 private agencies offering vocational counseling services that meet certain professional criteria set forth by the American Board on Counseling Services, Inc., is provided in the *Directory of Approved Counseling Agencies*, 1965–66, available from the American Personnel and Guidance Association, Inc., at $2 a copy.

ENGINEERING

Engineers contribute in countless ways to the welfare, technological progress, and defense of the Nation. They develop complex electric power, water supply, and waste disposal systems to meet the problems of urban living. They design industrial machinery and equipment needed to manufacture goods on a mass production basis, and heating, air conditioning, and ventilation equipment for the comfort of man. Also, they develop scientific equipment to help probe the mysteries of outer space and the depths of the ocean, and design and supervise the construction of highways and rapid transit systems for safe and more convenient transportation.

This chapter contains an overall discussion of engineering, followed by separate statements on several branches of the field—aerospace, agricultural, ceramic, chemical, civil, electrical, industrial, mechanical, metallurgical, and mining engineering. Although most engineers specialize in these or other specific branches of the profession, a considerable body of basic knowledge and methodology is common to most areas of engineering. Therefore, young people considering engineering as a career should become familiar with the general nature of engineering as well as with its various branches.

Nature of Work

Engineers develop methods for converting the raw materials and sources of power found in nature into useful products at a reasonable cost in time and money. They use basic scientific principles discovered by scientists to solve the practical problems involved in designing goods and services and developing methods for their production. The emphasis on the use of scientific principles, rather than on their discovery, is the main factor that distinguishes the work of the engineer from that of the scientist. For example, a physicist may discover that the properties of a gas change when it is converted into a liquid at extremely low temperatures, but the engineer attempts to develop uses for the liquid, or economical methods for its production.

In designing or developing a new product, engineers must consider many factors. In designing a space capsule, for example, they must calculate just how much heat, radiation, air pressure, and other forces the capsule must withstand during its flight. Experiments must be conducted which relate these factors to various construction materials, as well as to the many possible capsule sizes, shapes, and weights. In addition, the engineer must take into account the relative cost of the required materials and the cost and time of the fabrication process. Similar factors must be considered by engineers who design and develop a wide variety of products ranging from transistor radios and washing machines to electronic computers and industrial machinery.

Besides design and development, engineers are engaged in many other activities. Many work in inspection, quality control, and other activities related to production in manufacturing industries, mines, and farms. Others are in administrative and management positions, where knowledge of engineering methods is of great importance. A large number plan and supervise the construction of buildings and highways. Many are employed in sales positions, where they must discuss the technical aspects of a product or assist in planning its installation or use. (See statement on Manufacturers' Salesmen.) Some conduct research aimed at supplying the basic technological data needed for the design and production of new or improved products. Smaller numbers inspect and supervise the maintenance of the Nation's highways. Some engineers with considerable experience work as consultants. A relatively small group teach in colleges and universities or engineering schools.

Most engineers specialize in one of the many branches of the profession. More than 25 engi-

neering specialties are recognized by the profession or in engineering school curriculums. Besides the major branches—10 of which are discussed separately in this chapter—there are many subdivisions of these branches. Structural and highway engineering, for example, are subdivisions of civil engineering. Engineers may also become specialists in the engineering problems of one industry, or in a particular field of technology such as propulsion or guidance systems. Nevertheless, the basic knowledge required for all areas of engineering often makes it possible for engineers to shift from one field of specialization to another, particularly for those beginning their careers.

Engineers within each of the branches may apply their specialized knowledge to engineering problems in many fields. For example, electrical engineers may work in the fields of medicine, missile guidance, or electric power distribution. Because engineering problems are usually complex, the work in some applied fields cuts across the traditional branches. Thus, engineers often work closely with specialists in other branches of engineering.

Electrical engineers confer on design of electronic equipment.

Where Employed

Engineering is the second largest professional occupation, exceeded in size only by teaching; for men it is the largest profession. Approximately 975,000 engineers were employed in the United States in mid-1964.

Manufacturing industries employed more than half of all engineers—about 575,000 in mid-1964. The manufacturing industries employing the largest numbers of engineers were the electrical equipment, aircraft and parts, machinery, chemicals, ordnance, instruments, primary metals, and fabricated metal products industries. About 225,000 engineers were employed in nonmanufacturing industries in mid-1964, primarily in the construction, public utilities, engineering and architectural services, and business and management consulting services industries.

Federal, State, and local government agencies employed another large group of engineers—more than 140,000 in mid-1964. About half of these were employed by the Federal Government, chiefly by the Department of Defense. Other Federal agencies which employed significant numbers of engineers were the Departments of the Interior, Agriculture, and Commerce, and the National Aeronautics and Space Administration. Most engineers in State and local government agencies were employed by highway and public works departments.

Educational institutions employed approximately 30,000 engineers in mid-1964, in research as well as in teaching positions. A small number were employed by nonprofit research organizations.

Engineers are employed in every State, in small cities as well as large, and in some rural areas. The profession also offers opportunities for employment overseas. Some branches of engineering are concentrated in particular industries, as indicated in the statements presented later in this chapter.

Training, Other Qualifications, and Advancement

A bachelor's degree in engineering is the generally accepted educational requirement for entrance into engineering positions. Well-qualified graduates with training in physics, one of the other natural sciences, or in mathematics may qualify for some beginning positions in engineer-

ing. Some persons without a degree are able to become engineers after long experience in a related occupation—such as draftsman or engineering technician—and some college-level training.

Advanced training is being emphasized for an increasing number of jobs. Graduate degrees are desirable for beginning teaching and research positions, and are helpful for advancement in most types of work. Furthermore, in some engineering specialties, such as nuclear engineering, training is generally available only at the graduate level.

Education leading to a bachelor's degree in engineering is offered by about 250 colleges, universities, and engineering schools located throughout the country. Although curriculums in the larger branches of engineering are offered in most schools, some of the smaller engineering specialties are taught in relatively few institutions. A student who desires to specialize in one of the smaller branches should, therefore, investigate the curriculums offered by the various schools before selecting his college. For admission to an undergraduate program, engineering schools usually require high school courses in mathematics and the physical sciences and place emphasis on the general quality of the applicant's high school work.

In the typical 4-year engineering curriculum, the first 2 years are spent mainly in studying basic science—mathematics, physics, and chemistry—and the humanities, social sciences, and English. The last 2 years are devoted chiefly to advanced study in basic science, and to engineering courses with emphasis on the branch of engineering in which the student is specializing. Some engineering programs offer only general engineering training in the undergraduate curriculum, allowing the student to choose a specialty in graduate school or acquire one through work experience.

Some engineering curriculums require more than 4 years to complete. Approximately 25 institutions have 5-year programs leading to the bachelor's degree. In addition, about 50 engineering schools have arrangements with liberal arts colleges whereby a student spends 3 years in the college and 2 years in the engineering school, receiving a bachelor's degree from each. This type of program usually offers the student an opportunity for greater diversification in his studies.

Some institutions have 5- or 6-year cooperative plans under which students spend alternate periods in engineering school and in employment in industry or government. Under most such plans, classroom study is coordinated with practical industrial experience. In addition to the practical experience he gains in this type of program, the student is provided an opportunity to finance part of his education.

Engineering graduates usually begin work as trainees or as assistants to experienced engineers. Many large companies have special training programs for their beginning engineers which are designed to acquaint them with specific industrial practices. These programs are valuable in determining the type of work for which the individual is best suited. As they gain experience, engineers may move up to positions of greater responsibility. Those with proven ability are often able to advance to the high-level technical supervisory and administrative positions, and an increasingly large number are being promoted to top executive posts.

All 50 States and the District of Columbia have laws providing for the licensing (or registration) of those engineers whose work may affect life, health, or property. In 1964, about 250,000 engineers were registered under these laws in the United States. Generally, registration requirements include graduation from an accredited engineering curriculum, plus at least 4 years of experience and the passing of a State examination. Examining boards may accept a longer period of experience as a substitute for a college degree.

Employment Outlook

Employment opportunities for engineers are expected to be very good through the mid-1970's. Engineering has been one of the fastest growing professions in recent years, and it is anticipated that the demand for engineers will continue to grow. There will probably be an especially strong demand for new engineering graduates with training in the most recently developed engineering principles and techniques. New graduates with advanced degrees will have excellent opportunities in research and teaching.

Among the factors underlying the anticipated increase in demand for engineers is the growth in population, and the resulting expansion of industry to meet the demand for additional goods and

services. The need for engineers will probably also rise as a result of the increasingly larger amount of engineering time required for the development of complex industrial products and processes and the increasing automation of industry.

Another factor which will tend to increase the demand for engineers is the expected continued growth of expenditures for research and development. Such expenditures have increased very rapidly in recent years, and it is likely that they will continue to rise through the mid-1970's, although somewhat more slowly than in the past. The growth of research activities will result in the expansion of existing fields of work and in the creation of new ones, especially in the fields of automated machinery and computers.

Because a large proportion of all engineers are engaged in defense and related work (estimated to be about one-fourth of the total in 1964), expenditures for defense and space programs will play an important role in determining the overall level of demand for engineers. The level of such expenditures is not expected to change substantially in the years ahead, but should this occur, the employment of engineers would be affected accordingly.

In addition to the engineers needed to fill new positions, thousands more will have to be trained to replace those who transfer to other occupations, retire, or die. These losses to the profession—estimated to be about 20,000 in 1964—are expected to rise slowly in the future.

Along with the anticipated growth in demand for engineers, the number of new engineering graduates at all academic levels is also projected to increase in the late 1960's and early 1970's. Despite this increase, the number of new graduates seeking employment in the profession may still fall short of demand. Thus, employment opportunities for new graduates will probably continue to be very good through the 1970's.

Women engineers, who represent less than 1 percent of the profession, are also expected to have favorable employment opportunities during the next 10 years.

The preceding analysis relates to the outlook for the engineering profession as a whole. The employment outlook in various branches of engineering is discussed in the statements on these branches later in this chapter.

Earnings and Working Conditions

Average (median) starting salaries for engineering graduates with the bachelor's degree were about $7,425 a year in private industry in mid-1964, according to a survey conducted by the Engineering Manpower Commission. Graduates with the master's degree and no experience usually received from $1,000 to $1,500 a year more than those with only the bachelor's degree. Salaries for graduates with the doctor's degree were generally between $10,500 and $12,700 a year.

Starting salaries for new engineering graduates with the bachelor's degree varied considerably by industry, as may be seen in the following tabulation based on the same 1964 survey.

Industry	*Median* [1]	*Upper decile* [2]	*Lower decile* [3]
Chemicals	$7,415	$7,955	$7,010
Communications	6,850	7,370	6,215
Construction	7,210	8,010	6,325
Consulting services	6,925	7,645	6,135
Electrical machinery and electronics	7,490	8,340	7,015
Instruments	8,150	9,615	7,145
Machinery (except electrical)	7,320	7,980	6,660
Missiles, aircraft, and parts	7,635	8,585	6,930
Motor vehicles	7,600	7,955	7,120
Petroleum	7,450	7,955	6,785
Research and development activities	7,740	8,395	7,180
Utilities (electric and gas)	7,275	7,855	6,720

[1] 50 percent earned more and 50 percent earned less than amounts shown.
[2] 10 percent earned more than amounts shown.
[3] 90 percent earned more than amounts shown.

In the Federal Government service in early 1965, engineers with the bachelor's degree and no experience could start at $5,990 or $7,050 a year, depending on their college records. Beginning engineers with the bachelor's degree and 1 or 2 years of graduate work could start at $7,050 or $7,710. Those with the Ph. D. degree could begin at $8,945 or $10,250.

In colleges and universities, the salary of beginning engineers with the bachelor's degree averaged about $5,800 a year; with the master's degree, $6,250 a year; and with the Ph. D. degree, $8,650. (Also see statement on College and University Teachers.)

Most engineers can look forward to an increase in earnings as they gain experience. For example, in industry in 1964, the average (median) salary of engineers with 21–25 years of experience was about $14,500, nearly twice that of beginning engi-

neers. Only 10 percent of those with 21–25 years of experience earned less than $10,500 a year, and over 10 percent earned $20,000 or more. A small number in top-level executive positions had much higher earnings.

Although engineers generally work under quiet conditions found in modern offices and research laboratories, they may be involved in more active work—at a missile site preceding the launching of a space vehicle, in a mine, at a construction site, or at some other out-of-doors location.

Where To Go for More Information

General information on engineering careers—including student selection and guidance, professional training and ethics, and salaries and other economic aspects of engineering—may be obtained from:

Engineers' Council for Professional Development,
345 East 47th St., New York, N.Y. 10017.
Engineers Joint Council,
345 East 47th St., New York, N.Y. 10017.
National Society of Professional Engineers,
2029 K St. NW., Washington, D.C. 20006.

Information on engineering schools and curriculums and on training and other qualifications needed for entrance into the profession may also be obtained from the Engineers' Council for Professional Development. Information on registration of engineers may be obtained from the National Society of Professional Engineers.

In addition to the organizations listed above, other engineering societies represent the individual branches of the engineering profession; some are listed with the branches presented later in this chapter. Many other engineering organizations are listed in the following publications available in most libraries.

Engineering Societies Directory, published by Engineers Joint Council.

Scientific and Technical Societies of the United States and Canada, published by the National Academy of Sciences, National Research Council.

Some engineers are members of labor unions. Information on engineering unions may be obtained from:

The American Federation of Technical Engineers (AFL–CIO),
900 F St. NW., Washington, D.C. 20004.

Aerospace Engineers

(2d ed. D.O.T. 0–19.03)
(3d ed. D.O.T. 013.081)

Nature of Work

Aerospace engineers play a vital role in America's space age activities. Engineers in this branch of the profession work on all types of aircraft and spacecraft including missiles, rockets, and conventional propeller-driven and jet-powered planes. They are concerned with all phases of the development of aerospace products from the initial planning and design to the final manufacture and testing.

Aerospace engineers usually specialize in a particular area of work, such as structural design, instrumentation, propulsion systems, materials, reliability testing, or production methods. They may also specialize in a particular type of aerospace product such as conventional passenger planes, jet-powered military aircraft, rockets, satellites, or manned space capsules. Engineers working in the conventional aircraft field are usually called aeronautical engineers. Those in the field of missiles, rockets, and spacecraft are often referred to as astronautical engineers.

Where Employed

Nearly 60,000 aerospace engineers were employed in mid-1964, mainly in the aircraft and parts industry. Some worked for Federal Government agencies, primarily the National Aeronautics and Space Administration and the Department of Defense. Small numbers worked for commercial airlines, consulting firms, and colleges and universities.

Employment Outlook

Employment opportunities for aerospace engineers are expected to be favorable through the mid-1970's. The relatively small number of new

graduates in aeronautical engineering will be barely enough to replace those who leave the field due to retirements, deaths, or transfers to other occupations. Because expenditures for defense, the major area of work of aerospace engineers, are not expected to increase in the years ahead, openings due to growth will probably not be significant.

Recent technological developments have shifted the focus of aerospace engineering from propeller-driven and jet-powered aircraft to rocket-powered missiles and vehicles for outer space travel. The ever-increasing complexity of these aerospace products is expected to create some increase in the demand for aerospace engineers. Research aimed at developing new aircraft—such as vertical takeoff and landing and supersonic transport planes—and improving those now in use should also require some additional engineers. (See introductory section of this chapter for discussion on training requirements and earnings. Also see chapter on Occupations in Aircraft, Missile, and Spacecraft Manufacturing.)

Where To Go for More Information

American Institute of Aeronautics and Astronautics, Inc.,
2 East 64th St., New York, N.Y. 10021.

Agricultural Engineers

(2d ed. D.O.T. 0–19.10)
(3d ed. D.O.T. 013.081)

Nature of Work

Agricultural engineers use basic engineering principles and concepts to develop equipment and methods to improve the efficiency and economy of the production, processing, and distribution of agricultural products. They are concerned primarily with the design of farm machinery, equipment, and structures; the utilization of electrical energy on farms and in agricultural processing plants; the conservation and management of soil and water resources; and the design and operation of processing equipment to prepare agricultural products for market. They usually specialize in a particular area of work, such as research and development, design, testing and application, production, sales, or management.

Where Employed

Most of the 5,000 to 10,000 agricultural engineers in mid-1964 were employed in private industry, especially by manufacturers of heavy farm equipment and specialized lines of field, barnyard, and household equipment; electrical service companies; and distributors of farm equipment and supplies. Some worked for engineering consultants who supply technical or management services to farmers and farm related industries; others were independent consultants.

The Federal Government employed about 1,000 agricultural engineers in 1964—chiefly in the Soil Conservation Service and Agricultural Research Service of the Department of Agriculture. Colleges and universities employed nearly an equal number. A few were employed by State and local governments.

Employment Outlook

Employment of agricultural engineers is expected to grow through the mid-1970's. Among the factors which will contribute to a greater demand for these engineers are the growing mechanization of farm operations, increasing emphasis on conservation of resources, and the broadening use of agricultural products and wastes as industrial raw materials. Additional engineers will be needed to work on problems concerning the enormous energy and power requirements of farms. (See introductory section of this chapter for discussion on training requirements and earnings. Also see chapter on Occupations in Agriculture.)

Where To Go for More Information

American Society of Agricultural Engineers,
420 Main St., St. Joseph, Mich. 49085.

Ceramic Engineers

(2d ed. D.O.T. 0–15.11)
(3d ed. D.O.T. 006.081)

Nature of Work

Ceramic engineers develop methods for processing clay, silicates, and other nonmetallic minerals into a wide variety of ceramic products, ranging from glassware, cement, and bricks, to coatings and refractories for missile nose cones. They may also design and supervise the construction of the plant and equipment used in the manufacture of these products. Many ceramic engineers are engaged in research and development work. Some are employed in administration, production, and sales; others work as consultants or teach in colleges and universities.

Ceramic engineers usually specialize in one or more products—for example, products of refractories (fire- and heat-resistant materials, such as firebrick); whiteware (such as porcelain and china dinnerware or high voltage electrical insulators); structural materials (such as brick, tile, and terra cotta); protective and refractory coatings for metals; glass; and abrasives.

Where Employed

Most of the estimated 5,000 to 10,000 ceramic engineers in mid-1964 were employed in manufacturing industries—primarily in the stone, clay, and glass industry. Others worked in the iron and steel, electrical equipment, and chemicals industries which produce or use ceramic products. Some were employed by educational institutions, independent research organizations, and the Federal Government.

Employment Outlook

The outlook is for rapid growth in the employment of ceramic engineers through the mid-1970's. Although ceramic engineering is a small field and the number of openings in any one year will be small compared with those in the large branches of engineering, the number of graduates with degrees in ceramic engineering is also small. Thus, opportunities for new graduates should be excellent.

The growth of programs related to nuclear energy, electronics, and space exploration will provide many of the opportunities for ceramic engineers. Ceramic materials which are corrosion-resistant, and capable of withstanding radiation and extremely high temperatures are becoming increasingly important in the development of nuclear reactors and space vehicles. Increasing use of the more traditional ceramic products such as whiteware and abrasives, both for consumer and industrial use, will also require additional ceramic engineers to improve and adapt these products to new requirements. The growing use of structural-clay and tile products in construction will add to employment opportunities in the production of these items. Furthermore, the development of new glasses of unusual properties and the expanding use of conventional glasses in the construction and in the container field probably will create additional openings for ceramic engineers. (See introductory section of this chapter for discussion on training requirements and earnings.)

Where To Go for More Information

American Ceramic Society,
4055 North High St., Columbus, Ohio 43214.

Chemical Engineers

(2d ed. D.O.T. 0–15.01)
(3d ed. D.O.T. 008.081)

Nature of Work

Chemical engineers design the chemical plants and equipment required to manufacture chemicals in large quantities. They also determine the best combination of the many chemical operations that will result in the most effective manufacturing process. They often test their work by designing and operating pilot plants.

The work in this branch of engineering is so diversified and complex that chemical engineers

frequently become specialists in a particular type of chemical operation such as oxidation, polymerization, distillation, or hydrogenation. Others specialize in the manufacture of a specific product such as plastics, paper, or rubber. Chemical engineers may be engaged in research and development, production, plant operation, design, sales, management, or teaching.

Where Employed

Approximately four-fifths of the more than 45,000 chemical engineers in the United States in mid-1964 were employed in manufacturing industries—primarily in the chemicals industry. Some were employed by government agencies and by colleges and universities. A small number worked for independent research institutes or engineering consulting firms, or as independent consulting engineers.

Employment Outlook

The outlook is for continued growth of employment in chemical engineering through the mid-1970's. The major factors underlying this expected growth are expansion of industry—the chemicals industry in particular—and continued high levels of expenditures for research and development, in which about one-third of all chemical engineers are employed. The increasing complexity of chemical processes and the growing trend toward automation of these processes, especially in the chemicals and petroleum industries, will require additional chemical engineers for work related to designing, building, and maintaining the necessary plants and equipment. Chemical engineers will also be needed in many relatively new areas of work, such as the design and development of nuclear reactors for industrial use, and research aimed at developing new and better solid and liquid fuels for rockets. Furthermore, the development of new chemicals for use in the manufacture of consumer goods such as fertilizers, drugs, and paints will probably create additional openings for chemical engineers. (See introductory section of this chapter for discussion on training requirements and earnings. Also see statement on Chemists and chapter on Occupations in the Industrial Chemical Industry.)

Where To Go for More Information

American Institute of Chemical Engineers,
345 East 47th St., New York, N.Y. 10017.

Civil Engineers

(2d ed. D.O.T. 0–16.01)
(3d ed. D.O.T. 005.081)

Nature of Work

Civil engineers design and supervise the construction of roads, harbors, airfields, tunnels, bridges, water supply and sewage systems, buildings, and many other types of structures. Civil engineering is so broad that many specialties have developed within it—among them are structural, highway, hydraulic, and sanitary engineering.

Many civil engineers are in supervisory or administrative positions, ranging from that of site supervisor of a construction gang or head of a drafting department to top-level executive positions. Some are engaged in design, planning, research, inspection, or maintenance activities. Others teach in colleges and universities or work as consultants.

Where Employed

About 180,000 civil engineers were employed in the United States in mid-1964. The majority were employed by Federal, State, and local government agencies and the construction industry. Large numbers were employed by consulting engineering and architectural firms, or worked as independent consulting engineers. Some were employed by public utilities, railroads, and educational institutions. Others worked in the iron and steel industries and other major manufacturing industries.

Civil engineers work in all parts of the country, in every State and city—usually in or near the major industrial and commercial centers. However, since these engineers are frequently called upon to work at construction sites, they are some-

Civil engineers discuss electric power transmission facility model.

times stationed in remote areas of the United States or in foreign countries. Furthermore, civil engineers in some positions are often required to move from place to place to work on different projects.

Employment Outlook

The outlook in civil engineering—one of the largest and oldest branches of the profession—is for continued growth through the mid-1970's. Growth in this branch, however, is not likely to be as rapid as in electrical and mechanical engineering, the other large branches of the profession.

The expanding employment opportunities for civil engineers will result from the growing needs for housing, industrial buildings, and highways created by an increasing population and expanding economy. Work related to the problems of urban living, such as water and sewage systems, air and water pollution, and giant urban redevelopment projects, may also require additional civil engineers.

Large numbers of civil engineers will be needed each year to replace those leaving the field. As a group, civil engineers are older than those in other engineering specialties, and the proportion lost to the profession each year by retirement or death is therefore relatively high. The number of civil engineers needed annually to fill such vacancies—estimated to be 3,500 in 1964—will probably rise slowly in the future. (See introductory section of this chapter for discussion on training requirements and earnings.)

Where To Go for More Information

American Society of Civil Engineers,
345 East 47th St., New York, N.Y. 10017.

Electrical Engineers

(2d ed. D.O.T. 0–17.01 and .02)
(3d ed. D.O.T. 003.081, .151, and .187)

Nature of Work

Electrical engineers design, develop, and supervise the manufacture of electrical and electronic equipment—including electric motors and generators; communications equipment; electronic apparatus such as television, radar, computers, and missile guidance systems; and electrical appliances of all kinds. They also design and participate in the operation of facilities for generating and distributing electric power.

Electrical engineers usually specialize in a major area of work such as electronics, electrical equipment manufacturing, communications, or power. Many specialize in subdivisions of these broad areas; for example, electronics engineers may specialize in computers, or in missile guidance and tracking systems.

A large number of electrical engineers are engaged in research, development, and design activities. Another large group is employed in administrative and management positions. Others are employed in various manufacturing operations, or in technical sales or teaching positions.

Where Employed

Electrical engineering is the largest branch of the profession. It is estimated that more than 200,000 electrical engineers were employed in the

Industrial engineers plan production operations.

through the mid-1970's. The increasing complexity of industrial operations and the expansion of automated processes, coupled with the continued growth of the Nation's industries, are among the major factors expected to increase the demand for industrial engineers. Growing recognition of the importance of scientific management and safety engineering in reducing costs and increasing productivity is also expected to stimulate greatly the demand for persons in this branch of engineering.

Besides those needed to fill new positions, additional numbers of industrial engineers will be required each year to replace those who retire or die. The number needed to fill such vacancies, estimated to be approximately 1,700 in 1964, will probably rise slowly in the future. (See introductory section of this chapter for discussion on training requirements and earnings.)

Where To Go for More Information

American Institute of Industrial Engineers, 345 East 47th St., New York, N.Y. 10017.

Mechanical Engineers

(2d ed. D.O.T. 0–19.01, .05, .81, and .91)
(3d ed. D.O.T. 007.081, .151, .168, .181, and .187; 011.081; and 019.187)

Nature of Work

Mechanical engineers are concerned with the production, transmission, and use of power. They design and develop machines which produce power, such as internal combustion engines, steam and gas turbines, jet and rocket engines, and nuclear reactors. They also design and develop a great variety of machines which use power—refrigeration and air-conditioning equipment, elevators, machine tools, printing presses, steel rolling mills, and many others.

Many specialized areas of work have developed within mechanical engineering. Among these specialties are those concerned with motor vehicles, marine equipment, railroad equipment, rocket engines, steam power, heating, ventilating and air conditioning, hydraulics or fluid mechanics, instrumentation, ordnance, and machines for specialized industries, such as petroleum, rubber and plastics, and construction.

Large numbers of mechanical engineers are engaged in research, development, and design. Many are also employed in administrative and management activities. Others work in maintenance, sales, and activities related to production and operations in manufacturing industries. Some teach in colleges and universities or work as consultants.

Where Employed

More than 180,000 mechanical engineers were employed in the United States in mid-1964. Nearly all manufacturing and nonmanufacturing industries employed some members of the profession. However, nearly three-quarters of all mechanical engineers were employed in manufacturing industries—mainly in the primary and fabricated metals, machinery, transportation equipment, and electrical equipment industries. Others were employed in government agencies, educational institutions, and consulting engineering firms. Some worked as independent consulting engineers.

United States in mid-1964. They were employed chiefly by manufacturers of electrical and electronic equipment, aircraft and parts, business machines, and professional and scientific equipment. Many were employed by telephone and telegraph and electric light and power companies. Sizable numbers were employed by government agencies and by colleges and universities. Others worked for construction firms, for engineering consultants, or as independent consulting engineers.

Employment Outlook

The outlook is for continued rapid growth of employment in electrical engineering through the mid-1970's. An increased demand for electrical equipment to automate and mechanize production processes, especially for such items as computers and numerical controls for machine tools, is expected to be among the major factors contributing to this growth. The anticipated growing need for electrical and electronic consumer goods is also expected to create many job openings for electrical engineers.

A large number of electrical engineers are engaged in defense and space work. As a result, a significant increase or decrease in expenditures for these activities would change the overall demand for electrical engineers accordingly. However, if such expenditures change little through the mid-1970's, as expected, employment of electrical engineers in these activities should remain relatively stable.

In addition to those needed to fill new positions, many electrical engineers will be required to replace personnel lost to the profession because of retirement or death. The number needed to fill such vacancies, estimated to be about 2,700 in 1964, will probably rise slowly in the future. (See introductory section of this chapter for discussion of training requirements and earnings. Also, see chapter on Occupations in Electronics Manufacturing.)

Where To Go for More Information

Institute of Electrical and Electronic Engineers,
345 East 47th St., New York, N.Y. 10017.

Industrial Engineers

(2d ed. D.O.T. 0–18.01)

(3d ed. D.O.T. 012.081, .168 and .188)

Nature of Work

Industrial engineers determine the most effective method of using the basic factors of production—machines, materials, and personnel. They may specialize in planning plant layouts so that the production process will be efficient, or in selecting and designing the machines and equipment to be used in manufacturing operations. Some plan automated manufacturing processes and supervise the installation of industrial equipment. Among numerous other specialties of industrial engineers are the design of work measurement systems, including wage incentive systems; production methods and standards; cost control and records; quality control; safety engineering; systems engineering; and operations research.

Where Employed

More than two-thirds of the estimated 110,000 industrial engineers employed in mid-1964 were in manufacturing industries. They were more widely distributed among manufacturing industries than were those in other branches of engineering. Some worked for insurance companies, construction and mining firms, and public utilities. Others were employed by retail organizations and other large business enterprises to improve operating efficiency. Still others worked for government agencies, educational institutions, and consulting engineering firms. A few were independent consulting engineers.

Employment Outlook

The outlook is for continued rapid growth of employment in this branch of the profession

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Employment Outlook

The outlook in mechanical engineering—the second largest branch of the profession—is for rapid growth through the mid-1970's. The expected expansion of industry with the consequent demand for industrial machinery and machine tools, and the increasing technological complexity of industrial machinery and processes will be among the major factors contributing to greater employment. Continued growth of expenditures for research and development will also be a factor in the growth of this branch of the profession. Moreover, newer areas of work, such as atomic energy and missile and spacecraft development, will probably provide additional openings for large numbers of mechanical engineers.

Besides those needed to fill new positions, large numbers of mechanical engineers will be required each year to replace those who retire or die. The number needed to fill such vacancies, estimated to be 3,000 in 1964, will probably rise slowly in the future. (See introductory section of this chapter for discussion on training requirements and earnings.)

Where To Go for More Information

The American Society of Mechanical Engineers,
345 East 47th St., New York, N.Y. 10017.

Metallurgical Engineers

(2d ed. D.O.T. 0–14.10 and .20)

(3d ed. D.O.T. 011.081)

Nature of Work

Metallurgical engineers develop methods of processing and converting metals into useful products. These engineers usually work in 1 of 2 main branches of metallurgy—extractive or physical. Extractive metallurgy deals with the extraction of metals from their ores, and with refining them to obtain pure metal. Physical metallurgy deals with the properties of metals and their alloys, and with methods of converting refined metals into useful final products. Persons working in the field of metallurgy may be referred to as either metallurgists or metallurgical engineers.

Where Employed

The metalworking industries—primarily the iron and steel and nonferrous metals industries—employed over one-half of the estimated 5,000 to 10,000 metallurgical engineers in mid-1964. Many metallurgical engineers worked in the machinery, electrical equipment, and aircraft and parts industries. Others were employed in the mining industry, and in government agencies, consulting firms, independent research organizations, and educational institutions.

Employment Outlook

Employment in this small branch of the profession is expected to grow rapidly through the mid-1970's. Increasing numbers of metallurgical engineers will be needed by the metalworking industries to work on problems involved in the adaptation of metals and alloys to new needs. For example, the development of such products as supersonic jet aircraft, missiles, satellites, and spacecraft has brought about a need for lightweight metals capable of withstanding both extremely high and extremely low temperatures. Metallurgical engineers will also be needed to solve metallurgical problems connected with the efficient use of nuclear energy. Furthermore, as the supply of high-grade ores diminishes, more metallurgical engineers will be needed to find ways of processing low-grade ores now regarded as unprofitable to mine. (See introductory section of this chapter for discussion on training requirements and earnings. Also see chapter on Occupations in the Iron and Steel Industry.)

Where To Go for More Information

American Institute of Mining, Metallurgical, and Petroleum Engineers,
345 East 47th St., New York, N.Y. 10017.

Mining Engineers

(2d ed. D.O.T. 0–20.01 and .11)
(3d ed. D.O.T. 010.081, .168, and .187)

Nature of Work

Mining engineers are responsible for the extraction of minerals from the earth and for the preparation of minerals for use by manufacturing industries. They design the layouts of mines, supervise the construction of mine shafts and tunnels in underground operations, and devise methods of transporting extracted minerals to processing plants. Mining engineers are responsible for the efficient operation of mines and mine safety, including ventilation, water supply, communications, and maintenance of equipment. Some mining engineers work with geologists, locating and appraising new ore deposits. Others conduct research to develop new mining equipment and to devise improved methods of processing extracted minerals.

Mining engineers frequently specialize in the extraction of specific metal ores or coal and other nonmetallic minerals. Engineers who specialize in the extraction of petroleum and natural gas are usually considered members of a separate branch of the profession—Petroleum Engineering.

Where Employed

Approximately three-quarters of the estimated 14,000 mining engineers were employed in the mining and petroleum industries in mid-1964. Most of the remainder worked in colleges and universities or government agencies, or as independent consultants.

Mining engineers are usually employed at the location of mineral deposits. Therefore, they may work near small communities or in out-of-the-way places. However, those engaged in research, teaching, management, or consulting, are often located in large metropolitan areas.

Employment Outlook

Employment opportunities for mining engineers are expected to be favorable through the mid-1970's. Although employment is expected to grow more slowly here than in most other branches of engineering, the number of new college graduates with degrees in mining engineering will be barely large enough to replace mining engineers who transfer to other fields of work, retire, or die. For example, it is estimated that about 300 persons left the field in 1964, while only 144 bachelor's degrees were granted in mining engineering.

Exploration for most minerals has declined in recent years, and it is unlikely that these activities will expand significantly in the near future. However, easily mined deposits are being depleted, thus creating a growing need for mining engineers to devise new methods for finding new deposits, and to develop more efficient methods for mining low grade ores. Additional areas of employment for mining engineers will arise as the development of new alloys and the discovery of new uses for metals increase the demand for less widely used ores. (See introductory section to this chapter for discussion on training requirements and earnings. See also chapter on Petroleum Production and Refining Occupations.)

Where To Go for More Information

American Institute of Mining, Metallurgical, and Petroleum Engineers,
345 East 47th St., New York, N.Y. 10017.

HEALTH SERVICE OCCUPATIONS

Almost everyone knows something about the professional services provided by doctors, dentists, and pharmacists. Many people also have some firsthand knowledge of the duties performed by nurses, attendants, and other workers who take care of patients in hospitals. Less well known, but also of great importance to the public health, are the large number of people employed behind the scenes in other health service occupations, such as the laboratory or X-ray technician. Altogether, about 2.5 million people were employed in the health field in early 1965. Employment in this field has increased rapidly in recent years.

Nurses, physicians, pharmacists, and dentists are the largest of the professional health occupations. In early 1965, the numbers in these occupations ranged from nearly 100,000 dentists to over 580,000 registered professional nurses. Other professional health occupations with sizable employment are dietitian, veterinarian, optometrist, chiropractor, osteopathic physician, and hospital administrator. Other health service workers include technicians of various types, such as medical technologist, medical X-ray technician, dental hygienist, and dental laboratory technician. Large numbers—over three-quarters of a million—worked as practical nurses and auxiliary nursing workers, including orderlies, nursing aids, hospital attendants, and psychiatric assistants.

Workers in the health field are employed in hospitals, clinics, laboratories, pharmacies, nursing homes, industrial plants, public health agencies, mental health centers, private offices, and patients' homes. Those employed in health-related occupations work mainly in the more heavily populated and prosperous sections of the Nation.

Many women are employed in the health field. Nursing, the largest of the major health service occupations, is second only to teaching as a field of professional employment for women. Other health service occupations in which women predominate are practical nurse, medical X-ray technician, medical technologist, dietitian, physical therapist, occupational therapist, speech pathologist and audiologist, dental hygienist, and medical record librarian. On the other hand, the majority of dentists, optometrists, physicians, veterinarians, pharmacists, hospital administrators, and sanitarians are men.

The educational and other requirements for work in the health field are as diverse as the health occupations themselves. For example, professional health workers—physicians, dentists, pharmacists, and others—must complete a number of years of preprofessional and professional college education and pass a State licensing examination. On the other hand, some health service occupations can be entered with little specialized training.

A continued rapid expansion of employment in the health field is expected through the mid-1970's, although the rates of growth will differ considerably among the various health service occupations. In general, the factors which are expected to contribute to an increase in the demand for health care are the country's expanding and aging population; wider health education and the resultant rising health consciousness of the general public; extension of prepayment programs for hospitalization and medical care, including the programs for the aged provided in the Social Security Amendments of 1965; rapid expansion of expenditures for medical research; and increasing expenditures by Federal, State, and local governments for health care and services. In addition, many new workers will be needed each year to replace those who retire, die, or—particularly in the case of women—leave the field for other reasons. Thus, there will be many opportunities for employment in the health services.

Chiropractors

(2d ed. D.O.T. 0-39.90)

(3d ed. D.O.T. 079.108)

Nature of Work

Chiropractic is a system of treatment based on the principle that the nervous system largely determines a person's health and that interference with this system impairs his normal functions and lowers his resistance to disease. Chiropractors treat their patients primarily by manual manipulation of parts of the body, especially the spinal column. Many also use such supplementary measures as water, light, and heat therapy and prescribe diet, exercise, and rest. Because of the emphasis on the importance of the spine and its position, most chiropractors use X-ray extensively to aid in locating the source of patients' difficulties. Chiropractic as a system for healing does not include the use of drugs or surgery.

Where Employed

About 23,500 chiropractors were employed in the United States in early 1965—approximately 10 percent were women. The largest group of chiropractors were engaged in independent private practice. Some were salaried assistants of established practitioners, or worked for chiropractic clinics, athletic organizations, and industrial firms. Others taught or conducted research at chiropractic schools. About 45 percent of all chiropractors were located in California, New York, Texas, Missouri, and Pennsylvania.

Training, Other Qualifications, and Advancement

Most States and the District of Columbia regulate the practice of chiropractic and grant licenses to chiropractors who meet certain educational requirements and pass a State board examination. The type of practice permitted and the educational requirements for licensure vary considerably from one State to another. In 1965, three States—Louisiana, Massachusetts, and Mississippi—did not regulate the practice of chiropractic nor issue licenses to chiropractors.

Most States require the successful completion of a 4-year chiropractic course following high school graduation. About one-half of the States also require 1 or 2 years of preparatory college work before chiropractic training. About half the States also require that chiropractors pass a basic science examination. Chiropractors licensed in one State may generally obtain a license in another State without further examination.

Some of the 12 chiropractic schools in the United States in 1965 restricted their teaching to manipulation and spinal adjustments, while the others offered a broader curriculum including such subjects as chiropractic physiotherapy and nutrition. In most chiropractic schools, the first 2 years of the 4-year curriculum are devoted chiefly to classroom and laboratory work in subjects such as anatomy, physiology, and biochemistry. The last 2 years are spent in obtaining practical experience in the schools' clinics. The degree of Doctor of Chiropractic (D.C.) is awarded by all schools to students completing 4 years of chiropractic training.

Among the personal qualities considered desirable for a chiropractor is the ability to deal with people sympathetically. The work requires considerable dexterity with the hands but does not call for unusual strength or endurance.

Most newly licensed chiropractors either set up a new practice or purchase an established practice. Some start as salaried chiropractors to acquire experience and funds necessary to establish their own practice. A moderate financial investment is usually necessary to open and equip an office.

Employment Outlook

The employment outlook for chiropractors is expected to be favorable through the mid-1970's. Only a slight increase in the demand for chiropractic services is expected, but the number of new graduates of chiropractic colleges is also expected to be small and probably will be barely enough to fill openings left by chiropractors who retire, die, or stop practicing for other reasons. In view of the trend in many States toward raising educational requirements for chiropractic practice,

opportunities may be best for those with the most thorough training.

Opportunities for new graduates to begin their own practice are likely to be best in those parts of the country where chiropractic is most fully accepted as a method of treatment. Opportunities should also be good for those who wish to enter salaried positions in chiropractic clinics, chiropractic schools, and other organizations employing chiropractors.

The expected slight growth in demand for chiropractors' services will be related to an expanding population and its increasing demand for various types of health care, including chiropractic treatment.

Women are expected to have good opportunities in chiropractic, since some women and children prefer to go to women chiropractors for treatment. All chiropractic schools accept women as students.

Earnings and Working Conditions

In chiropractic, as in other types of independent practice, earnings are relatively low at the beginning but rise after the first few years. Though incomes of chiropractors vary widely, experienced chiropractors generally had average yearly incomes ranging from $10,000 to $15,000 in early 1965, according to the limited data available.

Where To Go for More Information

Information on State licensing requirements may be obtained from the State board of licensing in the capital of the State in which the individual plans to practice.

General information on chiropractic as a career may be obtained from:

American Chiropractic Association,
American Building, 2200 Grand Ave.,
P.O. Box 1535, Des Moines, Iowa 50306.

International Chiropractors Association,
741 Brady St., Davenport, Iowa 52805.

Dental Hygienists

(2d ed. D.O.T. 0–50.07)

(3d ed. D.O.T. 078.368)

Nature of Work

Dental hygienists, all of whom work under the supervision of dentists, clean teeth by removing stains and calcium deposits, polish teeth, and massage gums. While performing this work (oral prophylaxis), they chart conditions of decay and disease for diagnosis by the dentist. They may also take and develop X-rays, mix filling compounds, prepare solutions, administer prescribed medicaments, sterilize instruments, and act as chairside assistants to the dentist. Hygienists provide dental health education, including the techniques of mouth care and proper diet.

Dental hygienists working in school systems promote dental health by examining children's teeth, assisting dentists in determining the dental treatment needed, and reporting their findings to parents. They also perform oral prophylaxes and give instruction on correct care and brushing of teeth. Some help to develop classroom projects or assembly programs on oral health. Dental hygienists employed by health agencies work on dental health projects or perform clinical duties. A few assist in research projects. Those with advanced training may teach in schools of dental hygiene.

Where Employed

Approximately 12,000 dental hygienists were employed in early 1965; almost all were women. Many work part time. The majority of all dental hygienists were employed in private dental offices; about one-fourth worked for public health agencies or school systems; and others worked in industrial plants, clinics, hospitals, dental hygiene schools, and as civilian employees of the Armed Forces.

Although some hygienists are employed in small towns, the majority work in metropolitan areas.

Training and Other Qualifications

Dental hygienists must pass an examination to be licensed by the State in which they wish to

Dental hygienist checks patient's teeth.

practice. In all States except Alabama and Georgia, eligibility for the licensure examination is limited to graduates of accredited dental hygiene schools. In 1964, candidates could complete part of the State licensing requirements by passing an examination given by the National Board of Dental Examiners in 40 States. Upon being licensed, a hygienist becomes a Registered Dental Hygienist (R.D.H.). In order to practice in a different State, a licensed dental hygienist must take that State's examination.

In 1964, 49 schools of dental hygiene in the United States were accredited or provisionally accredited by the Council of Dental Education of the American Dental Association. Most of these schools provide a 2-year dental hygiene certification course. A few have 4-year programs leading to the bachelor's degree, and some offer both programs. Most of the schools admit only women.

For dental hygienists interested in practicing in a private dental office, completion of the 2-year program is usually sufficient. In order to work in research, teaching, and in public or school health programs, the completion of a 4-year program is usually required.

The minimum requirement for admission to a school of dental hygiene is graduation from high school. Several schools which offer the bachelor's degree admit students to the dental hygiene program only after they have completed 2 years of college. The majority of schools also require that applicants take aptitude tests conducted by the American Dental Hygienists' Association.

The curriculum at a school of dental hygiene consists of courses in the basic sciences, dental sciences, and liberal arts. These schools offer laboratory work, clinical experience, and classroom instruction in such subjects as anatomy, chemistry, histology, pathology, pharmacology, and English. The ability to work well with people, and patience as well as manual dexterity and attentiveness to detail are essential for work in this field.

Employment Outlook

Employment opportunities for dental hygienists are expected to continue to be excellent through the mid-1970's. Despite the anticipated continued rise in the number of graduates from schools of dental hygiene, the demand is expected to be greater than the number available for employment, as in past years.

The demand for hygienists is expected to continue to grow as a result of the expanding population and the growing awareness of the importance of regular dental care. Increasing interest in dental care programs for children will lead to more employment opportunities in school systems. Increased participation in dental prepayment plans and more group practice among dentists may also result in new jobs for dental hygienists. In addition, a great number of job openings will be created by young women who leave their jobs for marriage and family responsibilities.

Mature women who wish to return to the field and those who desire part-time positions can expect to find good opportunities for employment.

Earnings and Working Conditions

Earnings of dental hygienists are affected by the type of employer, education, and experience of the individual hygienist, and the part of the country in which the job is located. Dental hygienists working in private dental offices are usually salaried employees, though some are paid a commission for work performed or a combination of salary and commission. Those employed in research,

administrative, supervisory, or teaching positions often earn higher salaries.

Starting salaries of dental hygienists employed full time in private offices averaged about $6,000 a year in mid-1964, according to the limited data available. The annual beginning salary for a dental hygienist employed by the Federal Government was either $4,480 or $5,000 in early 1965, depending on education and experience. Most of those in the Federal Government earned between $5,000 and $6,000 per year.

Dental hygienists employed full time in private offices usually work between 35 and 40 hours a week. They may work on Saturdays or during evening hours. Some hygienists work for two dentists or more.

Most dental hygienists are employed in clean, well-lighted offices, but may have to stand for long periods of time. The hygienist generally provides her own uniforms. Regular medical checkups and strict adherence to established procedures for using X-ray equipment and for disinfection are important health protections for persons in this occupation.

A paid vacation of 2 or 3 weeks is common among hygienists who work full time in dental offices. Dental hygienists employed by school systems, health agencies, and the Federal or State governments have the same hours, vacation, sick leave, and retirement benefits as other workers in these organizations.

Where To Go for More Information

Information about approved schools and the educational requirements needed to enter this field may be obtained from:

American Dental Hygienists' Association,
100 East Ohio St., Chicago, Ill. 60611.

Information concerning licensing requirements can be obtained from the State Board of Dental Examiners in each State.

Dental Laboratory Technicians

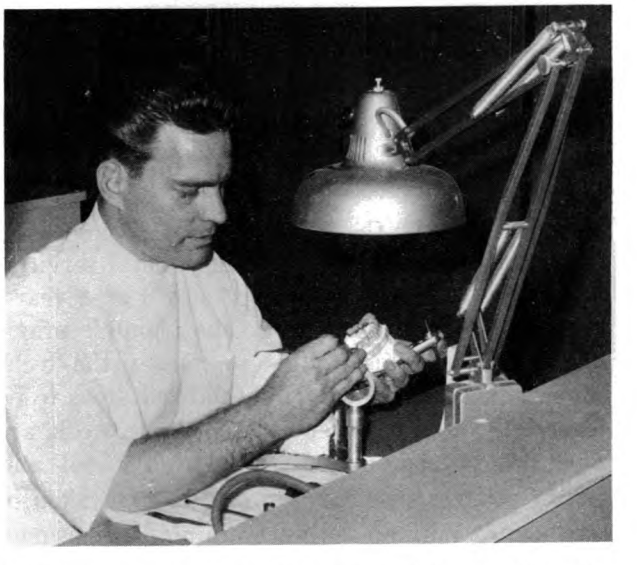
(2d ed. D.O.T. 0–50.06)
(3d ed. D.O.T. 712.381)

Nature of Work

Artificial dentures—teeth, crowns, bridges, and other dental and orthodontal appliances—used to be made by dentists. Now, dental laboratory technicians do most of this highly skilled work. These technicians do not deal directly with patients but receive prescriptions from dentists.

In making many kinds of artificial dentures, the first step is to form models in dental stone (hard plaster) from impressions of patients' mouths taken by dentists. Technicians may also make metal castings for dentures; polish and finish dentures; construct metal or porcelain crowns or inlays for partially destroyed teeth; make gold and other metal bridges; and make appliances to correct such abnormalities as cleft palates. In performing this work, dental laboratory technicians use small handtools, special electric lathes and drills, high-heat furnaces, and other kinds of specialized laboratory equipment.

Some dental laboratory technicians do all types of dental laboratory work. Others specialize in such areas as fabricating crowns and bridges, arranging artificial teeth on dental appliances so that they function properly, processing plastic materials, working with dental ceramics (porcelain), or making castings of gold or nonprecious



Dental laboratory technician employs small hand tool to refine artificial teeth.

metal alloys used in dentistry. In beginning jobs, trainees usually perform relatively simple jobs such as mixing and pouring plaster into casts and molds. As they gain experience, they are assigned more difficult laboratory work and may use expensive metals.

Where Employed

It is estimated that about 25,000 dental laboratory technicians were employed in early 1965. Most of these technicians worked in commercial laboratories, either as employees or as owners of the business. Commercial laboratories, which handle orders from any dentist, are usually 1- or 2-man shops. However, a few large laboratories may employ many technicians.

About 3,000 dental laboratory technicians were employed by individual dentists. Some worked in hospitals that provided dental services. A few were employed by the Federal Government, chiefly in the Veterans Administration and in the Department of the Army. Women, who account for about 10 percent of all dental laboratory technicians, worked mainly in large commercial laboratories.

Dental laboratory technicians, like the dentists who use their services, are located mainly in cities and in the States with large populations. More than half of all dental laboratory technicians are in cities of over 50,000 population.

Training, Other Qualifications, and Advancement

Although no minimum formal educational requirements prevail for entry into this occupation, graduation from high school is an asset. The most common method of becoming a dental laboratory technician is to secure a trainee position and learn the craft on the job, usually in a commercial laboratory or a hospital offering dental services. Typically, on-the-job training lasts 3 or 4 years, depending on such factors as the trainee's previous experience, his ability to master the techniques, and the number of specialized areas to be learned. Courses in dental laboratory work are offered in some public vocational high schools and junior colleges; the course-work may be taken in conjunction with on-the-job training. Persons may also qualify by taking 1- to 2-year programs in dental laboratory technology offered by a few schools. But regardless of a student's educational background, employers consider actual work experience to be necessary for an applicant to qualify as a full-fledged technician.

The National Association of Dental Laboratories and the American Dental Association sponsor a certification program for dental laboratory technicians who can meet certain training and other requirements. In 1964, five schools were accredited by the American Dental Association to provide high school graduates (or those with equivalent education) with the 2 years of training required under this program. Some scholarships are available in the accredited schools.

In the first year of training in accredited schools, formal classroom instruction is given in dental law and ethics, chemistry, ceramics, metallurgy, and other related subjects. During the second year, the student must complete 12 months of supervised practical experience in the school or a dental laboratory. He may receive some pay for work performed during this period. After completion of the 2-year training program, 3 years of practical experience in a dental office or a laboratory are required before the dental laboratory technician is eligible to take the examination for certification in one or more of five areas—generalist, full denture fabrication, partial dental fabrication, ceramics, and crown and bridge fabrication.

Certification may become important for obtaining employment as a dental laboratory technician, because many employers are likely to regard the certificate as the best evidence of the technician's competence.

Among the personal qualifications which employers look for in selecting trainees are a high degree of manual dexterity, good color perception, patience, and a liking for detailed work. Preference may also be given to young people who have completed high school courses in art, ceramics and pottery, sculpturing, blueprint reading, plastics, metalworking, and physiology.

Employment Outlook

Job opportunities for both well-qualified, all-round craftsmen and for specialists are expected to be very good through the mid-1970's. Opportunities for trainees should also be favorable. Be-

cause growth in demand is expected to be only moderate, most openings for dental laboratory technicians will probably stem largely from the need to replace technicians who transfer to other fields of work, retire, or die.

Opportunities for salaried employment for both experienced and trainee dental laboratory technicians will be best in commercial laboratories and in the Federal Government. Some experienced technicians should also be able to establish laboratories of their own. A technician whose work has become known to several dentists in a community will have the best prospect of building a successful business.

A moderate increase in the demand for dental laboratory technicians is anticipated over the next 10 years. Among the factors underlying this expected increase are the growing public awareness of the importance of preventive dentistry; the availability of new dental prepayment plans to help people of moderate income; and the increasing number of older people with an accompanying increase in the number of persons requiring artificial dentures. Moreover, the number of dentists is not expected to keep pace with the demand for their services; hence, in order to devote more time to treatment of patients, dentists will send more and more of their laboratory work to commercial firms.

Earnings and Working Conditions

Trainee dental laboratory technicians employed in commercial laboratories in 1964 usually earned between $50 and $65 a week, according to the National Association of Dental Laboratories. Experienced technicians in commercial laboratories generally earned between $80 and $150 a week, depending on their skill level and experience. Technicians who work with ceramics or gold and other metals received the highest salaries. Foremen and managers in large dental laboratories may earn $200 or more per week. In general, net earnings of self-employed technicians are higher than those of salaried workers.

The starting salary for dental laboratory technicians employed in the Federal Government was about $96 a week in early 1965. The majority of experienced dental laboratory technicians employed in the Federal Government earned between $106 and $128 a week.

Salaried technicians usually work the standard 40-hour week, but self-employed technicians frequently work longer hours. Many technicians in commercial laboratories receive paid holidays and vacations, and some are also provided paid sick leave, bonuses, and other fringe benefits. Technicians employed by the Federal Government have the same benefits as other Federal employees.

The work of dental laboratory technicians is not strenuous and most jobs can be done by handicapped workers provided they have good use of their hands and fingers.

Where To Go for More Information

Information about the training and lists of approved schools are available from:

American Dental Association, Council on Dental Education,
222 East Superior St., Chicago, Ill. 60611.

Information on career opportunities in commercial laboratories, scholarships, requirements for certification, and apprenticeship programs may be obtained from:

National Association of Dental Laboratories, Inc.,
500 Walker Building, Washington, D.C. 20005.

Information about employment in dental laboratories in veterans' hospitals may be obtained from local veterans' hospitals and offices throughout the country.

Dentists

(2d ed. D.O.T. 0–13.10)

(3d ed. D.O.T. 072.108)

Nature of Work

Dentists look for and fill cavities in the teeth, straighten teeth, take X-rays of the mouth, and treat gum diseases. Dentists also extract teeth and substitute artificial dentures especially designed for the individual patient. In addition, they clean teeth and examine the mouth for diseases. They spend most of their time with patients, but devote

some time to laboratory work—making dentures, inlays, and other dental appliances. Many dentists, however—particularly in large cities—send most of their laboratory work to commercial firms. Some dentists employ dental hygienists to clean patients' teeth. They also employ other assistants who perform office work and assist the dentist in his "chairside" duties.

Most dentists are general practitioners who provide many types of dental care; only about 5 percent are recognized as specialists. More than half of these specialists are orthodontists, who straighten teeth. The next larger number, oral surgeons, perform operations in the mouth and jaws. The remainder specialize in periodontology (treating the tissues that support the teeth), prosthodontics (making artificial teeth or dentures), pedodontics (dentistry for children), oral pathology (diseases of the mouth), endodontics (root canal therapy), and public health dentistry.

About 3 percent of all dentists are employed primarily in work that does not involve "chairside" practice, such as teaching and research. Many dentists in private practice, however, do this work on a part-time basis.

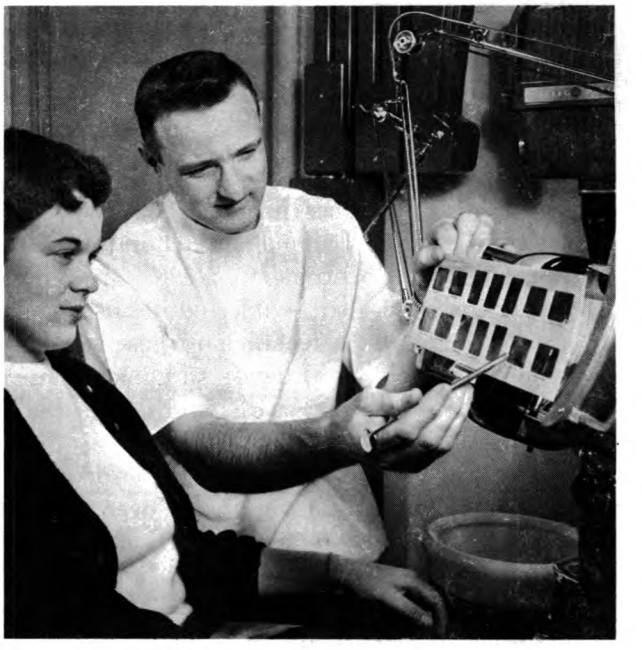
Where Employed

About 96,000 dentists were at work in the United States in mid-1964. Nine out of every ten were in private practice. Of the remainder, about 6,000 served as commissioned officers in the Armed Forces; about 1,200 had other types of Federal Government positions—chiefly in the hospitals and clinics of the Veterans Administration and the Public Health Service; and about 1,500 held full-time positions in schools, hospitals, or State and local health agencies. Women dentists represented only about 2 percent of the profession.

Dentists tend to be concentrated in large cities and in populous States. In 1964, about a third of the dentists were located in the four States of New York, California, Pennsylvania, and Illinois.

Training, Other Qualifications, and Advancement

A license to practice dentistry is required in all States and the District of Columbia. To qualify for a license, a candidate must be a graduate of an approved dental school and pass a State Board examination. In 1964, 40 States and the District of Columbia recognized the examination given by the National Board of Dental Examiners as a substitute for the written part of the State Board examinations. One State, Delaware, also requires new graduates to serve 1 year of hospital internship. Most State licenses permit dentists to engage in both general and specialized practice. In 10 States, however, a dentist cannot be licensed as a "specialist" unless he has 2 or 3 years of graduate education, several years of specialized experience, and passes a special State examination. Few States permit dentists licensed in other States to practice in their jurisdictions without further examination.



Dentist interprets oral X-rays for patient.

The minimum education requirements for graduation from an approved dental school is 2 years of predental college work followed by 4 years of professional dental school training; 7 of the 48 dental schools in operation in the United States in 1965 required 3 years of predental study. Predental education must include at least a half-year course in organic chemistry and full-year courses in English, biology, physics, and inorganic chemistry.

In dental college, the first 2 years are usually devoted to classroom instruction and laboratory work in basic sciences such as anatomy, bacteriology, and pharmacology. The last 2 years are spent

chiefly in the school's dental clinic, treating patients. The degree of Doctor of Dental Surgery (D.D.S.) is awarded by most dental colleges. An equivalent degree, Doctor of Dental Medicine (D.M.D.) is conferred by a few schools.

Competition is keen for admittance to dental schools. In selecting students, schools give considerable weight to college grades and amount of college education; about half of the students enrolling in dental schools have bachelor's degrees. In addition, all dental schools participate in a nationwide aptitude testing program, and scores earned on these tests are considered along with information gathered about the applicant through recommendations and interviews. Many State-supported dental schools also give preference to residents of their particular States.

Dentists interested in research or teaching, or in becoming specialists, often take graduate work. Graduate training may be obtained at most schools of dentistry, or by serving an internship or residency at 1 of the 233 approved hospitals that offer these programs.

Dental training is very costly because of the length of time it takes to earn the dental degree. However, the Health Professions Educational Assistance Act of 1963 provides Federal funds for loans up to $2,000 a year to help needy students pursue full-time study leading to the degree.

The profession of dentistry requires both manual skills and a high level of intelligence. Dentists should have good visual memory, excellent judgment of space and shape, delicacy of touch, and a high degree of manual dexterity, as well as scientific ability. A liking for people and a good business sense are helpful in achieving success in private practice.

The majority of newly qualified dentists open their own offices or purchase established practices. Some start in practice with dentists who are already established, to gain experience and to save the money required to equip an office; others may enter residency or internship training programs in approved hospitals. Dentists entering the Armed Forces are commissioned as captains in the Army and Air Force and as lieutenants in the Navy, and may progress to higher ranks. Graduates of recognized dental schools are eligible for Federal Civil Service positions and for commissions in the U.S. Public Health Service.

Employment Outlook

Opportunities for dentists are expected to be very good through the mid-1970's. It is anticipated that the demand for dental services will increase along with an expanding population, the growing awareness of the importance of regular dental care, and the development of new payment arrangements which make it easier for people of moderate means to obtain dental service. Expanded dental research activities will require more trained personnel; dental public health programs will need qualified administrators; and dental colleges will need additional faculty members. A number of dentists will continue to serve in the Armed Forces.

Improved dental hygiene and fluoridation of community water supplies may prevent some tooth and gum disorders, but such measures—by preserving teeth that might otherwise be extracted—may tend to increase rather than decrease the demand for dental care. Other new techniques, equipment, and drugs, as well as the more extensive use of dental hygienists, assistants, and laboratory technicians may permit individual dentists to care for more patients. However, these developments are not expected to offset the need for more dentists.

Of all new dental school graduates, the majority will be needed to replace dentists who retire or die. The remaining graduates will be barely enough to maintain the present ratio of dentists to population. Thus, the outlook for those who complete dental training is very good. Despite this favorable outlook, the number of men and women who will be able to enter this field will be restricted by the present limited capacity of dental schools. However, opportunities to obtain dental training are expected to increase because of recent Federal legislation which provides Federal funds to assist in the construction of additional training facilities for dentists.

Earnings and Working Conditions

During the first year or two of practice, dentists often earn little more than the minimum needed to cover expenses, but their earnings usually rise rapidly as their practice develops. Specialists generally earn considerably more than general practitioners. Average (median) income above expenses

for all self-employed dentists in 1964 was about $16,000 a year. In the Federal Government, new graduates of dental schools in early 1965 could receive starting yearly salaries ranging from $8,650 to $11,305, depending on college records and other qualifications. In State health departments, in early 1964, the annual salaries of State dental health directors ranged from an average minimum of $11,000 to an average maximum of $13,600, according to the U.S. Public Health Service. Dental directors in local health departments, in early 1964, received yearly salaries ranging from an average minimum of $9,930 to an average maximum of $12,074, according to the limited information available.

Location is one of the major factors affecting the income of dentists who open their own offices. For example, in high-income urban areas, dental services are in greater demand; however, a practice can be developed most quickly in small towns where new dentists can easily become known and where there may be less competition with established practitioners. Although the income from practice in small towns may rise rapidly at first, over the long run the level of earnings, like the cost of living, may be lower than that in larger communities.

Most dental offices are open 5 days a week and some dentists have evening hours. Dentists usually work between 40 and 50 hours a week, although many spend more than 50 hours a week in the office. Dentists often work fewer hours as they grow older, since the hours of work are usually determined by the dentist himself. A considerable number continue in part-time practice well beyond the usual retirement age.

Where To Go for More Information

People wishing to practice in a given State should get the requirements for licensure directly from the board of dental examiners of that State. Lists of State boards and of accredited dental schools, as well as information on dentistry as a career, may be obtained from:

American Dental Association, Council on Dental Education,
222 East Superior St., Chicago, Ill. 60611.
American Association of Dental Schools,
840 North Lake Shore Dr., Chicago, Ill. 60611.

Dietitians

(2d ed. D.O.T. 0–39.93)

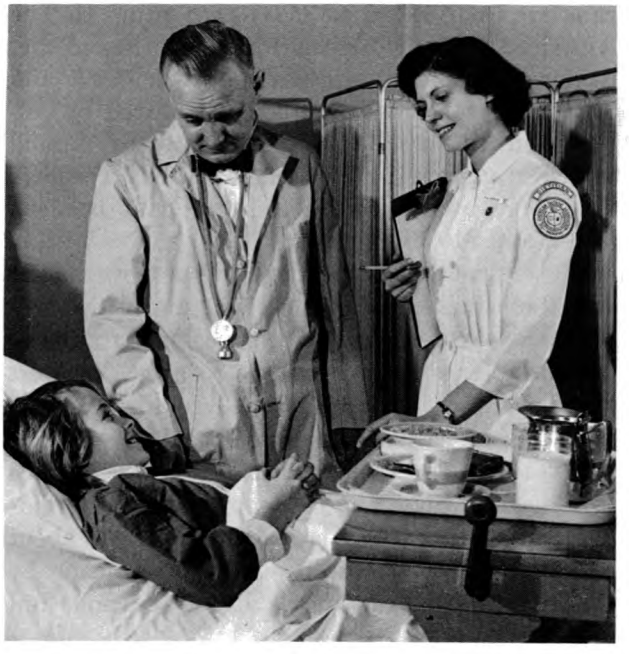
(3d ed. D.O.T. 077.081 through .168)

Nature of Work

Dietitians plan and supervise the preparation and serving of appetizing and nutritious meals to help people maintain or recover good health. Their work includes planning general menus and modified diets that meet nutritional requirements for medical treatment, supervising the personnel who prepare and serve the meals, managing purchases and accounts, and providing guidance on good eating habits. Administrative dietitians form the largest group in this occupation; the others are therapeutic dietitians, teachers, or research workers.

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 preparation of meals; select, train, and direct food-service supervisors and workers; arrange for the buying of food, equipment, and supplies; enforce sanitary and safety regulations; and prepare records and reports. Dietitians who are directors of a dietary department also formulate departmental policy, coordinate dietary service with the activities of other departments, and are responsible for the development and management of the dietary department budget, which in large organizations may amount to millions of dollars annually.

Therapeutic dietitians plan and direct the preparation of special meals for patients on modified diets, taking into consideration the nutritional value of foods. They supervise the serving of meals, discuss food likes and dislikes with patients, and note their intake of food. Other duties of therapeutic dietitians include conferring with doctors regarding patients' diets, instructing patients and their families on the requirements and



Therapeutic dietitian recommends special meals for a young patient.

importance of their diets, and suggesting ways to help them stay on these diets after leaving the hospital. In a small institution, one person may serve as both the administrative and therapeutic dietitian.

Some dietitians, particularly those in hospitals affiliated with medical centers, teach dietetic, medical, dental, and nursing students such subjects as dietetics, foods and nutrition, and diet therapy. A few dietitians act as consultants to commercial enterprises, including food processors, equipment manufacturers, and utility companies.

Other members of the profession, called public health nutritionists, conduct studies or surveys of food and nutrition. They also take part in research projects, such as those concerned with the nutritional needs of the aging, persons with chronic diseases, or space travelers.

Where Employed

Approximately 28,000 dietitians were employed in 1964, of whom less than 10 percent were men. About half of all the dietitians worked in hospitals, including about 1,200 who were employed by the Veterans Administration and the U.S. Public Health Service. A sizable number were employed by colleges, universities, and school systems as teachers or as dietitians in food-service programs. Most of the remainder worked for public health agencies, restaurants or cafeterias, and large companies that operate food-service programs for their employees. Some dietitians were commissioned officers in the Armed Forces.

Training, Other Qualifications, and Advancement

The minimum educational requirement for dietitions is a bachelor's degree with a major in foods and nutrition or institution management. This education can be obtained in the home economics departments of about 450 colleges and universities. Undergraduate work should include courses in foods and nutrition, institution management, chemistry, bacteriology, and physiology, and such related courses as mathematics, psychology, sociology, and economics.

To qualify for professional recognition, The American Dietetic Association recommends the completion of a 1-year dietetic internship program approved by the Association, or 3 years of experience including 2 years under the supervision of a dietitian who is a member of the Association. Many employers prefer to hire dietitians who have completed an internship. An important phase of the intern's education is on-the-job experience; the remainder of the internship is devoted to classroom study of menu planning, budgeting, institution management, and other advanced subjects, and to special projects. In 1964, 64 internship programs were approved by The American Dietetic Association—56 for hospitals, 7 for business firms or colleges and universities, and 1 for a food clinic.

Experienced dietitians may be advanced to assistant director or director of a dietary department in a large hospital or other institution. Graduate education is usually required for advancement to higher level positions in teaching and research. Those interested in becoming public health nutritionists must usually earn a graduate degree in this field. Graduate study in institutional or business administration is valuable to those interested in administrative dietetics.

Qualifications needed for work in this field are an interest in and an aptitude for the sciences, particularly chemistry and mathematics. Ability

to organize and manage work programs and to work well with others is also important.

Employment Outlook

Opportunities for qualified dietitians are expected to be excellent through the mid-1970's. The supply of trained dietitians is expected to be considerably less than the demand for them. Because of the anticipated heavy demand, some hospitals and other establishments may employ college graduates with suitable undergraduate education to assist dietitians. Small hospitals and some other institutions that cannot obtain dietitians for full-time positions may employ them on a part-time basis.

The major factors expected to contribute to increasing opportunities for dietitians include the expansion of hospital and nursing home facilities, more widespread use of hospitals and medical services by an increasing population, and the growth of community health programs. An increasing number of dietitians will also be needed to direct food services for schools, industrial plants, and commercial eating places, and to engage in food and nutrition research programs. In addition, since many women select this field because of their interest in food and homemaking and then leave the profession for marriage and family responsibilities, replacement needs will probably continue to be high.

The number of men employed as dietitians has been growing slowly but steadily. Men are likely to find increasing employment opportunities, especially as administrative dietitians in college and university food services, hospitals, and commercial eating places.

Earnings and Working Conditions

In early 1965, hospitals offered new graduates of approved internship programs annual salaries ranging from $4,700 to $5,500, according to The American Dietetic Association. Experienced dietitians in hospitals were paid between $5,500 and $10,000 a year. Staff dietitians employed by college and school food services received annual salaries ranging from $4,700 to $8,000. Teachers in colleges and universities were paid between $6,000 and $10,500 a year.

The entrance salary in the Federal Government for those who had completed internship was $6,050 a year in early 1965. New college graduates without internship started at $5,000 per year. Most experienced dietitians employed by the Federal Government earned between $6,050 and $10,250 per year; a few earned over $12,000. Dietitians employed by State and local governments in mid-1964 received yearly salaries ranging from about $6,000 to $7,600, according to a survey made by the U.S. Department of Health, Education, and Welfare.

Most dietitians are employed on a weekly work schedule of 40 hours; however, dietitians in hospitals may sometimes work on weekends, and those in restaurants have somewhat irregular hours. Some hospitals provide laundry service and meals in addition to salary. Paid vacations, holidays, and health and retirement benefits are usually received.

Where To Go for More Information

Information on approved dietetic internship programs, scholarships, and employment opportunities, and a list of colleges providing training for a professional career in dietetics, may be obtained from:

The American Dietetic Association,
620 North Michigan Ave., Chicago, Ill. 60611.

The U.S. Civil Service Commission, Washington, D.C., 20415, has information on the requirements for dietetic interns and dietitians in Federal Government hospitals.

Hospital Administrators

(2d ed. D.O.T. 0–99.84)
(3d ed. D.O.T. 187.118)

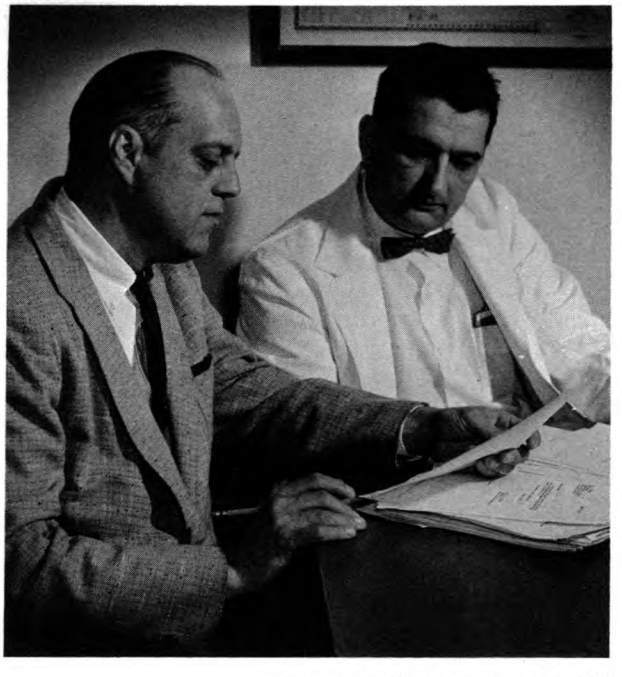
Nature of Work

Hospital administrators hold the top-level executive job in a hospital. They have responsibility for directing all the administrative activities of the hospital. General guidance for their work comes from a governing board with whom they work closely in the development of plans and policies.

The day-to-day work of administrators involves direction of the many and varied activities of the hospital, usually with the aid of assistant administrators and other staff members. They work closely with the medical and nursing staffs and make available to them the necessary personnel, equipment, and auxiliary services. Administrators are responsible for hiring and training personnel; preparing and administering the budget; establishing accounting procedures; planning current and future space needs; insuring the proper maintenance of buildings and equipment; purchasing supplies and equipment; and providing for laundry, mail, telephone, information, and other services for the patients and staff.

In small hospitals, typically located in rural or suburban areas, the administrator generally assumes all management functions. In large hospitals, he is assisted by specialists who have been trained in hospital administration.

Under the direction of the governing board, administrators may carry out large projects concerned with expanding or developing the hospital's services. For example, they may organize fund-raising campaigns or plan new building or research programs.



Courtesy of the National Institutes of Health

Hospital administrator plans for expansion of hospital services.

778-316 O—65——8

Administrators meet regularly with their staff to discuss progress, make plans, and solve problems concerning the functioning of the hospital. In cooperation with the medical staff and department heads, they may also develop and maintain teaching programs for nurses, interns, and other hospital staff members. They may address community gatherings, organize community health campaigns, represent their hospitals at meetings, or participate in study groups.

Where Employed

An estimated 13,000 hospital administrators and assistants were employed in hospitals and related institutions in early 1965. About two-thirds of them worked in nonprofit or private hospitals, and the remainder generally worked in Federal, State, and local government hospitals. Of those employed by the Federal Government, the largest numbers were in Veterans Administration hospitals; most of the remainder were employed in Armed Forces and Public Health Service hospitals. It is estimated that one-fifth of the total number of hospital administrators and their assistants are women. Many are members of religious orders.

Training, Other Qualifications, and Advancement

The background needed to qualify for this work depends, to a large extent, on the qualifications established by individual employers. Most employers prefer persons with at least a master's degree in hospital administration. Others look for people who have formal training in law or business administration and also extensive experience in the health field. A few require that their administrators be physicians or registered professional nurses. Specialized hospitals (such as orthopedic or mental hospitals) frequently prefer physicians for administrators whose medical specialty is the same as that of the hospital. Hospitals run by religious groups usually seek administrators of the same faith.

In 1964, master's degree programs in hospital administration were offered in 20 colleges and universities. These programs usually consist of a year of academic study followed by a year of administrative residency in a selected hospital. For entrance into these programs, applicants must have

a bachelor's degree including some courses in the natural sciences, psychology, and sociology. The curriculum may include such courses as hospital organization and management, accounting and budget control, personnel administration, public health administration, and the economics of health care. The residency involves an orientation to all of the hospital's activities under the supervision of the administrator or his assistant. The American College of Hospital Administrators provides financial loans and scholarships to a limited number of students for graduate work in hospital administration. The U.S. Public Health Service also gives a few awards for graduate work in this field.

New graduates with a master's degree in hospital administration usually enter the field as assistant administrators or department heads. As they gain experience, they may qualify for the hospital administrator job. A Ph. D. in hospital administration, which is offered in three higher institutions, is helpful for advancement.

Some persons without a master's degree in hospital administration gain experience that may qualify them for advancement to the administrator's job by working in one of the specialized administrative areas such as personnel, records, budget and finance, or data processing. With this experience and some graduate work, they may be promoted to department head, assistant administrator, and eventually to administrator.

Personal qualifications needed for success in this field include good health and vitality as well as an interest in helping the sick. Skills in working with people, organizing and directing large-scale activities, and public speaking are important assets.

Employment Outlook

The position of hospital administrator, especially in a large hospital, represents a career goal, and these positions are likely to continue to be filled by promotion from within or by transfers from smaller hospitals. Although graduates of hospital administration programs are usually preferred for such advancement, some positions as administrator are likely to continue to be filled by physicians and nurses.

New graduates with the master's degree in hospital administration are expected to have excellent opportunities to enter this field as assistant administrators or as heads of administrative departments such as personnel, records, budget and finance, or data processing. Applicants without graduate training will find it difficult to enter this field except by gaining experience at the lower level jobs. Some employment expansion is expected over the next decade, but most of the openings will be to replace employees who retire, stop working for other reasons, or transfer to other types of employment.

As more and larger hospitals are built to take care of the increasing population, and as health services are expanded, more positions are likely to be created for assistants and department heads to handle the increase in management functions. These positions will provide additional employment and promotional opportunities, especially for graduates of schools of hospital administration. Such graduates will also find increasing employment opportunities outside of hospitals in hospitalization and health insurance programs, nursing homes and other long-term care institutions, rehabilitation facilities, and public health centers.

Earnings and Working Conditions

Salaries of hospital administrators depend on factors such as the type of hospital, the size of its administrative staff and budget, and the policy of the governing board. New graduates in hospital administration received about $7,500 a year in 1964; experienced administrators generally earned up to $15,000 or more, according to the limited data available. New graduates employed in Veterans Administration hospitals started at about $7,200 a year in early 1965, although a few VA hospital administrators, most of whom are physicians, were paid up to $19,000 a year.

Commissioned officers in the Armed Forces and in the U.S. Public Health Service working in the field of hospital administration hold ranks ranging from second lieutenant to colonel. Commanding officers of large Armed Forces hospitals are physicians, and they may hold higher ranks.

Hospital administrators often work long hours. Since hospitals operate on a round-the-clock basis, the administrator may be called upon to settle emergency problems at any time of the day or

night. Fringe benefits usually include paid vacations and holidays, sick leave, and pension and insurance coverage.

Where To Go for More Information

Additional information about hospital administration and a list of colleges and universities offering such training may be obtained from:

American College of Hospital Administrators,
840 North Lake Shore Dr., Chicago, Ill. 60611.

Information on awards available from the U.S. Public Health Service for graduate training in hospital administration may be obtained from that agency's Division of Community Services, Training Resources Branch, Washington, D.C., 20202.

Licensed Practical Nurses

(3d ed. D.O.T. 079.378)

Nature of Work

Licensed practical nurses assist in caring for medical and surgical patients, convalescents, handicapped people, and others who are physically or mentally ill. Under the direction of physicians and professional nurses, they provide nursing care which requires technical knowledge but not the professional training of a registered nurse. (See statement on Registered Professional Nurses.) In some parts of the country, licensed practical nurses are known as *licensed vocational nurses.*

In hospitals, licensed practical nurses work with other medical personnel as members of the nursing team. They provide much of the bedside care needed by patients whose illnesses are not at a critical stage—for example, taking and recording temperatures and blood pressures, changing dressings, administering certain prescribed medicines, and bathing bed patients and helping them in other ways with personal hygiene tasks. They may also give hypodermic injections and assist physicians and registered professional nurses in examining patients and in carrying out complex nursing procedures. In maternity hospitals, licensed practical nurses may assist in the delivery, care, and feeding of infants; and in hospitals caring for surgical patients, they may help registered nurses in recovery rooms by watching for and reporting on any adverse changes in patients recovering from the effects of anesthesia. The duties of some licensed practical nurses include helping in the supervision of hospital attendants. (See statement on Hospital Attendants.)

Licensed practical nurses employed in private homes care mainly for patients whose day-to-day care seldom involves highly technical procedures or complicated equipment. In addition to providing the nursing care ordered by their patients' physicians, they may prepare patients' meals, keep their rooms tidy, and perform many other tasks essential to patients' comfort and morale. Teaching family members how to perform simple nursing tasks is another duty performed by many practical nurses working in private homes, as well as by those who are employed in public health agencies.

In doctors' offices and in clinics, licensed practical nurses help physicians by draping and positioning patients for examinations and treatments in much the same way as in hospitals. In addition, they may perform clerical tasks such as making appointments and recording addresses, ages, and other information about patients.

Where Employed

The number of licensed practical nurses employed in 1965 is estimated at approximately 250,000. The great majority were women. Men employed as practical nurses provide care mainly for male patients.

Most practical nurses—men as well as women—work in hospitals, nursing homes, clinics, doctors' offices, and similar establishments. In hospitals, the number of part-time workers is relatively high—about 10 percent of the total number employed, according to a private survey made in 1964. Public health agencies, welfare and religious organizations, and government establishments also employ a considerable number of licensed practical nurses. Still others are on private duty, working in the homes of their patients, or in hospitals.

Courtesy of the U.S. Office of Education

Practical nurse trainees receive instruction in anatomy.

Training, Other Qualifications, and Advancement

All States and the District of Columbia have laws which regulate the training and licensing of practical nurses. Usually, licenses are issued only to those candidates who have completed a course of instruction in practical nursing which has been approved by the State board of nursing, and who have also passed a licensing examination. Physical examinations are often required and aptitude tests given.

Young people seeking to enroll in State-approved training programs must usually be at least 17 (or 18) years old and have completed at least 2 years of high school or its equivalent. In some States, candidates may be accepted who have completed only the eighth or ninth grade, and, in still others, high school graduation is required. Many schools that do not require completion of high school nevertheless give preference to graduates; and most of the thousands of men and women who enroll in practical nurse training programs each year are high school graduates.

About 900 State-approved training programs provided instruction in practical nursing in 1964. More than half were public school courses offered as a part of vocational and adult education programs. Other courses were available at junior colleges, or were sponsored by local hospitals, health agencies, and private educational institutions. The courses offered by these institutions were usually 1 year in length. In some schools, tuition was free, and in others the charge generally ranged between $50 and $100.

The training offered includes both classroom study and clinical practice. Classroom instruction covers basic nursing skills and related subjects such as body structure and functions, personal hygiene, nutrition, first aid, and community health; and this work is supplemented by laboratory practice—first with life-size manikins or with students playing the part of patients, and later by supervised work in hospitals where students apply their skills to actual nursing situations.

Among the personal qualities essential for practical nurses are a liking for people and a genuine desire to help them. Other attributes include common sense, mental alertness, patience, understanding, emotional stability, and dependability. Good health is extremely important.

Opportunities for advancement in this occupation are limited, unless workers undertake additional training qualifying them for more responsible positions at higher salaries. Thus, through in-service training, some practical nurses prepare themselves for work in specialized fields such as rehabilitation. (Practical nurses cannot advance to positions as registered professional nurses, however, unless they undertake the years of additional schooling which are required in order for them to qualify for such work.)

Employment Outlook

Licensed practical nurses are expected to be in strong demand during the years ahead. In spite of a rapid increase in employment in this occupation during recent years, the supply of qualified workers is still insufficient to fill all jobs. Employment is expected to continue to rise very rapidly during the 1965–75 decade, and a large number of new jobs will have to be filled each year as health facilities continue to expand. In addition, more than 15,000 workers will be needed annually to replace practical nurses who retire or stop working for other reasons. Opportunities will be excellent for men as well as for women.

The need for more workers in this occupation has been due in large part to the greater utiliza-

tion of licensed practical nurses for certain kinds of patient care which do not require the skills of a registered professional nurse. This use of practical nurses as members of hospital nursing teams is expected to continue to create many job opportunities. Other factors which will contribute to an increase in employment are a greater need for health services because of growth in the population and particularly in the number of elderly people; an increasing public awareness of the importance of maintaining good health; rising income levels; and the continuing expansion of voluntary health insurance plans.

Earnings and Working Conditions

The salaries of licensed practical nurses employed in hospitals surveyed in mid-1963 ranged from an average of $54 a week in the Southern States to $73 in the West. Nationwide, the average was $64.50. Differences in the salaries paid individuals by the various hospitals surveyed were great; a few earned less than $40 a week, and a few others $100 or more.

In many hospitals, practical nurses receive periodic pay increases after they have completed specified periods of satisfactory service. Some hospitals also provide free laundering of uniforms; less frequently, meals and uniforms are furnished without charge. In a few institutions, free lodging may be provided. The scheduled workweek is generally 40 hours and, because nursing care must be provided around the clock, often includes some work at night and on weekends and holidays. Provisions for paid holidays and vacations, and for health insurance and pension plans are common in many hospitals.

In private homes, licensed practical nurses are usually on duty for 8, 10, or 12 hours a day and go home at night. A few, on 24-hour duty, live at the homes where they are employed. The earnings of those who are on duty only during the daytime hours are roughly estimated at $1.25 to $2 an hour.

Salaries of licensed practical nurses employed by public health agencies averaged $3,757 a year in 1963. In the Federal Government, the salaries of practical nurses employed in Veterans Administration hospitals early in 1965 ranged from $4,005 a year for beginners to a maximum of $6,485 for experienced workers with several years of Federal service.

Where To Go for More Information

Information about approved schools of practical nursing is available from State practical nursing associations and from the State board of nursing at each State capital. A list of State-approved training programs and information about the occupation of practical nurse may also be obtained from:

National League for Nursing, Inc., Committee on Careers,
10 Columbus Circle, New York, N.Y. 10019.

National Association for Practical Nurse Education and Service, Inc.,
535 Fifth Ave., New York, N.Y. 10017.

National Federation of Licensed Practical Nurses, Inc.,
250 West 57th St., New York, N.Y. 10019.

American Nurses Association,
10 Columbus Circle, New York, N.Y. 10019.

Information about employment opportunities in United States Veterans Administration hospitals may be obtained from:

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

Medical Record Librarians

(2d ed. D.O.T. 0-23.25)
(3d ed. D.O.T. 100.388)

Nature of Work

Medical record librarians plan, prepare, maintain, and analyze records and reports on patients' illnesses and treatments. They assist medical staff members in research projects; develop auxiliary records (such as indexes of physicians, diseases treated, and operations performed); compile statistics, especially those pertaining to services given patients; make summaries or "abstracts" of medical records; develop systems for preserving medical records; and direct the activities of the medical record department.

Computers are becoming increasingly important in work of medical record librarians.

The size and type of institution employing medical record librarians will affect the duties and amount of responsibility assigned to these workers. In large hospitals, chief medical record librarians supervise other medical record librarians, medical record technicians, and clerical workers. They usually represent their department at hospital staff meetings, and may be called to testify in court actions involving medical records. In small hospitals, they may be the only employee in the medical record department, and may perform clerical as well as professional duties.

Medical record librarians prepare the records that contain medical and surgical information on each patient, including history of illnesses, physical examination findings, doctors' orders and progress notes, nurses' notes, and reports on X-rays and laboratory findings. These records are used for research, insurance claims, legal actions, evaluation of treatment and medications prescribed, and for instruction in the training of medical, nursing, and related personnel. The medical information found in hospital records is also useful in planning community health centers and programs.

Medical record librarians should not be confused with the medical librarians who work chiefly with books, periodicals, and other publications. (See statement on Librarians.)

Where Employed

It is estimated that over 9,000 medical record librarians were employed in 1965. Of these, about 3,500 were Registered Record Librarians, according to the American Association of Medical Record Librarians. In addition, over 23,000 other medical record personnel were working in this field. Most of the librarians were employed in hospitals; the remainder worked in clinics, medical research centers, the medical departments of insurance companies and industrial firms, and in local and State health departments. Of those who worked in hospitals, about three-fourths were located in general hospitals and the rest in specialized hospitals. Although most medical record librarians are women, the number of men in the occupation is growing.

Training, Other Qualifications, and Advancement

Thirty schools approved by the American Medical Association in 1965 offered training in medical record library science. These schools are located in colleges and universities, and in hospitals. The specialized academic training program, about 1 year in length, has about the same curriculum wherever offered, but prerequisites range from 2 to 4 years of college-level work, the latter now being preferred more and more frequently. A certificate is granted upon completion of the 1-year specialized training, except when it has been taken for credit as part of a 4-year undergraduate program leading to a bachelor's degree in medical record science.

The specialized curriculum includes both theoretical instruction and practical experience. The required courses include anatomy, physiology, fundamentals of medical science, medical terminology, medical record science, and ethics. Practical experience involves hospital admitting and discharging procedures; standard indexing and coding practices; compilation of statistical reports; analysis of medical data from clinical records; and knowledge of medical record systems for the X-ray, pathology, outpatient, and other hospital departments.

Graduates of approved schools in medical record science are eligible for the national registra-

tion examination, given by the American Association of Medical Record Librarians. Upon passing this examination, they receive professional recognition as Registered Record Librarians.

Medical record librarians must be accurate, meticulous, interested in detail, and willing to persist in obtaining data. Because the information is of a confidential nature, they must be especially discreet in processing and releasing it. They should be able to maintain accuracy despite pressure, since the work is exacting and yet subject to frequent interruption. Those in administrative and supervisory positions must be able to work effectively with other hospital personnel.

Medical record librarians may advance to supervisory or administrative positions. They may be promoted to chief of a single department or become the coordinator of medical record departments of several hospitals.

Employment Outlook

Opportunities for medical record librarians are expected to be very good through the mid-1970's. For many years, shortages of registered librarians have been reported despite the increase in newly trained persons. The shortage was so great in 1965 that many hospitals were unable to hire registered personnel, and the American Association of Medical Record Librarians estimated that 3,000–4,000 more Registered Record Librarians were needed. Because of this shortage, many opportunities exist for high school graduates to become medical record technicians who assist the librarians.

The increasing number of hospitals and the volume and complexity of hospital records will contribute to a growing demand for medical record librarians over the longrun. The importance of medical records will continue to grow rapidly, owing partly to the increased demand for clinical data necessary for research on diseases, on the use of new drugs, and other methods of treatment. Special interest in the aged may necessitate recording data on the conditions of persons in nursing homes and home care programs. More consultants and group supervisors will also be needed to help standardize records in areas where medical record librarians are not available. Replacement needs will probably remain high as many young women leave the field for marriage and family responsibilities.

Earnings and Working Conditions

The salaries of medical record librarians are influenced by the location, size, and type of employing agency, as well as by the duties and responsibility of the position held. Average weekly salaries ranged from $95 to $112, according to a survey of hospital employees in 15 metropolitan areas in mid-1963.

The average salary for chief medical record librarians (registered) in 1964 was estimated by the American Association of Medical Record Librarians to be $5,600 a year. Those with the bachelor's degree in medical record science from an approved school earned, on the average, about $300 more a year than graduates of schools that did not offer such degrees.

Newly graduated medical record librarians employed by the Federal Government started at $5,000 a year in early 1965. Annual salaries of experienced medical record librarians in the Federal Government generally ranged between $6,000 and $7,500.

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

Where To Go for More Information

Information about approved schools and employment opportunities may be obtained from:

The American Association of Medical Record Librarians,
840 North Lake Shore Dr., Chicago, Ill. 60611.

Medical Technologists

(2d ed. D.O.T. 0–50.01)
(3d ed. D.O.T. 078.281 and .381)

Nature of Work

Laboratory tests play an important part in the detection, diagnosis, and treatment of disease. Medical technologists perform these tests under the direction of a pathologist (a physician who specializes in diagnosing the causes and nature of

disease) or a scientist specializing in a clinical science.

The tests performed by medical technologists may include tests for blood count and blood cholestorol level, and skin tests. Other body fluid and tissue samples may be examined microscopically; cultured to determine the presence of bacteria, fungus, or other organisms; and analyzed for chemical content or reaction. Technologists type and cross-match blood samples; determine blood coagulation time and sedimentation rates; measure basal metabolism; and analyze water, food products, or other materials for bacteria. Medical technologists prepare slides from tissue specimens for study of cellular structure.

Technologists who work in small laboratories often perform many types of tests. Those employed in large laboratories usually specialize in making several kinds of related tests in areas such as bacteriology, parasitology, biochemistry, microbiology, blood banking, hematology (the study of blood cells), histology (tissue preparation and examination), virology (the study of viruses), cytology (analysis of body cells), and nuclear medical technology (the use of radioactive isotopes to help detect diseases).

Most medical technologists conduct tests connected with the examination and treatment of patients. Some do research on new drugs or on the improvement of laboratory techniques; others teach or perform administrative duties.

Medical technologist searches tissue sample for diseased cells.

The occupation of the medical technologist should not be confused with that of the medical technician or laboratory assistant. This statement does not include these workers, who usually assist the medical technologist by performing simple, routine tests and related work that can be learned in a relatively short time.

Where Employed

It is estimated that about 35,000 medical technologists were employed in early 1965, and about 9 out of 10 were women. In recent years, however, the number of men in the field has been increasing. The great majority of all medical technologists work in hospitals; most of the others are employed by laboratories, public health agencies, research institutions, and pharmaceutical manufacturers.

The Federal Government is the largest single employer of medical technologists. In 1965, about 1,000 were employed in the hospitals and laboratories of the Veterans Administration, U.S. Public Health Service, and the Army, Navy, and Air Force.

Training, Other Qualifications, and Advancement

The usual minimum educational requirement for beginning medical technologists is the completion of a specialized training program in medical technology. Such training is given in 800 hospitals, of which over 600 are affiliated with colleges and universities. For entrance to programs approved by the American Medical Association, the prospective technologist must complete 3 years of undergraduate work, including courses in chemistry, biology, and mathematics. A few schools require a bachelor's degree for entry into the program. The training usually requires 12 months of study and includes extensive laboratory work. A bachelor's degree is often awarded upon completion of the college affiliated program. Eight universities also offer advanced degrees in medical technology for those who plan to specialize in teaching, administration, or research.

Graduates of AMA-approved schools may take an examination to qualify for certification by the Registry of Medical Technologists of the American Society of Clinical Pathologists (ASCP). Technologists registered by the ASCP are preferred by many employers, especially in large hos-

pitals and research laboratories. In four States—Alabama, California, Florida, and Hawaii—medical technologists must also be licensed by the appropriate State agency.

Promotion may be to supervisory positions in certain areas of laboratory work or, after several years' experience, to the position of chief medical technologist in a large hospital. Graduate education, in one of the biological sciences or chemistry, may be required for advancement in research laboratories.

Personal characteristics important for medical laboratory work include accuracy, patience, dependability, and the ability to work under pressure. Manual dexterity and good eyesight (with or without glasses) are essential.

Employment Outlook

Employment opportunities for medical technologists are expected to remain excellent through the mid-1970's. New graduates with a bachelor's degree in medical technology will be sought by employers to fill entry positions in hospitals. A particularly strong demand is anticipated for technologists with graduate training in biochemistry, bacteriology, immunology, and virology.

Employment opportunities for medical technologists are expected to expand as physicians increasingly depend upon laboratory tests in routine physical checkups as well as in the diagnosis and treatment of disease. Also, the construction of additional hospital and medical facilities will increase demand. Other factors affecting growth in this field are the increasing complexity of laboratory work, and the development of new drugs and techniques. Newly developed automated equipment is not expected to affect materially the demand for highly qualified medical technologists as these machines require well-trained persons to operate them.

Replacement needs are likely to continue to be high because many workers in this field are young women who may leave their jobs for marriage and family responsibilities. Many opportunities for part-time employment are also likely to continue to be available.

Earnings and Working Conditions

The average (median) annual salary for registered medical technologists was $5,190 in 1963, according to a survey conducted by the National Committee for Careers in Medical Technology; those with graduate degrees had an average annual salary of $6,300. Salaries varied by employer and location of employment.

Average weekly salaries of women medical technologists employed by private and non-Federal Government hospitals in metropolitan areas in mid-1963 ranged from $87 in the Northeast to $109.50 in the West. Men usually received slightly higher salaries. In general, higher salaries were paid by government hospitals than by private hospitals in the same areas.

Newly graduated medical technologists employed by the Federal Government in early 1965 received a salary of $5,000 a year. Most experienced technologists in Federal Government agencies earned annual salaries of between $6,050 and $7,900.

The average workweek of medical technologists is 40 hours, and they generally are covered by vacation and sick leave benefits; some are covered by retirement plans.

The laboratories in which medical technologists work are usually well-lighted and clean, although unpleasant odors and specimens of many kinds of diseased tissue are often present. Few hazards exist in the laboratories using proper methods of sterilization and handling of specimens, materials, and equipment. If proper care is exercised, there is no danger of medical technologists being cut by laboratory instruments and glassware, or burned by chemicals.

Where To Go for More Information

Information about employment opportunities, as well as costs and entrance requirements of AMA-approved schools of medical technology, may be obtained from:

American Society of Medical Technologists,
Suite 25, Hermann Professional Bldg.,
Houston, Tex. 77025.

Registry of Medical Technologists of the American Society of Clinical Pathologists,
P.O. Box 44, Muncie, Ind. 47344.

Information about employment opportunities in Veterans Administration hospitals may be obtained from the individual hospitals or the Department of Medicine and Surgery, Veterans Administration, Washington, D.C., 20421.

Medical X-Ray Technicians

(2d ed. D.O.T. 0–50.04)

(3d ed. D.O.T. 078.368)

Nature of Work

Medical X-rays play a major role in the diagnostic and therapeutic field of medicine. Medical X-ray technicians—also called medical X-ray technologists—operate X-ray equipment under the direction of physicians who are usually radiologists (specialists in the use of X-rays).

Most technicians perform diagnostic work, using X-ray equipment to take pictures of internal parts of the body which the doctor wishes to examine. They may prepare a prescribed X-ray "opaque," such as barium salts, which the patient swallows in order to shade various organs to provide proper visibility in the X-ray picture. To prepare patients for X-ray, technicians position them between the X-ray tube and the film and cover body areas not to be exposed to the rays with a protective lead plate. When necessary, they set up or adjust devices to prevent the patient from moving. After determining the proper voltage, current, and desired exposure time, the technician operates the controls to obtain the pictures for interpretation by the physician.

Medical X-ray technologist performs a special operating room procedure.

Other technicians perform therapeutic X-ray work. They regulate special X-ray equipment used for treatment of diseases (for example, certain types of cancer). After placing the patient in the proper position, these technicians operate the equipment from an adjoining room. They may also assist radiologists by preparing radium and other radioactive materials. Some technicians are qualified to perform duties involved in both diagnostic and therapeutic X-ray work.

Medical X-ray technicians keep equipment in good working order by cleaning and making minor repairs. Other duties include processing film and keeping records of services performed for patients. Some X-ray technicians operate special equipment such as that used in diagnosing heart disease or brain damage.

Where Employed

More than one-fourth of the approximately 70,000 X-ray technicians employed in early 1965 worked in hospitals. Most of the remainder worked in medical laboratories, physicians' and dentists' offices or clinics, Federal and State health agencies, and for school systems.

Most technicians work in or near large cities where medical facilities and services are concentrated. However, some are employed in hospitals and clinics in small towns or rural areas. A few work as members of small mobile X-ray teams, engaged mainly in tuberculosis detection.

About three-fourths of all X-ray technicians are women, although the number of men in the field has increased in recent years.

Trainin Other Qualifications, and Advancement

Training programs in X-ray technology are conducted by hospitals or by medical schools affiliated with hospitals. In 1964, 789 schools of X-ray technology were approved by the American Medical Association (AMA). A program in X-ray technology usually takes 24 months to complete. A few schools offer 3- or 4-year programs and 20 schools award the bachelor's degree. Also, some junior colleges coordinate academic train-

ing with work experience in hospitals in 3-year X-ray technician programs and offer an Associate of Arts degree.

In addition to training programs in approved hospital schools, some courses in X-ray technology are offered by vocational or technical schools. Training also may be obtained in the military service, or through on-the-job experience under the supervision of a radiologist.

All of the approved schools require that applicants be high school graduates, and a few require 1 or 2 years of college or graduation from a nursing school. High school courses in mathematics, physics, chemistry, biology, and typing are desirable. Preference is generally given to applicants between the ages of 18 and 35.

The program in X-ray technology usually includes courses in anatomy and physiology, nursing procedures, physics, radiation protection, darkroom chemistry, principles of radiographic exposure, X-ray therapy, radiographic positioning, medical ethics, department administration, and the operation and maintenance of equipment.

Registration with the American Registry of Radiologic Technologists is an asset in obtaining highly skilled and specialized positions. Registration requirements, effective July 1, 1966, are to include graduation from an approved school of medical X-ray technology and the satisfactory completion of an examination. After registration, the title "Registered Technologist, R.T. (ARRT)" may be used.

Some technicians employed in large X-ray departments may be advanced to the job of chief X-ray technician as openings occur, and may also qualify as instructors in X-ray techniques.

Good health and stamina are important qualifications for this field. Because of the possible exposure to radiation, people with a tendency toward anemia should avoid working with X-ray equipment, being relatively more susceptible to adverse effects of X-rays.

Employment Outlook

Employment opportunities for medical X-ray technicians are expected to remain excellent through the mid-1970's. In 1964, for example, the American Society of Radiologic Technologists reported that the demand for technicians was much greater than the number of persons who had completed approved courses. This situation is likely to persist during the next decade.

The increasing use of X-ray equipment in the diagnosis and treatment of disease, and the continuing expansion of this use are the leading factors in the expected very rapid growth of employment opportunities. In addition, more workers will be needed to help administer radiotherapy, as new knowledge of the medical benefits of radioactive material becomes more widespread. Routine X-raying of large groups of people will be extended as part of disease prevention and control programs. For example, many employers now demand that chest X-rays be taken of all employees, and most insurance companies include a chest X-ray as part of the physical examination required for an insurance policy.

In addition to the medical X-ray technologists needed for new jobs, replacement demands will probably be high because of the large number of women who leave their jobs each year for marriage or family responsibilities.

Along with the increase in demand, an increase is also expected in the number of persons graduating from medical X-ray technology training programs. Nevertheless, the demand for technologists is expected to be far greater than the number of graduates available for employment. Thus, for graduates and trained women who have left the field and want to return to work part time, opportunities should be excellent through the mid-1970's.

Earnings and Working Conditions

Average salaries of medical X-ray technicians ranged from $76.50 a week in the South to $91.50 in the West, according to a survey of all hospitals in mid-1963. The weekly salaries of chief X-ray technicians averaged about $116. At all levels, men generally received higher average salaries than women.

New graduates of AMA-approved schools of X-ray technology, or X-ray technicians with 1 year of general and 1 year of specialized experience, were employed by the Federal Government at an annual salary of $4,480 in early 1965; those with no experience or specialized training, but who had passed an aptitude test, received $3,680 per year.

Full-time technicians generally work 8 hours a day, 40 hours a week, but may be "on call" for some night or emergency duty. Most are covered by the same vacation and sick leave provisions as other workers in the same organization.

Care must be taken to protect medical X-ray technicians from the potential hazards of radiation exposure. Precautionary measures include the use of safety devices such as individual instruments that measure radiation, lead aprons, rubber gloves, and other shieldings.

Where To Go for More Information

The American Society of Radiologic Technologists, 537 South Main St., Fond du Lac, Wis. 54935.

The American Registry of Radiologic Technologists, 2600 Wayzata Blvd., Minneapolis, Minn. 55405.

Occupational Therapists

(2d ed. D.O.T. 0–32.04)
(3d ed. D.O.T. 079.128)

Nature of Work

Occupational therapists, guided by physicians' instructions, select and direct educational, vocational, and recreational activities designed to help mentally and physically disabled patients become self-sufficient. They work as members of a medical team which, in addition to physicians, may include physical therapists, speech therapists, nurses, social workers, and other specialists.

The rehabilitation goals of the treatment set for a patient may include regaining physical, mental, or emotional stability; combating boredom during a long-term illness; developing maximum self-sufficiency in the routine of daily living (such as eating, dressing, writing, and using a telephone); and, in the latter stage of treatment, performing jobs in a practical work situation for eventual return to employment.

As part of the treatment program, occupational therapists teach manual and creative skills such as weaving, clay modeling, and leather-working, as well as business and industrial skills such as typing, operating some business machines, and using power tools. Therapists may design and make special equipment or splints to aid some disabled patients in performing their activities. Other duties may include supervising student therapists, occupational therapy assistants, volunteer workers, and auxiliary nursing workers.

About half of the total number of occupational therapists work with emotionally handicapped patients, and the rest with persons having physical disabilities. These patients are of all ages, with varying diagnoses. The chief occupational therapist in a hospital may teach medical and nursing students the principles of occupational therapy. Many occupational therapists have administrative duties such as directing occupational therapy programs, coordinating patient activities, or acting as consultants to local and State health departments and mental health authorities. Some occupational therapists are faculty members at colleges and universities offering programs in occupational therapy.

Where Employed

About 8,000 occupational therapists were employed in 1965—over 7,000 were registered with the American Occupational Therapy Association. Although most occupational therapists are women, an increasing number of men have been entering the field in recent years.

Courtesy of the National Institutes of Health

Occupational therapist helps a child through play therapy.

The great majority of all occupational therapists work in hospitals, rehabilitation centers, homes for the aged, nursing homes, schools, outpatient clinics, and research centers. Some are employed in special workshops, sanitariums, camps for handicapped children, and in State health departments. Others are employed in home-visiting programs for patients unable to attend clinics or workshops. A number are members of the Armed Forces.

Training, Other Qualifications, and Advancement

The usual minimum requirement for entry into the profession is a degree in occupational therapy awarded by a college or university. In 1964, 31 colleges and universities in the United States offered programs in occupational therapy which were accredited by the American Medical Association and the American Occupational Therapy Association. Nearly all of these schools offer 4-year programs to high school graduates, and the rest offer 2-year programs to students who have completed 2 years of college. About half of the schools also offer shorter programs to students with a bachelor's degree in another field—with courses in the physical, biological, and behavioral sciences—which lead to a certificate in occupational therapy.

The academic work in a 4-year program emphasizes sciences and the application of skills. To qualify for professional registration, 9 to 10 months of supervised clinical experience in hospitals or health agencies is also required. Some programs give the clinical practice during the summer or during part of the senior year. The Armed Forces offer programs whereby graduates of approved schools of occupational therapy, who meet the requirements to become commissioned officers, may receive the clinical part of their training while in the service.

Upon graduation and the completion of the clinical practice period, therapists are eligible to take the examination given by the American Occupational Therapy Association. Those who pass this examination may use the initials O.T.R. (Occupational Therapist Registered).

Five universities offer a program leading to a master's degree in occupational therapy. A graduate degree is often required for teaching, research, or administrative work.

Newly graduated occupational therapists usually begin as staff therapists. After several years on the job they may qualify as senior therapists. Experienced therapists may become directors of occupational therapy programs in large hospitals or clinics, or may become teachers. Some high-level positions are also available as program coordinators and as consultants with large institutions and agencies.

Personal qualifications needed in this profession include emotional stability, a sincere interest in helping people, and a sympathetic but objective approach to illness and disability. Manual dexterity, ingenuity, and imagination are also needed.

Employment Outlook

Employment opportunities for occupational therapists are expected to be excellent through the mid-1970's. Despite the anticipated increase in the number of graduates of occupational therapy programs, the demand for therapists is expected to remain greater than the supply as public interest in the rehabilitation of disabled persons and the success of established occupational therapy programs increase. Many occupational therapists will probably be needed to staff the growing number of community health centers that may be built with funds provided by the Mental Retardation Facilities and Community Mental Health Centers Construction Act of 1963. There will be numerous opportunities for work with psychiatric patients, children, and aged persons, as well as with persons suffering from cerebral palsy, tuberculosis, and heart disease. In addition, many openings will arise because of the need to replace the high proportion of young women who leave the field for marriage and family responsibilities.

Although hospitals and other employers prefer to hire registered occupational therapists, some opportunities will continue to be available for therapists who are not registered but have some of the required training and skills. Opportunities for experienced women who wish to return to work part time after rearing their children should be excellent.

Earnings and Working Conditions

Average annual salaries of staff occupational therapists ranged from $5,000 to $10,000 in 1964,

according to the limited data available. Directors of services, coordinators, consultants, and others in top administrative positions earned annual salaries up to $14,000 in 1964.

In the Federal Government, the beginning annual salary for an occupational therapist without experience was $5,505 in early 1965. More than one-third of all occupational therapists in the Federal Government earned $7,220 or more a year.

Most occupational therapists work an 8-hour day, 40-hour week, with some evening work required in a few organizations. Vacation leave usually ranges from 2 to 4 weeks a year, and many positions offer health and retirement benefits.

Where To Go for More Information

American Occupational Therapy Association. 250 West 57th St., New York, N.Y. 10019.

Optometrists

(2d ed. D.O.T. 0–39.92)
(3d ed. D.O.T. 079.108)

Nature of Work

Optometrists help people improve and protect their vision. They examine eyes, make tests to determine defects in vision, and, when needed, prescribe eyeglasses, contact lenses, corrective eye exercises, or other treatment that does not require drugs or surgery. Most optometrists supply their patients with the eyeglasses prescribed, and sometimes do minor repair work such as straightening eyeglass frames. Some optometrists specialize in work such as fitting partially sighted persons with telescopic spectacles, studying the relationship of vision to highway safety, and analyzing lighting and other conditions that affect the efficiency of workers in industry or business. A few are engaged primarily in teaching, research, or a combination of the two.

Optometrists should not be confused with opthalmologists, sometimes referred to as oculists, or dispensing opticians. Opthalmologists or oculists are physicians who specialize in the medical and surgical care of the eyes and may prescribe drugs or other treatment, as well as lenses. Dispensing opticians fit and adjust eyeglasses according to prescriptions written by opthalmologists or optometrists; they do not examine eyes or prescribe treatment. (See statement on Dispensing Opticians.)

Where Employed

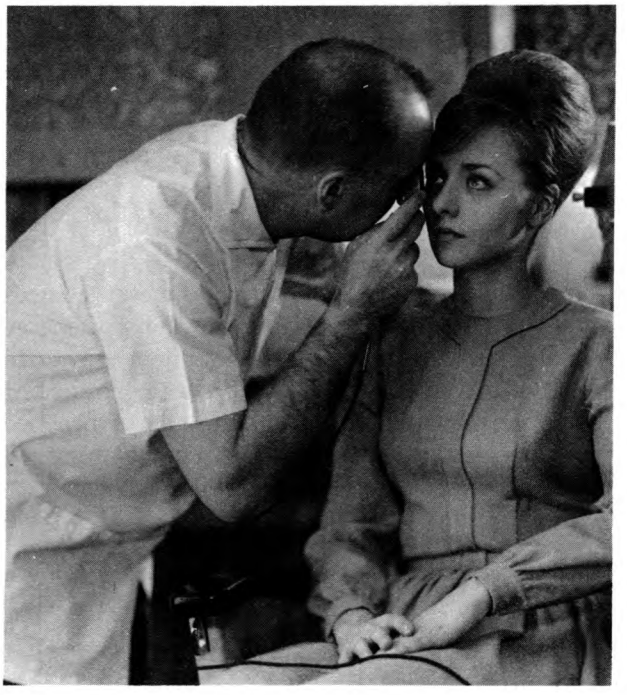
Approximately 17,000 optometrists were employed in the United States in 1965. About four-fifths of all optometrists were self-employed. Of the remainder, most worked for established practitioners, health clinics, hospitals, optical instrument manufacturers, or government agencies. A few taught in colleges of optometry or served as optometrists in the Armed Forces.

Optometrists are located chiefly in large cities and industrial areas, where many people are engaged in office work or other occupations that tend to create or emphasize vision problems. About 40 percent of the total are found in five States—California, New York, Illinois, Pennsylvania, and Ohio. Many small towns and rural areas, especially in the South, have no optometrists.

Training, Other Qualifications, and Advancement

A license is required to practice optometry in all States and the District of Columbia. Applicants for licenses must be graduates of an accredited school of optometry and pass a State board examination. In some States, only graduates of certain schools of optometry are admitted to these examinations. A student planning to become an optometrist should, therefore, choose a school approved by the Board of Optometry in the State where he expects to practice. There were 10 schools of optometry in the country in 1965. Applicants with the necessary qualifications have an excellent chance for admission to these schools.

At least 5 years of college are needed to become an optometrist. The usual requirement is 2 years of preoptometry education in an approved college, followed by 3 years of training in an optometry school. However, completion of a 4-year course is required by some optometry schools after



Optometrist uses ophthalmoscope to detect possible abnormal eye conditions.

the 2 years of preoptometry study. Preoptometry courses include mathematics, physics, biology, and chemistry, as well as English and other liberal arts courses. Students in schools of optometry have classroom and laboratory work, as well as an opportunity to gain professional experience in the out-patient clinics run by the schools. Most schools award the degree of Doctor of Optometry (O.D.), but some confer the degree of Bachelor of Science in Optometry. Federal legislation approved in the fall of 1964 provides for loans from Federal funds to help needy students pursue full-time study leading to a degree in optometry. Optometrists who wish to specialize often take graduate training. A master's or Ph. D. degree in physiological optics, or in a related field, is usually required for teaching and research work.

A prospective optometrist should have a liking for mathematical and scientific work, the ability to use delicate precision instruments, mechanical aptitude, and good vision. In addition, to become a successful practitioner, he must be able to deal with people tactfully.

Many beginning optometrists either set up a new practice or purchase an established one. Some start as salaried optometrists to obtain experience and the necessary funds to establish their own practice.

Employment Outlook

Employment opportunities for new optometry graduates are expected to remain favorable through the mid-1970's. The demand for optometric services is expected to increase, but the number of new graduates will probably be little more than the number needed to fill the vacancies as optometrists retire, die, or stop practicing for other reasons.

Opportunities to set up a new practice will be best generally in small towns and in residential areas of cities, where the new optometrist can become known easily and where competition is not as keen as in large business centers. Communities, especially in the South, that have no optometric services available will also offer opportunities for new graduates. A good office location is of major importance for a successful practice. The optometrist should consider the number of optometrists and medical eye specialists in the vicinity in relation to the size, occupations, age, and income level of the population in the area.

Among the factors underlying the expected increase in demand for eye care services are a growing population with a larger proportion of older people and white-collar workers, the groups most likely to need glasses; the wider recognition of the importance of good vision for efficiency at work and in school; and the greater acceptance of the use of eyeglasses and contact lenses to counteract eye strain and visual defects. Although expanded demand will be met in part by medical doctors who are eye specialists, optometrists will continue to supply a substantial proportion of all eye-care services.

Women optometrists, who constitute about 5 percent of the profession, have many opportunities to work as salaried assistants in the field of visual training. Those in private practice have been particularly successful in work with children.

Earnings and Working Conditions

New optometry graduates who go into practice for themselves generally have a low income dur-

ing the first few years. They usually earn less than new optometrists who take salaried positions. After a few years of experience, the situation is likely to be reversed since the income of independent practitioners may exceed the earnings of salaried optometrists.

In 1965, new optometry graduates in salaried positions generally earned between $6,000 and $6,500 a year, according to the limited data available. Experienced optometrists had annual net incomes between $8,000 and $20,000, depending on their location, specializations, and other factors; the self-employed generally had highest incomes.

Working hours in this profession are usually regular. Since the work is not strenuous, optometrists can often continue to practice after the normal retirement age.

Where To Go for More Information

Additional information on optometry as a career is available from:

American Optometric Association,
7000 Chippewa St., St. Louis, Mo. 63119.

Information on required preoptometry courses may be obtained by writing to the optometry school in which the prospective student wishes to enroll. The Board of Optometry in the capital of the State in which the student plans to practice will provide a list of optometry schools approved by that State, as well as licensing requirements.

Osteopathic Physicians

(2d ed. D.O.T. 0–39–96)
(3d ed. D.O.T. 071.108)

Nature of Work

Osteopathic physicians diagnose, prescribe remedies, and treat diseases of the human body, paying particular attention to impairments in the musculo-skeletal system. They emphasize manual manipulative therapy, but in most States they also use surgery, drugs, and all other accepted methods of medical care. Most osteopathic physicians are "family doctors" who engage in general practice. These physicians usually see patients in their offices, make house calls, and treat patients in osteopathic and some city and county hospitals. A few doctors of osteopathy are engaged primarily in research, teaching, or writing and editing scientific books and journals. In recent years, there has been an increase in specialization. The specialties include: Internal medicine, neurology and psychiatry, opthalmology and otorhinolaryngology, pediatrics, anesthesiology, physical medicine and rehabilitation, dermatology, obstetrics and gynecology, pathology, proctology, radiology, and surgery.

Where Employed

Nearly all of the 12,000 osteopathic physicians professionally active in the United States in early 1965 were in private practice. Less than 5 percent held full-time salaried positions, mainly in osteopathic hospitals and colleges. A few were employed by private industry or government agencies.

Osteopathic physicians are located chiefly in those States which have osteopathic hospital facilities. In 1965, about half of all osteopathic physicians were in five States: Michigan, Pennsylvania, Missouri, Ohio, and Texas. Twenty-two States and the District of Columbia each had fewer than 50 osteopathic physicians. More than half of all general practitioners are located in towns and cities with under 50,000 population; specialists, however, practice mainly in large cities.

Training and Other Qualifications

A license to practice as an osteopathic physician is required in all States. In early 1965, licensed osteopathic physicians were qualified to engage in all types of medical and surgical practice in 39 States and the District of Columbia. The remaining States limit in varying degrees the use of drugs or the type of surgery that can be performed by osteopathic physicians.

To obtain a license, a candidate must be a graduate of an approved school of osteopathy and pass a State board examination. In 21 States and the District of Columbia, the candidate must

pass an examination in the basic sciences before he is eligible to take the professional examination; 28 States and the District of Columbia also require a period of internship after graduation from osteopathic school. All States except California and Florida grant licenses, without further examination, to properly qualified osteopathic physicians already licensed by another State.

Although 3 years of preosteopathic college work is the minimum requirement for entry to schools of osteopathy, 4 years is often preferred. Osteopathic colleges require successful completion of 4 years of professional study for the degree of Doctor of Osteopathy (D.O.). Preosteopathic education must include courses in chemistry, physics, biology, and English. During the first 2 years of professional training, emphasis is placed on basic sciences such as anatomy, physiology, and pathology, and on the principles of osteopathy; the last 2 years are devoted largely to work with patients in hospitals and clinics.

After graduation, almost all doctors of osteopathy serve a 12-month internship at 1 of the 89 osteopathic hospitals which the American Osteopathic Association has approved for intern training. Those who wish to become specialists must have at least 3 years of additional training followed by 2 years of supervised practice in the specialty.

The osteopathic physician's training is very costly because of the length of time it takes to earn the degree of Doctor of Osteopathy. However, the Health Professions Educational Assistance Act of 1963 provides Federal funds for loans of up to $2,000 a year to help needy students pursue full-time study leading to the degree.

Every year, more young people apply for admission to the five approved schools of osteopathy than can be accepted. In selecting students, these colleges consider grades received in preprofessional education, scores on medical aptitude tests, and the amount of preosteopathic college work completed (in 1964, nearly three-fourths of the students entering osteopathic colleges had bachelor's degrees). The applicant's desire to serve as an osteopathic physician, rather than as a doctor trained in other schools of medicine, is a very important qualification. The colleges also give considerable weight to a favorable recommendation by an osteopathic physician familiar with the applicant's background.

Newly qualified doctors of osteopathy usually establish their own practice. A few work as assistants to experienced physicians or become associated with osteopathic hospitals. In view of the variation in State laws regulating the practice of osteopathy, the osteopathic physician should study carefully the professional and legal requirements of the State in which he plans to practice. The availability of osteopathic hospitals and clinical facilities should also be taken into account when choosing a location.

Employment Outlook

Opportunities for osteopathic physicians are expected to remain excellent through the mid-1970's. Greatest demand for their services will probably continue to be in those localities where osteopathy is a widely accepted method of treatment, such as Pennsylvania and a number of Midwestern States. Generally, prospects for beginning a successful practice are likely to be best in rural areas, small towns, and city suburbs, where the young doctor of osteopathy may encounter less competition and therefore establish his professional reputation more easily than in the centers of large cities.

The demand for the services of osteopathic physicians is expected to grow over the next 10 years because of such factors as the anticipated population growth with a larger proportion of old people; the extension of prepayment programs for hospitalization and medical care including the program for the aged provided in the Social Security Amendments of 1965; and the trend toward higher standards of health care. Furthermore, there is a likelihood of greater public acceptance of osteopathy, liberalization of certain State restrictions on the use of drugs and surgery by osteopathic physicians, and the establishment of additional osteopathic hospitals.

Despite the expected growth in demand, the employment of osteopathic physicians is expected to increase only moderately because the number of new osteopathic physicians being trained is restricted by the limited capacity of osteopathic colleges. Approximately half of all graduates expected each year through the mid-1970's probably will be needed to replace osteopathic physi-

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cians who retire, die, or leave the profession for other reasons; hence the number of new graduates will be barely sufficient to maintain the present ratio of osteopathic physicians to population. Although some expansion in osteopathic college facilities is anticipated because of recent Federal legislation, which provides Federal funds to assist in the construction of new teaching facilities for osteopathic physicians, no significant increase in graduates is expected through the mid-1970's.

Women osteopathic physicians will find good opportunities not only in private practice but also on faculties of osteopathic colleges and on the staffs of hospitals and clinics. Approximately 7 percent of all osteopathic physicians are women. Women students, however, represented only about 2 percent of the total enrollment in osteopathic colleges in 1964, although men and women are equally eligible for admission.

Earnings and Working Conditions

In osteopathy, as in many of the other health professions, incomes usually rise markedly after the first years of practice. Earnings of individual practitioners are determined mainly by such factors as ability, experience, the income level of the community served, and geographic location. The average income above business expenses of general practitioners, in 1964, ranged from $15,000 to $20,000, according to the limited data available. Specialists usually had higher incomes than general practitioners.

Many osteopathic physicians work more than 50 and 60 hours a week. Those in general practice work longer and more irregular hours than specialists.

Where To Go for More Information

Persons wishing to practice in a given State should find out about the requirements for licensure directly from the board of examiners of that State. A list of State boards, as well as general information on osteopathy as a career, may be obtained from:

American Osteopathic Association,
212 East Ohio St., Chicago, Ill. 60611.

Pharmacists

(2d ed. D.O.T. 0–25.10)
(3d ed. D.O.T. 074.081)

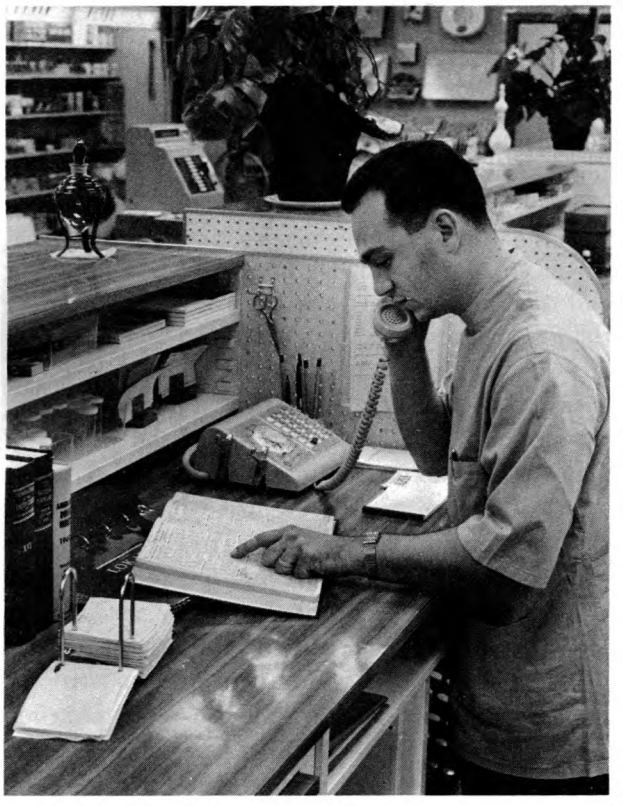
Nature of Work

Pharmacists dispense drugs and medicines and provide information on their use to help protect people's health. They fill prescriptions ordered by physicians and other medical practitioners, and sell many medicines which can be bought without prescriptions. Pharmacists must understand the composition and effects of drugs and be able to test them for purity and strength. Compounding —the actual mixing of ingredients to form powders, pills, capsules, ointments, and solutions—is only a small part of present-day pharmacists' work, since many drugs are now produced by manufacturers in the form used by the patient.

Many pharmacists in drugstores or community pharmacies have sales and managerial as well as professional duties. Besides dispensing drugs, these pharmacies may buy and sell other kinds of merchandise and hire and supervise salesclerks. Some pharmacists, however, operate prescription pharmacies which sell only drugs, medical supplies, and health accessories. Pharmacists in hospitals fill prescriptions and advise the medical staff on the selection and effects of drugs; they may also make sterile solutions, buy medical supplies, teach in schools of nursing, and perform administrative duties. Some pharmacists, employed as medical sales representatives or "detail men" by drug manufacturers and wholesalers, sell medicines to pharmacies and inform doctors, dentists, and nurses about new drugs. Others teach in colleges, perform research, supervise the manufacture of pharmaceuticals, develop new drugs, write articles for pharmaceutical journals, or do administrative work.

Where Employed

Of the 120,000 licensed pharmacists working in mid-1964, about 100,000 were in retail pharmacies.



Pharmacist consults physician about patient's medicine.

Of these retail pharmacists, approximately half owned their drugstores alone or as members of a partnership, and the other half were salaried employees. Most of the remaining pharmacists were employed by pharmaceutical manufacturers and wholesalers, or worked for hospitals. Others were civilian employees of the Federal Government, working chiefly in hospitals and clinics of the Veterans Administration and the U.S. Public Health Service. Some served as pharmacists in the Armed Forces, taught in colleges of pharmacy, or worked for State and local government agencies.

Nearly every town has at least one drugstore with one or more pharmacists in attendance. Most pharmacists, however, are employed in or near cities and in those States which have the greatest 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 most States, also have 1 year of practical experience under the supervision of a registered pharmacist. In late 1964, 24 States required that part or all of this experience be acquired after graduation. All States except California, Florida, Hawaii, and New York grant a license without an examination to properly qualified pharmacists already licensed by another State.

In 1965, there were 74 accredited colleges of pharmacy in the United States. Some of these were not filled to capacity and qualified applicants could usually expect to be accepted.

To graduate from a college of pharmacy, one must have at least 5 years of study beyond high school; two schools require 6 years. A few colleges admit students directly from high school and offer all the education necessary for graduation. Most provide 3 or 4 years of professional instruction and require all entrants to have completed their prepharmacy education in an accredited college or university. A prepharmacy curriculum usually emphasizes mathematics and basic sciences, such as chemistry and biology, but also includes courses in the humanities and social science.

The bachelor's degree in pharmacy is the minimum educational qualification for most positions in the profession. However, the master's or doctor's degree in pharmacy or a related field—such as pharmaceutical chemistry, pharmacology (study of the effects of drugs on the body), pharmacognosy (study of the drugs derived from plant or animal sources), or pharmacy administration—is usually required for research work or college teaching. Graduate study is desirable also for pharmacists planning to work in hospitals. Those interested in becoming hospital pharmacists can sometimes secure 1- or 2-year internships which combine graduate study and practical experience in a hospital pharmacy.

Prospective pharmacy students should have a good high school background in mathematics and science. Orderliness and a liking for detail are desirable qualities. In addition, for those planning to become community pharmacists, the ability to deal with people and manage a business is of special importance.

Pharmacists often begin as employees in community pharmacies. After obtaining some experi-

ence and the necessary funds, they may become owners of drugstores. A pharmacist who gains experience in a chain drugstore may advance to store manager and, later, to a higher executive position within the company. Hospital pharmacists with the necessary training and experience may be advanced to chief pharmacist, or to other administrative positions.

Employment Outlook

Most new pharmacy graduates will probably find employment readily, through the mid-1970's. From 3,500 to 4,000 openings will arise each year as pharmacists retire, die, or transfer out of the profession. These openings, together with the anticipated gradual increase in new positions for pharmacists, are expected to provide enough employment opportunities to absorb each year's graduates.

Some employment growth for pharmacists will result from the establishment of new pharmacies, particularly in residential areas or suburban shopping centers; the country's expanding population —especially the growing number of older people and children; and the rising standard of medical care. Many drugstores may hire additional pharmacists because of a trend towards shorter working hours. Continued expansion in the manufacture of pharmaceutical products and in research are expected to provide more opportunities for pharmacists, not only in production and research, but also in distribution and sales positions. Employment in hospitals will probably rise with the construction of additional facilities and the more extensive use of pharmacists for hospital work. Pharmacists with graduate education will be needed for college teaching and laboratory research.

Women, who represent about 7 percent of all pharmacists, will continue to find their best opportunities in hospital pharmacies, prescription pharmacies, and in laboratory work, although some are employed in all branches of the profession. Women students are accepted by all colleges of pharmacy, and in 1964 they constituted about 14 percent of undergraduate enrollments.

Earnings and Working Conditions

Beginning pharmacists employed in drug manufacturing firms could expect to receive salaries ranging from $6,000 to $7,000 a year in 1965, according to the limited information available. The entrance salary for newly graduated pharmacists in the Federal Civil Service was $6,050 in 1965; however, pharmacists with a year of experience could start at $7,220.

The annual salaries of experienced pharmacists working for retail pharmacies were generally between $7,000 and $10,000. Pharmacists who owned and operated drugstores generally made more than this; however, their earnings, and also to a lesser extent those of salaried pharmacists, are greatly affected by the length of their workweek, the size and geographic location of the store, and many other factors.

Retail pharmacists generally work more than the standard 40-hour workweek. Drugstores are often open in the evenings and on weekends, and all States require a registered pharmacist to be in attendance during store hours. Despite the general trend toward shorter hours, 48 hours is still the basic workweek for many salaried retail pharmacists, and some work 50 hours or more a week. Self-employed pharmacists often work more hours than those in salaried positions. Those who teach or work for industry, government agencies, or hospitals have shorter workweeks. Salaried pharmacists frequently receive paid vacations, health insurance, and other fringe benefits.

Where To Go for More Information

General information on pharmacy as a career may be obtained from:

American Pharmaceutical Association,
2215 Constitution Ave. NW., Washington, D.C. 20037.

Information about chain drug stores may be obtained from:

National Association of Chain Drug Stores,
1625 Eye Street NW., Washington, D.C. 20006.

Information about retail pharmacies may be obtained from:

National Association of Retail Druggists,
1 East Wacker Dr., Chicago, Ill. 60601.

A list of accredited colleges may be obtained from:

American Council on Pharmaceutical Education,
77 West Washington St., Chicago, Ill. 60602.

Current requirements for licensure in a particular State may be obtained from the Board of Pharmacy of that State. Information on college entrance requirements, curriculums, and scholarships is available from the dean of any college of pharmacy.

Physical Therapists

(2d ed. D.O.T. 0–52.80)
(3d ed. D.O.T. 079.878)

Nature of Work

Physical therapists help persons with muscle, nerve, joint, and bone diseases or injuries to overcome their disabilities. Following physicians' instructions, they treat patients through physical exercise, the use of mechanical apparatus, massage, and applications of heat or cold, light, water, or electricity. Most of their patients are accident victims, crippled children, and disabled older persons.

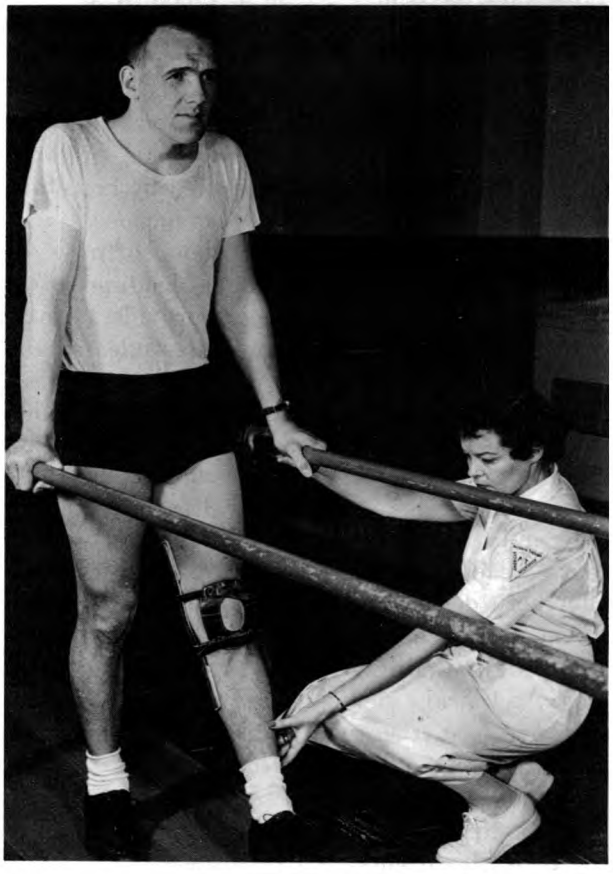
To obtain information needed to develop the proper programs for treatment, physical therapists perform muscle and nerve tests. They also keep records of their patients' progress during treatments and attend conferences with physicians and other medical personnel to discuss this progress. In many instances, they help disabled persons to accept their physical handicaps and learn how to adjust to them. Therapists teach patients how to perform exercises and to use and care for braces, crutches, and artifical limbs. They may also show members of the patients' families how to continue treatment at home.

Physical therapists are members of a rehabilitation team which is directed by a physician and may include a nurse, clinical social worker, occupational therapists, psychologist, vocational counselor, and other specialists. Although qualified physical therapists may treat many types of patients, some specialize in caring for children, or for patients with amputations, arthritis, or paralysis. They must instruct physical therapy students, as well as students of related professions and other health workers.

Where Employed

About 10,000 licensed physical therapists were employed in 1964. In addition, it is estimated that approximately 2,000 therapists were employed in States not requiring a license. Nearly 80 percent of all therapists were women.

The majority of all physical therapists work in hospitals. About half of this group are employed in private hospitals, and approximately one-fourth in State or local government hospitals. Others work in hospitals operated by the Veterans Administration and the U.S. Public Health Service. Although most therapists are employed in general hospitals, some work in hospitals that specialize in the care of pediatric, orthopedic, psychiatric, or chronically ill patients.



Courtesy of the National Institutes of Health

Physical therapist assists disabled patient.

Approximately one-fourth of all physical therapists are employed by rehabilitation or treatment centers, schools or societies for crippled children, and public health agencies. Most of these organizations provide treatment for patients with chronic diseases, and some have home visiting programs.

Some therapists work in physicians' offices or clinics, teach in schools of physical therapy, or work for research organizations. A few serve as consultants in government and voluntary agencies.

Training and Other Qualifications

A license is required to practice physical therapy in 43 States and the District of Columbia. To obtain a license, an applicant must have a degree or certificate from a school of physical therapy and pass a State board examination. In the remaining States, employers generally require a degree from a school of physical therapy. In 1964, 41 schools of physical therapy (including the Army Medical Service School) were approved by the American Medical Association and the American Physical Therapy Association. The majority of approved schools are part of large universities; the others are operated by hospitals, which usually have university affiliations.

About half of the approved schools of physical therapy offer 4-year programs leading to a bachelor's degree. Some schools provide 1- to 2-year undergraduate programs to students who have completed required courses in the biological, physical, and social sciences, and through which students may earn either a degree or a certificate in physical therapy. Other schools accept those who already have a bachelor's degree, including the required courses, and give a 12- to 24-month course leading to the certificate. Many schools offer both degree and certificate programs.

Among the courses included in a physical therapy program are: Anatomy, physiology, pathology, clinical medicine, psychology, electrotherapy, heat therapy, hydrotherapy, massage, and exercise. In addition to classroom instruction, students are assigned to a hospital or treatment center for supervised clinical experience in the care of patients.

Several universities offer the master's degree in physical therapy. A graduate degree, combined with clinical experience, increases the opportunities for advancement to positions of responsibility in teaching, research, and administration, as well as in the treatment area of physical therapy.

Because an important part of a therapist's job is to help patients and their families understand the treatments and prepare them emotionally for the changes that occur, therapists must have patience, resourcefulness, and a sympathetic attitude toward people. Their work also requires good verbal expression and the ability to plan their work to insure optimum use of time. In addition, physical therapists should have manual dexterity and physical stamina. For those who wish to determine whether they have the personal qualities needed for this occupation, summer or part-time work as a volunteer in the physical therapy department of a hospital or clinic may prove helpful.

Employment Outlook

Employment opportunities for physical therapists are expected to remain excellent through the mid-1970's. The demand for qualified physical therapists is likely to continue to exceed the supply. Although the outlook for new graduates has been favorable in recent years, schools of physical therapy have not been filled to capacity and opportunities to receive the training needed to enter the field should be very good.

Many new positions for physical therapists are expected to be created during the 1965–75 decade, as rehabilitation centers are enlarged and new ones are built to meet the demands created by the increasing number of disabled people who require physical therapy, and by the growing public interest in rehabilitating handicapped persons. Programs to aid crippled children and vocational rehabilitation activities in States that are assisted by Federal funds, and possible expansion of public health services at State and local levels, may add further to the demand for physical therapists. Also, more physicians are expected to recommend physical therapy for patients as techniques and equipment for treatment are improved. In addition, many openings will continue to arise each year to replace the large number of women who leave the profession for marriage and family responsibilities.

Part-time positions will continue to be available in many communities. These positions are particularly attractive to married women who wish to return to work on a part-time basis.

Earnings and Working Conditions

Annual salaries of inexperienced physical therapists averaged $6,000 in 1964, and those of experienced therapists ranged from $7,000 to $12,000, according to the American Physical Therapy Association. Salaries of coordinators, directors, and administrators were generally higher.

Average weekly salaries for physical therapists employed in hospitals ranged from $101.50 in the Northeast to $111 in the North Central States in mid-1963, according to a survey conducted by the Bureau of Labor Statistics. Salaries were generally higher for men in comparable jobs.

In early 1965, newly graduated therapists employed by the Federal Government received annual starting salaries of $5,505; those who were exceptionally well qualified, however, were offered $6,050. At the same time, an entrance salary of $4,610 including allowances was paid to physical therapists commissioned in the Armed Forces as second lieutenants or ensigns, and to junior assistants in the U.S. Public Health Service.

Most physical therapists work 40 hours a week. Almost all receive 2 or more weeks' vacation and the majority receive sick leave and other fringe benefits.

Where To Go for More Information

American Physical Therapy Association,
1790 Broadway, New York, N.Y. 10019.

Physicians

(2d ed. D.O.T. 0–26.10)
(3d ed. D.O.T. 070.101 and .108)

Nature of Work

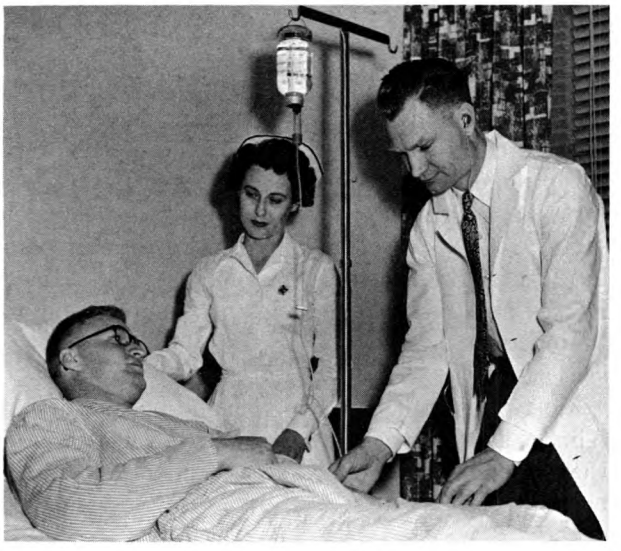
Physicians diagnose diseases and treat people who are ill or in poor health. In addition, they are concerned with preventive medicine and with the rehabilitation of people who are injured or ill.

Physicians generally examine and treat patients in their own offices and in hospitals, but they also visit patients at home when necessary. Some physicians combine the practice of medicine with research or teaching in medical schools. Others hold full-time research or teaching positions or perform administrative work in hospitals, professional associations, and other organizations. A few are primarily engaged in writing and editing medical books and magazines.

More than one-third of the physicians engaged in private practice are general practitioners; the other two-thirds are specialists in 1 of the 35 fields recognized by the medical profession. In recent years, there has been a marked trend toward specialization. Among the largest specialties are internal medicine (treating diseases of the internal organs), surgery, obstetrics and gynecology (childbirth and women's diseases), psychiatry (mental disorders), pediatrics (medical care of children), radiology (use of X-ray and other radioactive sources), ophthalmology (the eye and its diseases), and pathology (diagnosing changes in body tissues).

Where Employed

About 265,000 physicians—of whom 7 percent were women—were professionally active in the United States in mid-1964. The great majority—over 175,000—were engaged in private practice. About 35,000 were interns or residents in hospitals, and nearly 12,000 held regular positions on hospital staffs. Approximately 20,000 physicians were serving as commissioned officers in the Armed Forces or were employed in Federal Government agencies, chiefly in the hospitals and clinics of the Veterans Administration and the Public Health Service. The remainder were employed in private industry, State and local health departments, medical schools, research foundations, and professional organizations.



Courtesy of the National Institutes of Health

Physician examines patient.

In 1964, more than 40 percent of all physicians were in the five most populous States: New York, California, Pennsylvania, Illinois, and Ohio. In general, the Northeastern States have the highest ratio of physicians to population and the Southern States, the lowest. General practitioners are much more widely distributed geographically than specialists, who tend to be concentrated in large cities.

Training and Other Qualifications

A license to practice medicine is required in all States and the District of Columbia. To qualify for a license, a candidate must graduate from an approved medical school, pass a licensing examination, and—in 32 States and the District of Columbia—serve a 1-year hospital internship. As of 1964, 18 States permitted a physician to be licensed immediately after graduation from medical school, but even in these States an internship is always necessary for full acceptance by the profession. Twenty-three States and the District of Columbia require candidates to pass an examination in the basic sciences to become eligible for the medical licensing examination.

Licensing examinations are given by State boards. The National Board of Medical Examiners also gives an examination which is accepted by 43 States and the District of Columbia as a substitute for State examinations. Although physicians licensed in one State can usually obtain a license to practice in another without further examination, some States limit this reciprocity.

In 1964, there were 88 schools in the United States in which students could begin the study of medicine. Eighty-four awarded the degree of Doctor of Medicine (M.D.) to those completing the 4-year course; 3 offered 2-year programs in the basic sciences to students who could then transfer to regular medical schools for the last 2 years of study. The remaining school (set up as a 2-year institution) had not yet graduated its first class. Because the number of people applying to medical schools exceeds the beginning enrollment capacity, preference is given to the most highly qualified applicants.

Most medical schools require applicants to have completed at least 3 years of college education for admission to their regular programs, and some require 4 years. A few medical schools allow selected students with exceptional qualifications to begin their professional study after completion of 2 years of college. The great majority of students entering medical schools have a bachelor's degree.

Premedical study must include undergraduate courses in English, physics, biology, and inorganic and organic chemistry in an accredited college. Students should acquire a broad general education by taking courses in the humanities, mathematics, and the social sciences. Other factors considered by medical schools in selecting students include the individual's college record; the standing of the college where his premedical work was taken; and his scores on the Medical College Admission Test, which is taken by almost all applicants. Consideration is also given to the applicant's character, personality, and leadership qualities, as shown by personal interviews, letters of recommendation, and extracurricular activities in college. In addition, many State-supported medical schools give preference to residents of their particular States and, sometimes, those of nearby States.

The first 2 years of medical training are spent in laboratories and classrooms, learning basic medical sciences, such as anatomy, biochemistry, physiology, pharmacology, microbiology, and

pathology. During the last 2 years, students spend most of their time in hospitals and clinics under the supervision of experienced physicians. They learn to take case histories, perform examinations, and recognize diseases.

New physicians increasingly are taking training beyond the 1-year hospital internship. Those who plan to be general practitioners often spend an additional year or two as interns or residents in a hospital. To become recognized as specialists, physicians must pass specialty board examinations. To qualify for these examinations, they must spend from 2 to 4 years—depending on the specialty—in advanced hospital training as residents, followed by 2 years or more of practice in the specialty. Some doctors interested in teaching and research take graduate work leading to the master's or Ph. D. degree in a field such as biochemistry or microbiology.

Many graduates of foreign medical schools (in September 1963, 8,275 foreign citizens as well as 1,275 U.S. citizens) serve as interns and residents in this country. To be appointed to approved internships or residencies in U.S. hospitals, however, these graduates (citizens of foreign countries as well as U.S. citizens) must pass the American Medical Qualification Examination given by the Educational Council for Foreign Medical Graduates.

Medical training is very costly because of the long time required to earn the medical degree. However, the Health Professions Educational Assistance Act of 1963 provides Federal funds for loans of up to $2,000 a year to help needy students pursue full-time study leading to the degree of doctor of medicine.

Among the personal qualifications needed for success in this profession are a strong desire to become a physician, above-average intelligence, and an interest in science. In addition, prospective physicians should possess good judgment, be able to make decisions in emergencies, and be emotionally stable.

The majority of newly qualified physicians open their own offices. Those who have completed their internships and who enter on active military duty serve as captains in the Army or Air Force or as lieutenants in the Navy. Graduates of accredited medical schools are eligible for Federal Civil Service medical positions and for commissions as senior assistant surgeons in the U.S. Public Health Service.

Employment Outlook

Excellent opportunities are anticipated for physicians through the mid-1970's. Because the number of new physicians being trained is restricted by the present limited capacity of medical schools, the employment of physicians is expected to grow only moderately, despite a steady increase in the demand for their services. However, some expansion in medical school facilities is expected because of recent Federal legislation which provides Federal funds to assist in the construction of new training facilities for physicians. Nonetheless, any increase in the supply of physicians resulting from the implementation of the Act may not be significant until the late 1970's.

The expected increase in demand for physicians' services will result from factors such as the anticipated population growth and change in the age composition of the population, which will have a larger proportion of old people; the rising health consciousness of the public; and the trend toward higher standards of medical care. Extension of prepayment programs for hospitalization and medical care, including the program for the aged provided in the Social Security Amendments of 1965; continued Federal Government provision of medical care for members of the Armed Forces, their families, and veterans; and the continuing growth in the fields of public health, rehabilitation, industrial medicine, and mental health will also increase the demand for more doctors. In addition, more physicians will be needed for medical research and to teach in medical schools.

In addition to those needed to fill new openings, many newly trained doctors will be required to replace those who retire or die. The number needed to fill vacancies caused by losses to the profession is estimated to be about 6,000 each year through the mid-1970's.

To some extent, the rise in the demand for physicians' services will be offset by developments that are enabling physicians to care for more patients. For example, increasing numbers of medical technicians are assisting physicians; new drugs and new medical techniques are shortening illnesses; and growing numbers of physicians are able to use their time more effectively by engag-

ing in group practice. In addition, fewer house calls are being made by physicians because of the growing tendency to treat patients in hospitals and physicians' offices. However, these developments are not expected to offset the overall need for more physicians.

Earnings and Working Conditions

New graduates serving as interns in 1964 had an average annual salary of $3,053 in hospitals affiliated with medical schools and $3,678 in other hospitals. Residents during 1964 earned average annual salaries of $3,739 in hospitals affiliated with medical schools and $4,309 in nonaffiliated hospitals. Many hospitals also provided full or partial room, board, and other maintenance allowances to their interns and residents.

Graduates employed by the Federal Government early in 1965 could expect to receive an annual starting salary of $10,420 if they had completed their internship, and $12,075 if they had completed 1 year of residency or demonstrated superior achievement during their internship.

Newly qualified physicians who establish their own practice must make a sizable financial investment to open and equip a modern office. It is estimated that during the first year or two of independent practice, physicians probably earn little more than the minimum needed to pay the expenses for maintaining their offices. As a rule, however, their earnings rise rapidly as their practice develops.

The net income of physicians in private practice in 1963 averaged about $19,000, according to a report of the Internal Revenue Service of the U.S. Treasury Department. Earnings of physicians depend on factors such as the region of the country in which they practice; the patients' income level; and the physician's skill, personality, and professional reputation as well as his length of experience. Physicians engaged in private practice usually earn more than those in salaried positions, and specialists usually earn considerably more than general practitioners. Many physicians have a long working day and irregular hours. Most specialists work fewer hours each week than general practitioners. As doctors grow older, they may not accept new patients and tend to work fewer hours. Many, however, continue in practice well beyond 70 years of age.

Where To Go for More Information

Persons wishing to practice in a given State should find out about the requirements for licensure directly from the board of medical examiners of that State. Lists of approved medical schools, as well as general information on premedical education and medicine as a career, may be obtained from:

Council on Medical Education and Hospitals,
American Medical Association,
535 North Dearborn St., Chicago, Ill. 60610.

Association of American Medical Colleges,
2530 Ridge Ave., Evanston, Ill. 60201.

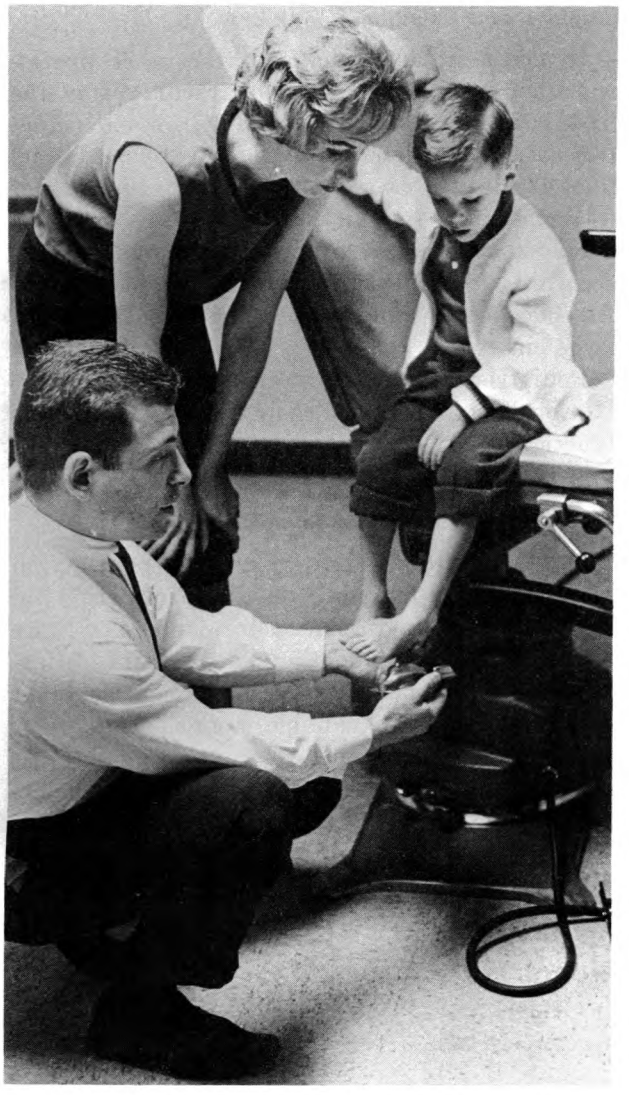
Podiatrists

(2d ed. D.O.T. 0–39.901)
(3d ed. D.O.T. 079.108)

Nature of Work

Podiatrists (sometimes called *chiropodists*) diagnose and treat diseases and deformities of the feet. They perform foot surgery, use drugs and physical therapy, prescribe proper shoes, and fit corrective devices. To help in diagnoses, they take X-rays of the feet and perform blood and other tests. Among the conditions podiatrists treat are corns, bunions, calluses, ingrown toenails, skin and nail diseases, deformed toes, and arch disabilities. They refer patients to medical doctors whenever they observe symptoms in the feet and legs that may be evidence of diseases—such as arthritis or heart or kidney trouble—which also affect other parts of the body.

As a rule, podiatrists provide most types of foot care. Some, however, confine their practice to such specialties as orthopedics (bone, muscle, and joint disorders), podopediatrics (children's diseases), or foot surgery. A few act as consultants to shoe manufacturers, and a small number do research or teach in colleges of podiatry.



Podiatrist explains to a mother the condition of her child's foot.

Where Employed

Approximately 8,000 podiatrists were actively engaged in the profession in 1964; less than 5 percent were women. Nearly all podiatrists were in private practice. The few who held full-time salaried positions worked mainly in hospitals or podiatry colleges, or for other podiatrists; others who earned salaries were employed by the Veterans Administration or were commissioned officers in the Armed Forces.

Podiatrists practice mainly in large cities. More than half were in five of the most heavily populated States—New York, Pennsylvania, Illinois, California, and Massachusetts. In many small towns and rural areas, especially in the South and the Northwest, there were no podiatrists.

Training, Other Qualifications, and Advancement

All States and the District of Columbia require a license for the practice of podiatry. To qualify for a license, an applicant must be a graduate of a college of podiatry, and must pass a State board examination. In addition, four States—Michigan, New Jersey, Rhode Island, and West Virginia—require applicants to serve a 1-year internship in a hospital or clinic after graduation from a podiatry college; the State of Oklahoma requires 1 year of practice under the direct supervision of an experienced podiatrist. More than half the States grant licenses without further examination to podiatrists already licensed by another State.

The five podiatry colleges in the United States will admit only students who have already completed at least 2 years of college. This education must include courses in English, chemistry, biology or zoology, and, in some instances, also physics or mathematics.

The first 2 years of podiatry training are devoted chiefly to classroom instruction and laboratory work in such basic sciences as anatomy, bacteriology, chemistry, pathology, and physiology, though in the second year students obtain some limited experience in the school clinics. During the final 2 years, students spend most of their time obtaining clinical experience. The degree of Doctor of Podiatry (P.D.) or Doctor of Podiatric Medicine (D.P.M.) is awarded upon graduation. Additional education and experience are generally necessary in order to qualify for work in a specialized area of podiatry.

Among the personal qualifications considered desirable for a career in this profession are scientific aptitude, manual dexterity, and a good business sense. The ability to get along well with people is also important.

Most newly licensed podiatrists open their own practices. Some purchase established practices. Others begin by taking salaried positions in hospitals, or with podiatrists already in practice,

to gain experience and to save the money needed to establish their own practices.

Employment Outlook

The employment outlook for podiatrists is expected to be good through the mid-1970's. The demand for their services is expected to increase, and the number of new graduates of podiatry schools will probably be only slightly more than the number needed to fill openings left by podiatrists who retire, die, or stop practicing for other reasons.

Opportunities for new graduates to establish their own practices should be especially favorable in those parts of the country where the services of podiatrists are widely used. Opportunities should be good also for those who wish to enter salaried positions in schools, factories, and organizations providing health services.

The demand for podiatrists' services is expected to grow with the demand for other health services. An important factor underlying this anticipated growth is an expanding population with a greater proportion of older people—the age group needing most foot care. Furthermore, the trend toward providing preventive foot care for children is increasing.

Earnings and Working Conditions

In podiatry, as in many of the other professions, incomes usually rise markedly after the first years of practice. Earnings of individual podiatrists are determined mainly by such factors as ability, experience, the income level of the community served, and location. In 1963, the averaged net income of podiatrists was $11,426, according to a survey by the American Podiatry Association. Income was generally higher in large cities.

Podiatrists generally work 40 hours a week. However, they may set their hours to suit their practice.

Where To Go for More Information

Applicants for licenses to practice podiatry in a particular State may obtain information on the requirements for licensure from the State board of examiners in the State capital. Information on entrance requirements, curriculums, and scholarships is available from the colleges of podiatry. Additional information on podiatry as a career, as well as a list of colleges, may be obtained from:

American Podiatry Association,
3301 16th St. NW., Washington, D.C. 20010.

Registered Professional Nurses

(2d ed. D.O.T. 0–33)
(3d ed. D.O.T. 075.118 through .378)

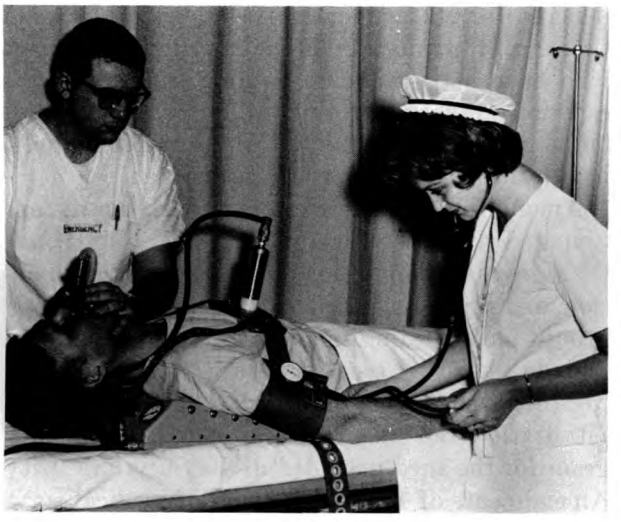
Nature of Work

Nursing care plays a major role in the treatment of persons who are ill. Registered professional nurses administer medications and treatments prescribed by physicians; observe, evaluate, and record symptoms, reactions, and progress of patients; assist in education and rehabilitation of patients and improve their physical and emotional environment; instruct auxiliary personnel or students; and perform other duties concerned with the care of the sick and injured, prevention of illness, and promotion of good health.

The largest group of professional nurses are *hospital nurses*. Most of these are general duty nurses, who perform skilled bedside nursing such as caring for a patient after an operation, assisting with blood transfusions and intravenous feedings, and giving medications. They also supervise auxiliary nursing workers. Some hospital nurses work primarily in the operating room. Others limit their work to certain types of patients such as children, the elderly, or the mentally ill. Still others are engaged primarily in administrative work.

Private duty nurses give individual nursing care to patients who need constant attention. In hospitals, one private duty nurse may sometimes take care of a few patients who require special nursing care but not full-time attention.

Office nurses assist physicians and dental surgeons, and occasionally dentists, in the care of patients in private practice or clinics. Sometimes, they perform routine laboratory and office work.



Registered professional nurse assists a staff physician in emergency room.

Public health nurses care for patients in clinics or visit them in their homes. Their duties include giving first aid treatment or periodic nursing care as prescribed by a physician, demonstrating diet plans to groups of patients, and arranging for immunizations. These nurses may work with community leaders, teachers, parents, and physicians in community health education programs. Some public health nurses work in schools.

Nurse educators teach students the principles and skills of nursing, both in the classroom and at the bedside. They may also conduct refresher and in-service courses for registered nurses.

Occupational health or *industrial nurses* provide nursing care to employees in industry and government, and along with physicians are responsible for promoting employee health. They may work alone (with a doctor on call), or they may be part of a health service staff in a large organization. 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 may also assist with health examinations and inoculations to help prevent or control diseases.

Nurses also engage in other activities such as research and serving on the staffs of nursing organizations. (Practical nurses who also perform nursing service are discussed elsewhere in the *Handbook.*)

Where Employed

More than 580,000 registered professional nurses were employed in the United States in early 1965. About two-thirds worked in hospitals and related institutions. More than 65,000 were private duty nurses who cared for patients in hospitals and private homes, and about 47,000 were office nurses. Public health nurses in government agencies, visiting nurse associations, and clinics numbered over 37,000; nurse educators in nursing schools accounted for more than 20,000; and occupational health nurses in industry nearly 19,000. More than 25,000 professional nurses were employed by the Federal Government, mainly by the Veterans Administration, and about 8,500 were serving as commissioned officers in the Armed Forces. Most of the others were staff members of professional nurse organizations or were employed by research organizations.

More than one-fifth of all nurses employed in 1964 worked on a part-time basis. About 1 percent of all employed professional nurses are men.

Training, Other Qualifications, and Advancement

A license is required to practice professional nursing in all States and in the District of Columbia. To obtain a license, a nurse must have graduated from a school approved by a State board of nursing and pass a State board examination. A nurse may be licensed in more than one State, either by examination or endorsement of a license issued by another State.

Graduation from high school is required for admission to all schools of professional nursing. Many schools accept only graduates in the upper third or half of their class. Demonstrated competence in science and mathematics may also be required.

Three types of educational programs—diploma, baccalaureate degree and associate degree—offer the basic education required for careers in professional 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 late 1964, over 1,150 programs of these three types were offered in the United States. Nearly 75 percent were diploma; over 15 percent, baccalaureate degree; and the rest, associate degree programs.

All professional nursing programs include classroom instruction and supervised nursing practice. Students take courses in anatomy, physiology, microbiology, nutrition, psychology, and basic nursing care. Under close supervision, they are given practical experience in the care of patients who have different types of illnesses, in hospitals and health facilities. Students in colleges offering bachelor's degree programs and in some of the other schools are assigned to public health agencies and learn how to care for patients in clinics and in the patients' homes. General education is combined with nursing education in baccalaureate and associate degree programs and in some diploma programs.

Young people considering a nursing career should have an interest in people and a desire to care for the sick and injured. Other personal qualifications needed are dependability, good judgment, patience, and good physical and mental health.

Hospital nursing usually begins with general duty work, from which experienced nurses may be advanced to progressively more responsible supervisory positions, such as those filled by a head nurse, supervisor, assistant director, and director of nursing service. A bachelor's degree or master's degree, however, is customarily required for supervisory and administrative positions, as well as for positions in nursing education, clinical specialization, and research. Funds to cover tuition, fees, and a stipend and allowances for trainees seeking advanced training for such positions are provided in the Nurse Training Act of 1964. In public health agencies, advancement opportunities are usually limited for nurses who do not have degrees in public health nursing.

Employment Outlook

Employment opportunities for registered professional nurses are expected to be excellent through the mid-1970's. As in recent years, the demand for professional nurses is expected to continue to be greater than the supply. For nurses who have had graduate training, the outlook is especially favorable for obtaining positions as administrators, teachers, clinical specialists, public health nurses, and for work in research.

Among the principal factors underlying the anticipated rise in the demand for nurses is the country's growing population, with a greater proportion of very young and elderly people, the age groups most needing nursing care. Other factors include improved economic status of the population; extension of prepayment programs for hospitalization and medical care, including the program for the aged provided in the Social Security Amendments of 1965; 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 number of nurses needed for new positions, several thousand nurses will be needed to replace those who leave the field each year because of marriage and family responsibilities.

The anticipated increase in demand for professional nurses is expected to be accompanied by a rapid increase in the number of nurses graduating during the late 1960's and early 1970's. This growth is expected to result from increasing numbers of high school graduates who will enter nursing schools, and from two recently enacted Federal laws—the Health Facilities Act of 1963 and the Nurse Training Act of 1964—which authorize funds for construction of nursing school facilities. Moreover, under the Nurse Training Act, a needy student may obtain a loan, a portion of which does not have to be repaid if the student obtains full time employment in nursing after graduation. In addition to the anticipated increase in the number of new graduates entering nursing each year, an increase is also expected in the number of inactive nurses who will return to work. Nevertheless, the demand for professional nurses is expected to be greater than the supply through the mid-1970's.

Earnings and Working Conditions

Average weekly salaries for various classifications of registered professional nurses employed by hospitals in metropolitan areas ranged from $86.50 for general duty nurses to $152 for direc-

tors of nursing in mid-1963, according to a survey conducted by the Bureau of Labor Statistics. Salaries were generally highest in the West and lowest in the South. Salaries for industrial nurses averaged $105.50 a week in early 1964, according to another survey conducted by the Bureau of Labor Statistics.

Fees for private duty nurses generally were between $14 and $27.50 for a basic 8-hour day in early 1965, according to the American Nursing Association (ANA). Office nurses in mid-1964 reported average (median) monthly salaries ranging from $350 for those who had less than 3 years' experience, to $397 for those who had more than 15 years of service, as indicated by the ANA.

Average annual salaries for public health nurses employed by local government agencies were $5,313 in 1964 as indicated by a National League for Nursing study. Nurse educators and administrators earned average (median) salaries of $6,000 a year in schools of professional nursing when surveyed by the ANA in late 1963.

In early 1965, the Veterans Administration offered inexperienced nurses, who had either a diploma or an associate degree, an annual salary of $5,505; and baccalaureate graduates were offered $6,050. In other Federal Government agencies, the entrance rate for nurses was $5,000 for graduates of 3-year training programs or for graduates of 2-year nursing schools who had 1 year of experience or additional nursing education. The beginning salary, in early 1965, for nurse officers (second lieutenants and ensigns) in military services was $4,610 including allowances. Those with bachelor's degrees who were commissioned in the U.S. Public Health Service received salary and allowances totaling $5,093 a year.

The majority of hospital nurses receive extra pay for work on evening or night shifts. Nearly all are provided at least 2 weeks of paid vacation after 1 year of service. Most hospital nurses receive from 5 to 13 paid holidays a year and also some type of health and retirement benefits.

Where To Go for More Information

Information on approved schools of nursing, nursing careers, Future Nurses Clubs, loans, and scholarships may be obtained from:

National League for Nursing, Committee on Careers,
10 Columbus Circle, New York, N.Y. 10019.

Information on salaries, working conditions, and employment opportunities may be obtained from:

American Nurses' Association,
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.

Sanitarians

(2d ed. D.O.T. 0–66.41)

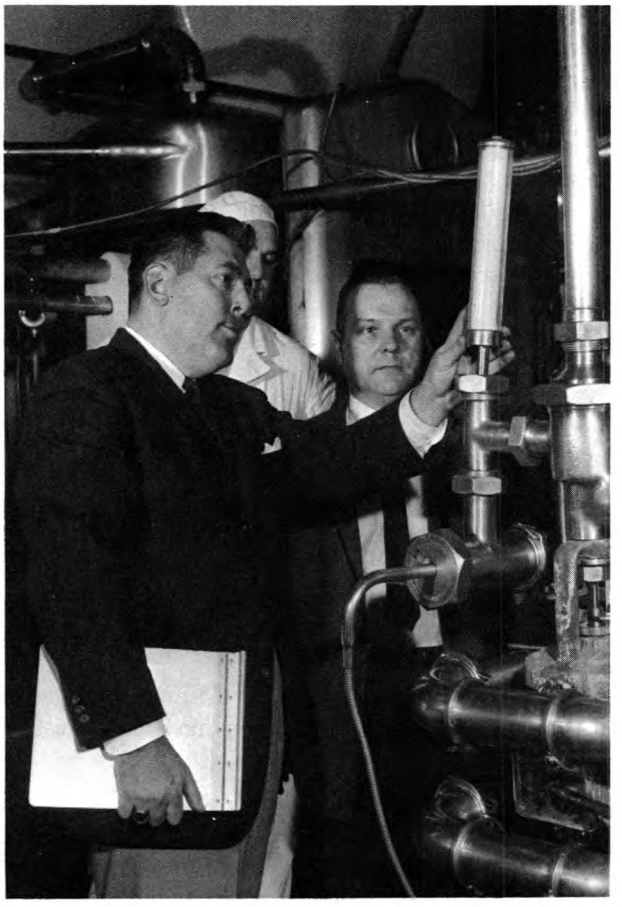
(3d ed. D.O.T. 079.118)

Nature of Work*

Most people assume that the food they eat, the liquids they drink, the public swimming pools they use, and the air they breathe, are clean and safe. The job of the sanitarian is to insure this. They find and remove health hazards in order to make the physical environment safe for everyone. In carrying out their responsibilities, they perform a broad range of job duties, from inspecting sanitary conditions in restaurants to promoting health laws and administering health programs.

Sanitarians entering the profession usually start out in public health departments. They inspect hotels, restaurants, dairy plants, canneries, water supplies, swimming pools, and other places to prevent conditions harmful to the public health and well-being, at times taking samples of food, air, and water, to test for safety. When necessary they recommend corrective action in the places visited, and try to obtain compliance with health laws and regulations. As they progress to more responsible investigational work they frequently are required to give advice on more complex individual and industrial sanitation problems.

Sanitarians with supervisory duties analyze reports of inspections and investigations made by other environmental health specialists, evaluate their performance and advise them on difficult or



Courtesy of the U.S. Public Health Service

Sanitarians examine line thermometer in milk plant.

unusual sanitation problems. They have greater responsibilities of investigation and health law promotion, and may be required to give evidence in court against violators of health regulations. Also, they engage in health education activities, sometimes teaching classes in hygiene, and speaking before student assemblies, civic groups, and other organizations on the prevention of communicable diseases. Those in top supervisory positions are involved with the planning and administration of environmental health programs and their coordination with programs of other agencies. Other duties may include advising government officials on environmental health matters and drafting new health laws and regulations.

Public health sanitarians work closely with other health specialists in the community (such as the health officer, sanitary engineer, and public health nurse) to investigate and prevent outbreaks of disease, plan for civil defense and emergency disaster aid, make public health surveys, and conduct health education programs.

In large local and State health departments, and in the Federal Government, sanitarians may specialize in a particular area of work, such as milk and other dairy products, food sanitation, refuse and other waste control, air pollution, occupational health, housing, and insect and rodent control. In rural areas and small cities, they may be responsible for a wide range of environmental health activities.

Increasing numbers of sanitarians are being employed outside government agencies. Many work in industry as food or milk sanitarians where they attempt to prevent or minimize contamination hazards, and see that clean, healthful, and safe working conditions exist in plants manufacturing and processing food. For example, in a cannery the sanitarian is concerned with the proper removal of refuse; the cleaning of plant equipment; the control of micro-organisms; and the proper maintenance of buildings, equipment, and employee facilities.

Where Employed

An estimated 10,000 of the approximately 12,000 sanitarians employed in 1965 worked for Federal, State, and local governments. Most of the remainder worked in private industry for manufacturers and processors of food products; a small number were teachers in colleges and universities; a few were consultants; others worked for trade associations, in hospitals, or for other organizations. Probably less than 1 percent of all sanitarians are women.

Sanitarians are employed by government health departments in every State, and by private industry in most States. About half of them work in 10 States: California, Florida, Illinois, Indiana, New York, Ohio, Pennsylvania, Texas, Virginia, and Wisconsin.

Training, Other Qualifications, and Advancement

A 4-year college education with a major in physical, biological, or sanitary science is generally required for a beginning job as a sanitarian, and a graduate degree in some aspect of public health is usually necessary for higher level posi-

tions. Some health departments may hire beginning sanitarians with only 2 years of college work, and, in some, high school graduates may be able to start as sanitary inspectors and work their way up to sanitarian. However, rising hiring standards in public health departments are restricting entrance opportunities for those without degrees.

Science courses recommended by the American Public Health Association for the first 2 years of college are mathematics, biology, chemistry, physics, and elementary bacteriology. In the second 2 years, the recommended program includes advanced general bacteriology, medical entomology, and a series of public health courses. The liberal arts courses are also considered useful.

Beginning sanitarians usually start at the trainee level where they remain up to a year, working under the supervision of experienced sanitarians. They receive on-the-job training in environmental health activities, and learn to evaluate facts and recommend corrective action. After a few years of experience, they may move to minor supervisory positions with more responsibilities. Greater supervisory responsibilities may come with more experience; sometimes specialization begins at this level, especially in large local health offices. With more experience, further advancement is possible to top supervisory and administrative positions.

To keep up with new developments and to supplement their academic training, many sanitarians take specialized short-term training courses in such subjects as occupational health, water supply and pollution control, air pollution, radiological health, milk and food protection, and metropolitan planning.

In 1964, 26 States had laws providing for registration of sanitarians; most of these States required registration to practice. Although requirements for registration vary considerably among the States, the minimum educational requirement for registration is usually a bachelor's degree, with emphasis on the biological, physical, and sanitary sciences. In some States, applicants must pass a written as well as an oral examination.

Among the personal qualities useful to sanitarians is the ability to get along well with people. For example, it is often necessary to be tactful in securing correction of unsanitary conditions by restaurant owners and other businessmen. Sanitarians also should be undisturbed by the collection of specimens for laboratory testing and contact with unpleasant physical surroundings, such as slum area housing or sewage disposal units.

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Employment Outlook

Good employment opportunities for beginning sanitarians will exist through the mid-1970's for young men who have a bachelor of science degree with a major in physical, biological, or sanitary science. Although it still may be possible for young people with less than a college education to get jobs in the sanitation field, it is becoming increasingly difficult for them to do so.

The employment of sanitarians is expected to increase rapidly through the rest of the 1960's and on into the 1970's, as health departments expand their activities in the field of environmental health. The areas of radiological health, occupational health, food protection, water pollution, and air pollution are expected to require the services of more trained personnel as health dangers associated with them grow under the stimulus of an expanding, highly technological civilization. Expansion, however, will be limited by the amount of funds allocated to environmental health activities by the various levels of government.

Air pollution is an example of a growing hazard and area of public concern that may increase the demand for sanitarians. It has attracted attention throughout the United States, especially in large cities where smog has become a problem. The discomfort and danger of air pollution from the exhausts of automobiles and from the fumes of industrial plants and other sources have been recognized in new Federal, State, and local legislation. The possible relation of lung cancer and other respiratory ailments to air pollution has also served to focus attention on this problem.

An expanding population will require the services of more trained sanitarians. If the present movement of people from rural to urban areas continues, along with the growth of industries, a greater strain will be placed on the food-service, housing, water, recreational, and waste-disposal facilities of urban communities. Over the long run, some increase in demand for sanitarians is expected in private industry, primarily be-

cause of the growth of the food industry—these jobs, however, will be largely for experienced sanitarians.

Earnings and Working Conditions

In 1962, the average (median) annual salary of sanitarians with college degrees was $6,350; those in the Federal Government averaged $7,890. Sanitarians without college degrees averaged $5,350. Salaries of sanitarians engaged in teaching averaged $9,540, compared with $8,590 for those employed by industry. While little current data are available, earnings have probably risen since then. For example, beginning salaries for sanitarians with college degrees employed in State health agencies increased about 8 percent between 1962 and 1964 and averaged about $5,000 in 1964.

Sanitarians spend considerable time away from their desks. Transportation or gasoline allowances are frequently given and some health departments provide an automobile.

Where To Go for More Information

Information about careers as sanitarians is available from the following associations:

American Public Health Association,
1790 Broadway, New York, N.Y. 10019.

International Association of Milk, Food, and Environmental Sanitarians,
Blue Ridge Rd., P.O. Box 437, Shelbyville, Ind. 46176.

National Association of Sanitarians,
1550 Lincoln St., Denver, Colo. 80203.

Speech Pathologists and Audiologists

(3d ed. D.O.T. 079.108)

Nature of Work

The inability to speak or hear clearly is a severe hardship to persons of all ages. Children who have difficulty speaking or hearing are usually unable to play freely with others or to participate fully in normal classroom activities. Adults suffering from speech or hearing impairments often face severe problems of job adjustment. Speech pathologists and audiologists help people suffering from such disorders by diagnosing their problems and by providing treatment. In addition, they may conduct research in the speech and hearing field. Some teach courses in speech pathology and audiology at colleges and universities.

Speech and hearing are so interrelated that, although the speech pathologist concerns himself primarily with speech disorders and the audiologist with hearing problems, to be competent in either of these occupations one must have a familiarity with both. The speech pathologist works with children and adults who have such problems as stuttering, defective articulation, brain injury, foreign dialect, cleft-palate, mental retardation, or emotional problems which are reflected in speech and voice disorders. The audiologist also works with children and adults, but he concerns himself primarily with the assessment and treatment of hearing problems such as those caused by certain otological or neurological disturbances.

The duties performed by speech pathologists and audiologists vary with their education, experience, and employment setting. In a clinical capacity, they evaluate speech and hearing disorders using various diagnostic procedures. This is followed by an organized program of therapy, with the cooperation of other specialists, such

Audiologist uses auditory training instrument to aid child with hearing loss.

as physicians, psychologists, social workers, physical therapists, counselors, and teachers. They perform research work, which may consist of investigating communicative disorders and their causes and improving methods for clinical services.

Some speech pathologists and audiologists working in colleges or universities provide instruction in the principles and bases of communication and clinical techniques. Many also participate in educational programs for physicians, nurses, teachers, and other professional personnel. In addition, they may work in university clinics and conduct research, usually at university centers.

Where Employed

In 1965 over 15,000 people were employed as speech pathologists and audiologists. Women represented a large proportion of this employment. The majority of speech pathologists and audiologists work in public school systems and clinical service centers. Colleges and universities employ the next largest number of these specialists, in classrooms and clinics. The remainder are distributed among hospitals, research centers, State and Federal government agencies, industry, and private practice. Speech pathologists and audiologists are employed in all States; however, they are concentrated where training and clinical facilities are well equipped, as in New York, California, Illinois, Ohio, Pennsylvania, and Michigan.

Training and Other Qualifications

A bachelor's degree is the minimum educational requirement for a beginning job as a speech pathologist or audiologist. However, requirements are being raised in most States and areas of employment and a master's degree is likely to become the standard entrance requirement in the future.

Undergraduate training in speech and audiology should include course work in anatomy, biology, physiology, physics, semantics, phonetics, and related areas. Some specialized course work in speech and hearing, as well as in child psychology and mental hygiene, also is helpful. This training is usually available at colleges and universities offering a broad liberal arts program.

Graduate education in speech and audiology is offered at over 100 colleges and universities. Professional preparation at the graduate level involves extensive training in the fundamental areas of speech and hearing, including anatomy and physiology, acoustics, and psychological aspects of communication; the nature of speech and hearing disorders; and the assessment, evaluation, and analysis of speech production, language abilities, and auditory processes; as well as familiarity with various research methods used in studying speech and hearing. Persons who wish to work in public schools should complete not only the education and other requirements necessary for a teacher's certificate in the State in which they wish to work, but also may have to fulfill special requirements, prescribed by some States, for people who are going to work with handicapped children.

Many scholarships, fellowships, assistantships and traineeships are available in colleges and universities; however, most of these are at the graduate level. The U.S. Vocational Rehabilitation Administration allocates funds for teaching and training grants to over 50 colleges and universities offering graduate study in the field of speech and hearing. The Veterans Administration provides funds for a predoctoral program, during which the students receive monthly payments. The Children's Bureau, the U.S. Office of Education, and the National Institutes of Health also expend funds for the training of these specialists.

Since speech pathologists and audiologists are devoted to helping people with speech and hearing handicaps, they should have an interest and liking for people and the ability to approach problems with objectivity. To work effectively with persons having speech and hearing disorders, one must be sensitive, patient, and have personal warmth and emotional stability.

Employment Outlook

Employment opportunities for well-qualified speech pathologists and audiologists are expected to be good through the mid-1970's. Individuals who have completed graduate study in speech pathology and audiology will find the best em-

ployment opportunities. Some opportunities will be available for individuals with only the bachelor's degree and some professional experience, but increasing emphasis is being placed on the master's degree as the minimum educational standard for the profession.

The present supply of qualified speech pathologists and audiologists with graduate training is inadequate. It is estimated that about 8 million persons in the Nation have speech and hearing handicaps; and that an average of about 1,400 new speech pathologists and audiologists will be needed annually through the mid-1970's to staff new and expanding programs and to replace those who leave the profession. This annual demand considerably exceeds the number of graduate students presently being trained and entering the field. Over the next few years, the supply of trained people may be augmented, as people holding only a bachelor's degree in speech pathology and audiology, as well as some personnel from related fields take graduate work.

During the remainder of the 1960's and through the mid-1970's, several factors are expected to influence demand for the services of speech pathologists and audiologists: Population growth, which will result in an increase in the absolute number of persons having speech and hearing problems; a lengthening life span, which will increase the number of persons with speech and hearing problems that are common to later life; a rapid expansion in expenditures for medical research; and the growing public interest and awareness of the serious problems connected with speech and hearing disorders.

Earnings and Working Conditions

Median earnings of speech pathologists and audiologists in colleges and universities, according to a 1963 survey, ranged from $6,700 in private institutions to $8,400 in State universities for a 9- to 10-month contract period. Median salaries may be as much as $2,000 higher for an 11- to 12-month contract. Many experienced speech pathologists and audiologists in educational institutions supplement their regular salaries with incomes from consulting, special research projects, and writing books and articles.

In early 1965, the annual starting salary for speech pathologists and audiologists employed by the Federal Government was $8,650. Applicants for positions with the Federal Government must have completed all requirements for the doctoral degree.

Most speech pathologists and audiologists work 40 hours a week; however, some personnel engaged in research may work longer hours. Almost all employment settings provide fringe benefits such as paid vacations, sick leave, and retirement programs. Working conditions are generally pleasant, although in some cases facilities may be inadequate, because the expansion of facilities may have failed to keep pace with the demands of a growing population.

Where To Go for More Information

Information on certification requirements for persons wishing to work in public schools can be obtained from the State department of education at the State capital. General career information may be obtained from:

American Speech and Hearing Association,
1001 Connecticut Ave. NW., Washington, D.C. 20036.

A list of colleges and universities that have received grants to provide traineeships at the graduate level is available from:

U.S. Department of Health, Education, and Welfare,
Washington, D.C. 20201.

Veterinarians

(2d ed. D.O.T. 0–34.10)
(3d ed. D.O.T. 073.081 through .281)

Nature of Work

Veterinarians (doctors of veterinary medicine) treat sick and injured animals. They diagnose diseases and injuries on the basis of the animal's appearance and behavior, and by taking temperatures and making tests. When necessary, veterinarians operate on animals and prescribe and administer drugs, medicines, biologicals, serums, and vaccines. Their work helps to prevent the outbreak and spread of diseases among animals. Be-

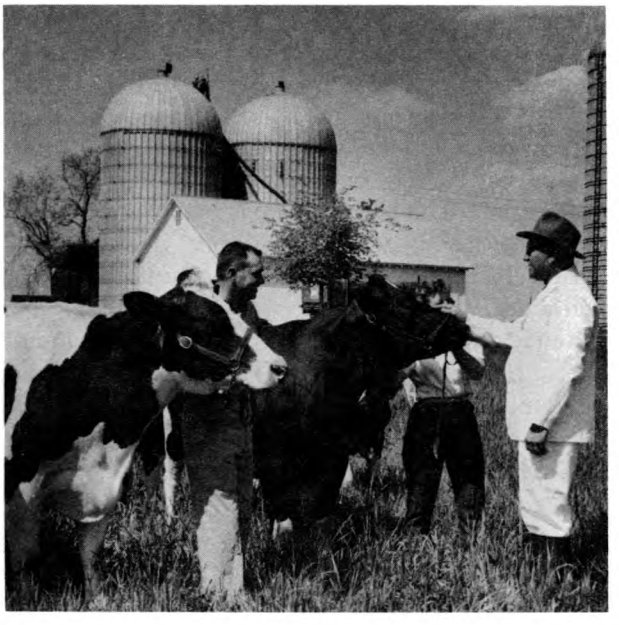
cause many animal diseases can be transmitted to people, this work is important to the public health.

Veterinarians use X-ray machines, hypodermic needles, syringes, and other medical equipment especially made for animals. They may treat animals on the farm—sometimes in open fields—or in veterinary clinics or hospitals. Veterinarians also give advice on the care and breeding of animals.

The majority of veterinarians are general practitioners. Of those who are specialists, the greatest number treat small animals, often operating hospitals with boarding facilities for dogs and cats. Some specialists treat specific kinds of animals, such as prize livestock, poultry, or thoroughbred horses. Many veterinarians inspect meat, poultry, and other foods as a part of the Federal and State public health programs. Others teach in colleges or do research related to animal diseases, drugs, and foods.

Where Employed

About 22,000 veterinarians were working in early 1965; less than 5 percent were women. More than two-thirds of all veterinarians were in private practice. The Federal Government employed about 2,200 veterinarians, chiefly in the U.S. Department of Agriculture; a few worked for the U.S. Public Health Service. About 900 veterinarians were commissioned officers in the Veterinary Corps of the Army and the Air Force. In addition, many worked for State and local government agencies and a few worked for international health agencies. Some were also employed by schools of veterinary medicine, agricultural colleges, research and development laboratories, large livestock farms, animal food companies, and pharmaceutical companies that manufacture drugs for animals.



Veterinarian advises farm couple on herd health problems.

In 1965, more than one-third of all veterinarians in the United States were in six States—California, New York, Illinois, Iowa, Ohio, and Texas. Veterinarians in rural areas chiefly treat large animals; those in small towns usually engage in general practice; those in cities and suburban areas frequently limit their practice to pets.

Training, Other Qualifications, and Advancement

A license is required for the practice of veterinary medicine in all States and the District of Columbia. To obtain a license, an applicant must be a graduate of a veterinary school approved by the American Veterinary Medical Association, pass a State Board examination, and, in a few States, have some practical experience under the supervision of a licensed veterinarian. A limited number of States issue licenses without further examination to veterinarians already licensed by another State.

For positions in public health and other research or college teaching, the master's or Ph. D. degree in a field such as pathology, public health, or bacteriology may be required, in addition to the degree of Doctor of Veterinary Medicine (D.V.M.), awarded upon graduation from veterinary school.

The minimum requirements for the D.V.M. is 2 years of preveterinary college work followed by 4 years of professional study in a school of veterinary medicine. It may take 3 or 4 years, however, to complete the preveterinary curriculum, which emphasizes chemistry and other science courses. The veterinary college training includes considerable practical experience in treatment of animals, as well as laboratory work in anatomy,

biochemistry, and other scientific and medical fields.

There were 18 colleges of veterinary medicine in the United States in 1965. Some of the qualifications considered important by these colleges in selecting students are a good scholastic record, amount and character of preveterinary training, good health, and a liking for animals. Since veterinary colleges are largely State supported, residents of the State in which the school is located are usually given preference. In the South and West, regional educational plans permit cooperating States without veterinary schools to send a few students to designated regional schools. In other areas, schools may informally decide to accept a certain number of students from other States, often giving priority to applicants from nearby States which do not have veterinary schools. Although women students are accepted by all colleges of veterinary medicine, the number of women admitted to the schools is relatively small; only about 6 percent of the undergraduates in 1964 were women.

Some veterinarians begin as assistants to, or partners of, established practitioners. Many establish their own practice and start with a modest financial investment in such essentials as drugs, instruments, and a car. However, a substantial financial investment is required to open an animal hospital or purchase an established practice. Newly qualified veterinarians who enter the Army or Air Force are commissioned as first lieutenants. New graduates who pass Federal civil service examinations can qualify for Federal positions as meat and poultry inspectors, disease-control workers, and research assistants. In addition, the U.S. Department of Agriculture offers students who have completed their junior year in schools of veterinary medicine opportunities to serve as trainees during the summer months.

Employment Outlook

Veterinarians are expected to continue to have very good employment opportunities through the mid-1970's. Although an increase in the demand for veterinary services is anticipated in the years ahead, the number of veterinarians will be restricted by the present limited capacity of schools of veterinary medicine. About 900 veterinarians are expected to receive degrees annually, most of whom will be needed to replace those lost to the profession through retirement or death. Hence, unless there is an expansion in teaching facilities, the demand for veterinarians will probably exceed the supply during the 1965–75 decade.

Among the factors underlying the increasing need for veterinary services are an increase in the number of livestock and poultry required to feed an expanding population; a growing pet population resulting from a trend toward suburban living; and an increase in veterinary research. Emphasis on scientific methods of raising and breeding livestock and poultry, and a growth in domestic and international public health and disease-control programs will probably also add to the opportunities for veterinarians.

Women will continue to have best opportunities in small animal practice, teaching, and research.

Earnings and Working Conditions

Veterinarians beginning their own practice can generally cover their expenses the first year and may often add to their earnings by working part time for government agencies. As they gain experience, their incomes usually increase substantially; however, the income of the veterinarian in private practice depends largely on the availability of other veterinary services in his geographical area, and the attitude of potential clients toward the use of professional care for animals.

The average annual salary of veterinarians employed by State governments was $10,200 in 1964, and the average annual salary of veterinarians employed by universities was $11,600, according to a survey of the American Veterinary Medical Association. The income of veterinarians in private practice is generally higher than that of other veterinarians, according to the limited data available.

Newly graduated veterinarians had an annual starting salary of $7,710 in the Federal Government in early 1965. Summer trainees in the U.S. Department of Agriculture were paid $116 for each week they worked (representing a rate of $6,050 per year).

Veterinarians are sometimes exposed to danger of physical injury, disease, and infection. Those in private practice are likely to have long and irregular working hours. Veterinarians in rural

areas may have to spend much time traveling to and from distant farms and may have to work outdoors in all kinds of weather. Veterinarians can continue working well beyond the normal retirement age because of the many opportunities for part-time employment or practice.

Where To Go for More Information

Additional information on the earnings of veterinarians and on veterinary medicine as a career, as well as a list of schools providing training, may be obtained from:

American Veterinary Medical Association,
600 South Michigan Ave., Chicago, Ill. 60605.

Information on opportunities for veterinarians in the U.S. Department of Agriculture is available from:

Agricultural Research Service, U.S. Department of Agriculture,
Washington, D.C. 20250.

MATHEMATICS AND RELATED FIELDS

Mathematics is both a profession and a tool essential for many kinds of work. Although mathematics has always been of fundamental importance in science and engineering, it is only since electronic computers have become widely used that its potentialities as a field of employment have been as fully realized as they are today. The introduction of electronic computing equipment has opened up broad new horizons for the application of mathematics—not only in the natural sciences and engineering, but also in connection with medicine, social science research, management, and administration. As a result, employment opportunities for persons trained in mathematics have expanded remarkably in the past 15 years.

This chapter includes descriptions of the occupation of mathematician and two closely related occupations—statistician and actuary. For entrance into any of these fields, college training in mathematics is required. For many types of work, graduate education is necessary.

In addition to the professions covered in this chapter, workers in many other jobs use mathematics extensively in performing their work. These include engineers, chemists, physicists, astronomers, geophysicists, and oceanographers, whose work is discussed elsewhere in the *Handbook*. Secondary school teachers of mathematics are not covered in this chapter but are included in the statement on Secondary School Teachers.

Mathematicians

(2d ed. D.O.T. 0–35.76)

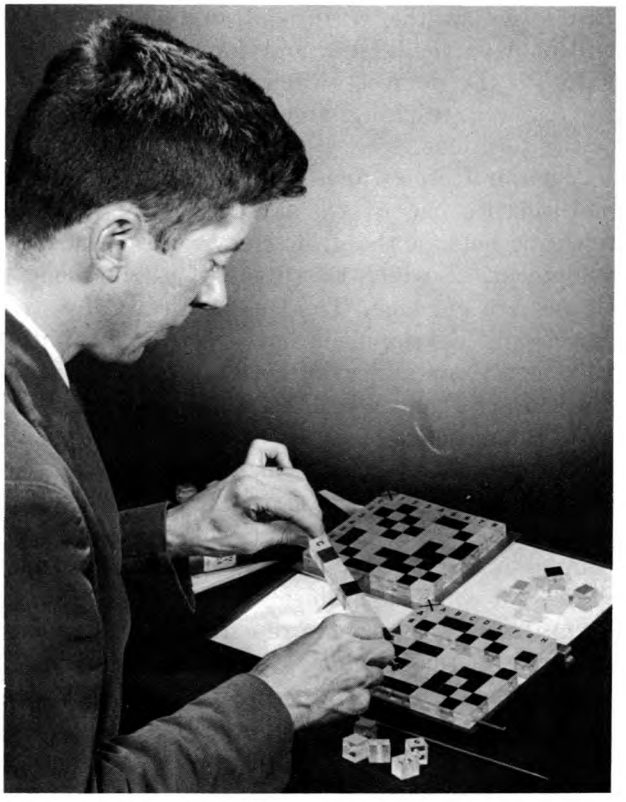
(3d ed. D.O.T. 020.088)

Nature of Work

Mathematics is one of the oldest and most basic sciences. It is also one of the most dynamic and rapidly growing professions. Mathematicians today are engaged in a wide range of activities which include studying the behavior of the atom, calculating orbits of earth satellites, and translating business and scientific problems into mathematical terms for solutions by electronic computers.

Mathematical work may be divided into two broad classes: pure or theoretical mathematics; and applied mathematics, which includes mathematical computation. Theoretical mathematicians are concerned with the development of mathematical principles and the discovery of relationships among mathematical forms. They seek to increase basic mathematical knowledge without necessarily considering its use. Yet, this pure and abstract mathematical knowledge has been instrumental in many scientific and engineering achievements. For example, a seemingly impractical non-Euclidean geometry invented by Bernhard Riemann in 1854 became an integral part of the theory of relativity developed by Albert Einstein more than a half-century later.

Mathematicians engaged in applied work develop techniques and approaches to solve practical problems in the physical, biological, and social sciences. They analyze the various parts of a problem and describe the existing relationships in mathematical terms. They work on programs ranging from the analysis of vibrations and stability of rockets in outer space to studies of the effects of new drugs on disease. Applied and pure mathematics are not always sharply separated in practice; many important developments in theoretical mathematics have arisen directly from practical problems. For example, Isaac Newton developed differential calculus to de-



Courtesy of the National Bureau of Standards

Mathematician solves theoretical problem by manipulating a matrix device.

scribe and analyze the velocity and acceleration of moving objects—something which could not be done satisfactorily by earlier systems of mathematics.

An important part of the work in applied mathematics involves using mathematical knowledge and modern computing equipment (ranging from desk calculators to complex electronic computers) to obtain numerical answers to specific problems. Some work in this area, such as developing advanced techniques for solving complex engineering problems, requires a very high level of mathematical knowledge and skill. However, much of this work, such as that of programers for digital computers, does not require the advanced training and inventiveness of the mathematician. (See statement on Programers. For other occupations related to the mathematics profession, see statements on Statisticians and Actuaries in this chapter.)

The largest number of mathematicians are engaged in research to increase the knowledge of basic mathematics or to solve practical problems. Many teach in colleges and universities, where they often combine teaching and research. Others are engaged in the management and administration of scientific activities, and a few do consulting work.

Where Employed

Approximately 50,000 mathematicians were employed in the United States in mid-1964; about 10 percent were women. Nearly one-half of all mathematicians are employed by private industry. About two-thirds of this group work in manufacturing industries—primarily in the aerospace and electrical equipment industries, and those manufacturing office machines and computers. Other mathematicians work for consulting firms or are self-employed as consultants.

Colleges and universities employ more than two-fifths of all mathematicians; many of these work full time on research projects in the university laboratories. Others are employed by the Federal Government, chiefly by the Department of Defense. A few work for State and local governments and nonprofit organizations.

Mathematicians are employed in all States. However, they are concentrated in those States with large industrial areas and sizable college and university enrollments. Nearly half of the total are employed in six States: California, New York, Massachusetts, Pennsylvania, New Jersey, and Illinois.

Training, Other Qualifications, and Advancement

The minimum educational requirement for most beginning positions in mathematics is the bachelor's degree with a major in mathematics or with a major in an applied field and a minor in mathematics. For many entrance positions, particularly in research and teaching, graduate training in mathematics is required. Advanced study is also needed for advancement to most high-level positions in all types of work.

The bachelor's degree in mathematics is offered in several hundred colleges and universities located throughout the country. A few of the mathematics courses usually required in an undergraduate curriculum are analytical geome-

try, calculus, differential equations, statistics, mathematical analyses, and modern algebra.

Advanced degrees in mathematics are awarded by about 200 colleges and universities. In graduate school, the student builds upon the basic knowledge acquired in the undergraduate curriculum. He usually specializes in a specific field of mathematics such as algebra, statistics, applied mathematics, or topology by conducting intensive research and taking several advanced courses in that field.

The bachelor's degree is adequate preparation for many positions in private industry and the Federal Government, particularly those connected with computer work. Some new graduates with the bachelor's degree assist senior mathematicians by working out computations and solving minor mathematical problems in applied research. Others work as graduate teaching or research assistants in colleges and universities while working toward advanced degrees.

Advanced degrees are required for an ever-increasing number of jobs in industry and Government—in research and many areas of applied mathematics. The Ph. D. degree is necessary for most high-level college and university teaching positions and for the more advanced research work, such as formulating mathematical theories to describe an engineering or scientific situation.

For work in applied mathematics, training in the field to which the mathematics will be applied is important. In applied mathematics, the main fields of application are physics and engineering; other fields include business and industrial management, economics, statistics, chemistry, and biology. For work concerned with high-speed electronic computers, training in numerical analysis and programing is especially desirable.

Some personal qualifications needed by mathematicians are a keen logical mind, imagination, intellectual curiosity, and the desire and ability to analyze and solve new and difficult problems. Mathematicians must also be able to express mathematical ideas clearly and concisely for scientists, engineers, and others who use mathematics but are not mathematicians.

Employment Outlook

The outlook is for continued rapid growth in employment of mathematicians through the mid-1970's. As in the early and mid-1960's, there will be a particular demand for mathematicians with Ph. D. degrees—women as well as men—for research, teaching, and many applied mathematics positions.

A major factor which should continue to make mathematics one of the most rapidly growing scientific fields is the growth in research and development, in which two-fifths of all mathematicians are engaged. Total expenditures for research and development have increased rapidly in recent years and are expected to continue to rise through the mid-1970's, although somewhat slower than in the past.

The demand for mathematicians in research and development is closely associated with the use of high-speed electronic computers. These computers have made it possible to solve a wide variety of complex problems in engineering, and natural and social science research, and also have opened broad new fields for mathematics in business management. Using these computers, mathematicians can provide information to business managers and officials to help them solve problems in such areas as production programing, operations research, product distribution, sales promotion, advertising, and inventory control.

The demand generated by computers is not only for mathematicians, but also for people who can apply mathematics to specific problems. Part of this demand probably will be satisfied by the inclusion of more advanced mathematical training in the education of engineers, physicists, biologists, and specialists in other fields. However, there will be a growing need for mathematicians who have a high degree of mathematical competence and a broad knowledge of particular fields of application. The demand for people to do mathematical computation work will also expand.

The employment of mathematicians as college and university teachers should also rise substantially during the late 1960's and early 1970's when enrollments are expected to grow rapidly. Not only is the number of students majoring in mathematics expected to increase sharply, but the number of mathematics courses taken by those majoring in other fields may also rise. Colleges and universities will continue to provide most of the employment opportunities for specialists in theoretical mathematics.

areas such as probability theory, experimental design, and regression analysis. Unlike applied statisticians, mathematical statisticians usually do not specialize in a subject-matter field. However, the latter frequently work with applied statisticians in making statistical studies.

Most statisticians are engaged in planning surveys, designing experiments, or analyzing data. Those who plan surveys choose the source from which the data are to be collected, determine the type and size of the sample to be studied, and draw up the questionnaire or reporting form. They may also prepare instructions for the workers who will collect the data and for the statistical clerks who will code and tabulate the returns. Statisticians who design experiments prepare mathematical models which can be tested to confirm or contradict a particular theory. Those who are engaged in analytical work interpret data already collected and summarize their findings in tables, charts, and written reports. Some statisticians perform administrative functions in connection with statistical research programs. Others teach in colleges and universities—often combining research with teaching activities.

Because statistics is a tool used in many different fields, it is sometimes difficult to distinguish people who are primarily statisticians from those who are chiefly subject-matter specialists making only a limited use of statistics. For example, an applied statistician who works with data on economic conditions may have the title of economist instead of statistician, or a mathematical statistician engaged in applying probability theory to the development of new statistical methods may be classified as a mathematician.

Statistician plots a graph from computer tabulated data.

Where Employed

Approximately 21,000 professional workers were employed as statisticians in 1965; nearly one-third were women. The largest number of statisticians were employed by private industry, mostly in market research, quality control, production and sales forecasting, and administration of statistical programs. Some worked for consulting firms or as independent statistical consultants.

Federal Government agencies also employ a sizable number of statisticians, primarily in the Departments of Commerce; Defense; Agriculture; Health, Education, and Welfare; and Labor. Colleges and universities employ some applied statisticians and are a major source of employment for mathematical statisticians. Other statisticians are employed by State and local governments, and nonprofit organizations.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in statistics or mathematics is the minimum educational requirement for many beginning positions in applied and mathematical statistics. For some beginning positions in applied statistics, however, a bachelor's degree, with a major in economics or some other applied field and a minor in statistics, is acceptable preparation. A master's degree in statistics or mathematics is required for many entrance positions in mathematical statistics and teaching, and is almost indispensable for promotion to high-level positions in mathematical statistics. The Ph. D. degree is essential for advancement to top-level teaching positions and is an asset in obtaining high-ranking administrative positions and consulting work. For advancement in analytical and survey work, there is a trend toward requiring advanced academic training in the subject-matter field as well as in statistics.

Relatively few colleges and universities offer training leading to a bachelor's degree with a ma-

Along with the anticipated rise in demand for mathematicians, a significant increase is expected in the number of graduates with degrees in mathematics, particularly at the bachelor's level. If graduates in this field continue to increase as rapidly as they have in recent years, the number of new graduates seeking employment in the profession will more than double over the 1965–75 period. Thus, new graduates with only the bachelor's degree may face increasing competition for entry positions in mathematics in the late 1960's and early 1970's. Nevertheless, graduates with advanced degrees and those with bachelor's degrees who rank high in their class should continue to have excellent employment opportunities in the profession. The training required of mathematics graduates also serves as an excellent foundation for employment in many occupations, including high school teaching and certain jobs in engineering, economics, and statistics.

Earnings and Working Conditions

Annual starting salaries in private industry for mathematicians with bachelor's degrees were about $7,000 in mid-1964, according to the limited information available. New graduates with the master's degree received starting salaries about $500 to $1,000 a year higher. Yearly salaries for new graduates with Ph. D. degrees, most of whom usually have some experience, ranged from about $10,000 to $16,000 in 1964.

In the Federal Government in early 1965, mathematicians with the bachelor's degree and no experience could start at either $5,990 or $7,050 a year, depending on their college records. Beginning mathematicians who had completed all requirements for the master's degree could start at $7,050 or $7,710; those with the Ph. D. degree could begin at $8,945 or $10,250.

In colleges and universities, starting salaries for mathematicians with the Ph.D. degree who were employed as teachers in 1964 ranged from about $4,500 to $11,000 for 9 months of teaching. Mathematicians in educational institutions often supplement their regular salaries with income from special research projects, consulting work, and writing for publications.

The average (median) annual salary for mathematicians in the National Science Foundation's National Register of Scientific and Technical Personnel, was $11,000 in 1964. Only 10 percent earned less than $7,000 a year, and about 10 percent earned $18,500 or more.

Where To Go for More Information

American Mathematical Society,
190 Hope St., Providence, R.I. 02906.

Mathematical Association of America,
University of Buffalo, N.Y. 14214.

Statisticians

(2d ed. D.O.T. 0–36.51)

(3d ed. D.O.T. 020.088 and .188)

Nature of Work

Statisticians plan and conduct studies to help natural and social scientists extend their knowledge and to provide government and business officials with statistical information needed in making decisions. They use statistical methods to collect, analyze, and interpret numerical data. Their prime objective is to obtain accurate information on the subject being studied with a minimum expenditure of time and money.

Statisticians specialize either in the application of statistical methods to a subject-matter field or in mathematical statistics. Applied statisticians use statistical methods to collect and analyze data in a particular field, such as economics, agriculture, psychology, public health, demography, physics, or engineering. They may forecast population growth or economic conditions, predict and evaluate the results of a new marketing program, develop methods of testing the quality of mass produced products, or help engineers and scientists determine the best design for a jet airplane.

Mathematical statisticians use mathematical theory to design and improve statistical methods for obtaining and interpreting numerical information. They are primarily theoreticians, concerned with developing new statistical tools in

jor in statistics. Most schools, however, offer either a degree in mathematics or a sufficient number of courses in statistics to qualify graduates for beginning positions. Courses essential for statisticians include college algebra, plane trigonometry, analytical geometry, differential and integral calculus, linear algebra, and at least one course in statistical methods. Other courses of importance include sampling, correlation analysis, design of experiments, probability theory, and courses on the use of computers. For many quality control positions, training in engineering and in the application of statistical methods to manufacturing processes are desirable. For many market research, business analysis, and forecasting positions, courses in business administration or a related field are helpful.

Graduate instruction in statistics was offered by approximately 40 colleges and universities in 1964. For entrance into a graduate program in statistics, schools usually require a bachelor's degree with a good background in mathematics. The student interested in applied work should attend a school where he can pursue research projects in his subject-matter field, as well as take advanced courses in statistics.

Inexperienced statisticians with only the bachelor's degree often spend much of their time in clerical work, or its supervision, on their first jobs. As they gain experience, statisticians usually move up to positions of greater technical and often supervisory responsibility. Those with exceptional ability and interest may advance to high-level supervisory or administrative positions.

Among the personal qualifications needed by statisticians are a logical and inquiring mind, an interest and facility in mathematics, and the ability to translate practical problems into statistical terms. They should be able to express themselves clearly and concisely in order to work with scientists, business officials, and others who must use statistics but are not statisticians.

Employment Outlook

The employment outlook is good for statisticians through the mid-1970's. A growing emphasis on modern statistical methods in conducting research and an increasing use of electronic computers are major factors in the growing demand for statisticians in private industry, government, and colleges and universities.

The largest expansion in employment is expected in private industry. Persons who have broad training in mathematics and statistics, as well as a knowledge of engineering or the physical sciences, will be needed for quality control work in manufacturing, and for work with scientists and engineers in research and development activities. Business firms are also expected to rely more and more on statisticians to forecast sales, analyze business conditions, modernize their accounting procedures, and help solve other management problems.

The employment of statisticians in Federal Government agencies will probably increase moderately. Additional personnel will be needed not only in research and development work, but also for expanded programs in such fields as social security, health, and education. Some statisticians will also be needed to fill positions in continuing programs which involve the collection and analysis of many kinds of social and economic data.

The employment of statisticians as college and university teachers is also expected to rise through the mid-1970's, primarily as a result of the overall increase in enrollments. Furthermore, it is anticipated that many colleges will offer additional courses in statistics, as the importance of statistical methods in government, business, academic, and industrial research becomes even more widely recognized.

In addition to the number needed to fill new positions, several hundred statisticians will be required each year to replace members of the profession who retire, die, or transfer to other occupations.

Along with the anticipated rise in the demand for statisticians, an increase is expected in the number of statistics graduates. However, in 1964 the number of these graduates was barely enough to meet replacement needs. Thus, employment opportunities for new college graduates with degrees in statistics at all degree levels are expected to be very good through the mid-1970's.

Well-qualified women statisticians should find favorable opportunities in all phases of statistical work. Opportunities for advancement for women

statisticians will probably be best in teaching and in research positions in the social sciences.

Earnings and Working Conditions

Starting salaries for new college graduates employed as applied statisticians in private industry generally averaged between $5,500 and $6,000 a year in 1964, according to the limited information available. Starting salaries for mathematical statisticians with the bachelor's degree were usually somewhat higher. Salaries for beginning statisticians with the master's degree averaged between $600 and $1,200 a year more than for those with only the bachelor's degree.

In the Federal Government service in early 1965, analytical and survey statisticians with the bachelor's degree and no experience could start at either $5,000 or $6,050 a year, depending on their scholastic records. Beginning analytical and survey statisticians who had completed all requirements for the master's degree could start at $6,050 or $7,220. Those with the Ph. D. degree could begin at $8,650 or $10,250. In the Federal Government, mathematical statisticians had somewhat higher starting salaries than analytical and survey statisticians.

Statisticians employed by colleges and universities generally earn somewhat less than those employed by private industry and the Federal Government. Some indication of the salary levels of statisticians employed as teachers may be obtained from the earnings data for college and university teachers as a group. (See statement on College and University Teachers.) In addition to their regular salaries, statisticians in educational institutions sometimes obtain income from outside research projects, consulting work, and writing for publications.

Where To Go for More Information

American Statistical Association,
810 18th St. NW., Washington, D.C. 20006.

Actuaries

(2d ed. D.O.T. 0–36.55)
(3d ed. D.O.T. 020.188)

Nature of Work

Actuaries are responsible for developing and keeping insurance and pension plans on a sound financial basis. Using mathematical methods and techniques, they develop and analyze statistical tables to evaluate the probability of loss on whatever is to be insured. They are concerned with mortality (death) and morbidity (sickness) rates, the frequency of injuries, and personal and property losses from fire, burglary, explosion, and other hazards. Taking into consideration the estimates of payments to policyholders, as well as estimates of their company's future expenses and investment income, actuaries determine the premium rates for each particular type of insurance policy. They also analyze company earnings and prepare policy contract provisions.

To perform their duties effectively, actuaries must keep abreast of general economic trends and legislative, health, social, and other developments that may affect the soundness of insurance practices. Because of their broad knowledge of the insurance field, actuaries frequently work on problems arising in several different departments of their companies, such as investment, underwriting, group insurance, and pension sales and service departments. Those in executive positions may help to determine general company policy and may testify before public agencies on proposed legislation which would affect the insurance business or on the justification for intended changes in company premium rates or contract provisions.

Actuaries employed by the Federal Government usually deal with a particular Government insurance or pension program, such as social security (old-age, survivors, disability, and health insurance) or life insurance for veterans and members of the Armed Forces. Actuaries in State government positions are involved in the supervision and regulation of insurance companies, in the operation of State retirement or pension systems, and they may work on problems connected with unemployment insurance or workmen's compensation. Consulting actuaries perform services, on a fee basis, for private companies, unions, and govern-

ment agencies. They often set up employee pension and welfare plans and periodically make actuarial valuations of them.

Where Employed

Approximately 2,500 actuaries were employed in the United States in 1965. They are concentrated in States that are major centers of the insurance industry. Nearly half of all actuaries are employed in four States—New York, Connecticut, Illinois, and Massachusetts.

Private insurance companies employ about two-thirds of all actuaries. Nearly nine-tenths of this group work for life insurance companies and the remainder work for property and casualty companies. The size of an insurance company's actuarial staff depends primarily upon the volume of its insurance work. Large companies may employ as many as 50 to 100 actuaries, whereas small companies may have only 1 or 2 actuaries on their staffs or may rely entirely on consulting firms or rating bureaus (associations which supply actuarial data to member companies).

Several hundred actuaries are employed by consulting firms or are in business for themselves. Significant numbers are also employed by private firms other than insurance companies to administer private pension and welfare plans. Others work for Federal and State Governments. Some are employed by property and casualty rating bureaus and a few teach in colleges and universities.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in mathematics is usually required for entry into actuarial work. Some new graduates with a major in such fields as economics or business administration and a minor in mathematics can qualify for beginning actuarial positions. Although only a few colleges and universities offer training specifically designed for actuarial careers, several hundred institutions offer the necessary courses. The mathematics courses that should be taken by the prospective actuary include algebra, analytical geometry, differential and integral calculus, mathematical statistics, and probability. Other desirable courses include insurance law, economics, investments, accounting and other aspects of business administration, and English composition and speech.

To gain full professional status, actuaries usually must pass a series of examinations, which cover general mathematics, specialized actuarial mathematics, and all phases of the insurance business. It is desirable for the student considering an actuarial career to take the beginning examinations covering general mathematics while he is still in college. Success in passing these examinations helps the student determine whether he has the ability to become an actuary. Also, those who pass have better opportunities for employment and a higher starting salary. The more advanced examinations, usually taken by those in junior actuarial positions, require extensive home study and experience in insurance work. It usually takes from 5 to 10 years after entering a beginning actuarial position to complete an entire series.

The actuarial examinations for the life insurance field are given by the Society of Actuaries, and those in property and casualty insurance by the Casualty Actuarial Society. Associate membership is awarded after completion of part of the examination series. The designation of "Fellow" is conferred after successful completion of either all 10 examinations given by the Society of Actuaries or the 8 examinations of the Casualty Actuarial Society.

Besides mathematical ability, applicants for beginning actuarial positions are likely to be evaluated also on personal characteristics, such as ability to deal with people, leadership qualities, and interest in business problems. Preference is given to applicants who have passed at least one or more of the actuarial examinations, and to those with some actuarial experience. This experience is provided in some insurance companies which hire and train college undergraduates during the summer months.

A beginning actuary in an insurance company is usually rotated among different jobs in his department to learn the various actuarial operations and become familiar with the different phases of insurance work. At first, the trainee may make calculations or tabulations for actuarial tables or for the annual statement. Later, he may supervise actuarial clerks and prepare correspondence and reports.

Advancement to more responsible work as an assistant actuary and later as associate or chief actuary depends largely upon on-the-job performance and the number of actuarial examinations successfully completed. Some actuaries, because of their broad knowledge of the insurance and related fields, qualify for administrative positions in other company activities, particularly in the underwriting, accounting, or data-processing departments. A significant number of actuaries advance to top executive positions.

Employment Outlook

Employment opportunities for actuaries are expected to be very good through the mid-1970's. New graduates who have the necessary mathematical education and who have passed some examinations of either professional society will be in particular demand.

Employment of actuaries is expected to increase in both the life and casualty insurance fields, primarily because of anticipated growth in the number and type of insurance policies and employee-benefit plans. (See chapter on Occupations in the Insurance Business.) More actuaries will be needed to solve the increasing number of problems arising from continuously changing and increasingly complex insurance and pension coverage. The rapidly growing number of group life insurance plans and health and pension plans will require additional actuarial service. In the property and casualty insurance field, additional actuaries will be needed to make studies which are used in determining policy rate changes, and to justify these changes before State regulatory agencies. There will be continuing strong demand for actuaries capable of working with the electronic computers in widespread use by large insurance companies. Besides actuaries who will be needed to fill new positions, a few will have to be trained to replace those who retire, die, or transfer to other occupations.

Employment opportunities will probably continue to be good for the few women who seek actuarial work. Advancement opportunities will also be good for women actuaries who complete the years of continuous training and study required to pass the actuarial examinations to gain full profesisonal status.

Earnings and Working Conditions

Annual starting salaries of new college graduates entering actuarial work in insurance companies were generally about $6,000 in 1964, according to the limited information available. Those who had passed some of the beginning actuarial examinations or who had gained some experience in the summer programs offered by insurance companies usually received higher starting salaries.

In the Federal Government service in early 1965, new graduates with the bachelor's degree entering actuarial work could start at either $5,990 or $7,050 a year, depending on their college records. (See chapter on Occupations in Government.)

Beginning actuaries can look forward to a marked increase in earnings as they pass the examinations of either Society and gain professional experience. Most Fellows of either the Society of Actuaries or the Casualty Actuarial Society earn over $12,000 a year. Many actuaries earn more than $18,000 a year and some in executive positions in large insurance companies earn over $25,000.

Where To Go for More Information

Society of Actuaries,
208 South LaSalle St., Chicago, Ill. 60604.

Casualty Actuarial Society,
200 East 42d St., New York, N.Y. 10017.

NATURAL SCIENCES

The natural sciences are concerned with the physical world and the living things within it. They may be divided into three broad groups—the physical sciences, the biological sciences, and the earth sciences—all of which are discussed in this chapter. Mathematics, often considered as part of the natural sciences, is discussed in a separate chapter elsewhere in the *Handbook*.

The physical sciences are the largest field of employment among the natural sciences; over 175,000 physical scientists were employed in mid-1964. These scientists are usually classified into four occupational specialties—chemistry, physics, metallurgy, and astronomy. Chemistry is by far the largest of these specialties, with nearly 120,000 chemists employed in mid-1964. Smaller numbers were in physics (40,000), metallurgy (15,000), and astronomy (1,000).

A large number of natural scientists—about 130,000 in mid-1964—worked in the biological sciences. Most of these scientists specialized in one of three broad fields—biology, medicine, or agriculture. The largest number, nearly 60,000, worked in biology. More than 40,000 were employed as agricultural scientists, and about 28,000 worked on problems related to medicine.

The earth sciences are relatively small fields of scientific employment. In mid-1964, the number of earth scientists totaled 28,000. Of these earth scientists, the largest number, 16,000, worked in geology. Smaller numbers were employed in geophysics, 6,000; meteorology, 3,000; and oceanography, 3,000.

A bachelor's degree is the usual minimum educational requirement for work in the natural sciences. Graduate training is needed for many positions, especially in teaching and research, and is helpful for advancement in all types of work. In some specialties, advanced degrees are needed for most positions.

Employment in the natural sciences has grown rapidly in recent years and the outlook is for continued rapid growth through the mid-1970's. In general, the most important factor underlying the expected increase in employment is the likely growth of expenditures for research and development. Such expenditures have increased very rapidly in recent years and are expected to continue to increase, although somewhat more slowly than in the past. Other factors contributing to the expected employment growth in the natural sciences are the expansion of industry, the increasing complexity of industrial products and processes, and the sharp increase in science enrollments expected in colleges and universities.

The following chapter presents descriptions of some of the major occupations within the natural sciences. In addition to these occupations, workers in many other fields may require a strong background in the natural sciences. Among these are engineering, mathematics, and medical occupations, which are described elsewhere in the *Handbook*.

Biological Sciences

The biological sciences are concerned with the world of living things—men and microbes, wild and domestic animals, plants and insects, birds and fish. Some scientists in this field conduct research to expand our knowledge about living organisms; others teach in colleges and universities. Still others apply biological knowledge to the solution of practical problems, such as the development of new drugs and vaccines or new varieties of plants. (Among professional workers in the biological sciences are foresters, soil scientists, soil conservationists, biochemists, and range

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managers whose work is discussed elsewhere in the *Handbook*.

Nature of Work

Biological scientists, who also may be called life scientists, study living organisms, their structure, evolutionary development, and life processes. They also study the relation between these organisms and their environment. The number and variety of plants and animals are so vast and the life processes so varied and complex that biologists must, of necessity, become specialists. Some biologists learn as much as possible about a particular kind of animal or plant. Others, interested in how an animal or human body functions, study such things as the nervous system, how food is digested, or how organisms are affected by disease. Some are interested in the evolution of living organisms, the mechanism of heredity, or the ways environmental factors, such as light or heat, affect life processes. In general, biological scientists specialize in a subdiscipline of the three broad areas of the life sciences—biological, medical, or agricultural science.

A substantial number of biological scientists are engaged in research and development. Many conduct basic research, aimed at adding to our knowledge of living organisms with only secondary regard to its application. Nevertheless, the development of insecticides, disease-resistant crops, and antibiotics have all stemmed from basic research in the biological sciences.

Biological research may take many forms. A botanist exploring the volcanic Alaskan valleys to see what plants live in this strange environment and a zoologist searching the jungles of the Amazon valley for previously unknown kinds of animals are both doing research, as is an entomologist in a laboratory testing various chemical insecticides for effectiveness and possible hazards to human and animal life.

Regardless of the type of research in which they are engaged, biological scientists must be familiar with fundamental biological research techniques and with the use of microscopes and other laboratory equipment. Advanced techniques and principles drawn from chemistry and physics are frequently used. Furthermore, because of the enormous number of variable factors involved in biological experiments, a knowledge of mathematical and statistical procedures, as well as of the operation of electronic computers, is often needed.

Courtesy of the U.S. Department of Army

Biological scientists rely heavily on microscopes.

Teaching in colleges and universities is the major function of a sizable number of biological scientists. Many teachers of biological sciences combine independent research with their regular teaching duties, and in some large institutions spend the major portion of their time on research.

Some biological scientists are engaged in management and administrative work, primarily the planning, supervision, and administration of programs of research or testing of foods, drugs, and other products. Others act as liaison between the Federal Government and the agricultural experiment stations at State universities, and aid in the planning, development, and evaluation of research programs at these stations.

Relatively small numbers of biologists are engaged in a variety of other types of work, such as consulting, writing, testing, and inspection. A few are employed in technical sales or field service work for industrial firms; such work may include, for example, teaching company salesmen and prospective purchasers the value and proper

use of new chemicals. Some are engaged in research in natural history museums.

Biological scientists may be classified into three broad groups characterized by the general type of organism with which they work: Botanists, who study plants; zoologists, who are concerned with animals; and microbiologists, who work with micro-organisms.

Biological scientists may also be classified according to their specialties—some of which are wholly within 1 of the 3 major groupings, and others which can be found in all 3 groups. For example, some biological scientists are classified according to the specific type of organism studied, as are mycologists, who are botanists concerned with the study of fungi. Others are classified according to the type of approach used, as are geneticists, who may be botanists, zoologists, or microbiologists studying the mechanisms of the heredity of a particular plant, animal, or micro-organism. Scientists whose work cuts across more than one of these major groupings, often the case with college teachers, may simply call themselves biologists. A description of the work of some biological scientists follows.

Botanists (D.O.T. 041.081) study plant life. Some, known as plant taxonomists, specialize in the identification and classification of plants. Other botanists include plant morphologists, concerned primarily with the structure of plants and plant cells; plant physiologists, whose primary interest is in the life processes of plants; and plant pathologists who study the causes and control of plant diseases.

Microbiologists (D.O.T. 041.081) investigate bacteria, viruses, molds, and other organisms of microscopic or submicroscopic size. The terms bacteriology and microbiology are sometimes used interchangeably, but microbiology, the broader term, is preferable when referring to the study of all microscopic organisms. Microbiologists grow these organisms and study them under light and electron microscopes and with a variety of other specialized equipment. Some microbiologists study medical problems, such as the relationship between bacteria and infectious disease, or the effect of antibiotics on bacteria. Others specialize in soil bacteriology (the study of micro-organisms in soils, and the relation of such organisms to soil fertility), virology (the study of viruses, some of which may cause diseases in animals or plants), immunology (the study of mechanisms by which the body fights off infection), or serology (the study of animal and plant fluids, including blood serums). Still others specialize in the study of the fermentations involved in manufacturing such products as beer and wine, or in the search for new or better antibiotics. Many specialize in the production and testing of biological products or in the testing of food products and water supplies.

Zoologists (D.O.T. 041.081) study animal life—its origin, classification, behavior, life processes, diseases, and parasites—and the ways in which animals influence and are influenced by their environment. Zoologists who specialize in the study of certain classes of animals usually use titles which indicate the kind of animal studied; thus, ornithologists study birds; herpetologists study reptiles and amphibians; ichthyologists study fishes; and mammalogists, mammals.

Agronomists (D.O.T. 040.081) investigate methods of growing, breeding, and improving crops such as corn, wheat, tobacco, cotton, and sugar. They seek new, hardier varieties of crops and search for better methods of controlling disease, pests, and weeds. Agronomists may specialize in the problems of a geographical region, a particular crop, or a technical area such as crop breeding or production methods.

Anatomists (D.O.T. 041.081) study the structure and biological processes of plants and animals. Those who specialize in the structure of cells are known as cytologists, while those who specialize in the structure of tissues and organs are known as histologists. Anatomists may study structures visible to the naked eye or of microscopic size, or those of submicroscopic size, visible only through the use of the electron microscope. Many anatomists specialize in human anatomy; others compare relationships within the animal or plant kingdoms.

Biophysicists (D.O.T. 041.081), who are trained in both physics and biology, study the physical properties and relationships of living cells and organisms, and the response of living organisms to physical forces—including heat, light, radiation, sound, and electricity. They may use the electron microscope to make tissues visible down to their smallest units, or they may use

nuclear reactors to study the effect of radiation on cells and tissues.

Embryologists study the development of an organism from fertilization of the egg until it becomes a complete organism. They study the physiological, biochemical, and genetic mechanisms which control and direct the processes of development, how and why this control is accomplished, and the causes of abnormalities in development.

Entomologists (D.O.T. 041.081) study insects; very often to determine their effect on people, animals, and plants. Many entomologists do research on methods of controlling harmful insects which carry disease and spoil food supplies. Others study ways to utilize beneficial insects such as honeybees. Some entomologists specialize in identifying and classifying the enormous number of different kinds of insects.

Geneticists (D.O.T. 041.081) are concerned with the nature and transmission of hereditary characteristics. Geneticists engaged primarily in improving plant and animal breeds of economic importance—such as cereal and tobacco crops or diary cattle and poultry—may be classified as plant or animal breeders, agronomists, or animal science specialists. Theoretical geneticists search for the mechanisms which produce heritable traits in plants, animals, or humans.

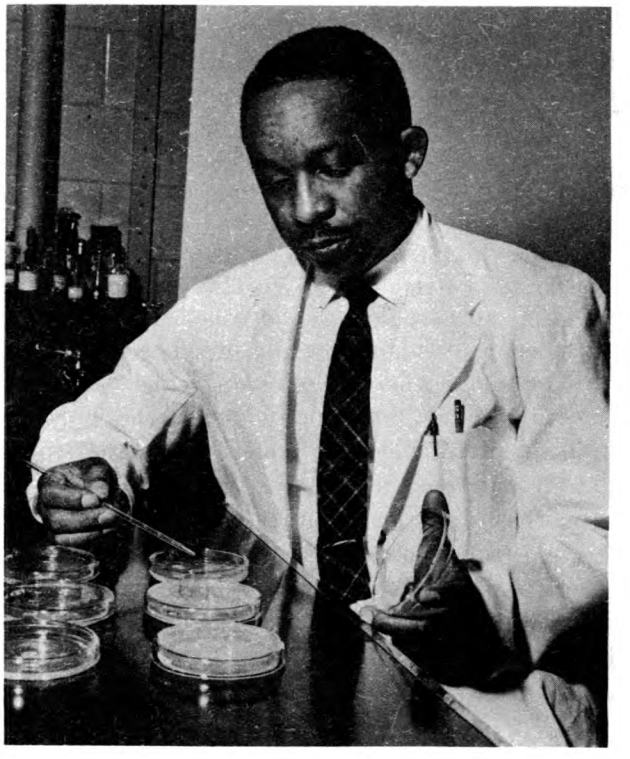
Horticulturists (D.O.T. 040.081) are concerned with orchard and garden plants such as fruits, nuts, vegetables, flowers and ornamental plants, and other nursery stocks. They develop new or improved plant varieties and try to find better methods of growing, harvesting, storing, and transporting horticultural crops. Horticulturists usually specialize in either a specific plant or a particular technical problem, such as plant breeding.

Husbandry specialists (animal) (D.O.T. 040.081 and .15) investigate and experiment with the breeding, feeding, management, and diseases of domestic farm animals to improve the health and yield of these animals.

Nutritionists (D.O.T. 077.128) study the processes through which food is utilized; the kinds and quantities of food elements such as the minerals, fats, sugars, vitamins, and proteins that are essential to build and repair body tissues and maintain health; and how these food elements are transformed into body substances and energy. Nutritionists also analyze foods to determine their composition in terms of essential ingredients or nutrients.

Pathologists (D.O.T. 070.081) study the causes and processes of disease, degeneration, and abnormal functioning in humans, other animals, or in plants. Many specialize in the study of the effects of diseases, parasites, and insect pests on cells, tissues, and organs. Others study genetic variations and other abnormal effects caused by drugs. The term "pathologists" is normally reserved for specialists in human pathology (medical pathology). Specialists in animal pathology are usually veterinarians. (See statement on Veterinarians.) Those who study plant diseases may be called plant pathologists or phytopathologists; their work is discussed under the section on botanists.

Pharmacologists (D.O.T. 041.081) are engaged primarily in determining the effects of drugs on life processes and in discovering and developing new or improved chemical compounds which will have certain desired effects on organisms. They conduct tests on animals to determine the physiological effects of drugs, gases, dusts, poisons, and



Courtesy of the National Institutes of Health

Biologist prepares cultures.

chemicals on tissues and organs, and correlate their findings with medical data on humans.

Physiologists (D.O.T. 041.081) study the functioning of cells, tissues, and organs and the effects of environmental factors on life processes. They may specialize in cellular activities; or in one of the organ systems, such as the digestive, nervous, circulatory, and reproductive systems. The knowledge gained in such studies often provides the basis for the work of many other specialists, such as biochemists, pathologists, pharmacologists, or nutritionists.

Where Employed

About 130,000 persons were employed in mid-1964 in the biological sciences and in the closely related fields of medical and agricultural sciences; an estimated 10 percent were women. The largest number of biological scientists—about half of the total—are employed by colleges and universities. Medical schools and their associated hospitals employ particularly large numbers of biological scientists in the medical field, while State agricultural colleges and universities and agricultural experiment stations operated by universities in cooperation with Federal and State Governments employ sizable numbers of agronomists, horticulturists, animal husbandry specialists, entomologists, and other agriculture-related specialists.

The Federal Government in mid-1964 employed about 30,000 biological scientists. The Department of Agriculture employs about two-thirds of all these scientists. The Interior Department employs nearly all the fish and wildlife biologists in the Federal Government. Other large numbers of biological scientists are employed by the Department of the Army and the National Institutes of Health. State and local governments also employ sizable numbers of biologists—mostly fish and wildlife specialists, microbiologists, and entomologists—for work in conservation, detection and control of disease, and plant breeding.

More than 25,000 biological scientists worked for private industry in mid-1964. Among the major industrial employers are manufacturers of pharmaceuticals, industrial chemicals, and food products. Some biological scientists work for nonprofit organizations—mainly hospitals, clinics, and privately financed research organizations or foundations. A few are self-employed.

Training, Other Qualifications, and Advancement

Young people seeking professional careers in the biological sciences should plan to obtain an advanced degree—preferably a Ph. D.—in their field of interest. The bachelor's degree with a major in one of the biological sciences is adequate preparation for many beginning jobs, but promotional opportunities for those without graduate training may be limited to intermediate level positions.

The Ph. D. degree is generally required for higher level college teaching positions and for independent research. It is also necessary for an increasing number of other positions involving the administration of research programs.

Biologists with master's degrees can qualify for most entry positions in applied research and for some types of positions in college teaching and basic research.

New graduates with bachelor's degrees can qualify for positions involving testing, production and operation work, technical sales and service, and duties connected with the enforcement of government regulations. They may also obtain positions as advanced technicians, particularly in the area of medical biology. Those who graduate near the top of their class can qualify for some research positions, but these positions are mostly of a routine nature or are performed under close supervision. Some graduates with bachelor's degrees take courses in education and choose a career as a high school teacher of biology rather than one as a biological scientist. (See statement on Secondary School Teachers.)

Training leading to a bachelor's degree with a major in biology or in one of the biological or agricultural specialties is offered by most colleges and universities. Courses differ greatly from one college to another and it is important that a student find out which college program best fits his interests and needs. In general, liberal arts colleges and universities emphasize training in the basic biological sciences and in the medical aspects of biological science. State universities and land-grant colleges offer special advantages to those interested in agricultural sciences, because their agricultural experiment stations pro-

vide many opportunities for practical training and research work.

Prospective biological scientists should obtain the broadest undergraduate training possible in all branches of biology and in related sciences, particularly organic and inorganic chemistry, physics, and mathematics. Courses in statistics, calculus, and biometrics are becoming increasingly essential. Important also are training and practice in laboratory techniques, in the use of laboratory equipment, and in fieldwork.

Advanced degrees in the biological sciences are also conferred by a large number of colleges and universities. Requirements for advanced degrees usually include fieldwork and laboratory research, as well as classroom studies and preparation of a thesis.

Qualities needed by young persons planning a career in the biological sciences include considerable interest in and curiosity about living things, keen powers of observation, logical thought processes, and patience. The biological scientist must also be able to communicate his findings simply and clearly, both in writing and speaking.

Employment Outlook

Employment opportunities for biological scientists with graduate degrees are expected to be very good through the mid-1970's. Demand will be strong for biological scientists with doctorates to do research on problems important to medicine and health. Employment opportunities are also likely to be favorable for persons with bachelor's degrees who graduate near the top of their class. New graduates holding the bachelor's degree will also find many opportunities to work as research assistants or in technician jobs while continuing their graduate education.

Employment in the biological sciences is expected to grow rapidly during the next 10 years. Although most employment opportunities will result from growth, over 4,000 biological scientists will be needed each year to replace those who transfer to other fields, retire, or die.

One of the major factors which will tend to increase employment of biological scientists is the anticipated continued growth in research and development, particularly in medical research programs sponsored by the Federal Government and voluntary health agencies, including those promoting studies of heart disease, cancer, and birth defects. Research in such relatively new areas as space biology (study of problems concerned with physical, chemical, and biological stresses of space flight and survival of men in space and on other planets) and radiation biology (research on the effects of radiation on the plant and animal kingdoms) will also probably increase.

Industry also is expected to increase its spending for research and development in the biological sciences. Furthermore, the more stringent health standards recently established by the Federal regulatory agencies may result in a need by industry for additional biological scientists to perform research and testing before new drugs, chemicals, and processing methods can be made available to the public.

Another factor which should increase employment of biological scientists is the substantially larger college and university enrollments expected during the late 1960's and early 1970's. Although the resulting rise in demand for teachers will be to a large extent for Ph. D.'s, there will be many openings for qualified people holding master's degrees.

Earnings and Working Conditions

In the Federal Government, in early 1965, biological scientists with the bachelor's degree could begin at $5,000 or $6,050 a year, depending on their college record. Beginning biological scientists with the bachelor's degree and some graduate study could start at $6,050, $7,220, or $8,650; those with the Ph. D. degree could begin at $8,650 or $10,250. Pharmacologists had somewhat higher starting salaries than other biological scientists.

Biological scientists with the Ph. D. degree employed as college and university teachers typically received starting salaries between $6,000 and $7,500 a year in 1964, according to the limited information available. (For further information, see statement on College and University Teachers.) Biologists in educational institutions sometimes supplement their regular salaries with income from writing, consulting, and special research projects.

The average (median) annual salary for biological scientists was $10,700 in 1964, according to the National Science Foundation's National

Register of Scientific and Technical Personnel; only 10 percent earned less than $6,500 a year, and about 10 percent earned $19,000 or more. In general, biological scientists in private industry tend to have higher salaries than those in either colleges and universities or Government employment. According to the Register, agricultural scientists generally earn somewhat lower salaries than other biological scientists except in educational institutions.

Where To Go for More Information

American Institute of Biological Sciences,
3900 Wisconsin Ave. NW., Washington, D.C. 20016.

Federation of American Societies for Experimental Biology,
9650 Wisconsin Ave., Bethesda, Md. 20014.

Office of Personnel, U.S. Department of Agriculture, Washington, D.C. 20250.

Employment Officer, U.S. Department of Health, Education, and Welfare,
National Institutes of Health, Bethesda, Md. 20014.

Earth Sciences

The earth sciences are concerned with the history, composition, and characteristics of the earth—its lands, oceans, and atmosphere. The largest portion of the scientists in this field are engaged in exploration for new sources of oil and minerals. Some do basic research designed to increase scientific knowledge. Others are concerned mainly with applied research, using the knowledge gained from basic research to solve practical problems. Meteorologists, for example, apply their scientific knowledge of the atmosphere to forecast weather for specific localities. Earth scientists also teach in colleges and universities and they may also administer scientific programs and operations.

Many earth scientists specialize in one particular branch of their broad occupational field. Geophysicists, for example, may be specialists in hydrology or seismology; oceanographers, in physical or biological oceanography. This chapter discusses the specialties and the employment outlook for the four major earth science occupations—geologist, geophysicist, meteorologist, and oceanographer.

Geologists

(2d ed. D.O.T. 0–35.63)

(3d ed. D.O.T. 024.081)

Nature of Work

Geology is the science of the earth. Geologists study the earth's history, structure, and composition as revealed by rock formations and by animal and vegetable fossils. They search for fuels, minerals, and water supplies and study the physical and chemical processes which bring about changes in the earth's structure and surface.

Many geologists spend a large amount of their time in field exploration. They study rock cores and cuttings from deep holes drilled into the earth and collect and examine rocks, minerals, and fossils found at or near the surface of the earth. Geologists also spend considerable time in laboratories, where they study geological specimens, analyze geological materials under controlled temperature and pressure, and do other research on geological processes. To present the results of their field and laboratory investigations, geologists prepare reports, articles, and maps of surface and subsurface geological phenomena. In their work, geologists use a variety of complex instruments, such as the X-ray diffractometer, which determines the structure of minerals, and the petrographic microscope, which permits close study of how rocks have been formed and modified by earth processes.

Some geologists administer research and exploration programs. Others teach in colleges and universities, where they may also work on research projects.

Geologists usually specialize in one branch of the science. *Economic geologists* find and supervise the development of mineral and fuel re-

sources. *Petroleum geologists*, who make up a majority of all geologists, are economic geologists specializing in the discovery and recovery of oil and natural gas. *Engineering geologists* apply geological knowledge to engineering problems in the construction of roads, airfields, tunnels, dams, harbors, and other structures. *Stratigraphers* study the distribution and relative arrangement of sedimentary rock layers in the earth's crust. *Sedimentologists* determine the processes and products involved in the formation of sedimentary rocks, and *paleontologists* identify, classify, and determine the significance of fossils found within the sediments. *Petrologists* and *petrographers* study the arrangement of minerals within rocks, to classify the rocks and determine their origins. *Mineralogists* examine, analyze, and classify minerals and precious stones according to their composition and structure. *Geomorphologists* analyze the form of the earth's surface and the processes—such as erosion and glaciation—which change it.

Increasing numbers of geologists specialize in new and rapidly growing fields that require a detailed knowledge of both geology and one or more other sciences. Among these specialists are *geochemists*, who study the chemical composition of and the changes in minerals and rocks, and *astrogeologists*, who use knowledge of the earth's geology to interpret data on surface conditions on the moon and the planets.

Where Employed

Nearly 16,000 geologists were employed in the United States in mid-1964. The majority of all geologists work for private industry. The petroleum and natural gas industry employs most of these scientists, chiefly in Texas, California, Louisiana, Oklahoma, and Colorado; some of those employed by American companies in this industry, are assigned to work in foreign countries for varying periods of time. Some geologists are employed by mining and construction companies, and by public utilities. Others work for consulting firms or as independent consultants, providing services on a fee or contract basis.

A number of geologists are employed by the Federal Government, mostly by the U.S. Geological Survey. Other Federal agencies employing geologists include the Army Corps of Engineers, the Soil Conservation Service, and the Bureau of Reclamation. State agencies also employ geologists, some of whom work on surveys conducted in cooperation with the U.S. Geological Survey. Although some positions are in foreign countries, the majority of Federal jobs are in the United States.

Some geologists are employed in colleges and universities. A few work for nonprofit research institutions and museums.

Training, Other Qualifications, and Advancement

Young people seeking professional careers in geology should obtain an advanced degree. The master's degree is required for beginning research and teaching positions and for many positions in exploration. For advancement in college teaching as well as for high-level research and administrative posts, the Ph. D. degree is required. The bachelor's degree is considered adequate training for only a few entry jobs, primarily in exploration work.

Many colleges and universities offer bachelor and advanced degrees in geology. In the typical undergraduate curriculum, students devote about a fourth of their time to geology courses, such as physical geology, historical geology, mineral-

Courtesy of the U.S. Geological Survey

Geologist prepares field map from aerial photograph.

ogy, and invertebrate paleontology. About a third of the work is in related natural sciences and in mathematics, and the remainder in subjects such as English composition, economics, and foreign languages. The academic work of the student seeking an advanced degree in geology consists primarily of advanced courses in geology, with major emphasis on the student's field of specialization.

The student planning a career in geology should have an aptitude not only for geology, but for physics, chemistry, and mathematics as well. He should be energetic, like outdoor activities, and have the physical stamina to participate in geological fieldwork, which sometimes necessitates camping out.

Employment Outlook

Employment opportunities for geologists with the Ph. D. or the master's degree are expected to be favorable through the mid-1970's. Among those with the bachelor's degree, including those who rank high in their class, there may be some competition for the few available entry positions. A number of new graduates with the bachelor's degree may find it necessary to enter semiprofessional positions, take training in teaching methods to qualify as science teachers in secondary schools, or seek other work outside the field of geology. However, should the number of graduates receiving advanced degrees in geology fail to increase along with the expected growth in demand, beginning geologists with the bachelor's degree would have improved employment opportunities.

Private industry is expected to increase its employment of geologists moderately during the next few years. Domestic exploration for oil and most minerals has declined in recent years and these activities are unlikely to expand significantly during the late 1960's and early 1970's. Geologists will, however, have increasing opportunities to help in solving engineering problems; to work on programs related to water supplies in many parts of the country; and to do research to develop new equipment and improved methods of locating and processing fuels and minerals.

In Federal agencies, demand for geologists is also expected to grow moderately, primarily in the U.S. Geological Survey. Employment of geologists in colleges and universities will probably rise slightly; the need will be primarily for those with Ph. D. degrees who are capable of doing high-level research.

Replacement needs are expected to be the chief source of openings over the next few years. Several hundred new geologists will be needed each year to replace those who are promoted to managerial positions or who transfer to other fields, retire, or die.

The longrun employment outlook in the profession is more favorable. As the world's population expands and nations become increasingly industrialized, the demand for petroleum, minerals, and water supplies will increase, thereby increasing the demand for geologists to locate these resources. Geologists with advanced training will be needed to devise new techniques for exploring deeper within the earth's crust and undersea areas and to work with petroleum engineers to develop more efficient methods of finding and recovering crude oil. It is likely that increasing space-age activities will require some geologists to study data concerning the surface conditions of planets.

Only a small number of women are professional geologists, primarily because fieldwork positions usually are considered unsuitable for them. Some well-qualified women with advanced degrees in geology will be able to find positions as teachers in colleges and universities, or to obtain laboratory or office positions in industry and government.

Earnings and Working Conditions

Annual starting salaries for new geology graduates with bachelor's degrees were typically between $6,500 and $7,000 in private industry in 1965, according to the limited information available. New graduates with master's degrees usually started at between $500 and $1,000 more a year than those with the bachelor's degree. Starting salaries for those with doctor's degrees ranged from $7,500 to $11,000, depending upon individual qualifications.

In the Federal Government, new graduates with bachelor's degrees could begin at either $5,495 or $6,650 a year in early 1965, depending on their college records. Those with master's degrees could start at $6,650 or $7,220 and those with the Ph. D. degree, at $8,650 or $10,250.

In general, salaries of geologists are usually somewhat higher in industry and in government than in educational institutions. However, teachers often supplement their regular salaries with income from research, consulting, or writing books or articles. Extra allowances are generally paid geologists for work outside the United States.

The work of geologists is often active and sometimes strenuous. Because much of their work is outdoors, geologists may be exposed to all kinds of weather. Many geologists travel a great deal and may do fieldwork away from home for long periods. Their hours of work are often uncertain because their field activities are affected by weather and travel.

Where To Go for More Information

American Geological Institute,
1444 N St. NW., Washington, D.C. 20005.

Geophysicists

(2d ed. D.O.T. 0–35.65)
(3d ed. D.O.T. 024.081)

Nature of Work

Geophysics is an overall term covering a number of sciences concerned with the composition and physical aspects of the earth—its interior and atmosphere, as well as the land and bodies of water on its surface and underground. Geophysicists study the earth's physical characteristics, such as its electric, magnetic, and gravitational fields; the earth's interior heat flow and vibrations; and solar radiation. To conduct their investigations, geophysicists apply the principles and techniques of physics, geology, mathematics, chemistry, and engineering. They use many instruments, including highly complex precision ones such as the seismograph, which measures and records the transmission time and magnitude of vibrations through the earth; the magnetometer, which measures variations in the earth's magnetic field; and the gravimeter, which measures minute variations in gravitational attraction.

Exploration geophysicists are the largest group of geophysical scientists. Most of these scientists search for oil and mineral deposits. Others conduct research, usually to develop new or improved techniques and instruments for prospecting. *Hydrologists* study the occurrence, circulation, distribution, and chemical and physical properties of surface and underground waters in the land areas of the earth. Some hydrologists are concerned with water supplies, irrigation, flood control, and soil erosion. Others specialize in studies of glaciers and sedimentation and in forecasting the flow of rivers. *Seismologists* study the structure of the earth's interior and the vibrations of the earth caused by earthquakes or manmade explosions. They may explore for oil and minerals, provide information for use in designing bridges, dams, and buildings in earthquake regions, or study the problems involved in detecting underground nuclear explosions. *Geodesists* measure the size and shape of the earth, determine the positions and elevations of points on or near the earth's surface, and measure the intensity and direction of the force of gravity. They also help track satellites orbiting in outer space. *Geomagneticians* are concerned with the variations in the earth's magnetic field, and with many aspects of space science. *Tectonophysicists* study the structure of mountains and ocean basins, the properties of materials forming the

Courtesy of the U.S. Geological Survey

Geophysicist operates a seismograph to study earth vibrations.

earth's crust, and the physical forces that cause movements and changes in it.

Oceanographers and meteorologists, often classified as geophysical scientists, are discussed separately in this chapter, as is the closely related occupation of geologist.

Where Employed

Over 6,000 geophysicists were employed in the United States in mid-1964. Private industry employs a majority of all geophysicists, chiefly in the petroleum and natural gas industry. Other geophysicists are employed by mining companies, exploration and consulting firms, and research institutions. A few are in business for themselves as consultants and provide services on a fee or contract basis to companies and individuals engaged in prospecting or other activities utilizing geophysical techniques.

Geophysicists in private industry are employed mainly in the southwestern and western sections of the United States, where most of the country's large oil and natural gas fields and mineral deposits are located. Some geophysicists, employed by American firms, are assigned to work in foreign countries for varying periods of time.

Federal Government agencies also employ significant numbers of geophysicists—mainly the Coast and Geodetic Survey, the U.S. Geological Survey, the Army Map Service, and the Naval Oceanographic Office. Colleges and universities, State governments, and nonprofit research institutions employ small numbers of geophysicists.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in geophysics or in one of the geophysical specialities qualifies young persons for many beginning jobs in geophysics. A bachelor's degree in a related science or in engineering, with courses in geophysics, physics, geology, mathematics, chemistry, and engineering, is also adequate preparation for many beginning jobs, especially in geophysical exploration. For example, in the Federal Government the minimum educational requirement for beginning positions in geophysical exploration is a bachelor's degree with at least 30 semester hours consisting of 12 hours in geology, 12 hours in physics, and the remaining 6 hours in additional courses in geology or physics, or in courses in geophysics.

For geophysical specialties other than exploration, and for the more desirable positions in exploration work, graduate education in geophysics or in a related physical science is usually required. A doctor's degree with a major in geophysics, or in a related science with advanced courses in geophysics, is generally required for teaching careers. The Ph. D. degree is also frequently required for positions involving fundamental research and for advancement in most types of geophysical work.

The bachelor's degree in geophysics was offered in only about 20 colleges and universities in 1964. These undergraduate programs provide training chiefly in exploration geophysics. Other curriculums that offer the required training for beginning jobs as geophysicists include geophysical technology, geophysical engineering, engineering geology, petroleum geology, and geodesy.

The master's and Ph. D. degrees in geophysics also were granted by only a few colleges and universities in 1964. For admission to a graduate program, a bachelor's degree with a good background in geology, mathematics, physics, or engineering, or a combination of these subjects is the usual requirement. In general, the graduate student should attend a school in which he can take advanced courses and carry out research projects in the aspect of geophysical science in which he has a special interest.

Beginning geophysicists with only the bachelor's degree are usually given on-the-job training in the application of geophysical principles to their employers' projects. If a new employee has not taken the courses in geophysics needed for his job, he is taught geophysical methods and techniques on the job.

Federal Government agencies also have training programs in which a few geophysicists are sent each year to universities for graduate training. Some Federal Government agencies provide a few summer jobs for promising undergraduates and make permanent positions available to them after graduation.

The prospective geophysicist should have an aptitude and interest in mathematics and the physical sciences. He should be energetic and in excellent health, since geophysicists often have to

work outdoors under somewhat rugged conditions. A willingness to travel is also important, since geophysicists may be required to move from place to place in the course of their employment.

Employment Outlook

Employment opportunities for the few new graduates with degrees in geophysics are expected to be favorable through the mid-1970's. Opportunities will be best for those with the master's or doctor's degree. There should also be good opportunities in geophysical work for well-qualified people with degrees in other sciences if they have had some formal training in geophysics.

The demand for geophysicists is expected to grow moderately during the late 1960's and early 1970's. Federal Government agencies will most likely need additional geophysicists for new or expanded geophysical programs. The petroleum and mining industries may also need additional geophysicists for exploration work. However, exploration for oil and mineral deposits is not expected to rise significantly in the next few years. In colleges and universities, employment of teachers of the geophysical sciences will probably show an increase because of the anticipated rise in the number of students majoring in the geophysical sciences. Some geophysicists will also be needed each year to replace those who leave the profession, retire, or die.

While the number of job openings for geophysicists is not expected to be large in any one year, the number of new graduates with degrees in the science is also expected to be small compared with graduates in other academic fields. In 1964, only 88 degrees in geophysics were granted—26 bachelor's, 36 master's, and 26 doctor's degrees—according to the U.S. Office of Education. As in past years, the number of geophysics graduates who are seeking work as geophysicists will probably be insufficient to meet employers' needs, and well-trained persons with degrees in related sciences and in engineering will probably continue to be hired for geophysical positions.

Over the long run, further growth in the profession is expected. There will be an increasing use of petroleum and mineral products by a growing population. As natural resources in the more easily accessible locations become depleted, additional exploration geophysicists will be needed by petroleum and mining companies to find the more concealed sites of fuels and minerals. In addition, the growing importance of basic research in the geophysical sciences, as well as the continuing need to develop new geophysical techniques and instruments, will create a demand for personnel with advanced training in hydrology, seismology, geodesy, and other geophysical specialties. In Federal Government agencies, additional geophysicists will probably be needed to study the problems of the Nation's water supplies and mineral resources; work on flood control; do research in radioactivity and cosmic and solar radiation; and explore the outer atmosphere and space, using such vehicles as sounding rockets and artificial satellites.

Opportunities for women have been and will continue to be limited, mainly because of the strenuous nature of much of the work. However, a small number of well-qualified women will be able to find positions in offices and laboratories or as teachers in colleges and universities.

Earnings and Working Conditions

In private industry in 1965, new graduates with bachelor's degrees typically received starting salaries between $6,500 and $7,000 a year, according to the limited information available. New graduates with master's degrees received between $500 and $1,000 more than those with the bachelor's degree. Those with doctor's degrees received salaries of between $8,000 and $12,000, depending upon individual qualifications. In industry, geophysical scientists working outside the United States usually receive bonuses and allowances.

In the Federal Government in early 1965, graduates with bachelor's degrees could enter most types of geophysical work at either $5,990 or $7,050 a year, depending upon their college records. Those who had completed all requirements for the master's degree could start at $7,050 or $7,710; those with the Ph. D. degree could start at $8,945 or $10,250. Exploration geophysicists had somewhat lower starting salaries. In the Federal Government as in industry, geophysicists stationed outside the United States are paid an additional amount. The provisions for salary increases, vacations, sick leave, pensions, life and health insurance, and other benefits are the same for geophysicists as for other civil serv-

ice employees. (See chapter on Occupations in Government.)

In educational institutions, starting salaries are generally lower than in private industry or in the Federal Government. University teachers, however, may supplement their income by doing consulting work, writing for scientific publications, or conducting research.

The work of geophysicists is often active and sometimes strenuous. Exploration geophysicists are subject to reassignment in various locations as exploration activities shift. Their working hours may be irregular and are frequently determined by the requirements of field activities.

Where To Go for More Information

American Geophysical Union,
1145 19th St. NW., Washington, D.C. 20036.
Society of Exploration Geophysicists,
Shell Building, Tulsa, Okla. 74119.

Meteorologists

(2d ed. D.O.T. 0–35.68)
(3d ed. D.O.T. 025.088)

Nature of Work

Meteorology is the science of the atmosphere. Its aim is understanding the atmosphere—not only its physical characteristics and movements, but also its effects upon the earth and upon people.

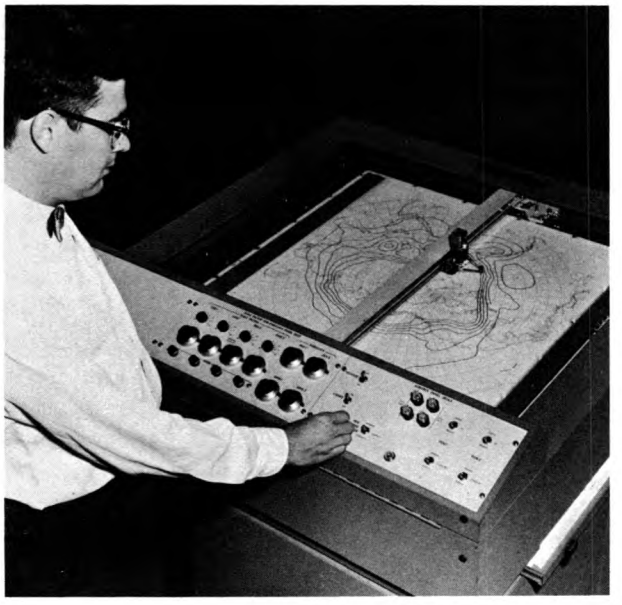
Meteorologists usually specialize in one branch of the science. Weather forecasters, known professionally as *synoptic meteorologists*, are the largest group of specialists. They interpret current weather information (such as air pressure, temperature, humidity, wind velocity) reported by observers in many parts of the world and by weather satellites to make short- and long-range forecasts for specific regions. *Climatologists* analyze past records on wind, rainfall, sunshine, temperature, and other weather data for a specific area to determine the general pattern of weather which makes up the area's climate. *Dynamic meteorologists* investigate the physical laws governing atmospheric motions. *Physical meteorologists* study the physical nature of the atmosphere, including its chemical composition and electrical, acoustical, and optical properties, the effect of the atmosphere on the transmission of light, sound, and radio waves, and the factors affecting the formation of clouds, precipitation, and other weather phenomena. Specialists in applied meterology, sometimes called *industrial meterologists*, study the relationship between weather and specific human activities, biological processes, and agricultural and industrial operations. For example, they make specialized weather forecasts for individual companies, attempt to induce rain or snow in a given area, and work on such problems as smoke control and air pollution abatement.

Research is the major activity of a growing number of meteorologists. These workers investigate subjects such as atmospheric electricity (for example, lightning), cloud and precipitation mechanisms, hurricane dynamics, and the best and quickest means of using the vast amount of weather data collected from weather satellites. They may also conduct research on severe weather phenomena (such as tornadoes), ways to modify weather, weather conditions affecting the behavior of forest fires, and other problems. In both weather forecasting and research, meteorologists use high-speed electronic computing machines to process large amounts of data.

Some meteorologists teach or do research in universities or colleges. In colleges without separate departments of meteorology, they may teach subjects such as geography, mathematics, physics, chemistry, and geology, as well as meteorology.

Where Employed

More than 3,000 civilian meteorologists were employed in the United States in 1965. The U.S. Weather Bureau, by far the largest employer of civilian meteorologists, employed more than 1,900 of these scientists at 300 stations maintained by the Bureau in all parts of the United States, the polar regions, Puerto Rico, Wake Island, and other sites in the Pacific area. Some meteorologists work for the Forest Service of the U.S. De-



Courtesy of the U.S. Weather Bureau

Meteorologist uses electronic computer-plotter to process weather data.

partment of Agriculture, and for a few other Federal Government agencies. The Armed Forces also employ some civilian meteorologists, particularly for research and development work.

Other employers of meteorologists are airlines, educational institutions, and weather consulting services. In 1965, the airlines employed about 300 meteorologists to forecast the weather along the companies' flight routes and to brief pilots on weather conditions. Colleges and universities employed about 300 meteorologists for teaching and research. Private weather consulting firms, which provide special weather information for a fee, employed more than 150 of these scientists. In addition, some meteorologists were working for companies that design and manufacture meteorological instruments, as well as for a number of large firms in the aerospace, insurance, utilities, and other industries. Still others worked for State and local governments and for nonprofit organizations; presented radio and television weather programs; or worked as editors and librarians.

In addition to the meteorologists in civilian employment, more than 3,000 members of the Armed Forces were engaged in meteorological work in 1965. Of these, approximately 2,800 were on active duty in the Air Force. Meteorologists in the Armed Forces usually make weather forecasts that are needed to plan military operations; some also do research.

Only a small number of women are meteorologists. These women are employed by the Weather Bureau (as forecasters), the Armed Forces, colleges and universities (primarily in research positions), and the airlines.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in meteorology is the usual minimum educational requirement for beginning meteorologists in weather forecasting. However, a bachelor's degree in a related science or in engineering is acceptable for many positions, provided the applicant has credit for courses in meteorology. For example, the Weather Bureau's minimum requirement for beginning positions is a bachelor's degree with at least 20 semester hours of study in meteorology and with training in physics and mathematics.

For research and teaching positions and for many top-level positions in other meteorological activities, an advanced degree in meteorology is highly desirable, although persons with graduate degrees in other sciences may also qualify if they have taken advanced courses in meteorology, physics, mathematics, and chemistry. The Ph. D. degree is usually essential for high-level teaching and research positions.

Degrees in meteorology were awarded by 20 colleges and universities in 1964. However, many other institutions offered courses in meteorology.

Meteorological training is also given by the Armed Forces. For example, each year the U.S. Air Force selects over 200 new college graduates who have received Air Force commissions and sends them to civilian universities for special 9- to 12-month programs in meteorology. Graduates of these programs are then assigned to meteorological work for the Air Force. The Armed Forces also send a number of military meteorologists to universities or to military training centers for advanced training leading to the master's or doctor's degree. Ex-servicemen with military training and experience as meteorologists are given preference for civilian positions with the Armed Forces; they can also qualify for

positions with other employers of weather personnel.

The Weather Bureau has an in-service training program under which scholarships are granted to some of its meteorologists, enabling them to take advanced and specialized training. Also, college students preparing for careers in meteorology may obtain summer jobs with the Weather Bureau, where they may get permanent positions after they receive their bachelor's degrees.

Promotions in the Weather Bureau, as in other Federal Government agencies, are given according to Civil Service regulations. (See section on Occupations in Government.) With the airlines, the chances for advancement are somewhat limited. However, after considerable work experience, some airline meteorologists may advance to the position of flight dispatcher, or to various supervisory or administrative positions. A few well-trained meteorologists with a background in science, engineering, and business administration may be able to establish their own weather consulting services.

Among the personal characteristics needed by meteorologists are mathematical aptitude and an interest in the physical sciences. For some jobs, the ability to draw quickly and neatly is important. Since most of the work is done in an office, the physical requirements are not heavy and can be met by any reasonably healthy person.

Employment Outlook

Employment opportunities for meteorologists are expected to be good through the mid-1970's. Meteorologists with advanced degrees will be in special demand to conduct research, teach in colleges and universities, and engage in management and consulting work. The advent of missiles, supersonic aircraft, manned spacecraft, and weather satellites has greatly expanded the boundaries of meteorology and opened new fields of activity. Opportunities to study weather on a global scale will be particularly good for meteorologists who can perform research on information obtained by spacecraft and weather satellites, and who can process, analyze, and interpret the information quickly and accurately. Growth will also stem from the demand for meteorologists to develop and improve instruments such as radar and radio probes, high-altitude balloons, research rockets, satellites, and electronic computers used for collecting and processing weather data. In addition, there will be a continuing demand for meteorologists to work on improving weather forecasts. Replacement of meteorologists who retire or otherwise leave the profession will also provide many opportunities.

New graduates with a bachelor's, master's, or Ph. D. degree and experienced men and women will be needed by the Weather Bureau to fill vacancies in existing programs such as weather measurements and forecasts, severe storm research, storm and flood forecasts, turbulence research, and air pollution research. It is estimated that during each of the next few years, the Weather Bureau will hire approximately 100 meteorologists with a bachelor's degree.

An increase is also expected in the number of meteorologists to be employed by the airlines. As more jet planes are placed in service and the number of aircraft flights increase, more meteorologists will be needed to assist in determining the safest and smoothest flight routes. Employment opportunities for meteorologists with other private companies and research organizations and in weather consulting services are also expected to increase somewhat, as the value of weather information receives further recognition. The number of teaching and research positions for meteorologists in colleges and universities should also rise in the years ahead, primarily because of increases in total college enrollments and increases in departments awarding degrees in meteorology. Opportunities for civilian meteorologists in the Armed Forces are not expected to increase significantly through the mid-1970's. However, there will probably be a growing need for military meteorologists throughout the later 1960's, mostly to replace those reaching retirement age.

Since meteorology is a relatively small profession, job openings will not be numerous in any year. On the other hand, qualified applicants for jobs as meteorologists probably will continue to be small. For example, in 1964, only 207 persons were awarded the bachelor's degree in meteorology, 96 the master's degree, and 27 the Ph. D. degree, and not all of these graduates took jobs as meteorologists. Furthermore, only a few graduates with majors in other fields and with

some training in meteorology enter the profession because of opportunities in other scientific fields. In addition, most military meteorologists who leave the Armed Forces do not take positions as civilian meteorologists.

Earnings and Working Conditions

Meteorologists with the bachelor's degree and no experience could start in Federal Government service at $5,990 or $7,050 a year depending on their college records, in early 1965. Meteorologists who had completed all requirements for the master's degree could start at $7,050 or $7,710; those with the Ph. D. degree could begin at $8,945 or $10,250. Workers stationed outside the United States are paid an additional amount. The provisions for salary increases, vacations, sick leave, pensions, life and health insurance, and other benefits are the same for meteorologists as for other civil service employees. (See section on Occupations in Government.)

Airline meteorologists, in 1965, received a starting salary of approximately $6,000 a year, according to the Air Transport Association. Meteorologists generally receive the same benefits as other airline employees. (See chapter on Occupations in Civil Aviation.)

According to the National Science Foundation's National Register of Scientific and Technical Personnel, the average (median) annual salary of meteorologists in 1964 was $10,600. Only 10 percent of the meteorologists earned less than $7,800 and about 10 percent earned more than $15,500.

Jobs in weather stations, which are operated on a 24-hour, 7-day week basis, often involve nightwork and rotating shifts. Most stations are at airports or at places in or near cities; some are in isolated and remote areas.

Where To Go for More Information

American Meteorological Society,
45 Beacon St., Boston, Mass. 02108.

The U.S. Weather Bureau, Environmental Science Services Administration, Department of Commerce, Washington Science Center, Building 5, Rockville, Md., 20852, will provide information on employment opportunities with that agency and on its student-assistant program.

Information on the Air Force meteorological training programs may be obtained from the nearest USAF recruiting office or by writing to Commander, USAF Recruiting Service, Wright-Patterson AFB, Ohio, 45899.

Oceanographers

(2d ed. D.O.T. 0-35.65)

(3d ed. D.O.T. 024.081)

Nature of Work

The ocean covers more than two-thirds of the earth's surface. It supplies food and minerals, influences the weather, provides a medium of transportation, and offers means of recreation. Oceanographers are the scientists who study the ocean—its characteristics, movements, physical elements, and animals and plants. The results of their studies not only extend basic scientific knowledge, but contribute to the development of practical methods for use in such operations as charting and forecasting weather phenomena; improving fisheries; mining the ocean's resources; and providing defense against enemy attack.

Oceanographers plan extensive tests and observational programs and conduct detailed surveys and experiments to obtain information about the ocean. They collect and study data on subjects such as the ocean's chemical and physical composition, including its tides, currents, waves, temperature, density, and acoustical properties; its bottom contours and composition; ice floes; and sea plants and animals. They analyze the samples, specimens, and data collected, often making use of electronic computers. To present the results of their studies, they prepare charts, tabulations, reports, and manuals.

In developing and carrying out tests and observational programs, oceanographers use the principles and techniques of physics, chemistry, mathematics, geology, biology, meteorology, and related sciences. They use a variety of special instruments and devices such as the magnetom-

eter, which measures the earth's magnetic field; the sound velocimeter, which measures the speed of sound traveling underwater; the echo sounder, which measures distances to the sea bottom by means of sound impulses; the heat flow probe, which penetrates the ocean bottom and measures flow of heat from the earth's interior; the mid-water trawl, which samples organisms from mid-ocean; and special thermometers and water bottles which measure water temperature and collect samples for analyzing the water's chemical composition at and below the surface. Oceanographers use specially developed cameras with strong lights to photograph marine organisms and the ocean bottom. When their work requires new oceanographic instruments or analytical techniques, they usually develop them.

Oceanographers are usually specialists in one of the branches of the profession. *Biological oceanographers* (marine biologists) study the ocean's plant and animal life, which ranges from microscopic plankton to the largest living creature—the blue whale. *Physical oceanographers* study the physical properties of the ocean, such as its density, temperature, and ability to transmit light and sound; the movements of the sea, such as waves, tides and currents; and the relationship between the sea and the atmosphere. *Geological oceanographers* (marine geologists) study the ocean floor—its topographic features, and the rocks and sediments found on and below it. *Chemical oceanographers* investigate the chemical composition of ocean waters, which include traces of more than half of the total number of known physical elements. In addition to these four groups of specialists, *oceanographic engineers* specialize in the design and building of the systems, devices, and instruments used in oceanographic research and operation.

About 3 out of every 4 oceanographers are engaged primarily in performing or administering research and development activities. A small but growing number of oceanographers teach in colleges and universities; a few are engaged in technical writing, consulting, and in the administration of activities other than research.

Most oceanographers spend at least part of their time aboard oceanographic ships at sea; such voyages may last from a few days to several months. A few oceanographers in survey positions spend nearly all their time aboard ship. On the other hand, a few oceanographers never go to sea, but analyze data collected by other scientists or pursue mathematical studies ashore.

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Where Employed

Oceanography is one of the smallest of the science fields; the total number of oceanographers and closely related scientists in the United States was estimated to be approximately 3,000 in 1965. About three-fourths of these were employed either by colleges and universities and university-operated research laboratories, or by the Federal Government. Those Federal agencies employing substantial numbers of oceanographers are the Navy Oceanographic Office of the Department of the Navy, the Bureau of Commercial Fisheries of the Department of the Interior, and the Coast and Geodetic Survey of the Environmental Science Services Administration in

Oceanographer obtains samples from the ocean floor with "orange peel grab".

the Department of Commerce. There are also a few positions in oceanography in other parts of the Department of the Navy, in the Weather Bureau, and in other Government agencies.

A small but growing number of oceanographers work in private industry for consulting or other firms which design and develop instruments for oceanographic research. Some oceanographers work for nonprofit laboratories other than those operated by colleges and universities. A few work for fishery laboratories of State and local governments.

Training, Other Qualifications, and Advancement

The minimum educational requirement for beginning professional positions in oceanography is the bachelor's degree with a major in oceanography or in physics, chemistry, biology, or one of the geo-sciences. For professional positions in research and teaching, and for advancement to high-level positions in most types of work, graduate training in oceanography or a related field is usually required.

Undergraduate training in oceanography was offered by relatively few colleges and universities in 1964, and only two institutions offered the bachelor's degree with a major in the subject. A prospective oceanographer is usually not handicapped, however, if he is unable to obtain undergraduate training in oceanography, provided that while in college he obtains a broad knowledge and understanding of the related sciences. Such training, when coupled with a strong interest in oceanography, is adequate preparation for most beginning positions in the field, or for entry into graduate school.

Important undergraduate courses for the prospective oceanographer are mathematics, physics, chemistry, geology, meteorology, biology, and zoology. In general, the student should specialize in the particular science field which is closest to his area of interest in oceanography. For example, those students interested in physical oceanography should major in physics or mathematics, whereas those interested in chemical oceanography should obtain a bachelor's degree in chemistry.

Advanced degrees in oceanography were offered by at least 16 colleges and universities in 1964, and about 20 institutions offered advanced courses in the marine sciences. The academic work of the graduate student in oceanography consists primarily of extensive training in oceanography combined with further training in his selected area of marine specialization—usually chemistry, geology, biology, or physics. A few of the oceanography courses typically offered in graduate school concern underwater acoustics, waves and tides, marine vertebrates and invertebrates, marine ecology (study of variables affecting the distribution and abundance of marine organisms), marine sediments, ocean currents and marine hydrodynamics (mathematical treatment of motion in the seas). Institutions generally require the graduate student to spend part of his time aboard ship—doing oceanographic research, acquiring familiarity with the sea and the techniques used to obtain oceanographic information, and learning the basic elements of seamanship.

Beginning oceanographers with the bachelor's degree usually start as research or laboratory assistants, or in routine positions involving data collection, analysis, or computation. Most new graduates are given on-the-job training in the application of oceanographic principles to the problems at hand. If a beginner has had no basic courses in oceanography, he is often given these courses as part of his on-the-job training.

Beginning oceanographers with advanced degrees can usually qualify for research and teaching positions. Experienced oceanographers, particularly those with the Ph. D. degree, may advance to administrative positions, in which they may supervise a research laboratory or direct specific survey or research projects.

Among the qualities desirable in the prospective oceanographer are an aptitude and interest in mathematics and the sciences, a creative imagination, and a disciplined and highly inquisitive mind. Since the oceanographer deals with scientists in many other fields, he must be able to work effectively with people and to express himself well. A liking for the sea and for life aboard ship is also important.

Employment Outlook

Employment opportunities for oceanographers are expected to be very good through the mid-

1970's, particularly for those with advanced degrees. For well-trained persons with bachelor's degrees in related sciences, the opportunities will be primarily to work as research assistants and in routine analytical positions.

The outlook is for rapid growth of this small profession, both during the rest of the 1960 decade and through the mid-1970's. In recent years, the growing recognition of the importance of the oceans to the Nation's welfare and security has heightened interest in oceanography and has opened new fields for specialists in the science. In the years ahead, oceanographers will be needed for research in such areas as underwater acoustics, surface and subsurface ocean currents, and ocean floor topography, all of which are of great importance in improving the Nation's defense against submarines and surface vessels. There will also be a demand for oceanographers to supply improved navigational charts, sailing directions, and weather and iceberg forecasts; to study the air-sea interaction in order to improve weather forecasts; to solve problems related to the mining of the sea and sea bottom, to predict or control damage caused by waves generated by storms or earthquakes, and to prevent beach erosion. Additional oceanographers will be needed to make studies of marine plants and animals for use in improving methods for deriving food supplies from the oceans, in developing and managing fisheries, and in classifying marine animals and plants.

The demand for oceanographers qualified to teach in colleges and universities is also expected to expand. Increased student interest in oceanography will likely result in a rise in the number of courses in oceanography, and this will create openings for more teachers of the science.

Replacement for oceanographers who transfer to other fields, retire, or die will also provide some opportunities.

Since oceanography is a relatively small profession, job opening will not be numerous in any one year. On the other hand, the number of new graduates with degrees in this science is extremely small and is expected to remain so. Thus, oceanography graduates should continue to have excellent opportunities.

Opportunities for women are somewhat limited because much of the work is carried on at sea, and oceanographic ships are not always equipped with living quarters for women. However, well-qualified women will be able to find employment in shore laboratories and in teaching.

Earnings and Working Conditions

In the Federal Government service in early 1965, oceanographers with the bachelor's degree and no experience could begin at $5,990 or $7,050 a year, depending on their college records. Beginning oceanographers who had completed all requirements for the master's degree could start at $7,050 or $7,710; those with the Ph. D. degree could begin at $8,945 or $10,250. Scientists in biological and geological oceanographic specialties had somewhat lower starting salaries. The provisions for salary increases, vacations, sick leave, pensions, life and health insurance, and other benefits are the same as for other Civil Service employees. (See chapter on Occupations in Government.)

Beginning oceanographers in educational institutions have roughly the same salary as other beginning faculty members. (See statement on College and University Teachers.) In addition to their regular salaries, many experienced oceanographers in educational institutions obtain income from consulting, lecturing, and writing books and articles.

Oceanographers engaged in research requiring seagoing voyages are frequently away from home for weeks or months at a time, sometimes living and working in cramped quarters. Young people who like the sea, however, may find this aspect of oceanographic work very satisfying.

Where To Go for More Information

American Society of Limnology and Oceanography,
Department of Oceanography,
Oregon State University, Corvallis, Oreg. 97331.

Interagency Committee on Oceanography,
Bldg. 159 E., Navy Yard Annex, Washington, D.C. 20390.

Woods Hole Oceanographic Institution,
Woods Hole, Mass. 02543.

Naval District Washington, D. C.,
Board of U.S. Civil Service Examiners For Scientific and Technical Personnel,
U.S. Naval Research Laboratory, Washington, D.C. 20390.

Physical Sciences

The physical sciences deal with the basic laws of the physical world. Many scientists in this broad field conduct basic research designed to increase man's knowledge of the properties of matter and energy. Others conduct applied research, using the knowledge gained from basic research to develop new products and processes. For example, chemists in applied research use their knowledge of the interactions of various chemicals to develop new fuels for rockets and missiles. Physicial scientists also teach in colleges and universities and supervise research and development programs.

This chapter includes descriptions of three major physical science occupations—chemist, physicist, and astronomer—and of biochemists, one of the major groups of chemists. Engineer and earth scientists also require a background in the physical sciences; these occupations are described in separate chapters elsewhere in the *Handbook*.

Chemists

(2d ed. D.O.T. 0–07.02 through .85)

(3d ed. D.O.T. 022.081, .168, .181, and .281)

Nature of Work

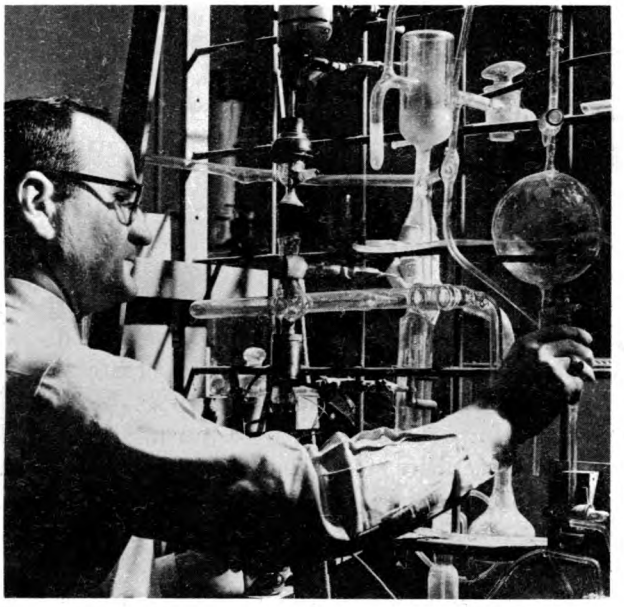
The work done by chemists helps to provide many new and improved products which make our lives healthier, more productive, and more comfortable. They develop vaccines and medicines, new methods of preserving food, and new materials and rocket fuels for use in the exploration of space. As a result of their discoveries, entirely new industries have been created, including the plastics, frozen foods, and synthetic textile fibers industries.

Chemists investigate the chemical composition and properties of matter and changes in its composition. They search for new knowledge of the chemistry of substances and for ways of using this knowledge. In conducting studies, they apply scientific principles and techniques. They also use a variety of instruments such as balances, spectrophotometers, refractrometers, and polarimeters. Chemists maintain accurate records of their work and prepare clear and concise reports showing the results of the tests or experiments. They often present their findings in scientific publications or in lectures before scientific groups.

Most chemists specialize in one of the five major branches of chemistry, or in a subdivision of one of these branches. *Organic chemists*, the largest group, deal primarily with carbon compounds, most of which are substances originally derived from animal and vegetable matter. *Inorganic chemists* are chiefly concerned with compounds of elements relatively free of carbon, including most of the minerals and metals. *Physical chemists* study the quantitative relationships between chemical and physical properties of both organic and inorganic substances—for example, how these substances are affected by electricty, pressure, heat, and radiation. *Analytical chemists* determine the exact chemical composition of substances and test them to determine their quality, purity, and other characteristics. *Biochemists* are concerned with the chemistry of living things. (See separate statement on Biochemists elsewhere in this chapter.)

Some chemists specialize in the product or process of a particular industry, such as agriculture, food, petroleum, plastics, or rubber. Such work may require a knowledge of more than one branch of chemistry. The specialist in plastics, for example, may need a knowledge of physical and analytical as well as of organic chemistry. All chemists, however, must know the fundamentals of chemistry—the composition and properties of substances and how they can be changed.

Nearly one-half of all chemists are engaged in research and development. Most research chemists work on applied research projects aimed at creating new products or improving or finding new uses for existing ones. Chemists in applied research have helped to develop a vast range of new products, including antibiotics, plastics, synthetic rubbers, detergents, insecticides, and synthetic fibers. Many chemists work on basic research projects designed to extend scientific knowl-



Courtesy of the U.S. Department of Navy

Chemist utilizes intricate laboratory apparatus.

edge rather than to solve immediate practical problems. However, many important practical applications have resulted from basic research. For example, basic research on polymerization—how and why certain small molecules unite to form giant molecules—resulted in the development of synthetic rubber, nylon, and plastics.

Sizable numbers of chemists are employed in management and administration—especially of research and development activities. Analysis and testing is another major activity of chemists because various kinds of tests must be made at practically every stage in the manufacture of a product, from its initial development to final production. Many chemists teach in colleges and universities, often combining research with teaching. Smaller numbers are employed as sales representatives of chemical companies and other manufacturers in positions where the employee must be able to discuss the technical aspects of a product. A few chemists work as consultants.

Where Employed

Chemistry is by far the largest field of employment in the sciences. There were approximately 120,000 chemists in the United States in mid-1964; more than 5 percent were women.

Approximately three-fourths of all chemists were employed by private industry in mid-1964. The major industrial employer of chemists is the chemicals manufacturing industry. This industry employed more than two-fifths of all chemists in private industry. Other manufacturing industries utilizing relatively large numbers of chemists are food, petroleum, electrical equipment, paper, and primary metals. Significant numbers of chemists are also employed by the wholesale trade industry; by distributors of chemical, food, and petroleum products; and by independent laboratories and research institutes providing consulting services.

Many chemists are employed in colleges and universities. Although most of these chemists teach, some work full or part time in research and development, often on projects for the Federal Government. Sizable numbers of chemists are also employed directly by Federal Government agencies, chiefly by the U.S. Departments of Defense; Health, Education, and Welfare; Agriculture; and the Interior. Smaller numbers work in State and local governments, primarily in agencies concerned with health, agriculture, and highways. A few work for foundations and other nonprofit organizations.

Chemists are employed in all States, and in small as well as large cities. However, they are concentrated in large industrial areas. Six States employ about half of the total—New York, New Jersey, California, Pennsylvania, Ohio, and Illinois.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in chemistry is usually the minimum educational requirement for starting a career as a chemist. Graduate training is essential for many positions, particularly in research and college teaching, and is helpful for advancement in all types of work.

Training leading to the bachelor's degree in chemistry is offered in several hundred colleges and universities throughout the country. A few of the required chemistry courses in an undergraduate curriculum are quantitative and qualitative analysis, and inorganic, organic, and physical chemistry. Courses in mathematics (especially analytical geometry and calculus), physics,

English, and one foreign language (usually German), are also required.

Advanced degrees in chemistry are awarded by over 200 colleges and universities, many of which offer financial assistance to above average students interested in graduate study. In graduate school, the student usually specializes by taking several courses in a particular field of chemistry. Requirements for the master's or doctor's degree usually include classroom studies, laboratory research, and preparation of a thesis.

New graduates with the bachelor's degree usually qualify for beginning positions in analysis and testing, quality control, technical service and sales, or as assistants to senior chemists in research and development work. Most chemists with the bachelor's degree start their careers in industry or government. In industry, employers often have special training programs for new chemistry graduates whom they employ. These programs are designed to supplement college training with specific industry techniques and to aid in determining the type of work for which the new employee is best suited. Some chemists with the bachelor's degree and above average grades are able to obtain positions in colleges and universities as research or teaching assistants while working toward advanced degrees.

Chemists with the master's degree can often qualify for applied research positions in government or private industry. They can also qualify for some teaching positions in colleges and universities.

The Ph. D. degree is generally required for positions in basic research and for higher level teaching positions in a college or university. It is also important for advancement to top-level positions in administration and in other activities.

Personal qualifications needed for a career in chemistry include an orderly mind, above-average intelligence, and an interest and facility in mathematics. Since chemists usually work in teams, an ability to communicate and work with others is important.

Employment Outlook

The employment outlook for chemists is expected to be very good through the mid-1970's. As in recent years, there will be a particular need for chemists with advanced degrees for research and teaching positions. For women chemists qualified to do research and teaching, employment opportunities are also expected to be good.

One of the major factors behind the expected increase in employment opportunities is the anticipated continued growth in expenditures for research and development. Such expenditures not only create jobs for chemists engaged in research and development—the activity of nearly half of all chemists—but the production of new products resulting from the research also creates new positions for chemists in other types of work. Another important factor involved in increasing the opportunities for chemists is the growing demand for products of industries that are major employers of chemists, especially for such products as plastics, synthetic fibers, drugs, fertilizers, and high energy fuels for missiles and rockets.

The demand for chemists to fill college and university teaching positions will also rise substantially, because of the large increases in college enrollments expected during the late 1960's and early 1970's. The greatest demand will be for those with Ph. D. degrees, but there will be many positions for chemists with the master's degree. (See statement on College and University Teachers.)

In addition to those needed to fill new positions, many chemists will also be needed each year to replace those who retire, die, or transfer to other occupations. These losses to the profession, estimated for 1964 at approximately 2,500, are expected to rise slowly in the future.

Along with the expected growth in demand for chemists, a steady increase is expected in the number of chemistry graduates. If their number continues to represent the same proportion of all college graduates as in recent years, the number seeking employment in the profession will rise rapidly throughout the mid-1970's. Nevertheless, the demand for chemists is expected to be greater than the number of new graduates who will be available for employment. Thus, although there may be some competition for the better paying entry positions, new chemistry graduates should continue to have favorable employment opportunities in the profession. New graduates will also find openings in high school teaching, provided they have completed the professional edu-

cation courses and other requirements for a State teaching certificate. However, they are usually regarded as teachers rather than as chemists. (See statement on Secondary School Teachers elsewhere in the *Handbook*.)

Earnings and Working Conditions

Inexperienced chemistry graduates with a bachelor's degree had an average (median) starting salary of about $6,800 a year in private industry in mid-1964, according to a survey conducted by the American Chemical Society. Inexperienced graduates with the master's degree averaged about $7,900 a year and those with the Ph. D. degree, about $11,200.

In academic institutions, the average (median) annual starting salary for the few entrants with the bachelor's degree and no experience was about $4,300, according to the American Chemical Society. The average salary for inexperienced graduates with the master's degree was about $5,400, and for those with the Ph. D. degree, $7,500. Many experienced chemists in educational institutions supplement their regular salaries with income from consulting, lecturing, and writing books.

In Federal Government positions in early 1965, the annual starting salary for inexperienced chemists with the bachelor's degree was either $5,990 or $7,050, depending on the individual's college record. Beginning chemists with 1 full year of graduate study could start at $7,050, and those with 2 full years of graduate study at $7,710. Chemists with the Ph. D. degree could start at $8,945 or $10,250.

The average (median) annual salary for all chemists was $11,000 in 1964, according to the National Science Foundation's National Register of Scientific and Technical Personnel. Only 10 percent of all chemists earned less than $7,200 a year, and about 10 percent earned $17,500 or more.

Chemists spend most of their time working in modern, well-equipped, well-lighted laboratories, offices, or classrooms. Chemists work with chemicals that can be dangerous if handled carelessly. However, if safety regulations are followed, health hazards are negligible.

Where To Go for More Information

American Chemical Society,
1155 16th St. NW., Washington, D.C. 20036.
Manufacturing Chemists' Association, Inc.
1825 Connecticut Ave. NW., Washington, D.C. 20009.

For additional sources of information, see also statements on Biochemists, Chemical Engineers, and Industrial Chemical Industry.

Biochemists

(2d ed. D.O.T. 0–07.02)
(3d ed. D.O.T. 041.081)

Nature of Work

The biochemist plays an important role in modern science's search for knowledge of the chemical basis of life and the factors that sustain life. His work bears on subjects ranging from heredity and disease to weightlessness in space and the existence of life on other planets.

Biochemists conduct tests to identify, classify, and analyze the chemical reactions involved in biological processes such as muscular contraction, reproduction, and metabolism. They investigate the manner in which chemical substances enter into, or are formed in, living things. Their studies are often concerned with changes in the chemical composition of living tissue and organs that are caused by environmental factors such as disease and radiation. Biochemists often present the results of their work in scientific journals or lectures before scientific groups.

To conduct their investigations, biochemists apply the principles and procedures of chemical and physical analysis. They use a variety of scientific instruments and devices such as electron microscopes and radioactive isotope counters. When the need arises, they may devise new instruments and analytical techniques.

Biochemists usually specialize in 1 of 3 fields: The biochemistry of medicine, nutrition, or agriculture. Those in the medical field may investi-

Courtesy of the U.S. Department of Navy

Biochemist analyzes samples under an electron microscope.

gate the causes and cures of disease, or develop diagnostic procedures. Sometimes they study the relation of a particular body function to different chemical substances under varying conditions. For example, they may analyze the effects of proteins, enzymes, or hormones on metabolism under conditions of high radiation or disease. Biochemists in the field of nutrition identify the nutrients needed by plants and animals to maintain good health; or they may determine the nutrient content of foods. Those who work in the field of agriculture investigate soils, fertilizers, and plants. Their job is to discover more efficient methods of cultivating, storing, and utilizing crops as well as to find additional uses for by-products of agricultural crops.

The greatest number of biochemists—3 out of every 4—are engaged in research. Although the emphasis is on basic research designed to increase scientific knowledge, some biochemists conduct applied research, using the discoveries of basic research to solve practical problems or develop a useful product. For example, through basic research, biochemists have discovered how a living organism forms a hormone. This knowledge is put to use by synthesizing the hormone in the laboratory and then producing it on a mass scale to enrich hormone-deficient organisms. The distinction between basic and applied research, however, is often one of degree, and it is therefore not unusual for biochemists to be proficient in both types of work.

Many biochemists teach in colleges and universities, often combining research with teaching. Others are engaged in production or testing activities; still others work as consultants.

Where Employed

Approximately 9,000 biochemists were employed in the United States in mid-1964; about 15 percent were women. Biochemists are employed in both large and small cities, and in all States.

Nearly 4,000 biochemists were employed in colleges and universities in mid-1964. Many of these scientists worked in university-operated laboratories and hospitals where they spent all of their time on research. Private industry employed approximately 3,000 biochemists. About half of these worked in manufacturing industries —primarily the chemicals and food industries. Within the chemicals industry, many biochemists were employed by manufacturers of drugs, insecticides, and cosmetics. Significant numbers of biochemists worked for private consulting firms or were self-employed as consultants.

Nearly 2,000 biochemists worked for Federal, State, and local government agencies. Most of these scientists were employed by the Federal Government, chiefly by the National Institutes of Health and the Food and Drug Administration of the U.S. Department of Health, Education, and Welfare; the Agricultural Research Service and regional research laboratories of the U.S. Department of Agriculture; and the Veterans Administration.

Several hundred biochemists worked for nonprofit organizations, including research institutes and hospitals.

Training, Other Qualifications, and Advancement

The minimum educational requirement for beginning positions in biochemistry is the bachelor's degree with a major in biochemistry or chemistry, or with a major in biology and a minor in chemistry. For most entrance positions in research and teaching, graduate training in biochemistry is required. Graduate work is also needed for advancement to most high-level positions in all types of work.

Although relatively few schools award the bachelor's degree in biochemistry, training in chemistry is offered in several hundred colleges and universities throughout the country. Important undergraduate courses for the prospective biochemist are physical, analytical, organic and inorganic chemistry; general biology; mathematics; physics; English; and a foreign language.

Graduate degrees in biochemistry are offered by over 50 colleges and universities. For entrance into a graduate program in biochemistry, schools usually require the student to have a bachelor's degree in biochemistry, chemistry, or biology. However, students with the bachelor's degree in one of the other sciences are usually admitted if they have had several undergraduate courses in chemistry.

In graduate school, the student builds upon the basic knowledge obtained in the undergraduate curriculum. He takes advanced courses and conducts research in many areas of biochemistry. He may become a specialist in a particular field of biochemistry by preparing a thesis or doing other intensive research.

Some graduate schools with extensive research facilities or a staff highly reputed in a special field have gained a reputation for training students in a particular field of biochemistry. For example, the colleges affiliated with a medical school or hospital often have the facilities and equipment available for studying the biochemistry of disease. A few schools may even train students to become specialists in one type of disease. A student who desires to specialize in a particular field of biochemistry should, therefore, investigate the specialties of the various schools and choose his college carefully.

New graduates with the bachelor's degree usually begin work in industry or government as research assistants in positions involving testing and analysis. In the drug manufacturing industry, for example, research assistants may analyze the ingredients of a product to verify and maintain its purity or quality. Some graduate students with above-average college grades are able to become research or teaching assistants in colleges and universities.

Beginning biochemists with advanced degrees can usually qualify for teaching and research positions. With experience, some biochemists with the Ph. D. degree advance to high-level administrative positions and supervise research programs. Other highly qualified biochemists, who prefer to devote their whole time to research, often become leaders in a particular field of biochemistry.

The young person who thinks he might like to enter the field of biochemistry would do well first to take inventory of his personal characteristics and aptitudes. Among the personal qualities needed are a curiosity about living things, a logical mind, an aptitude for science and mathematics, and the patience and perseverance needed to conduct detailed, complex experiments. Also, the ability to communicate clearly both in writing and speaking is a valuable asset for a successful career in biochemistry.

Employment Outlook

The employment outlook is very good for biochemists through the mid-1970's. Biochemists with the Ph. D. degree will be in special demand. Their services will be required to conduct independent research and to teach in colleges and universities.

Employment opportunities will stem mainly from the rapid growth expected in this field. A few positions, however, will have to be filled each year to replace workers who transfer to other fields of work, retire, or die. The major factor back of the anticipated growth is the anticipated continued increase in expenditures for research and development in the life sciences. Such expenditures by the Federal Government, which nearly doubled in the 5-year period ending 1964, are expected to continue to rise rapidly.

The greatest growth in employment of biochemists is expected in hospitals, medical clinics, and other places where medical research is conducted. Growth in this area will result chiefly

from the expansion of research on such diseases as cancer, heart disease, muscular dystrophy, and mental illness.

Private industry and the Federal Government are also expected to absorb a growing number of workers in the field of biochemistry. Stimulating this employment growth will be the more stringent standards that have been established by the Congress and Federal regulatory agencies for research on, and testing of, new drugs, chemicals, and processing methods before their use in medicine and agriculture.

Growing college enrollments will strengthen the demand for biochemists qualified to teach in colleges and universities. In addition to growing needs for teachers of prospective biochemists and students in related fields, an increasing interest in biochemistry among students in such curriculums as nursing and home economics will also add to the demand for teachers in the field.

Although biochemistry is a relatively small profession and job openings will not be numerous in any one year, the number of graduates with degrees in this science is also fairly small and is expected to remain so. Thus, for biochemistry graduates—women as well as men—the employment outlook should continue to be favorable. For women, the field of nutrition offers the best opportunities.

Earnings

In colleges and universities starting salaries averaged about $5,400 for biochemists with the master's degree, and $7,500 a year for those with the Ph. D. degree in mid-1964. Biochemists in educational institutions often supplement their income by engaging in outside research or consulting work.

In private industry, the average annual starting salary of biochemists with the bachelor's degree was about $6,500 in mid-1964, according to the limited amount of information available. Starting salaries for biochemists with the master's degree averaged $500 to $1,000 more a year than for those with the bachelor's degree. Annual starting salaries of biochemists with the Ph. D. degree ranged from $7,000 to $12,000, depending on their specialty and research experience in graduate school.

In the Federal Government in early 1965, beginning biochemists with the bachelor's degree had a starting salary of $5,990, or $7,050 a year, depending on their college record. Biochemists with the master's degree started at $7,050 or $7,710 and those with the Ph. D. degree, at $8,945 or $10,250.

Most biochemists can look forward to a substantial increase in earnings as they gain experience. For example, average beginning salaries approximately double after 20 years of experience. Average salaries of biochemists with the master's or Ph. D. degree tend to increase faster after 10 years of experience than the salaries of those with only the bachelor's degree, primarily because biochemists with advanced degrees are able to qualify for those high-level administrative and research jobs where salaries are higher.

Where To Go for More Information

American Society of Biological Chemists,
9650 Wisconsin Ave., Bethesda, Md. 20014.

Physicists

(2d ed. D.O.T. 0–35.73)

(3d ed. D.O.T. 023.081 and .088)

Nature of Work

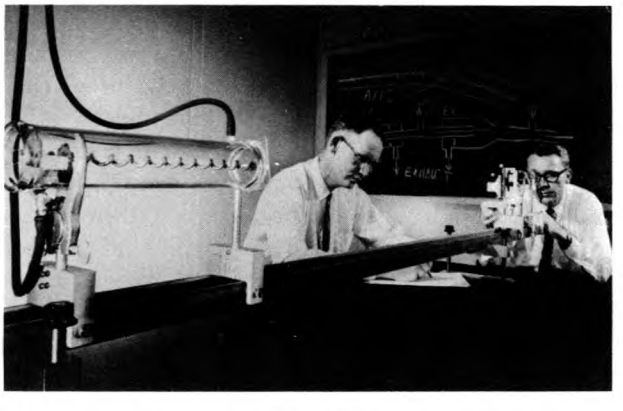
Physics is concerned with all forms of energy, the structure of matter, and the relationship between matter and energy. Physicists investigate and attempt to understand the laws governing the behavior of the physical world and how these laws may be formulated for the general knowledge and use of man. Their discoveries have made valuable contributions to the scientific progress of recent years in such areas as space exploration, nuclear energy, and electronics.

About 1 out of every 2 physicists is engaged in research and development. Many conduct basic research, designed to increase scientific knowledge with only secondary regard to its practical applications. Some of these, called theoretical

physicists, attempt to describe the interactions between matter and energy in mathematical terms. Others, called experimental physicists, make careful systematic observations and perform experiments to identify and measure these interactions. For example, they try to identify and measure the lifetime of tiny particles and antiparticles of matter which may exist within the core of the atom. Experimental physicists use apparatus such as particle accelerators, X-ray spectrometers, electron diffraction cameras, microwave devices, shock tubes, and phase and electron microscopes. When their research requires new kinds of instruments, they may design them. The difference between theoretical and experimental physicists is often merely one of emphasis. Some members of the profession are skilled in both types of work.

A large number of physicists conduct applied research. They use the knowledge gained from basic research to solve practical problems or to create new or improved products. For example, the work of physicists specializing in solid-state physics led to the development of transistors, now used in place of vacuum tubes in many types of electronic equipment ranging from hearing aids to guidance systems for missiles.

Many physicists teach in colleges and universities, often combining research with teaching. Some are engaged in management and administration, especially of research and development activities. Others work in activities related to the production of industrial products such as inspection and quality control. A few physicists do consulting work.



Physicists test an experimental helical gas convection lens in a laser beam project.

Most physicists specialize in one or more branches of the science—mechanics, heat, optics, acoustics, electromagnetism, electronics, atomic and molecular physics, nuclear physics, physics of fluids, solid-state physics, or classical theoretical physics. They may concentrate in a subdivision of one of these branches. For example, within solid-state physics they may specialize in ceramics, crystallography, or semiconductors, among others. In addition, new fields are continually emerging such as lasers and masers. However, since all physics specialties rest on the same fundamental principles, nearly all are closely related and the physicist's work may overlap a number of specialties.

Physicists often apply the theories and methodology of their science to problems originating in other sciences, including astronomy, biology, chemistry, and geology. Some people have become specialists in fields that combine the knowledge of physics and a related science. Thus, a number of specialties have developed on the borderline between physics and other fields—astrophysics, biophysics, physical chemistry, and geophysics. (Information on these occupations is contained elsewhere in the *Handbook*.) Furthermore, the practical applications of physicists' work has increasingly merged with engineering.

Where Employed

Approximately 40,000 physicists were employed in the United States in mid-1964. About 17,000 were employed by private industry. Nearly one-third of this group were employed in the electrical equipment industry. Other industries using relatively large numbers of physicists include the aerospace, chemicals, and instruments industries, independent commercial laboratories, and research institutes. Significant numbers are also employed by the ordnance, machinery, and engineering and architectural service industries.

Colleges and universities employed nearly 17,000 physicists in mid-1964. Although teaching is the main activity of most physicists in colleges and universities, a sizable number employed by such institutions work full time in research, often on projects conducted for Federal Government agencies such as the Atomic Energy Commission and the Department of Defense.

Federal Government agencies also employ large numbers of physicists—approximately 5,500 in mid-1964. The agencies employing the most physicists are the Department of Defense and the National Bureau of Standards.

Physicists are employed in all States. However, they are concentrated in those States with large industrial area and sizable college and university enrollments. Five States employ nearly one-half of the total—California, New York, Massachusetts, Pennsylvania, and New Jersey.

Relatively few physicists are women—only about 3 percent, according to the National Science Foundation's National Register of Scientific and Technical Personnel.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in physics is the minimum entrance requirement for young people seeking careers as physicists. Graduate training is required for many entry positions and is helpful for advancement in all areas of work.

A doctor's degree is required for high-level college and university teaching positions. It is usually needed for employment in positions involving independent research and development.

Physicists with master's degrees are able to qualify for many research jobs in private industry, educational institutions, and government. Some also obtain positions as instructors in colleges and universities. Usually, graduate students working toward a doctor's degree are assigned to teach elementary college courses, conduct laboratory sessions, or aid senior faculty members on research projects.

Physicists with bachelor's degrees can qualify for a variety of jobs in applied research and development work in private industry or the Federal Government. Some become research assistants in colleges and universities while working toward advanced degrees. Many persons with only a bachelor's degree in the science do not work as physicists but go into nontechnical work, one of the other sciences, or into engineering.

Training leading to the bachelor's degree in physics was offered by approximately 750 colleges and universities in 1964. In addition, many engineering schools offered a physics major as part of the general curriculum. The undergraduate program in physics provides a broad background in the science which serves as a base for later specialization either in graduate school or on the job. A few of the physics courses typically offered in an undergraduate program are mechanics, electricity and magnetism, optics, thermodynamics, and light and atomic physics. In addition, courses in chemistry and mathematics are required.

Master's degrees in physics were offered by approximately 250 colleges and universites in 1964, and the Ph. D. degree was offered by approximately 125. In graduate school, the student places emphasis on his particular field of interest. In 1963, among the largest fields of study in graduate school were solid-state physics, high energy physics, and nuclear structure. The graduate student spends a large portion of his time in research, especially the candidate for the Ph. D. degree.

The chief personal qualifications needed for a career in physics are a creative imagination and a highly inquisitive mind. Strong interest and facility in mathematics are also essential.

Employment Outlook

The outlook is for continued very rapid growth in the employment of physicists through the mid-1970's. As in recent years, there will probably be a particular demand for physicists with Ph. D. degrees to teach in colleges and universities and do high-level research and development work. Research organizations, whether those of government, universities, or industry, have considerable difficulty in filling their requirements for physicists with advanced degrees, and their needs for such physicists will probably continue to increase.

Employment opportunities will stem mainly from the very rapid growth expected in this field. A few positions will also have to be filled each year to replace workers who transfer to other fields of work, retire, or die. Among the major factors back of the anticipated growth in the number of jobs is the expected growth in expenditures for research and development by both industry and government. Such expenditures, which have increased very rapidly in recent years, will probably continue to rise, although somewhat slower than in the past.

The great increase in enrollments of physics students expected in the late 1960's and early

1970's, and the growing need for advanced physics training in other science fields and in engineering will also increase the need for physicists to teach in colleges and universities. During the early 1960's, many colleges were unable to recruit sufficient numbers of well qualified physics teachers, and this problem may well become more acute during the next decade. (See statement on College and University Teachers.)

Along with the anticipated rise in demand for physicists, an increase is expected in the number of physics graduates, especially at the bachelor's degree level. If physics graduates continue to represent the same proportion of all college graduates as in recent years, the number seeking employment in the profession will rise rapidly during the late 1960's and early 1970's. Nevertheless, the demand for physicists is expected to be greater than the number of new graduates available for employment. Thus, graduates with advanced degrees and well qualified graduates with the bachelor's degree should have very good employment opportunities in the profession through mid-1970's.

Earnings and Working Conditions

Starting salaries for physicists with bachelor's degrees were usually between $6,200 and $7,000 a year in private industry in 1964, according to the limited information available. Physicists with master's degrees received starting salaries about $500 to $1,000 higher than those with bachelor's degrees. Annual salaries for new graduates with Ph. D. degrees ranged roughly from $7,500 to as high as $15,000, depending on their specialty and experience.

In the Federal Government service in early 1965, physicists with the bachelor's degree and no experience could start at either $5,990 or $7,050 a year, depending on their college records. Beginning physicists who had completed all requirements for the master's degree could start at $7,050 or $7,710. Physicists with the Ph. D. degree could begin at $8,945 or $10,250.

Starting salaries for physicists with the Ph. D. degree employed as college and university teachers ranged from about $7,000 to $8,000 a year in mid-1964. (For further information, see statement on College and University Teachers.) In addition to their regular salaries, many physicists in educational institutions obtain income from other sources, such as consulting work and special research projects.

The average (median) annual salary for physicists was $12,000 in 1964, according to the National Science Foundation's National Register of Scientific and Technical Personnel. Only 10 percent earned less than $7,400 a year, and about 10 percent earned $18,700 or more.

Where To Go for More Information

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

Astronomers

(2d ed. D.O.T. 0–35.61)

(3d ed. D.O.T. 021.088)

Nature of Work

Astronomy, often considered the most theoretical of all sciences, has many practical applications. Astronomical observations of the sun, moon, planets, and stars are the basis for sea and air navigation, the calendar, and the accurate measurement of time. Astronomy provides both a proving ground for theories of time and space and a laboratory where matter may be observed under the most extreme conditions of temperature and density. Astronomy also helps fill in gaps in the understanding of the physical world. For example, astronomers who have studied the behavior of atoms under stellar temperatures have made valuable contributions to thermonuclear research and to knowledge of the atom.

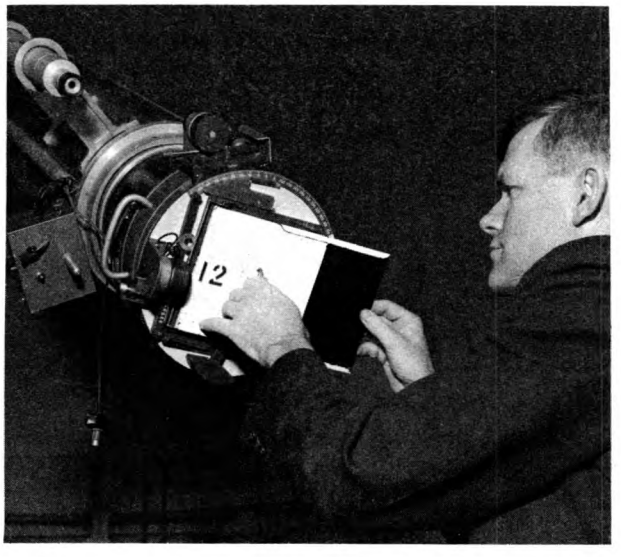
Astronomers study all the celestial bodies in the universe. They collect and analyze data on the sun, moon, planets, and stars and attempt to determine sizes, shapes, surface temperatures, chemical composition, and motions of these bodies. They compute the positions of the planets; calculate the orbits of comets, asteroids, and artificial satellites; and make statistical

studies of stars and galaxies. Astronomers also study the size and shape of the earth and the properties of its upper atmosphere.

In making their detailed observations of the heavens, astronomers use complex photographic techniques, light-measuring instruments, and other optical devices. The telescope is the major instrument used for observation. Devices for making specialized observations are often attached to the telescope, among these are the spectrograph, which produces a spectrum and enables the wave lengths of radiant energy to be measured; the photometer, which measures the intensity of light; and various other photoelectric, photographic, and electronic instruments and devices. Although most observations are made by means of telescopes permanently mounted in observatories, astronomers are gathering information increasingly by means of spacecraft and earth satellites containing various measuring devices. In processing and analyzing the vast amounts of data derived from their observations, astronomers often use electronic computers.

Astronomers usually specialize in one of the many branches of the science. In *astrophysics*, they apply physical laws to stellar atmospheres and interiors. Some astronomers work in the field of *celestial mechanics*, one of the oldest fields of astronomy and one that has recently acquired new importance because of the space program. Celestial mechanics deals, in part, with the motions of objects in the solar system, and hence has a particular application in the calculation of the orbits of spacecraft and artificial earth satellites and the paths of ballistic missiles. *Radio astronomy* is the study, by means of radio telescopes of extraordinary sensitivity, of the source and nature of celestial radio waves. Among the other specialties are *astrometry* (measurement of positions and movements of celestial bodies); photoelectric and photographic *photometry* (measurement of the intensity of light); *spectroscopy of astronomical sources* (wave length analyses of radiation from celestial bodies); and *statistical astronomy* (statistical study of large numbers of celestial objects, such as stars, to determine their average properties).

More than 3 out of 4 astronomers are engaged in teaching, research, or a combination of the two functions. In colleges and universities not having separate departments of astronomy or having only small enrollments in the subject, astronomers may teach courses in mathematics or physics as well as astronomy. Other members of the profession are engaged in a variety of activities, including development and design of astronomical instruments, administration, technical writing, and consulting.



Courtesy of the U.S. Department of Navy

Astronomer uses special equipment to photograph the solar system.

Where Employed

Astronomy is one of the smallest of the science fields; in 1965, the total number of astronomers in the United States was estimated to be about 1,000. Approximately half of all astronomers are employed by colleges and universities. Many of these work in university-operated observatories, where they usually devote most of their time to research, working alone or in cooperation with other astronomers.

The Federal Government employs about 150 astronomers. Among the major Government agencies employing astronomers are the National Aeronautics and Space Administration, which is responsible for directing and implementing the Nation's research efforts in aeronautics and the exploration of space; the U.S. Naval Observatory, which determines the Nation's official time, provides data for air and sea navigation, and conducts research in astrometry and astrophysics; the Naval

Research Laboratory, which does research in radio astronomy and space astronomy; and the Army Map Service, which utilizes astronomers in making exact measurements of distances on the earth and moon.

A relatively small but growing number of astronomers are employed in private industry, mostly by firms in the aircraft, missile, and spacecraft field. A few astronomers work for museums, planetariums, and other nonprofit organizations.

Training, Other Qualifications, and Advancement

Young people seeking professional careers in astronomy should obtain an advanced degree—preferably the Ph. D. The doctorate is usually required for high-level positions in teaching and research and is important for other types of work in this field. Although the bachelor's degree is adequate preparation for some entry jobs, astronomers without graduate work usually find opportunities for promotion limited.

Undergraduate curriculums leading to the bachelor's degree in astronomy are offered by relatively few schools. In 1964, only about 45 colleges and universities offered such a degree. The undergraduate work of the prospective astronomer is weighted heavily with courses in physics and mathematics (in addition to astronomy). A reading knowledge of at least one foreign language (German, French, or Russian) is required in the undergraduate program, and courses in chemistry, statistics, and electronics are useful. A few of the courses often taken by undergraduates in the field of astronomy are optics, spectroscopy, atomic physics, calculus, differential equations, solar and stellar systems, introductory astrophysics, and astronomical techniques and instruments.

The prospective astronomer is not necessarily handicapped if the college he has selected for his undergraduate study does not offer a major in astronomy. Well-qualified students with bachelor's degrees in physics or mathematics with a physics minor are usually able to enter graduate programs in astronomy.

Programs leading to the doctorate in astronomy are available at about 30 institutions located in various sections of the country. The academic work of the graduate student consists primarily of advanced courses in astronomy, physics, and mathematics. A few of the astronomy courses typically offered in graduate schools are celestial mechanics, galactic structure, radio astronomy, stellar atmospheres and interiors, theoretical astrophysics, and binary and variable stars. A reading knowledge of two foreign languages (German, French, or Russian) is required. Some schools require that graduate students spend several months in residence at an observatory. In most institutions, however, the program of work leading to the doctorate is flexible and allows the student to take the courses which will be of most value to him in his astronomical specialty or particular area of interest.

New graduates with bachelor's or master's degrees in astronomy usually begin as assistants in observatories, plantariums, large departments of astronomy in colleges and universities, Government agencies, or industry. Some persons, with only the bachelor's degree, work as research assistants while studying toward advanced degrees; others, particularly those in Government employment, receive on-the-job training in the application of astronomical principles. New graduates with the doctorate can usually qualify for college teaching positions and for research positions in educational institutions, Government, and industry.

Among the personal qualifications needed by prospective astronomers are a deep curiosity about the nature of the physical world, precise and logical thought processes, a strong interest and facility in mathematics and physics, and a fertile imagination. Astronomers should also be able to express themselves clearly and simply, both in writing and speaking, so as to communicate effectively with other astronomers and scientists and the public.

Employment Outlook

Employment opportunities for astronomers with the Ph. D. degree are expected to be excellent through the mid-1970's. Well-qualified persons with only bachelor's or master's degrees in astronomy will also have good employment prospects, primarily as research and technical assistants. As in the past, however, the higher level professional positions in astronomy will be filled mainly by persons with the doctorate.

The outlook is for very rapid growth of this small profession, during the late 1960's and early 1970's. However, because astronomy is a small profession, the number of job openings in any one year will not be large. On the other hand, because few college students are expected to receive advanced degrees in astronomy each year, the young men or women who do obtain these should have excellent employment opportunities.

Among the factors underlying the expected increase in demand for astronomers is the progress of the space age—the age of rockets, missiles, manmade earth satellites, and space exploration. Astronomers will be needed to help solve many of the practical problems connected with the flights of missiles and spacecraft. They will also be needed to study regions of space that can be observed by means of equipment placed in space vehicles.

Increased research activities in astronomy by educational institutions, government, and industry are expected to add to the demand for astronomers. In recent years, the growth of Federal Government-sponsored research, in the form of grants to educational institutions and observatories (for astronomical research and for new buildings, observatories, and equipment), has opened many new positions for astronomers.

Furthermore, enrollments in undergraduate astronomy courses in colleges and universities are likely to increase, not only as a result of heightened public interest in astronomy, but also because of the growing awareness of the value of astronomical training to many other scientific and engineering specialties. These factors, coupled with the anticipated increases in college enrollments in the late 1960's and early 1970's, are expected to create many new openings for teachers of the science.

The most favorable opportunities for women astronomers—particularly those with the Ph. D.—will be in research positions in Government agencies and in the larger observatories. Women's colleges and other educational institutions are expected to offer some employment opportunities for women astronomers. In addition, some openings for research assistants in observatories or universities will probably arise for women with bachelor's or master's degrees in astronomy.

Earnings and Working Conditions

In the Federal Government service, in early 1965, beginning astronomers with the Ph. D. degree were eligible to enter at $8,945 or $10,250 a year, depending on their college record. Astronomers with the bachelor's degree could start at $5,990 or $7,050 a year; those with a bachelor's degree and some graduate study could begin at $7,050 or $7,710. The provisions for salary increases, vacations, sick leave, and other benefits are the same as for other civil service employees. (See chapter on Occupations in Government.)

Average starting salaries for instructors of astronomy in colleges and universities ranged from about $5,500 to $7,500 in 1964, according to the limited data available. As the astronomer advances to higher level teaching positions, his earnings increase significantly. Some full professors earn over $20,000 a year. Astronomers in educational institutions sometimes earn extra income through writing books and articles, lecturing, or consulting.

Some astronomers spend much time in nightwork, making visual photographic or photoelectric observations. Others make observations only 4 or 5 nights each month and devote the remainder of the time to studying and analyzing photographic plates, photoelectric tracings, and other material during usual daytime working hours. Observational work at a telescope involves exposure to the outside air through the open dome of the observatory, sometimes on cold winter nights. In general, however, the physical requirements of astronomical work are not heavy and can be met by a reasonably healthy person.

Where To Go for More Information

The American Astronomical Society,
211 FitzRandolph Rd., Princeton, N.J. 08540.

Naval District Washington, D.C.,
Board of U.S. Civil Service Examiners For Scientific and Technical Personnel,
U.S. Naval Research Laboratory, Washington, D.C. 20390.

THE PERFORMING ARTS

The performing arts include music, acting, and the dance. In these fields, the number of first-rate artists seeking employment is generally much larger than the number of full-time employment opportunities 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 of the facts young people should bear in mind in considering an artistic career. They should, therefore, consider the possible advantages of making their art a hobby rather than a field of work. Aspiring young artists must usually spend many years in intensive training and practice before they are ready for public performances. A person needs not only great natural talent but also determination, a willingness to work long and hard, and an overwhelming interest in his chosen field.

The statements which follow this introduction give detailed information on the musician, singer, actor, and dancer as performing artists and in related work.

Actors and Actresses

(2d ed. D.O.T. 0–21.11, .15, and .41)
(3d ed. D.O.T. 150.028 and .048)

Nature of Work

Making a character come to life before an audience is a job which has great glamour and fascination. It is also hard and demanding work, requiring special talent and involving many difficulties and uncertainties.

Only a few of the approximately 15,000 actors and actresses in the United States in 1965 have achieved recognition as stars—on the stage, in motion pictures, or on television or radio. A somewhat larger number are well-known, experienced performers, who are frequently cast in supporting roles. The great majority, however, are struggling for a toehold in the profession, glad to pick up small parts whenever and wherever they can.

New actors generally start in "bit" parts, where they have only a few lines to speak. If successful, they may progress to larger supporting roles, of which there are several in most stage and screen productions. The actors who have minor parts in stage productions may also serve as understudies for the principals. If a leading player misses a performance, the understudy has a chance to demonstrate, and attract attention to, his acting ability.

Actors who prepare for roles either on the stage or in the movies spend many hours in rehearsal. They also must memorize their lines and know the cues—the last words or action by another actor which are the signal to come on stage, make an exit, or begin speaking. Radio actors typically read their parts. They have to be especially skilled in expressing character and emotion through the voice, since this is their sole means of creating an impersonation for their audience.

Besides the actors with speaking parts, "extras" who have no lines to deliver are used in almost every motion picture and many television shows. In spectacular productions, a large number of extras take part in crowd scenes.

Some actors find jobs as dramatic coaches or become directors of stage, television, radio, or motion picture productions. A few are engaged in teaching in schools of acting or in the drama departments of colleges and universities.

Where Employed

Stage plays and motion pictures, including films made especially for television, are probably the largest fields of employment for actors, al-

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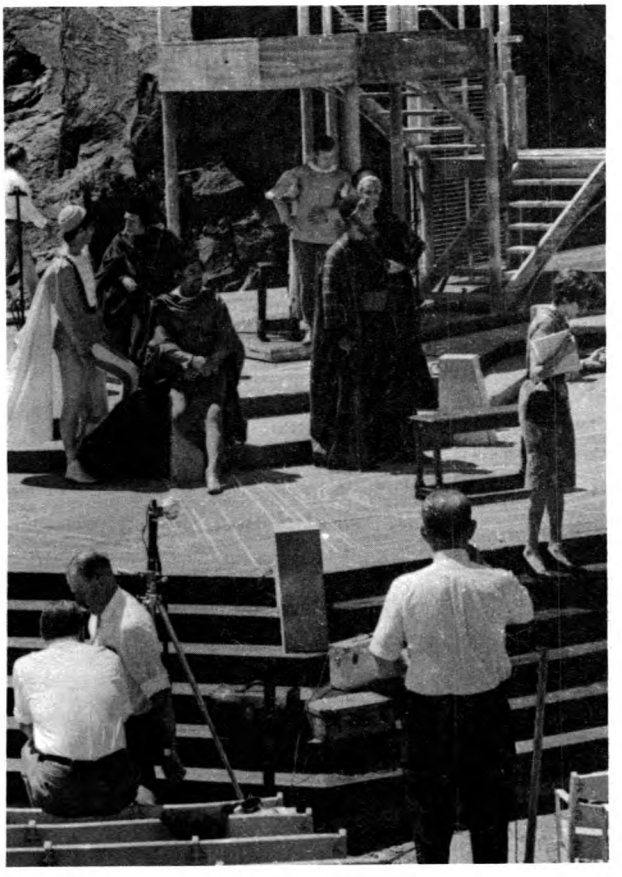


Actors and actresses spend many hours in rehearsal.

though "live" television and radio also employ actors.

In the winter, most employment opportunities on the stage are in New York. In the summer months, stock companies in suburban and resort areas throughout the Nation are a large field of employment. In addition, many cities now have community or "little" theaters, which provide opportunities for local talent as well as for professional actors and actresses from New York and other centers. Plays that go "on the road," moving from city to city, are normally produced in New York with casts selected there.

Although employment opportunities in motion pictures and film television are centered in Hollywood, a few studios are in Long Island, N.Y., and other parts of the country. In addition, many films are shot on location, providing employment for "extras" who live in the area. In live television and radio, most opportunities for actors are at the headquarters of the main networks—in New York, Los Angeles, and, to a lesser extent, Chicago. A few local television and radio stations occasionally employ actors.

Training and Other Qualifications

Since an actor learns largely through practice, young people aspiring to acting careers should get as much acting experience as possible by taking part in high school and college plays, or working with little theaters and other acting groups in their home towns.

Formal training in acting may also be helpful. Such training can be obtained at special schools of the dramatic arts, located chiefly in New York. The dramatic arts are also taught in about 500 colleges and universities. A college degree is becoming increasingly necessary for an acting career. Because college drama curriculums usually include courses in liberal arts, speech, pantomime, play production, and the history of the drama, as well as practical courses in acting, the actor develops an appreciation of the great plays, old and new, and a greater understanding of the roles he may be called on to play. Graduate degrees in the fine arts or in drama are necessary for college teaching positions.

Outstanding talent for acting and great interest and determination are essential for success in the theater. Ability to memorize, a good speaking voice, good health, and the physical stamina to work long hours are necessary. Ability to sing and dance is also an asset for those who seek an acting career.

In all media, whether the stage, motion pictures, radio, or television, the best way to start is to make use of local opportunities and to build on the basis of such experience. Many actors who are successful in local dramatic productions eventually try to appear on the New York stage. Inexperienced actors usually find it extremely difficult to obtain employment in New York or Hollywood. The motion picture field is an especially difficult one to enter, and employment is often a result of previous experience on the Broadway stage.

To become a movie extra, one must usually be listed by Central Casting, a no-fee agency which 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 people 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. Extras have very little, if any, opportunity to advance to speaking roles in the movies.

The length of an actor's working life depends largely on his skill and versatility. Great actors and actresses can go on almost indefinitely. On the other hand, for many members of the profession, employment opportunities become increasingly limited during and past middle age. This is especially true of those who become typed in romantic, youthful roles.

Employment Outlook

The overcrowding which has existed in the acting field for many years is expected to persist. In the legitimate theater and also in motion pictures and radio and television, job applicants outnumber by many time the jobs available. Moreover, many actors are employed in their profession for only a small part of the year.

With the development first of motion pictures, then of radio, then of TV, employment opportunities for actors in the theater have been more and more reduced. The recent growth of summer stock companies has somewhat increased the employment of actors in the summer months, but the numbers of New York stage productions, of motion pictures, and of radio shows requiring actors have been declining.

Although a motion picture production may use a very large number of actors, they are employed only while the picture is being filmed, and the films are widely distributed and may be used for years. Radio uses few actors. The number of filmed TV dramas and commercials using actors is increasing, but not enough to offset the decline in the other media. Moreover, television stations often broadcast "taped" dramas rather than live productions, and, like motion picture films, these tapes may be widely distributed and used for a long time. Taped TV plays give employment to actors for only one performance, whereas live dramas may give employment for several performances.

One possibility for future growth in the legitimate theater lies in the establishment of year-round professional acting companies in more cities. The number of communities with such acting groups is growing. Further increases are likely also in the employment of actors on television. In the acting field as a whole, however, employment opportunities are expected to change little through the mid-1970's. The number of new entrants to the profession is expected to outnumber employment opportunities that become available. Even highly talented young people are likely to face stiff competition and economic difficulties in the profession.

Earnings and Working Conditions

Actors and actresses employed in the legitimate theater belong to the Actors' Equity Association. If employed in motion pictures, including television films, they belong to the Screen Actors Guild, Inc., or to the Screen Extras Guild, Inc. If employed in television or radio, they belong to the American Federation of Television and Radio Artists. These unions and the show producers sign basic collective bargaining agreements which set minimum salaries, hours of work, and other conditions of employment. In addition, each actor enters into a separate contract which may provide for higher salaries than those specified in the basic agreement.

The minimum weekly salary for actors in large New York theaters was $125 in 1964. Those appearing in small "off-Broadway" theaters had considerably lower earnings. For shows on the road, the minimum rate was $160 a week. For rehearsal time, it was $107.50 a week in Broadway shows and much lower in small "off-Broadway" theaters. All minimum salaries are adjusted upward according to increases in the cost of living as reflected in the Bureau of Labor Statistics Consumer Price Index.

Motion picture actors and actresses had a minimum daily rate of about $100 in mid-1964. For extras, the minimum rate was about $25 a day. Actors on network television received a minimum program fee of $155 for a single half-hour program, and 10 hours of rehearsal time; actors on radio received $49.60 for a half-hour performance, 1 rehearsal hour included. To encourage more stable employment in the field, minimum

guarantees for those actors with contracts for a series of programs are sometimes discounted below the single program guaranteed fee.

In all fields, many well-known actors and actresses have salary rates above the minimums. The salaries of the few top stars are many times the figures cited. On the other hand, because of the frequent periods of unemployment characteristic of this profession, annual earnings may be low for many of the lesser known performers.

Eight performances amount to a week's work on the legitimate stage and any additional performances are paid for as overtime. The basic workweek after the opening of a show is 36 hours, including limited time for rehearsals. Prior to the opening, however, the workweek is usually longer to allow enough 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 over weekends and holidays. Traveling over the weekend is often necessary when plays are on the road.

Most actors are covered by a pension fund and a growing number have hospitalization insurance to which their employers contribute, but very few have paid vacations or sick leave. Most stage actors get little if any unemployment compensation, since they seldom have enough employment in any State to meet the eligibility requirements. Consequently, when a show closes, they often have to take any casual work obtainable while they are waiting for another role.

Dancers

(2d ed. D.O.T. 0–45, 11 through .51)
(3d ed. D.O.T. 151.028 and .048)

Nature of Work

Dancing is an ancient and worldwide art, having many different forms. Professional dancers may perform in classical ballet or modern dance, in dance adaptations for musical shows, in folk dances, or in tap and other popular kinds of dancing. In the classical ballet, movements are based on certain conventional or styled "positions," and women dance "en pointe" (on the tips of their toes). In modern dance, movements are much more varied but are nonetheless carefully planned and executed to follow a pattern.

In dance productions the performers most often work together as a chorus. However, a group of selected dancers may do special numbers, and a very few top artists do solo work.

Many dancers combine teaching with their stage work or teach full time in schools of the dance or in colleges and universities. The few dancers who have become choreographers create new ballets or dance routines. Others are dance directors who train dancers in new productions.

This statement does not include instructors of ballroom and other social dancing.

Where Employed

In 1965, there were more than 23,000 dancers and dancing teachers in the United States. It is estimated that more than half of this number were teachers employed at schools of the dance and in schools and colleges. Most of the other dancers were performers on the stage, screen, and television. A few trained in dance therapy were employed by hospitals to work in this new field used in the treatment of mental disorders. About 80 percent of all dancers are women, but in some types of dance, particularly ballet and modern, women performers comprise only about 50 percent.

Although dancing teachers are located chiefly in large cities, many smaller cities and towns have schools of the dance. New York City is the hub for the majority of performing dancers, others are situated in Los Angeles and Chicago.

Training and Other Qualifications

The traditional way of preparing for a dancing career is to begin serious training by age 12 or earlier. Girls wishing to become ballet dancers should begin taking lessons at the age of 8. In either case, 2 or 3 years of prior preparation is needed before the young girl should start dancing "en pointe." Professional training typically takes from 10 to 12 lessons per week for 11 or 12 months in the year, and many additional hours of practice. The length of the training period

depends on the student's ability and physical development, but most dancers have their professional audition by age 17 or 18.

The selection of a professional dancing school is important for two reasons. First, the school must use expert judgment in setting the pace of training since too early and too severe exercise can permanently damage the legs and feet. Second, the school's connections with producers may help the students in obtaining employment on the stage, screen, or television.

Because of the strenuous training program in the professional schools, the general education received by students in these schools may not exceed the legal minimum. However, a dancer's education should also include such subjects as music, literature, and history to aid him in his interpretation of dramatic episodes and of music. Nearly 150 colleges and universities confer bachelor's degrees on students who have either majored in physical education and concentrated on the dance, majored in a dance program designed to prepare student to teach dance, or majored in a dance program designed to prepare students as professional dance artists. Some of these schools also give graduate degrees. Labanotation, which is the method of writing dance routines and is comparable to writing an orchestral score, is one of the advanced courses taught. Knowledge of this is especially important to choreographers.

A college education is an advantage in obtaining employment as a teacher of professional dancing or choreography. However, the girls who postpone their first audition until graduation compete at a disadvantage with younger girls for openings in classical ballet. On the other hand, they can compete successfully for openings in modern dance performances which do not require a proficiency in toe dancing.

For teaching in the professional schools, experience as a performer is usually necessary; in colleges and conservatories, graduate degrees are generally required, but often experience as a performer may be substituted. Maturity and a broad educational background are also important for teaching positions.

Excellent health and unusual physical vitality are necessary for a dancing career. Height and body build should not vary much from the average. Good feet with normal arches are required.

Classical ballet requires intensive training and continuing practice.

These physical qualifications must be accompanied by an aptitude for dancing.

For women dancers, employment in ballet companies is very difficult to obtain after the age of 30, except for outstanding stars. Women past 25 are rarely hired for Broadway shows unless they have already had experience in such productions. Men who are ballet dancers, and men and women who perform in modern dance productions, can usually continue somewhat longer. After the employable age as performers has passed, some dancers teach in colleges, or conservatories, or establish their own schools. The few who become choreographers or dance directors can continue working as long as people in most other occupations do.

Employment Outlook

Opportunities for beginners in this field will be limited both by the small number of full-time jobs available, and the large supply of experienced applicants seeking full-time work. The supply of trained dancers has exceeded the demand for many years. The irregular employment experienced in this profession for many years may persist despite a few recent union-manage-

ment contracts aimed at guaranteeing some dancers full or near-full employment each year. Among the factors affecting demand are the decline in the total number of stage productions because of competition from motion pictures and television. Also very few stage shows have a run of 26 weeks or more, and many "fold" after the first week. On the other hand, the number of musical shows are increasing, and there is a growing trend toward using professional dancers at industrial exhibitions, such as auto shows. Also, a few new professional dance companies are being developed around the country, and television will offer some additional employment opportunities. Civic and community dance groups are increasing in number, and opportunities for dancers will expand as these develop into professional groups. Nevertheless, employment opportunities for dance performers will remain limited, and most of the openings for dancers in the years ahead will stem from the need to replace those who leave the field.

The employment outlook for dancers who have the personal and educational qualifications for teaching will be much better than for those trained only as performers. The growing interest in the dance as one of the fine arts is contributing to the demand for teachers of dancing. The increase in college enrollments will be another factor which will tend to enlarge teaching opportunities. (See statement on College and University Teachers.)

Men dancers face less competition for employment than do women dancers, since fewer men than women seek dancing as a career and nearly equal numbers are needed.

Earnings and Working Conditions

Dancers who perform professionally are members of one of the unions affiliated with the Associated Actors and Artistes of America (AFL–CIO). The American Guild of Musical Artists, Inc., is the union to which dancers belong who perform in opera ballets, classical ballet, and modern dance. Dancers who perform on television belong to the American Federation of Television and Radio Artists, and those who appear in musical comedies join Actors Equity Association. Dancers may also belong to other unions depending upon the field in which they perform. (See statement on Singers and Singing Teachers.) Minimum salary rates, hours of work, and other conditions of employment are specified in basic agreements signed by the unions and the producers. In addition, the separate contract signed by each dancer with the producer of the show has to be at least as favorable in the matter of salary, hours of work, and working conditions as the basic agreement.

The minimum salary for dancers in ballet and other stage productions was $110 a week, as of late 1964. The minimum rate for rehearsal time was $80 a week, except in small ballet companies which provide $60 for a rehearsal week. When a show goes on tour, salaries are increased, since dancers pay their own hotel bills. The employer pays the cost of first-class transportation. If a dancer signs a contract for a brief appearance—for instance, for a performance on television or a few days' work in a movie—the minimum rate is higher, relative to time worked. However, this difference is offset by the brevity of the engagement and the long period likely to be spent waiting for the next one. A few performers, of course, have much higher salaries. For principals, choreographers, and stars, salaries in stage productions ranged from $200 to over $2,000 per week in 1964.

Some dancers qualified to teach in the technical schools of the ballet are able to combine this work with engagements as performers. A much greater number of dancers have to supplement their incomes by other types of work.

Salaries of teachers in the technical schools of the ballet vary with the location and prestige of the school. Dancers employed as teachers 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 spent in rehearsals, and matinee and evening performances. Extra compensation is paid for hours worked outside the normal workweek. Most stage performances are, of course, in the evening, and rehearsals may require very long hours, often on weekends and holidays. When shows are on the road, traveling over the weekend is often required.

Dancers are entitled to some paid sick leave and

various health and welfare benefits provided by their unions, to which the employers contribute.

Where To Go for More Information

Information on colleges and universities and conservatories of music which provide for a major in the dance, or some courses in the dance, and details on the types of courses, and other pertinent information may be obtained from the Dance Directory, 1963 edition, compiled by the American Association for Health, Physical Education and Recreation, a division of the National Education Association, 1201 16th St. NW., Washington, D.C., 20036.

Musicians and Music Teachers

(2d ed. D.O.T. 0–24.12 and 0–24.31)
(3d ed. D.O.T. 152.048 and .028 090.168; 091.168; and 092.168)

Nature of Work

Professional musicians—whether they play in a symphony orchestra, dance band, or "jazz combo" —have behind them many years of study and intensive 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, or one of the "rhythm" instruments—the piano, string bass, drums, or guitar. Dance bands using these instruments play in nightclubs, restaurants, and at special parties. The best known bands, jazz groups, and solo performers sometimes give concerts and perform on television.

Musicians trained in classical music play in opera and theater orchestras, symphony orchestras, and for other kinds of performances needing orchestral accompaniments. Some form small groups—usually a string quartet or a trio—to give concerts of chamber music.

In a symphony orchestra, 85 to 100 musicians or more play together under the direction of a conductor. About half the musicians in the orchestra play the strings, smaller numbers play the brass and woodwinds, and a few play the drums, cymbals, and other percussion instruments. Usually the orchestra has among its members a pianist and one or two harpists.

Many pianists accompany vocal or instrumental soloists or choral groups or provide background music in restaurants or other places. Most organists play in churches, often directing the choir as well as playing the organ. A very few exceptionally brilliant and well known musicians—chiefly pianists and violinists—become concert artists, giving their own concerts and appearing as soloists with symphony orchestras. Both classical and popular musicians often make recordings, either individually or as members of a group.

Musicians perform at a private party.

Many musicians, in addition to their work as performers, give private lessons in their own studios or in pupils' homes. Almost two-thirds of the people primarily employed in the field of music (estimated at more than 160,000 in 1965) teach in the Nation's schools and colleges and are seldom, if ever, paid for performing. These teachers may be members of the faculty of music schools or conservatories or of colleges which offer instruction in instrumental music. Some are music teachers in elementary or secondary schools where they direct vocal and instrumental music programs, teach general classroom music appreciation, and may also give group instruction on an instrument.

In addition to the people primarily employed as musicians or music teachers, thousands of qualified instrumentalists have other full-time jobs and only occasionally work as musicians. Most of these part-time musicians belong to dance bands which are hired to play at private parties or for special occasions. Others, with a background in classical music, play occasionally in an orchestra, become conductors or composers, or do some part-time teaching.

Where Employed

Most professional musicians work in large cities, principally in New York, Chicago, and Los Angeles, where the Nation's entertainment activities are concentrated. Music teachers in elementary and secondary schools, as well as in colleges and universities, are employed all over the country. Moreover, just about every town and city has at least one private music teacher. Dance bands and civic orchestras are also located in many communities, although in the smaller towns, their members are usually only part-time musicians with other regular jobs.

A few musicians work in the field of music therapy in hospitals, and for music libraries.

Training and Other Qualifications

Most people who become professional musicians begin studying an instrument at an early age. To achieve a career as a performer or as a music teacher, young people need intensive training—either through private study with an accomplished musician, in a college or university with a strong music program, or in a conservatory of music. They need to acquire not only great technical skill but also a thorough knowledge of music, and they must learn how to interpret music. Before a young person can qualify for advanced study in a music conservatory or in a department or school of music of a college or university, it is frequently necessary to have an audition. Many of the teachers in these schools are accomplished artists who will train only promising young musicians.

Many conservatories of music and college and university schools of music offer 4-year programs leading to a bachelor's degree in music education. Students who complete these programs can qualify for the State certificate required for elementary and secondary school positions. Conservatories and collegiate music schools also frequently award the degree of bachelor of music to students who major in instrumental or vocal music. The 4-year program leading to either of these degrees provides not only training as a performer but also a broad background in musical history and theory, together with some liberal arts courses. Advanced degrees are usually required for college teaching positions, but exceptions may be made for especially well-qualified artists.

Musicians who play jazz and other popular music must have an understanding of and feeling for that style of music, but skill and training in classical styles may expand their employment opportunities. As a rule, when young, they take lessons with private teachers and then seize all opportunities, beginning while they are still in high school, to play in amateur or professional performances. Some groups of young people form their own small dance bands. As they gain experience and become known, the players may have opportunities to audition for other local bands and, still later, for the better known bands and orchestras.

Employment Outlook

As a field of employment, music performance has been overcrowded for many years, and it is expected to remain so through the mid-1970's. 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 is usually keen for positions which afford some stability of employment—for example, jobs with major orchestras and teaching positions in conservatories and colleges and universities. Because of the ease with which a musician can enter private music teaching, the number of music teachers has been and will probably continue to be more than sufficient to give instruction to all the young people seeking lessons. Though many opportunities for single and short-term engagements playing popular music in night clubs, theaters, and other places can be expected, the supply of qualified musicians seeking such jobs is

likely to remain greater than the demand. On the other hand, a shortage of highly qualified church organists may persist in many communities during the next few years; first-class, experienced accompanists and well trained, outstanding players of stringed instruments are likely to remain relatively scarce; and public school systems will probably continue to need more, fully qualified music teachers and supervisors.

Employment opportunities for performers are expected to increase slightly over the long run. Although the number of civic orchestras in smaller communities has been growing steadily, many of these orchestras provide only part-time employment for musicians who work chiefly as teachers or in other occupations. Moreover, the openings created by the establishment of these orchestras have been more than offset by the decline in opportunities in the theater, radio, motion pictures, and other places, which has resulted, in part, from the greatly increased use of recorded music.

The employment outlook in music education, for people who are well-qualified as both musicians and as teachers, is considerably brighter than for performers. A great increase in the numbers of young people of high school and college age will take place throughout the remainder of the 1960's and well into the 1970's. Moreover, the number of schools with music programs is growing steadily, and interest in music as an avocation is also rising, as evidenced by the increasing sales of musical instruments. Thus over the long run, an increase can be expected in the employment of elementary and secondary school music teachers and also in the teaching staffs of college and university music schools and conservatories of music.

Earnings and Working Conditions

The amount received for a performance by either classical or popular musicians depends to a large extent on their professional reputations. Musicians who were members of one of the 25 major symphony orchestras in the United States in 1964 had a very wide range of earnings, from a low of $1,650 to as high as $9,840 for the season. According to the American Symphony Orchestras League, Inc., the average of the salaries paid to all musicians by these orchestras was about $4,900 for the season, which averaged about 29 weeks in 1964, although the New York and Boston symphonies had 52- and 50-week seasons, respectively. Instrumentalists who were members of small ensembles reportedly received as much as $200 per concert. Those who played in dance bands were paid from $60 to $300 per week in 1964, according to the limited information available.

The salaries of public school music teachers are determined by the salary schedule adopted for all teachers. (See statements on Elementary and Secondary School Teachers.) However, they frequently supplement their earnings by giving private music lessons and taking church positions. Earnings from private teaching are very uncertain and vary according to the musician's reputation, the number of teachers in the locality, the number of students desiring lessons, the economic status of the community, and other factors.

Musicians who are performers customarily work at night and on weekends. They must also spend considerable time in regular daily practice and in rehearsing new scores.

Performers may have relatively long periods of unemployment between jobs and, thus, the overall level of their earnings is generally lower than that in many other occupations. Moreover, they do not usually work steadily for one employer. Consequently, some performers cannot qualify for unemployment compensation, and few have either sick leave or vacations with pay.

Most musicians who play professionally belong to the American Federation of Musicians (AFL–CIO). Concert soloists also belong to the American Guild of Musical Artists, Inc. (AFL–CIO).

Where To Go for More Information

Information about wages, hours of work, and working conditions for professional musicians is available from:

American Federation of Musicians (AFL–CIO),
425 Park Ave., New York, N.Y. 10022.

Information about employment opportunities for church musicians, as well as the requirements for certification of organists and choir masters, may be secured from:

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

A list of accredited schools of music is available from:

National Association of Schools of Music,
Knox College, Galesburg, Ill. 61401.

Further information about music teaching in elementary and secondary schools is available from:

Music Educators National Conference, The National Education Association of the United States,
1201 16th St. NW., Washington, D.C. 20036.

Information about employment opportunities with symphony orchestras may be obtained from:

The American Symphony Orchestra League, Inc.,
Symphony Hill, P.O. Box 66, Vienna, Va. 22180.

Singers and Singing Teachers

(2d ed. D.O.T. 0–24.00 through 0–24.05)

(3d ed. D.O.T. 152.048 and .028, 090.168; 091.168; and 092.168)

Nature of Work

Professional singing is an art which usually requires not only a fine voice, but also a highly developed technique and, generally, a broad knowledge of music. The tiny group of famous artists who have become singing stars go on tours in the United States and abroad and often make recordings. Somewhat larger numbers of singers obtain leading or supporting roles in operas and popular music shows, or secure engagements as soloists in oratorios and other types of performances. A much larger group—probably the majority of all professional singers of classical music—are soloists in churches or synagogues. Some singers also become members of opera and musical comedy choruses or other professional choral groups.

Singers who specialize in popular music have various styles of singing that are so different from that of singers of classical music, that the two groups have little in common technically. Popular music singers perform in musical shows of all kinds—in the movies, on the stage, on radio and television, and in nightclubs and other entertainment places. The best known popular music singers make and sell many recordings.

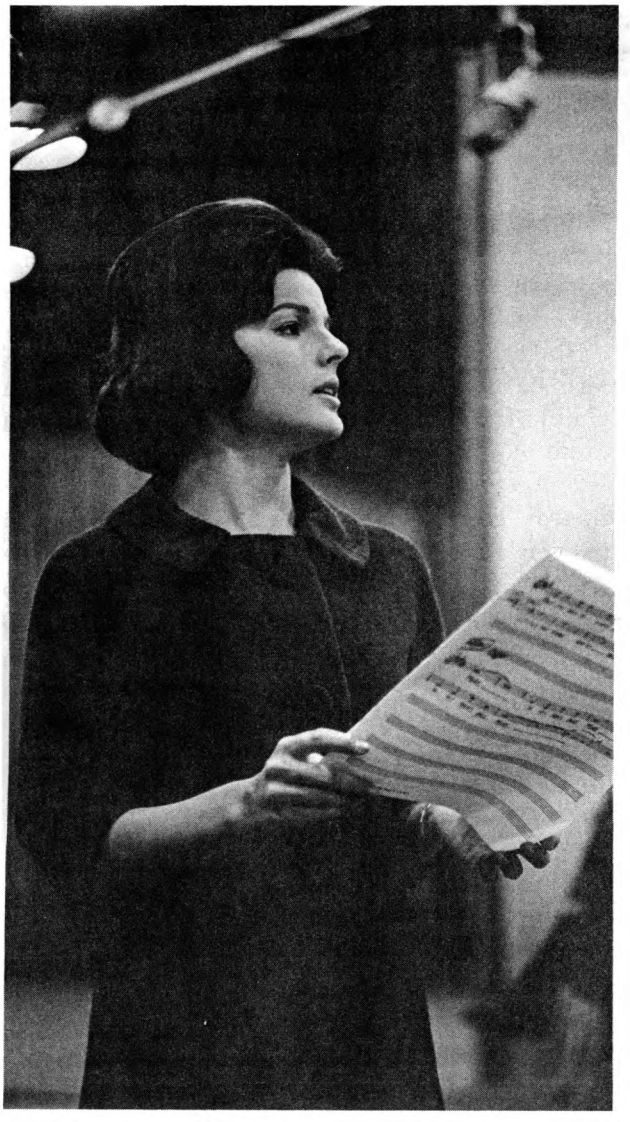
Since most singers of both classical and popular music have only part-time or irregular employment as singers, they often have full-time jobs of other types and sing only in the evenings or on weekends. Some give private voice lessons. A sizable number of singers are employed in elementary and secondary schools, where they are qualified to teach general music courses and lead choruses. Others give voice training or direct choral groups in churches, music conservatories, or in colleges and universities with schools or departments of music.

Where Employed

In 1965, almost 60,000 people were employed as professional singers or singing teachers. Opportunities for singing engagements are mainly in New York City, Los Angeles, and Chicago—the Nation's chief entertainment centers. Nashville, Tenn., also is a major place of employment for singers in both "live" performances and recordings and for those who specialize in folk and country music. Persons trained as singers who teach music in elementary and secondary schools and in colleges, universities, and conservatories of music are employed throughout the country. Opportunities for part-time employment, chiefly as church singers and choir masters, are to be found in small towns as well as in big cities.

Training and Other Qualifications

Young people who want to perform professionally as singers should acquire a broad background in music, including its theory and history. The ability to dance is also helpful since singers are sometimes required to dance as well as to sing. In addition, boys and girls interested in a singing career should start piano lessons at an early age. 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. Moreover, because of the work and expense involved in voice training—which often continues for years after the singer's professional career has



Popular music singers reach a wider audience through recordings.

started—it is important that a prospective singer show great determination and audition before a competent voice teacher to decide whether professional training is warranted.

Young people can prepare for careers as singers of classical music by enrolling in a music conservatory, a school or department of music connected with a college or university, or by taking private voice lessons. The schools provide not only voice training but other training necessary for understanding and interpreting music, including music-related training in foreign languages, and sometimes dramatic training. After completing a 4-year course of study, a graduate may be awarded either the degree of bachelor of music, bachelor of science or arts (in music), or bachelor of fine arts.

Young singers who plan to teach music in public elementary or secondary schools need at least a bachelor's degree with a major in music education, and must meet the State certification requirements for teachers. Such training is available in over 500 colleges and universities throughout the country. College teachers are usually required to have a master's degree and sometimes a doctor's degree, but exceptions may be made for especially 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 using a microphone.

Young singers of popular songs may become known by participating in amateur and paid performances in their communities. These engagements may lead to employment with local dance bands, and possibly later with better known ones.

In addition to musical ability, it often takes perseverance, an outstanding personality, an attractive appearance, good contacts, and luck to achieve a singing career. Furthermore, a singing career is sometimes relatively short, since it depends on a good voice and public acceptance of the artist, both of which may be affected by age.

Employment Outlook

The employment situation for singers will probably remain highly competitive through the mid-1970's. Competition among popular singers will continue to be especially keen. A great number of short-term jobs are likely to occur in the entertainment field—the opera and concert stage, the movies, the theater, nightclubs, radio and television, dance bands, and other places—but not enough to provide steady employment for all qualified singers. The demand for church singers is expected to expand because of the continued growth in number of religious congregations, but most of these openings will probably be filled either by part-time singers who have steady employment in other fields or by volunteers.

Little growth in overall employment opportunities for singers is likely over the long run. The use of recorded music has practically replaced the "live" singer on radio; also, the number of television performances given by singers is limited, although it may increase in future years. However, there is a growing demand for singers to record commercials for both radio and television advertising. The outlook for singers who can meet State certification requirements for positions as music teachers, or who can qualify for college teaching, will be considerably brighter than for performers. As school enrollments increase, the demand for music teachers in the Nation's elementary and secondary schools is expected to grow and some increased employment of music teachers can be expected in colleges and universities also, since enrollments in schools and departments of music in these institutions are likely to rise along with the increase expected in college enrollments generally. In addition, music teachers will be needed to replace those who will transfer to other fields of work, retire, or die.

Earnings and Working Conditions

Some singers employed by dance bands and in motion pictures earn as much as $200 per week, and a few well-known concert soloists, opera stars, or top recording artists of popular music may command more than $1,000 for a performance. However, the majority of professional singers experience difficulty in obtaining regular employment, and have to supplement their singing incomes by doing other types of work.

The salaries of public school music teachers are determined by the salary schedule adopted for all teachers in their school system. Private music teachers charge fees which vary greatly, depending on the teacher's reputation, the economic status of the families in the community, and other factors.

Singers generally work at night and on weekends. School teachers have regular working hours, and private voice teachers can usually give lessons at their own convenience. Work in the entertainment field is seasonal, and few performers have steady jobs.

Singers who perform professionally on the concert stage or in opera belong to the American Guild of Musical Artists, Inc.; those who sing on radio or television or who make phonograph recordings are members of the American Federation of Television and Radio Artists; singers in the variety and night club 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. All of these unions are branches of the Associated Actors and Artistes of America (AFL–CIO).

Where To Go for More Information

Information about accredited schools and departments of music may be obtained from:

National Association of Schools of Music,
Knox College, Galesburg, Ill. 61401.

Further information about music teaching in elementary and secondary schools is available from:

Music Educators National Conference, The National Education Association of the United States,
1201 16th St. NW., Washington, D.C. 20036.

OTHER ART RELATED OCCUPATIONS

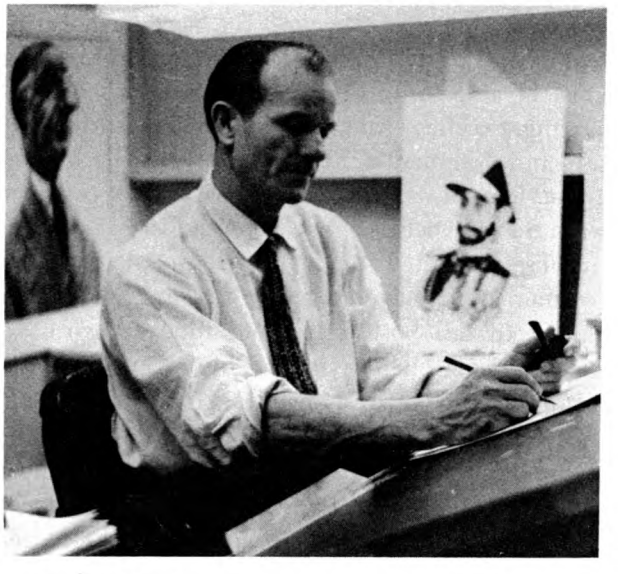
Commercial Artists

(2d ed. D.O.T. 0–44)

(3d ed. D.O.T. 141.081, 141.031; 149.051; 149.281; 970.081 through .884)

Nature of Work

The artwork necessary in the preparation of advertisements appearing in newspapers and magazines is often created by a team of commercial artists. The *art director* supervises a group of artists of varying levels of skill and diverse specializations. He may develop the art aspects of an advertising plan which he turns over to a layout man for further refinement. The *layout artist* works up the construction or arrangement of the elements of the advertisement, planning the selection and arrangement of illustrations, photographs, and typography and determining color and other elements of design. Then, he prepares a "rough visual" or sketch of the idea. He may, after consulting with the director, make changes in the visual and complete a more comprehensive layout for the customer's consideration.



Commercial artist makes caricatures for editorial features.

Working with the layout man in turning out the finished product are a variety of specialists such as *renderers*, who make rough pastel or wash drawings; *letterers*, who execute appropriate lettering either freehand or with mechanical aids; *illustrators*, who make sketches and drawings in more finished form; and *paste-up and mechanical men*, who cut and paste together the basic parts of the advertisement or other artwork, using a ruling pen or other drafting tool, as required. Some workers, called *general boardmen*, spend nearly all of their time at the drawing board performing many of these specializations. Often supporting the general boardmen or other specialists are apprentices who engage primarily in mechanical, routine, and noncreative functions such as separating colors, ruling pen work, washing paintbrushes, cutting mats, running errands, and so forth.

In a small office, the art director may perform all the layout and boardwork himself, with the aid of apprentices. In a large office he may be responsible mainly for developing ideas with the layout man; setting standards; dealing with clients; and purchasing needed photographs, illustrations, lettering, and other art work from freelancers or art services.

Much of the advertising artist's work is in creating the concept and artwork for a wide variety of promotional items or "collateral material" (including direct mail advertising, booklets, folders, brochures, catalogs, counter displays, etc.) used to supplement newspaper and magazine ads or television commercials. They may also prepare slides, film strips, and other visual aids.

Commercial artists also create the formats of magazines and other publications, designing or laying out the editorial pages and features and

producing or purchasing the necessary illustrations or artwork. Some commercial artists specialize in fashion illustrations, greeting cards, book illustrations, technical drawings for industry, etc.

Where Employed

An estimated 50,000 commercial artists were employed in early 1965; about one-fourth were women. Most commercial artists are employed in big cities, such as New York, Chicago, Philadelphia, Los Angeles, and Detroit, where the largest users of commercial art are to be found. Some, however, are employed in nearly every city.

Most commercial artists are employed as staff artists on a regular salaried basis by advertising agencies, commercial art studios, advertising departments of large companies, printing and publishing firms, textile companies, television and motion picture studios, department stores, sign shops, mail-order houses, greeting card companies, and a variety of other business organizations. Many work as freelance artists, selling their artwork to any available customers—chiefly to the same kinds of organizations that employ salaried artists. Some salaried commercial artists also do freelance work in their spare time. A number of commercial artists work for Federal Government agencies, principally in the Defense Department. A few teach in art schools on a regular or part-time basis.

Training, Other Qualifications, and Advancement

Artistic ability and good taste are the most important qualifications for success in the field of commercial art, but it is essential that these qualities be supplemented by specialized training in the techniques of commercial and applied art. In addition, extensive educational training in the fine arts—painting, sculpture, or architecture—and in academic studies provides a good foundation for obtaining employment as a commercial artist and is essential when seeking promotion to higher level jobs.

The most widely accepted training for commercial art is the instruction given in art schools or institutes that specialize in commercial and applied art. To enter art school, a high school education is usually, but not always, required. Some schools admit only those applicants who demonstrate talent by submitting acceptable work samples. The course of study, which may include some academic work, generally takes 2 or 3 years, and a certificate is awarded on graduation. A growing number of art schools, particularly those in or connected with universities, require 4 or more years of study and confer a bachelor's degree—commonly the bachelor of fine arts (B.F.A.) degree. In these schools, commercial art instruction is supplemented by liberal arts courses such as English and history. Some limited training in commercial art may also be obtained through courses offered by public vocational high schools, or through private home-study schools, and through practical experience on the job, but supplemental training is usually needed for advancement.

The first year in art school may be devoted primarily to the study of fundamentals—perspective, design, color harmony, composition—and to 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.

Accomplished draftsmanship, imagination, and artistic judgment concerning the harmony of color and line are basic requirements for a successful career in commercial art. The various specialties, however, differ in some of the specific abilities required. For example, letterers and retouchers must be able to do precise and detailed work requiring excellent coordination, whereas illustrators and designers need imagination, a distinctive art style, and, in most cases, the ability to draw well. Some experience with photography is useful to those interested in art direction or design. For commercial artists engaged in freelance work, the ability to sell both ideas and finished work to employers or clients is very important. Also, a business sense and responsibility in meeting deadlines are assets. Art directors need a strong educational background not only in art and business practices, but also in the liberal arts. The advertising art directors need a special kind of creativity—the ability to conceive ideas that will

stimulate the sale of the clients' products or services.

Beginning commercial artists usually need some on-the-job training before they can qualify for other than strictly routine work. Advancement is based largely on the individual's artistic talent, creative ability, and education. After considerable experience, many commercial artists leave salaried employment for freelance work.

Most commercial artists assemble their best artwork into a folder, or "portfolio," to use in displaying their work to others. A good up-to-date portfolio is essential in obtaining initial employment and freelance assignments as well as in changing jobs.

Employment Outlook

Employment and advancement opportunities for talented and well-trained commercial artists in most kinds of work are expected to be good throughout the rest of the 1960's. Young people with only average ability and little specialized training, however, will encounter competition for beginning jobs and will have limited opportunity for advancement.

The demand for commercial artists will continue to vary with the kind of specialization: For example, opportunities for illustrators, except those who are well known and have a unique style, are expected to continue to decline, largely because of increasing use of photography in advertising and editorial features. Demand for paste-up and mechanical artists is expected to continue to be steady, but jobs for designers, art directors, and layout men are few, much sought after, and open only to experienced, highly talented, and creative artists.

A moderate increase in employment of commercial artists is expected over the long run. The upward trend in business expenditures for all kinds of visual advertising will be reflected in a growing demand for commercial artists. Television graphics and packaging design are expected to continue to be sources of expanding employment opportunities. Demand for other forms of art, such as poster and window displays, and greeting cards, will probably create employment for an increasing number of artists. In addition, the growing field of industrial design is expected to need more artists who are qualified to perform three dimensional work with engineering concepts. (See statement on Industrial Designers.)

Generally, the effect of a serious economic downturn would be a reduction in advertising budgets and a decrease in employment of commercial artists. During minor business recessions, however, the policy of many companies is to advertise their products more vigorously, thus increasing the use of advertising art.

Women with exceptional artistic talent will continue to find employment in all aspects of commercial art work, but particularly in the textile industry and as fashion illustrators in department stores.

Earnings and Working Conditions

In early 1965, beginning commercial artists with no training beyond vocational high school typically earned $50 a week; graduates of 2-year professional schools generally received $65 a week and graduates of 4-year post-high school programs typically received $85 a week, according to the limited data available. Talented artists with strong educational backgrounds and a good portfolio, however, sometimes started at higher salaries. After a few years of experience, qualified artists may expect to earn $100–$150 or more a week. Art directors, designers, executives, well-known freelance illustrators, and others in top positions generally have much higher earnings, many beyond $15,000 a year.

The earnings of freelance artists have an especially wide range, since they are affected by such factors as the amount of artwork sold, the price that the individual artist receives for his work, and the nature of the work he performs. For example, a private survey in 1964 indicated that a freelancer received from $25 for a single black and white fashion sketch to $750 for a figure in full color with a background; from $1,000 to $2,000 for a color cover for a national magazine; or from $75 to $250 for a book jacket. Sometimes freelance artists are paid for their services by the hour; letterers may be paid $5 to $8 or more a word.

Salaried commercial artists generally work 35 to 40 hours a week, but sometimes they must work additional hours and under a considerable amount

of pressure in order to meet deadlines. Freelance artists usually have irregular working hours.

Where To Go for More Information

Information on art training and employment trends is available from:

National Society of Art Directors, Art Education Chairman,
115 East 40th St., New York, N.Y. 10016.

A list of schools offering highly specialized education in art and design is available from:

National Association of Schools of Art,
50 Astor Pl., New York, N.Y. 10003.

Industrial Designers

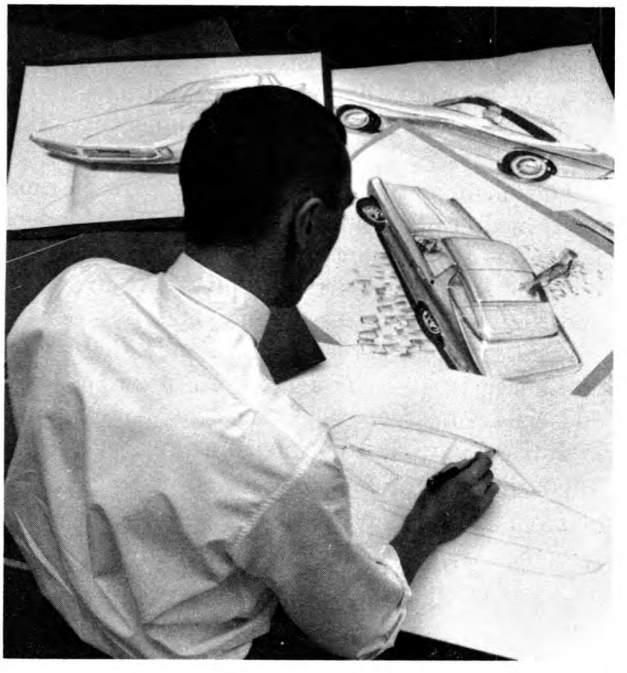
(2d ed. D.O.T. 0–46.88)

(3d ed. D.O.T. 142.081)

Nature of Work

Industrial designers combine technical knowledge of materials, machines, and methods of production with artistic talent to improve the appearance and functional design of machine-made products. Since the public has a wide choice of styles in products, particularly radios, television sets, automobiles, refrigerators, and furniture, a primary objective of the industrial designer is to design his employer's product to compete favorably with similar goods.

As a first step, the industrial designer spends time doing historical research on the product or related products. He studies competition in the market and the ways in which the product may be used. Then, he sketches a variety of possible designs, which are examined from many points of view. For example, the designer consults engineers, production supervisors, and the sales and market research staff for their opinions on the practicability of producing a newly designed product, or changing the design of an old product, and the sales potential of the proposed designs. After the most suitable design is selected by company officials, a model may be made by the designer. The first model of a new design is often made of clay so that it can be altered easily to reflect modifications. The final or working model is usually made of the material to be used in the finished product. If the model is approved in this form, it is put into production.



Automobile styling is a creative challenge for the most skilled and versatile designers.

Industrial designers also may be called upon to do related types of work. For example, they may design containers and packages, prepare small exhibits for display purposes, or design the entire layout for industrial fairs. Some also design the interior layout of special purpose commercial buildings, such as gasoline stations and supermarkets.

Industrial designers employed by a manufacturing company usually find their work limited to the one or few products made by their employer; many senior designers, however, are now given a free hand to engage in long-range planning for new or diversified products. Designers who work as consultants to more than one industrial firm, either as freelance designers or as members of consulting firms, may plan and design a great variety of products.

Where Employed

About 10,000 industrial designers were employed in 1965. The great majority worked for large manufacturing companies and in design consulting firms; of the remainder, the greatest number did freelance work or combined salaried employment with it. Some also worked for architects, and a few were on the staffs of firms of interior designers.

Industrial designers employed by consulting firms are located mainly in large cities. Those employed by industrial firms are found most often in the manufacturing plants of their companies.

Training, Other Qualifications, and Advancement

The completion of a course of study in industrial design—in an art school, an art department of a university, or a technical college—is the usual requirement for entering this field of work. People from other areas, however, notably engineering and architecture, often qualified as industrial designers if they have appropriate experience and artistic talent.

Formal education in industrial design at the college or university level usually takes at least 4 years to complete, and a few schools require 5 years of study. These schools award the bachelor's degree in industrial design or fine arts; some of these schools also award the master's degree for advanced study in the field. Some schools, usually private art schools or those associated with large art museums, offer a 3-year course of study in industrial design which leads to a diploma.

Entrance to the course of study in industrial design is limited, with rare exceptions, to qualified high school graduates; in addition, art schools and colleges may require students to present sketches and other examples of their artistic ability. Some schools require students to complete their freshman year or sophomore year before they select an industrial design major.

Industrial design curriculums differ considerably among schools. Some schools stress the engineering and technical aspects of the field, whereas others give students a strong cultural background in art. Nevertheless, all industrial design curriculums include at least one course in two-dimensional design (color theory, spatial organization, etc.) and one in general three-dimensional design (abstract sculpture and art structures), including a substantial amount of studio practice in the actual design of three-dimensional products. In the studio course, students learn to make working drawings and models with clay, wood, plaster, and other easily worked materials. In schools that have the necessary machinery, students gain experience in making models of their designs while learning to use metalworking and woodworking machinery. Some schools, principally those with a technical emphasis, require the completion of courses in basic engineering and in the composition of materials. All schools which offer 4- or 5-year courses leading to a bachelor's degree also include academic subjects, such as English, history, and science, in their curriculums.

Creative ability, skill in drawing, and the ability to predict consumer needs are the most important personal qualifications needed by young people aspiring to work in this field. A mechanical interest is also important. Applicants for jobs will find it helpful to have previously assembled a "portfolio" which demonstrates their skill in designing and their creative talent. Since industrial designers are frequently required to work cooperatively with engineers and other staff members, ability to work and communicate well with others is important. Young people who plan to do industrial design on a consulting basis should, in addition, have a knowledge of business practices, and possess sales ability.

New graduates of industrial design courses frequently start as assistants to other designers. They are usually given relatively simple assignments which do not involve making structural changes in the product. As they gain experience, designers may be assigned to supervisory positions with major responsibility for the design of a product or a group of products. Those who have the necessary funds, as well as established reputations in the field, may open their own consulting firms.

Employment Outlook

Employment in this relatively small occupation is expected to expand moderately through the mid-1970's. Employers will be actively seeking applicants with a college degree and outstanding talent. Some employment opportunities will also arise each year from the need to replace designers who retire or leave the field for other reasons.

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Although these vacated positions are likely to be filled by promoting designers' assistants, such promotions result in openings at the entry level.

A number of factors will affect employment of industrial designers. Rapid obsolescence of commercial equipment and the rising population will increase the demand for newly designed products. As in the past, manufacturers will strive to hold or increase their share of this market through creating new products, by improving the design of existing ones, and by changing package designs and otherwise modernizing the appearance and use of their products. Small companies probably will make increasing use of services offered by industrial design consulting firms in order to compete more effectively with larger firms. All of these factors, combined with rising per capita income, will contribute to long-term growth in the employment of industrial designers. However, as in the past, new entrants trained specifically in industrial designing are likely to encounter keen competition for beginning jobs from persons with engineering, architectural, and related educational backgrounds who have artistic and creative talent as well. Also, since personnel needs in this profession are very closely related to general business conditions, any downturn in the economy would tend to affect adversely the employment outlook.

Earnings

Starting salaries of inexperienced industrial designers employed by manufacturing firms ranged from $100 to $125 a week in 1964, according to the limited information available. Beginning salaries of those employed by consulting firms were usually lower. Salaries of experienced industrial designers vary greatly, depending on individual ability, size and type of firm in which employed, and other factors. According to scattered reports, those with several years of experience earned salaries ranging from $6,000 to $12,000 annually. Some large manufacturing firms paid $25,000 or more to experienced and talented designers.

Earnings of industrial designers who own their consulting firms, alone or as members of a partnership, may fluctuate markedly from year to year. In recent years, earnings of most consultants ranged between $12,000 and $20,000 with a few outstanding industrial designers making as much as $200,000.

Where To Go for More Information

Industrial Designers Society of America,
60 West 55th St., New York, N.Y. 10019.
Industrial Designers' Institute,
441 Madison Ave., New York, N.Y. 10022.
National Association of Schools of Art,
50 Astor Pl., New York, N.Y. 10003.

Interior Designers and Decorators

(2d ed. D.O.T. 0–43.40)

(3d ed. D.O.T. 142.051)

Nature of Work

The creative work of interior designers and decorators enhances the attractiveness of our homes and other buildings. Designers and decorators plan the functional arrangement of interior space and coordinate the selection (including colors) of furniture, draperies and other fabrics, floor coverings, and interior accessories. They may work on the interiors of residential or commercial structures, including ships and aircraft. Some design stage sets used for motion pictures and television. Interior designers are more concerned than decorators with space planning and other interior design; they often work for clients on large design projects such as the interior of an entire office building. Generally, their design plans include the complete layout of the rooms within the space allowed by the exterior walls and other framework. Sometimes they redesign the interiors of old structures. When their plans have been completed, the architect checks them against his blueprints to assure compliance with building requirements and to solve structural problems. Some interior designers also design the furniture and accessories to be used in interiors and then arrange for their manufacture.

Many professionals in this field have their own establishments, either alone or as a member of a

Interior designer confers with a client.

firm with other designers and decorators; they may sell some or all of the merchandise with which they work. Some work independently, or with one assistant; others have large staffs, sometimes including salespeople.

Many of the larger department and furniture stores have separate departments of interior decorating or interior design, or both, to advise customers on decorating and design plans. The main function of these departments is to help sell the store's merchandise, although materials from outside sources may be used when they are essential to the plans developed for the customer. Department store decorators and designers frequently advise the stores' buyers and executives concerning style and color trends in interior furnishings.

Interior designers and decorators usually work directly with clients to determine their preferences and needs in furnishings. They may do "boardwork," particularly on large assignments, which means working out floor plans and elevations and creating sketches, or other perspective drawings in watercolor, pastels, tempera, or other mediums so clients can visualize their plans. They also provide cost estimates. After the client approves both the plans and cost estimates, arrangements are made for the purchase of the furnishings; for the supervision of the work of painters, floor finishers, cabinetmakers, carpetlayers, and other craftsmen; and for the installation and arrangement of furnishings.

Where Employed

About 15,000 people were engaged full time in interior design and decoration in 1965. About half of them were women. Men, however, predominate in interior design. Many in design and decorating work on a part-time basis.

The majority of all workers in this field are located in large cities. In recent years, large department and furniture stores have become increasingly important sources of employment for professional interior designers and decorators. Some designers and decorators have permanent jobs with hotel and restaurant chains. Others are employed by architects, antique dealers, office furniture stores, industrial designers, furniture and textile manufacturers, or other manufacturers in the interior furnishing field, or by periodicals that feature articles on homefurnishings. Some large industrial corporations employ interior designers on a permanent basis.

Training, Other Qualifications, and Advancement

Formal training in interior design and decoration is becoming increasingly important for entrance into this field of work, although many present members of the profession achieved success without such training. Most department stores, well-established design and decorating firms, and other major employers will accept only professionally trained people for beginning jobs. Usually, the minimum educational requirement is completion of either a 2- or 3-year course at a recognized art school or institute specializing in interior decorating and design, or a 4-year college course leading to a bachelor of fine arts degree with a major in interior design and decoration. The course of study in interior design and decoration usually includes the principles of design, history of art, freehand and mechanical drawing, painting, the study of the essentials of architecture as they relate to interiors, design of furniture and exhibitions, and study of various materials, such as woods and fabrics. A knowledge of furnishings, art pieces, and antiques is important. In

addition, courses in salesmanship, business arithmetic, and other business subjects are of great value.

Membership in either the American Institute of Interior Designers (AID) or the National Society of Interior Designers (NSID), both professional societies, is a recognized mark of achievement in this profession. Such membership usually requires the completion of 4 years or more of post-high school education, the major emphasis having been on training in design, and several years of practical experience in the field, including responsibility for supervision of all aspects of decorating contracts.

New graduates with art training in interior design and decorating usually serve a training period, either with decorating firms, in department stores, or in the firm of an established designer. They may act as a receptionist, as a shopper with the task of matching materials or finding accessories, or as a stockroom assistant, assistant decorator, or junior designer. In most instances, from 1 to 3 years of on-the-job training is required before a trainee is considered eligible for advancement to the job of decorator. Beginners who do not obtain trainee jobs often work as salespeople for fabric, lamp, or other interior furnishings concerns, to gain experience both in dealing with customers and to become familiar with the merchandise. This experience often makes it easier to obtain trainee jobs with a decorating firm or department; it may also lead to a career in merchandising.

After considerable experience, decorators and designers with ability may be advanced to head of decorating or design departments, interior furnishings coordinator, or to other supervisory positions in department stores, or in large decorating or design firms; if they have the necessary funds, they may open their own establishments. Talented workers usually are able to advance rapidly.

Artistic talent, imagination, good business judgment, and the ability to deal with people are important assets for success in this field.

Employment Outlook

Talented art school or college graduates who majored in interior design and decoration will find good opportunities for employment during the remainder of the 1960 decade and on into the 1970's. Applicants who can plan and design space are in strong demand. Young people without formal training will find it increasingly difficult to gain a foothold in the field.

A slow but steady increase in employment of interior designers and decorators is anticipated. Population growth, larger expenditures for home and office furnishings, the increasing availability of well-designed furnishings at moderate prices, a growing recognition among middle-income families of the value of decorators' services, and increasing use of design services for commercial establishments should contribute to a greater demand for these workers. In addition to newly created jobs, some openings will arise each year from the need to fill vacancies.

Department and furniture stores are expected to employ an increasing number of trained decorators and designers. These stores are also expected to share in the growing volume of design and decorating work for commercial establishments and public buildings, formerly handled almost entirely by independent decorators. This development will result in an increase in opportunities for salaried employment. Interior design firms are also expected to continue to expand. As formerly, however, a sharp downturn in general economic conditions would adversely affect employment opportunities in this field.

Earnings and Working Conditions

Beginning salaries ranged generally from $65 to $85 a week in 1964 for art school or college graduates with formal training in interior design and decoration; some graduates of 4-year design schools received salaries as high as $100 a week, according to limited data available.

Many interior decorators with only average skill in this field earn only moderate incomes—from $5,000 to $7,500 a year, even after some years of experience. Other decorators who are well known in their localities may earn up to $12,000 or more. Designers and decorators whose talents are nationally recognized may earn well beyond $25,000 yearly.

Decorators in business for themselves have an especially wide range of earnings; their profits are related to factors such as the volume of business, their prestige as a decorator, economic level

of their clients, their own business competence, and the percentage of wholesale prices they receive from sale of furnishings. Decorators in the employment of others also have variable earnings, some are paid straight salaries; some receive salaries plus commissions which usually range from 5 to 10 percent of the value of their sales; others receive commissions only, which may be as much as one-third of the value of their sales.

Hours of work for decorators are sometimes long and irregular. They usually adjust their workday to suit the needs of their clients, meeting with them during the evenings or on weekends, when necessary. Designers' schedules follow a more regular workday pattern.

Where To Go for More Information

Information about employment and scholarship opportunities may be obtained from:

American Institute of Interior Designers,
673 Fifth Ave., New York, N.Y. 10022.
National Society of Interior Designers, Inc.
Suite 700, 157 West 57th St., New York, N.Y. 10019.

SOCIAL SCIENCES

The social sciences are concerned with all aspects of human society from the origins of man to the latest election returns. Social scientists, however, generally specialize in one major field of human relationships. Anthropologists study primitive tribes, reconstruct civilizations of the past, and analyze the cultures and languages of all peoples past and present. Economists study how man allocates resources of land, labor, and capital. Geographers study the distribution throughout the world of people, types of land and water masses, and natural resources. Historians describe and interpret the people and events of the past and present. Political scientists study the theories, objectives, and organizations of all types of government. Sociologists analyze the behavior and relationships of groups—such as the family, the community, and minorities—to the individual or to society.

Besides these basic social science fields, there are a number of closely related fields, some of which are covered in separate statements elsewhere in this *Handbook*. (See statements on Statisticians, Psychologists, and Social Workers.)

About 50,000 people were employed professionally in the basic social sciences in 1965. About 1 of every 10 was a woman. Overlapping among the basic social science fields and the sometimes hazy distinction between these and such related fields as business administration, foreign service work, and high school teaching, make it difficult to determine the exact size of each profession. Economists, however, are the largest social science group, and anthropologists the smallest.

The majority of social scientists are employed by colleges and universities. The Federal Government is the second largest employer. Except for economists, private industry employs comparatively few persons in social science professions; however, there is a trend in some industries toward hiring increasing numbers of college graduates who have majored in the social sciences as trainees for administrative and executive positions. Research councils and other nonprofit organizations provide an important source of employment for economists, political scientists, and sociologists.

Employment in the social sciences has been increasing and is expected to grow rapidly through the mid-1970's, mainly because of the anticipated rise in college teaching positions. The reasons for this expected increase are discussed in the statement on College and University Teachers. A moderate rise in employment in government also is expected. Employment in government agencies is often greatly affected by changes in public policy. For example, more social scientists will be needed to handle research and administrative functions resulting from the new programs established by Congress to relieve unemployment and remove poverty. The Vocational Education Act of 1963 and the Economic Opportunity Act of 1964, and the Appalachian Regional Development Act of 1965 are recent programs that will increase the demand for social science personnel. A moderate rise in employment in private industry and nonprofit organizations also is expected. In addition, hundreds of social scientists will be needed each year to replace those who leave the field because of retirement, death, or other reasons.

Social scientists with doctor's degrees will find excellent employment opportunities through the mid-1970's, in both teaching and nonteaching positions. For those with less training, the employment situation will differ considerably among the several social science fields. These differences are discussed in the occupational statements that follow.

Anthropologists

(2d ed. D.O.T. 0-36.01)
(3d ed. D.O.T. 055.088)

Nature of Work

Anthropologists study primitive and civilized man—his origins, physical characteristics, customs, languages, traditions, material possessions, and social and religious beliefs and practices. Most anthropologists specialize in cultural anthropology—usually archeology or ethnology. *Archeologists* excavate the places where earlier civilizations are buried in order to reconstruct the history and customs of the people who once lived there, by studying the remains of homes, tools, clothing, ornaments, and other evidences of human life and activity. For example, archeologists are digging in the Pacific Coast area between northern Mexico and Ecuador to find evidences of trade and migration in the pre-Christian Era. Some archeologists are excavating ancient Mayan cities in Mexico and restoring temples. Others are working in the Missouri river valley to salvage remnants of Indian villages and sites of early military forts and trading posts. *Ethnologists* may spend long periods living among primitive tribes or in other communities, to learn their ways of life at first hand. The ethnologist takes detailed and comprehensive notes describing the social customs, beliefs, and material possessions of the people, usually learning their language in the process. He may also make comparative studies of the cultures and societies of various groups. Some cultural anthropologists specialize in *linguistics*, the scientific study of the sounds and structures of languages and of the historical relationships among languages.

A few hundred people specialize as *physical anthropologists*. These anthropologists apply intensive training in human anatomy and biology to the study of human evolution, and to the scientific measurement of the physical differences among the races and goups of mankind. Because of their knowledge of body structure, physical anthropologists are occasionally employed as consultants on such projects as the design of more comfortable space suits and cockpits for astronauts.

Most anthropologists teach in colleges and universities, and in some schools teach related subjects, such as sociology and geography. Research and report writing are major aspects of their job. Some anthropologists specialize in museum work, which generally combines management and administrative duties with fieldwork and research on anthropological collections. Others are engaged primarily in consulting, nontechnical writing, or other activities.

Philippine Hanunóo tribesman shows an anthropologist how folklore is inscribed in bamboo.

Where Employed

About 1,500 people were employed as anthropologists in early 1965. About a fifth of them were women—a higher proportion than in any other social science field. The great majority were employed in colleges and universities. The Federal Government employed a considerable number, chiefly in museums, in Government-supervised areas such as parks, and in technical aid programs. The Government agencies which employed the largest number of anthropologists were the Smithsonian Institution and the National Park Service. Many other Government agencies,

including the Departments of Defense and of Health, Education, and Welfare, employed some members of the profession, mainly as consultants. State and local government agencies also employed some anthropologists, usually for museum work or health research. A few were employed in private industry and nonprofit organizations.

Training, Other Qualifications, and Advancement

Young people who are interested in careers in anthropology should obtain Ph. D. degrees. College graduates with bachelor's degrees can obtain temporary positions and assistantships in the 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 is generally reserved for individuals with the Ph. D. degree. In many colleges, and most universities, only anthropologists holding the Ph. D. degree can obtain a permanent teaching appointment.

Some training in physical anthropology, archeology, and ethnology is necessary for all anthropologists. Courses in linguistics are also valuable and are required for certain areas of work. A knowledge of mathematics is increasingly important since statistical methods and high speed computer technology are becoming more widely used in this field. Undergraduate students may begin their field training in archeology by arranging, through their university department, to accompany expeditions as laborers. They may advance to supervisory positions in charge of the digging or collection of material and may finally take charge of a portion of the work of the expedition. Ethnologists and linguists usually do their fieldwork alone, without direct supervision. Most anthropologists base their doctoral dissertations on data collected through field research; they are, therefore, experienced fieldworkers by the time they obtain the Ph. D. degree.

The choice of a graduate school is very important. Students interested in museum work should select a school that can provide experience in an associated museum having anthropological collections. Similarly, those interested in archeology should choose a university which offers opportunities for summer experience in archeological field work or should plan to attend an archeological field school elsewhere during their summer vacations.

Employment Outlook

The number of anthropologists is expected to increase very rapidly through the mid-1970's. The largest increase in employment will be in the college teaching field. Some additional opportunities will be found in museums, archeological research programs, mental and public health programs, and in community survey work. Opportunities in other fields are likely to be limited largely to the replacement of personnel who retire, die, or leave their positions for other reasons.

Anthropologists holding the doctorate will have excellent employment opportunities through the mid-1970's. Employment opportunities will also be favorable for those who have fulfilled all requirements for the Ph. D. degree except the dissertation. Graduates with only the master's degree, however, are likely to face persistent competition for professional positions in anthropology and may enter related fields of work. A few who meet certification requirements may secure high school teaching positions. Others may find jobs in public administration and in nonprofit organizations and civic groups, which prefer personnel with social science training as a general background.

Earnings

Salaries of social scientists (anthropologists among them) who are employed by 4-year colleges and universities, averaged $7,800 in 1962–63; instructors averaged $6,000; assistant professors, $7,200; associate professors, $8,500; and professors, $10,800.

In the Federal Government, the starting salary for anthropologists completing all the requirements for the Ph. D. degree was $8,650 in early 1965.

In general, anthropologists with the Ph. D. degree earn substantially higher salaries than those with the master's degree. Many anthropologists supplement their regular salaries with earnings from other sources. Summer teaching and research grants are the principal sources of income. Anthropologists employed in colleges and uni-

versities are the most likely to have additional earnings.

Where To Go for More Information

Additional information concerning employment opportunities and schools offering graduate training in anthropology may be obtained from the following sources:

Anthropology As A Career, Smithsonian Institution, Washington, D.C. 20560. Price 20 cents.

The American Anthropological Association, 1530 P St. NW., Washington, D.C. 20005.

Economists

(2d ed. D.O.T. 0–36.11)

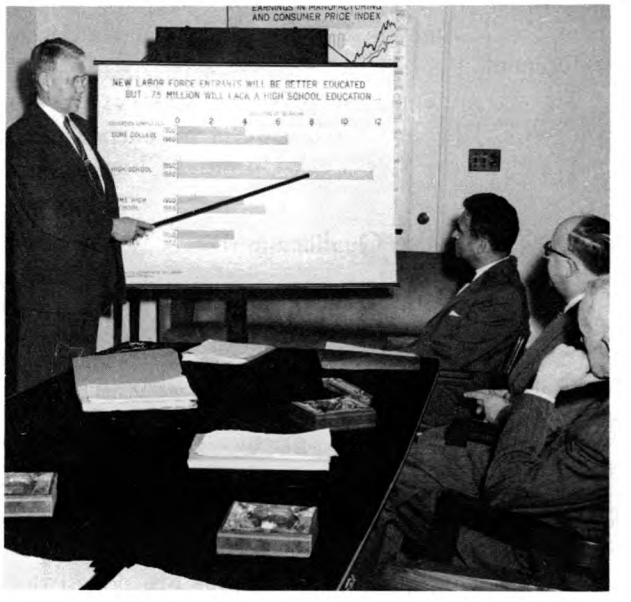
(3d ed. D.O.T. 050.088)

Nature of Work

Economists study man's activities devoted to satisfying human wants. They are concerned with the problems which arise in utilizing limited resources of land, raw materials, manpower, and manufactured products so as to meet, as well as possible, people's many unsatisfied wants. In this connection, they may analyze the relation between the supply of and demand for goods and services, and the ways in which goods are exchanged, produced, distributed, and consumed. Some economists are concerned with such practical problems as the control of inflation, the prevention of depression, and the development of farm, wage, tax, and tariff policies. Others develop theories to explain the causes of employment and unemployment or the ways in which international trade influences world economic conditions. Still others are engaged in the collection and interpretation of data on a wide variety of economic problems.

Economists are employed as teachers in colleges and universities, and as researchers in government agencies, private industry, and nonprofit research organizations. As teachers, they guide students in learning the principles and methods of economics, and frequently engage in writing, lecturing, or consulting activities. They also do research in economic theory and formulate many of the new ideas that directly or indirectly influence government and industry planning.

Most economists in the Federal Government are in the fields of agriculture, business, or labor economics, or in international trade and development. They may plan and carry out studies involving the collection of basic data in these fields, use these and other data to analyze the need for changes in government policy, assess the economic condition of the Nation, write reports on their findings, and present these reports before policy-making bodies.



Economists use charts to show economic trends.

Economists employed by business firms provide management with information to be used in making decisions on such matters as the markets for and prices of company products, recommendations regarding government policies affecting business or international trade, the advisability of adding new lines of merchandise, opening new branch operations, or otherwise expanding the company's business.

Where Employed

Economics is the largest of the basic social science fields. About 20,000 people were employed as economists in 1965. Roughly one-third were

employed by colleges and universities and another third worked for government agencies—chiefly Federal. Most of the remainder were employed by private industry or worked for private research agencies and community organizations. A few were self-employed, acting as consultants.

Economists are found in all large cities and in university towns. The largest group are in the Washington, D.C., area, where most of those in the Federal Government are located. A substantial number of economists are employed in foreign countries, mainly by the U.S. Department of State, including the Agency for International Development.

Most economists in private industry are employed in the home office of large corporations, particularly in New York City and Chicago.

Training and Other Qualifications

All economists must have a thorough grounding in economic theory, economic history, and methods of economic analysis, including statistics. An increasing number of universities also emphasize the value of mathematical methods of economic analysis.

A bachelor's degree with a major in economics is sufficient for many beginning research jobs in government and private industry, although persons employed in such entry jobs are not always regarded as professional economists. In the Federal Government, candidates must have a minimum of 21 semester hours of economics and 3 hours of statistics, accounting, or calculus for entrance positions.

Since beginning jobs usually involve the collection and compilation of data, a thorough knowledge of basic statistical procedures is usually required. Industrial and business firms often hire young people with the bachelor's degree in economics as management trainees and rotate them through various departments to acquaint them with company activities.

Graduate training is very important for young people planning to become economists. Students interested in research should select schools that emphasize training in research methods and statistics and provide good research facilities. Those who wish to work in the field of agricultural economics will find good opportunities for part-time work at State universities with agricultural experiment stations.

The master's degree is generally required for appointment as a college instructor, though in large schools graduate assistantships often are awarded to superior students working toward their master's degree. In many large colleges and universities, completion of all the requirements for the Ph. D. degree, except the dissertation, is necessary for appointment as instructor. In government or private industry, economists with the master's degree can usually qualify for more responsible research positions than are open to those with only the bachelor's degree.

The Ph. D. degree is required for a professorship in a high-ranking college or university and is an asset in competing for other responsible positions in government, business, or private research organizations.

Economists interested in overseas assignments will find training in other social sciences, as well as advanced training in economics, very helpful. For some positions with the U.S. Department of State, considerable experience is also required.

Employment Outlook

Employment of economists will increase very rapidly through the mid-1970's, especially in the college teaching field. Colleges and universities will need hundreds of new instructors annually to handle rapidly increasing enrollments and to replace economists who retire, die, or transfer to other fields of work. In other fields, opportunities may be fewer in number, even though growth will be rapid. Private industry is expected to employ many more economists, as businessmen become more accustomed to relying on scientific methods of analyzing business trends, forecasting sales, and planning purchasing and production operations. Employment of economists at the Federal, State, and local levels also will increase rapidly in order to meet the need for more extensive data collection and analysis, and to provide the staff for programs aimed at reducing unemployment and poverty.

Economists with the doctorate are expected to have excellent opportunities for employment. The demand for these economists is expected to be considerably greater than the supply over the

next 10 years. As a result, employment opportunities for economists with a master's degree will be favorable, especially for those with good training in statistics and mathematics. Persons with a bachelor's degree will continue to find employment opportunities in government agencies.

Earnings

According to the National Science Foundation's National Register of Scientific and Technical Personnel, the average (median) salary of economists employed by colleges and universities was $10,100 in 1964. Economists employed by business and by nonprofit organizations averaged $14,400 and $15,000, respectively. Salaries of economists engaged in the management or administration of research programs averaged $16,200 annually.

In the Federal Government, the entrance salary for beginning economists with a bachelor's degree was $5,000; however, those with superior academic records could begin at $6,050 in early 1965. Those with 2 full years of graduate training or experience can qualify for positions at an annual salary of $7,220. The majority of experienced economists in the Federal Government earned from $8,650 to $16,460 a year; some with greater administrative responsibilities earned considerably more.

Where To Go for More Information

American Economic Association,
629 Noyes St.
Northwestern University, Evanston, Ill. 60201.

Additional information on employment opportunities in economics and related fields is given in the following publications:

The Foreign Service Officer, U.S. Department of State, Publication 7533, Washington, D.C. 20520. Free.

Overseas Assignments, Agency for International Development, Washington, D.C. 20523. Free.

Geographers

(2d ed. D.O.T. 0-36.93)
(3d ed. D.O.T. 059.088)

Nature of Work

Geographers study the physical characteristics of the earth, such as its terrain, minerals, soils, water, vegetation, and climate. They relate these characteristics to the patterns of human settlements on the earth—where people live, why they are located there, and how they earn a living.

The majority of geographers are engaged in college and university teaching and/or research. Their research may include the study and analysis of the distribution of land forms, climate, soils, vegetation, and mineral and water resources, sometimes utilizing surveying and meteorological instruments. They also analyze the distribution of political organizations, transportation systems, and marketing systems. Many geographers spend considerable time in field study, and in analyzing maps, aerial photographs, and observational data collected in the field. Other geographers construct maps, graphs, and diagrams.

Most geographers specialize in one or more of the main branches of geography. Those working in *economic geography* deal with the geographic distribution of economic activities—including manufacturing, mining, farming, trade, and communications. *Political geography* is the study of how political processes affect geographic boundaries on subnational, national, and international scales. *Urban geography*, a growing field for geographers, is concerned with the study of cities, and with community planning. (See statement on Urban Planners.) Specialists in *physical geography* study the earth's physical characteristics. *Regional geography* pertains to all 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. Geographers in the field of *cartography* design and construct maps, as well as compile data for them.

Many professional workers in the field have job titles which describe their specialization, such as cartographer, map cataloger, or regional analyst, rather than the title geographer. Others have titles relating to the subject matter of their study, such as photointelligence specialist or climatological analyst. Still others have titles such as com-

Geographer transfers regional information to map.

munity planner, market or business analyst, or intelligence specialist. Most of those who teach in colleges and universities are called geographers.

Where Employed

Geography is a relatively small field of employment. Only about 3,000 geographers were employed in the United States in early 1965; about 10 percent were women.

About two-thirds of all geographers are employed by colleges and universities. Those teaching in institutions which do not have separate departments of geography usually are associated with departments of geology, economics, or other physical or social sciences.

The Federal Government also employs a significant number of geographers. Among the major agencies employing these workers are the Army Map Service; the Central Intelligence Agency; the Defense Intelligence Agency; and the Office of Geography of the Department of the Interior. State and local governments also employ a number of geographers, mostly on city and State planning and development commissions.

Most of the small but growing number of geographers employed by private industry work for marketing research organizations, map companies, textbook publishers, travel agencies, manufacturing firms, or chain stores. A few geographers work for scientific foundations and other nonprofit organizations and research institutes.

Training, Other Qualifications, and Advancement

The minimum educational requirement for beginning positions in geography usually is a bachelor's degree with a major in the field. For most positions in research and teaching, and for advancement in many other types of work, graduate training is required.

Training leading to the bachelor's degree in geography was offered by about 180 colleges and universities in 1964. Undergraduate study usually provides a general introduction to geographic knowledge and research methods and often includes some field studies. Typical courses offered are physiography, weather and climate, economic geography, political geography, urban geography, and regional courses, such as geography of North America, Western Europe, the U.S.S.R., and Asia. Courses in cartography and in the interpretation of maps and aerial photographs are also offered.

Advanced degrees in geography are offered by a relatively small number of schools. In 1964, master's degrees were awarded by about 70 institutions and Ph D. degrees by about 25, according to the U.S. Office of Education. For admittance to a graduate program in geography, a bachelor's degree with a major in geography is the usual requirement. However, most universities admit students with bachelor's degrees in such fields as economics, geology, or history, if they have a good background in geography. Requirements for advanced degrees include field and laboratory work, as well as classroom studies and thesis preparation.

New graduates with only the bachelor's degree in geography find employment mainly in positions connected with making, interpreting, or analyzing maps, either in government or private industry. Others enter beginning positions in the planning field. Some obtain positions as research or teaching assistants in educational institutions while studying for advanced degrees. New graduates with the master's degree can qualify for some teaching and research positions in colleges and universities and for many research positions in government and private industry. The Ph. D. degree is usually required for high-level posts in college teaching and research and may be necessary for advancement to top-level positions in other activities.

Employment Outlook

The employment outlook for geographers is favorable through the mid-1970's. The demand will be especially strong for geographers with graduate degrees to fill research and teaching positions in colleges and universities and research jobs in industry and government. Geographers with advanced training in such fields as economics or business administration will also be in strong demand.

Colleges and universities are expected to offer the greatest number of employment opportunities as college enrollments increase sharply in the next few years. Expanding interest about foreign countries, and growing awareness of the value of geography training in several other fields of work such as the foreign service, should also result in increased enrollments in geography and in a need for additional teachers at the college level. A growing demand for geography teachers in secondary schools is also anticipated.

Employment of geographers in government is also likely to increase. The Federal Government will need additional personnel in positions related to area development and regional and urban planning; resource management; planning, construction, and interpretation of maps; and in intelligence work. State and local government employment of geographers will probably expand also, particularly in such areas as conservation, highway planning, and city, community, and regional planning and development.

The number of geographers employed in private industry is also expected to rise. Market research and location analysis should continue to grow rapidly. Opportunities should also increase in private area planning and development work.

Since geography is a relatively small field, job openings, resulting from growth in the profession and the need to replace workers who retire or otherwise leave the profession, are not expected to be numerous in any one year. However, unless the number of persons receiving degrees in the field should grow far beyond current expectations, qualified geographers, particularly those with advanced degrees, should find employment readily through the mid-1970's.

Employment prospects for women geographers will be best in teaching, especially in junior colleges, women's colleges, and in the larger coeducational institutions. Government agencies should also offer good opportunities for women in mapping and planning work.

Earnings and Working Conditions

In the Federal Government in early 1965, geographers with the bachelor's degree and no experience could start at $5,000 or $6,050 a year, depending on their college record. Inexperienced geographers with 1 or 2 years of graduate training could start at $6,050 or $7,220; and those with the Ph. D. degree, at $8,650.

In colleges and universities, salaries of geographers depend on their teaching rank. (For further information, see statement on College and University Teachers.) Geographers in educational institutions usually have an opportunity to earn income from other sources, such as consulting work, special research projects, and publication of books and articles.

Working conditions of most geographers are similar to those of other teachers and office workers. Geographic research frequently requires extensive travel, in foreign countries as well as in the United States.

Where To Go for More Information

Association of American Geographers,
1146 16th St. NW., Washington, D.C. 20036.

Historians

(2d ed. D.O.T. 0-36.91)
(3d ed. D.O.T. 052.088)

Nature of Work

Historians study the records of the past and write books and articles describing and analyzing past events, institutions, ideas, and people. They may use their knowledge of the past to explain current events. They may specialize in the history of a specific country or region, or in a particular period of time—ancient, medieval, or modern—or

in economic, cultural, military, or other phases of history. More historians specialize in either United States or modern European history than in any other field; however, a growing number are now specializing in African and Latin American history. Some are experts in such fields as the history of the labor movement; others in art, architecture, or other fields of historical interest. The number of specialties is constantly growing. The history of business and the relation between technological changes and other aspects of historical development are among the newest fields.

Most historians are college teachers who also do some research, writing, and lecturing. Some, usually called archivists, specialize in identifying, preserving, and making available documentary materials of historical value. Others edit historical materials, prepare exhibits, write pamphlets and handbooks, and give talks for museums, special libraries, and historical societies. A few serve as consultants to editors and publishers and producers of materials for radio, television, and motion pictures. Historians employed in government mainly do research and administrative work in connection with research projects; they also prepare studies, articles, and books.

Where Employed

An estimated 8,000 to 9,000 persons were employed as historians in 1965. Approximately 85 percent of the historians were employed in colleges and universities. About 10 percent were employed in Federal Government agencies, principally the National Archives and the Department of Defense, Interior, and State. Small but growing numbers were employed by other government organizations (State, local, and international), nonprofit foundations, research councils, special libraries, State historical societies, museums, and by large corporations.

Since history is taught in all institutions of higher education, historians are found in all college communities. About half the historians in the Federal Government, including three-fourths of those working as archivists, are employed in Washington, D.C. Historians in other types of employment usually work in localities which have museums or libraries with collections adequate for historical research.

Training and Other Qualifications

Graduate education is usually necessary for qualification as a historian. The master's degree in history is the minimum requirement for appointment to the position of college instructor, but in many colleges and universities, the Ph. D. degree is necessary for appointment. The latter is essential for attaining high-level college teaching, research, and administrative positions in the field of history. Most historians in the Federal Government and in nonprofit organizations have a Ph. D. degree or the equivalent in training and experience.

Although a bachelor's degree with a major in history is sufficient training for some beginning jobs in Federal, State, and local governments, persons in such jobs may not be regarded as professional historians. These beginning jobs are likely to be concerned with the collection of and preservation of historical data, so that a knowledge of archival work is helpful. An undergraduate major in history is considered helpful for jobs in international relations and journalism.

Employment Outlook

Employment of historians is expected to continue to increase moderately through the mid-1970's. Hundreds of new history teachers will probably be needed annually to teach new classes made necessary by expanding college enrollments, and to replace those faculty members who retire, die, or leave for other types of work. The number of positions for historians in archival work is also expected to rise, though more slowly than the number in college teaching. Only a slight rise is foreseen in the number of historians in other types of work.

Historians with doctorates are expected to have very good employment opportunities through the mid-1970's. Historians who have completed all requirements for the Ph. D. except the dissertation are also expected to have favorable opportunities. However, those with no work beyond the master's degree will probably encounter considerable competition for professional positions. College graduates with only the bachelor's degree will find it difficult to obtain employment as professional historians. On the other hand, history majors who meet certification requirements will