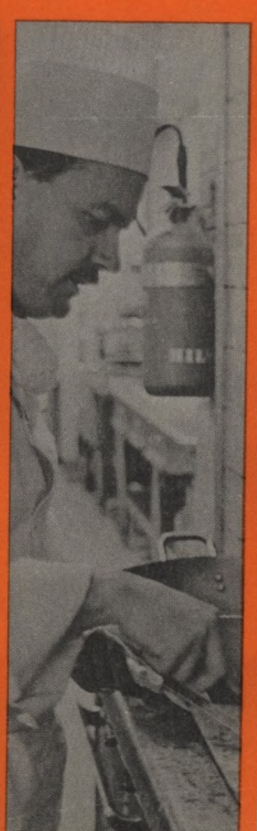
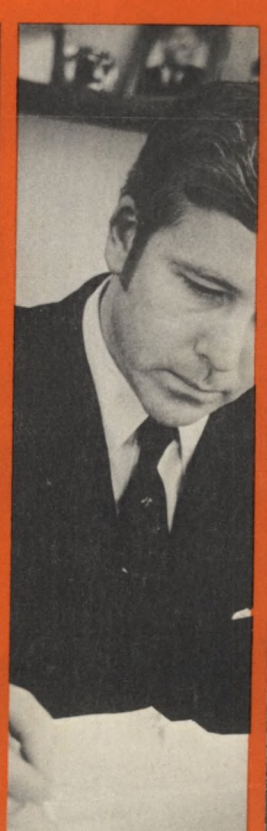
Occupational Outlook Handbook 1972-73 Edition

U.S. Department of Labor
Bureau of Labor Statistics
Bulletin 1700



Pointers on Using the Handbook

To learn the contents and arrangement of this Handbook see How the Handbook is Organized, page 5;

To locate an occupation or industry in this book, see:
Table of Contents, page ix.
Alphabetical Index, page 853.

For a general view of work and jobs in the United States, read the chapter on Tomorrow's Jobs, page 13.

Forecasts of the future are precarious! To interpret the standards on the outlook in each occupation, keep in mind the points made on page 13, as well as the methodology presented in the Technical Appendix. page 851.

The job picture is constantly changing. To find out how you can keep your information up to date, see the chapter on Sources of Additional Information or Assistance, page 9.

You may need local information too. The Handbook gives facts about each occupation for the United States as a whole. For suggestions on sources of additional information for your own locality, see page 10.

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U.S. Department of Labor
J. D. Hodgson, Secretary

Bureau of Labor Statistics
Geoffrey H. Moore, Commissioner

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For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402 - Price $6.25

Foreword

In both human and economic terms, employment can be one of life's most rewarding experiences. A good job offers the pride of human achievement, an opportunity for individual growth, and a sense of personal usefulness. It also provides the welcome security of an adequate income.

But satisfying employment seldom is achieved without wise and informed career planning. Individuals must examine their own interests, abilities, and goals, and must know which occupations are best suited to these traits. Future workers also must know which skills will be needed in tomorrow's working world; skills that are obsolete or in oversupply are no passport to rewarding careers.

We at the Department of Labor believe that the *Occupational Outlook Handbook* contains information necessary to intelligent career planning. This edition provides information for more than 800 occupations so that young persons, veterans, women returning to the labor force, and others choosing careers can determine which jobs are best suited to their individual needs. The *Handbook* discusses the nature of work in different occupations, as well as earnings, job prospects during the 1970's, and education and training requirements. This information can help tomorrow's workers prepare for jobs that have a good future in our changing society.

Knowing that the men and women who enter the work force during the 1970's will be the best educated and most highly skilled workers in our history, the Department of Labor dedicates this *Occupational Outlook Handbook* to the hope that they also will be the most satisfied.

J. D. HODGSON, *Secretary of Labor*

Prefatory Note

The *Occupational Outlook Handbook* is the major publication resulting from the Bureau of Labor Statistics continuing program of research in occupational and manpower trends. Published every other year, the *Handbook* contains job descriptions and employment outlook information for white-collar, blue-collar, and service occupations. The publication is designed as a basic reference source for vocational counselors and manpower planners, as well as for individuals seeking career information.

The 1972–73 edition of the *Handbook* updates previously published occupational information and also presents 26 new occupational and industry outlook statements. Many of the additions reflect the growing demand for health and service workers. New statements describe, for example, biomedical engineering as well as promising subprofessional health occupations, such as electrocardiograph technician, occupational therapy aide, surgical technician, and optometric assistant. In addition, other new statements describe the work of parking lot attendants, guards and watchmen, city managers, social welfare aides, and insurance specialists.

Information in the *Handbook,* both updated and new, is based on BLS analyses of information received from industry officials, labor organizations, trade associations, professional societies, government agencies, and other organizations. The assistance of these individuals and groups is sincerely appreciated.

The Bureau of Labor Statistics is proud to serve those who seek vocational information through its occupational outlook program. Other outlook program publications include reprints of individual *Handbook* statements and the *Occupational Outlook Quarterly,* a magazine which reports occupational developments and research occurring between *Handbook* editions.

GEOFFREY H. MOORE, *Commissioner*
Bureau of Labor Statistics

Letter From the American Personnel and Guidance Association

As our Nation continues its economic growth and technological advancement, new jobs are created and others become obsolete. Keeping abreast of these changes and informed regarding vocational opportunities is an ongoing responsibility for the counselor. To be effective in the career exploration and decision-making process, counselors and clients must have, as one important resource, relevant information about current and projected job descriptions and employment practices.

The Bureau of Labor Statistics is to be commended for the effective utilization of its research facilities to provide the timely, readable, and useful information contained in the *Occupational Outlook Handbook* and its companion publication the *Occupational Outlook Quarterly.*

DONNA R. CHILES, *President*
American Personnel and Guidance Association

Letter From the Veterans Administration

A quarter of a century has passed since publication of the first edition of the *Occupational Outlook Handbook*. Developed initially as an outgrowth of a project to meet the needs of the Veterans Administration for sound occupational information in counseling World War II veterans seeking to return to school and work, the *Handbook* over the years, in a variety of settings, has deservedly achieved wide usage by counselors, educators, and young people generally.

Within the Veterans Administration, the *Handbook* continues to serve as a major resource in counseling an expanded population that now includes, in addition to disabled and nondisabled veterans, the wives and children of deceased or totally and permanently disabled veterans and, most recently, the wives and children of servicemen missing in action or forcibly detained by a foreign country. Disparate as these groups are in many respects, they all share the need for accurate current information about occupations in order to be able to make sound educational and vocational choices and plans. The *Occupational Outlook Handbook* provides such information on a scope unequalled by any other single source.

The Veterans Administration appreciates the unique contribution made by the *Handbook* in the past, and looks forward to its continued usefulness in the 1972–73 and future editions.

Sincerely,
DONALD E. JOHNSON, *Administrator*
Veterans Administration

Letter From the United States Training and Employment Service

In fiscal year 1970, approximately 10 million individuals sought jobs through local employment service offices, and more than one million of them received employment counseling. Many of these needed assistance in making a career choice—which is one of life's most challenging problems—as well as referrals to suitable jobs or training. The need for job information runs the gamut from youth seeking work for the first time to senior citizens who have been displaced from their jobs.

The effectiveness of vocational counseling depends not only on the competency and skill of the counselor and the reliability of his assessment tools, but upon having readily at hand a dependable source of occupational information about many kinds of careers. This information is also a vital element in promoting the most effective use of the manpower work and training programs that are available to thousands of disadvantaged persons. The United States Training and Employment Service and affiliated State agencies welcome this new edition of the *Occupational Outlook Handbook,* which has long been a classic in the field of guidance literature.

ROBERT J. BROWN, *Associate Manpower Administrator for*
U.S. Training and Employment Service
U.S. Department of Labor

Letter From the Social and Rehabilitation Service

In the coming year, more than 280,000 disabled men and women will be returned to productive activity through the State-Federal vocational rehabilitation program. Dignity and self-support through work has been a basic principle of the rehabilitation process since the public program began more than 50 years ago.

This new edition of the *Occupational Outlook Handbook* will continue to be an invaluable resource to counselors who are responsible for guiding clients to suitable opportunities in the nation's job market.

JOHN D. TWINAME, *Administrator*
Social and Rehabilitation Service
U.S. Department of Health, Education, and Welfare

Letter From the United States Office of Education

An underlying goal of education in our democratic society is to provide an opportunity for the maximum realization of individual potential. Because of the prevailing emphasis upon the general curriculum, a significant segment of the student population is now limited to this offering. We must build a new leadership and a new commitment to the concept of a career education system. The career development emphasis in education holds promise for meaningful educational experiences in terms of individual needs.

Realistic planning for career development calls for keeping abreast of the rapidly changing occupational structure in this complex, technological society. The *Occupational Outlook Handbook* fulfills this function by providing current, systematically organized information about occupational trends, requirements and opportunities. It is an invaluable resource for students, and those who assist them in the career development process, as they seek to develop their talents and achieve personal fulfillment as human beings.

To the Bureau of Labor Statistics, and particularly the *Handbook* staff, I would like to extend the congratulations and the thanks of the Office of Education.

Sincerely,
S. P. MARLAND, Jr.
U.S. Commissioner of Education

Letter From the Department of Defense

Armed Forces education officers and counselors have been using the *Occupational Outlook Handbook* for many years. It is a primary source of occupational information used to guide members of the Armed Forces to the opportunities off-duty educational programs offer for advancement in their military careers or in preparation for their return to civilian life.

Servicemen may participate in many off-duty educational programs throughout their military service; they are encouraged to pursue educational goals that will help their military careers and prepare them for future civilian careers. The *Occupational Outlook Handbook* has added significantly to Armed Forces educational programs as a source of career information for both professional and citizen servicemen.

On the basis of our experience with this valuable career guide, we commend it to all concerned with career planning.

GEORGE BENSON, *Deputy Assistant Secretary of Defense for Education*

Contributors

The *Handbook* was prepared in the Bureau of Labor Statistics, Division of Manpower and Occupational Outlook, under the supervision of Russell B. Flanders. General direction was provided by Harold Goldstein, Assistant Commissioner for Manpower and Employment Statistics.

The planning and coordination of the *Handbook* was done by Neal H. Rosenthal, with the assistance of Gerard C. Smith. Michael F. Crowley directed the research program on white-collar and service occupations. Max L. Carey directed the research program on blue-collar occupations and on major industries and their occupations. The research and preparation of individual sections were supervised by William F. Hahn, Michael J. Pilot, and Joseph J. Rooney.

Members of the Division's staff who contributed sections were: Elinor Abramson, Marlene Ausmus, Louann Berman, Harold Blitz, Donald Clark, Norman J. Coakley, Jr., Constance B. DiCesare, Conley H. Dillon, Don Dillon, Susan C. Gentz, Kevin Kasunic, Joyce C. Kling, Annie Lefkowitz, Thomas M. McDonald, Maurice P. Moylan, Ludmilla K. Murphy, Kathleen A. Naughton, H. James Neary, Irving P. Phillips, John O. Plater, Jr., Joan Slowitsky, and Dixie Sommers.

Statistical assistance was provided by Sara G. Brown, Olive B. Clay, Jane K. Green, and Richard Frasch, under the direction of Jean F. Whetzel. Everett J. McDermott assisted in gathering and editing photographs.

The chapter on Agriculture was coordinated in the Office of Information, U.S. Department of Agriculture, under the direction of Harold R. Lewis, Director of Information.

Photograph Credits

The Bureau of Labor Statistics gratefully acknowledges the cooperation and assistance of the many government and private sources that either contributed photographs or made their facilities available to the U.S. Department of Labor photographers for this edition of the *Occupational Outlook Handbook*.

Government Sources

Federal. Department of Agriculture; Department of the Army—Walter Reed Army Medical Center; Atomic Energy Commission; Department of Commerce—National Oceanic and Atmospheric Administration, Maritime Administration, and National Bureau of Standards; Federal Power Commission; General Services Administration; Government Printing Office; Department of Health, Education, and Welfare—Health Services and Mental Health Administration, National Institutes of Health, and Vocational Rehabilitation Administration; Department of the Interior; Department of Justice—Federal Bureau of Investigation; Department of Labor—Training and Employment Service; National Aeronautics and Space Administration; Department of the Navy—Naval Photographic Center, and Naval Research Laboratory; Department of Transportation—Federal Aviation Agency; and Veterans' Administration.

State and Local. City of Chicago—Police Department; District of Columbia—Fire Department, Department of Sanitation, and Social Services Administration; and Commonwealth of Virginia—State Police.

Private Sources

Individuals. Burton Berinsky; Andrew Columbus; Jerome Footer, D.D.S.; and Alfred Statler.

Membership Groups. American Forest Products Industries, Inc.; American Home Economics Association; American Institute of Planners; American Optometric Association; American Paper Institute; American Podiatry Association; American Trucking Association; The College Placement Council, Inc.; International Alliance of Theatrical Stage Employers and Moving Picture Machine Operators of the United States and Canada; International Brotherhood of Electrical Workers; International Chiropractor Association; National Association of Home Builders; National Association of Metal Finishers; National Institute of Drycleaning; National Marine Engineer Beneficial Association; National Maritime Union of America; National Terrazzo and Mosaic Association; Pattern Makers League; Southeast Woman's Club of Washington, D.C.

Industry and Business. Acacia Mutual Life Insurance Co.; Aetna Shirt Co.; Allstate Insurance Co.; Aluminum Company of America; American Airlines, Inc.; American Machine and Foundry Co.; American Optical Co.; American Telephone and Telegraph Co.; Armstrong Cork Co.; Atchison, Topeka, and Santa Fe Railroad; Ball-Shea Norair; D. Ballauf and Co.; Banning Plymouth, Inc.; Bell Telephone Co.; Bethlehem Steel Corp.; Blake Construction Co.; Boeing Co.; Burroughs Corp.; Caterpillar Tractor Co.; Chrysler Corp.; Cities Service Oil Co.; Cleaver-Brooks; Collins Radio Co.; Danko Arlington, Inc.; D. C. Transit Co.; Don Reedy Appliance Service; E.I. DuPont de Nemours and Co.; Eastman Kodak Co.; Eastern Airlines; Erie Railroad; General Motors Corp.; Goodwill Industries; Great Northern Railway; Herson Auto and Appliance Co.; Hilton Hotels; Hughes Aircraft Co.; International Business Machines Corp.; I. C. Isaacs; Kaiser Engineers; Kimberly-Clark Corp.; Koons Ford, Inc.; Eli Lilly and Co.; Lockheed-Georgia Co.; Lustine Chevrolet; McLachlen Banking Corp.; Merkle Press, Inc.; Moore-McCormick Lines; Jack Morton Productions, Inc.; National Broadcasting Co.; New York, New Haven, and Hartford Railroad; North American Rockwell Corp.; North Indiana Public Service Co.; Oxford Paper Co.; Pan American Petroleum Corp.;

Pan American World Airways, Inc.; Potomac Electric Power Co.; Ransdell, Inc.; Reynolds Metals Co.; Royce's TV; Southern Pacific Co.; Standard Oil Company of New Jersey; Sterling Optical Co.; Swift and Co.; Tolman Laundry; Union Carbide Corp.; Union Pacific Railroad; United Air Lines; The Upjohn Co.; Westinghouse Corp.; and Woodward and Lothrop.

Publications. Clissold Publishing Co.; *Implement and Tractor* Magazine; *The Machinist Weekly; Signs of the Times* Magazine; and *The Washington Star.*

Schools. The Models Guild, Inc.

Others. Los Alamos Scientific Laboratory; National Symphony; Oakridge National Laboratory; and Washington Hospital Center.

Note

A great many trade associations, professional societies, unions, and industrial organizations are in a position to supply valuable information to counselors or young people seeking information about careers. For the convenience of *Handbook* users, 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

GUIDE TO THE HANDBOOK

USING THE HANDBOOK IN GUIDANCE SERVICES

The changing occupational structure and outlook within our increasingly complex technological society points up the urgency for greater emphasis upon career development and the vocational aspects of guidance. The career development concept may well become the focal point for a reorientation of the total educational effort towards the maximum development of each individual's potential. The process of career development stresses the importance of strengthening the program of informational services within a total program of guidance and counseling services. One of the most valuable resources for occupational and career information is the *Occupational Outlook Handbook*.

The Vocational Education Amendments of 1968 have reemphasized the need for education about the structure, nature, and trends of the entire spectrum of occupations as an essential and integral component of developmental career education. As a result, there is throughout the Nation a rapid increase in the number and variety of work and related education and training opportunities being developed, produced, and utilized. These multi-media approaches range from the printed word, through films and TV tapes, to computer-assisted methods. A great many of these resources depend upon the *Occupational Outlook Handbook* as a primary source of authoritative data.

It is being increasingly recognized that a developmental approach to career education and guidance requires sequential, articulated programming from the kindergarten through each successive "level" of education. In broad process terms, the progression is frequently described as moving primarily from early awareness, through orientation, to exploration, to more selective and intensive investigation and consideration as appropriate group and individual maturation and current needs. These broad processes, so described, relate both to the self and to the world of work, and to the interrelationships. In one form or another, then, the kinds of information provided by the *Occupational Outlook Handbook* increasingly become functional throughout the educational process.

It is basic to observe also that education for career development and guidance entails a total-school involvement. The teaching function as well as the counseling function takes on a greater commitment to this aspect of human development along with other aspects. The instructional curriculum as well as the specialized guidance and counseling services becomes crucially involved. As this total school approach evolves, occupational information from this *Handbook* and other sources will be more widely incorporated in academic as well pre-vocational and vocational courses of instruction, classroom activities, and teacher resource materials, in addition to being available in counseling offices and school libraries. A corollary of such developments as these is the need for buttressing the pre-service and in-service development of all kinds of educational personnel to plan and implement career education and guidance.

The *Handbook,* now in the eleventh edition, is designed both for individual and group use in a variety of settings. Settings include junior and senior high schools, vocational and technical schools, junior and community colleges, college student personnel centers, college preparation programs, private and public placement and counseling agencies, youth opportunity centers, and in-service education programs. A student, in pursuing his long-range career development goals—or those who assist him, such as counselors, teachers, parents—will find the *Handbook* to be a reliable, systematically organized reference, which

provides a comprehensive overview of occupational requirements and opportunities. The organization of the *Handbook* is especially appropriate for use by persons working with groups. It analyzes job prospects in the world of tomorrow with well-designed and easily understood charts and graphs. The *Handbook*'s supplementary services consisting of reprints of individual occupations and charts illustrating occupational trends are helpful not only in counseling individuals, but also in working with groups of students and with parents as they become involved in assisting their children with occupational choices.

Counselors find the *Handbook* an invaluable tool in career planning and educational counseling. It provides an overview of the world of work in terms of major occupational categories which is useful at the elementary school level as well as in and beyond junior and senior high schools. The *Handbook* lends itself well to use by teachers in relating the significance of subject matter areas to occupational "families" and by counselors in applying the career ladder concept to career development. The frequency of revision assures that the occupational and career information pertaining to the rapidly changing occupational structure is current and relevant. The *Handbook* reveals how the nature of occupations and their respective employment opportunities are changing, and the importance of flexible planning in terms of major interest areas.

As a part of the total information services within the guidance program, the *Handbook* deserves a high priority as an indispensible resource for career development.

Don D. Twiford,
Senior Specialist
Guidance and Personnel Services
and
David H. Pritchard,
Senior Program Officer
Guidance, Counseling, and Placement
Office of Education,
U. S. Department of Health, Education, and Welfare

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 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. It also describes briefly the counseling, placement, and other services available to jobseekers at local offices of State employment services affiliated with the U.S. Training and Employment Service in the Manpower Administration. The final introductory chapter describes some of the most important occupational and industrial employment trends to provide a background for interpreting the reports on individual occupations.

Occupational Reports

The reports on different fields of work make up the main body of the book. The seven major divisions of the book are: professional and related occupations; managerial occupations; clerical and related occupations; sales occupations; service occupations; skilled and other manual occupations; and some major industries and their occupations. Within each of these major divisions, occupations are grouped into related fields. The introductory statement for each major industry group provides information on occupational trends in the industry.

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 occupations covered in the *Occupational Outlook Handbook* also are coded according to the occupational classification system developed by 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 number can be used as a filing system for occupational information. The code numbers of the D.O.T. are listed in parentheses immediately below the main occupational group headings in the *Handbook*. Volumes I and II of the D.O.T. contain job classifications and definitions; a supplement lists individual physical demands, working conditions, and training time data for each job defined in the *Dictionary*.

The technical appendix of this *Handbook* discusses the sources and methods used to analyze 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.

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. Interviews with hundreds of persons in industry, unions, trade associations, and public agencies provided a great deal of up-to-date information. 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 the U.S. Training and Employment Service, Manpower Administration, Department of Labor; the Bureau of the Census, Department of Commerce; the

Office of Education and the Vocational Rehabilitation Administration, Department of Health, Education, and Welfare; the Veterans Administration; the Civil Service Administration; the Interstate Commerce Commission; the Civil Aeronautics Board; the Federal Communications Commission; the Department of Transportation; and the National Science Foundation. 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.

Some important facts about the occupational reports

Occupations Covered

The more than 800 occupations discussed in this *Handbook* generally are those of greatest interest to young people. Most of the major 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 97 percent of all workers in sales occupations; about 95 percent of all workers in professional and related occupations; about two-thirds of all workers in skilled, clerical, and service occupations, and two-fifths of those in semiskilled occupations. Smaller proportions of managerial workers and laborers are discussed. The main types of farming occupations also are 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 designed to aid the reader in interpreting the reports on individual occupations.

After the information from these many sources was brought together and analyzed in conjunction with the Bureau's overall economic model, conclusions were reached as to prospective employment trends in the occupations. (See the Technical Appendix, page 851, for a discussion of the methodology used in employment outlook analysis.) 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 also was analyzed, by studying statistics on high school and college enrollments and graduations, data on the number of apprentices in skilled trades, re-entries 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 reponsibility for all statements made. The technical appendix presents a more detailed discussion of the sources of information used in the occupational reports.

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 unpre-

dictable catastrophes, although, on the basis of historical experience, they must be prepared to weather economic ups and downs during their working lives. The basic economic assumptions are discussed in detail in the introductory section of the *Handbook,* Tomorrow's Jobs, page 13.

To avoid constant repetition, the assumptions seldom are 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 for an individual in a particular 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 1971. Much of the information came from Bureau of Labor Statistics surveys, but many other sources were utilized also. 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 1971, training programs (which last from several weeks to 2 years) covered several hundred 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, 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.

SOURCES OF ADDITIONAL 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 (see descriptions following index), 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 also may 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 guidance 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 usually can 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; their officials can supply information relating to the occupations with which they are concerned.

Occupational outlook service publications and materials

In addition to this *Handbook,* the Bureau of Labor Statistics 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.*

The Bureau also has developed a visual aid for counselors entitled *Jobs for the 70's.* It consists of a set of 40 color slides that show the changing occupational and industrial mix, and trends for manpower development, education, and training. The slides, which have an accom-

panying narrative, are available directly from the Bureau of Labor Statistics Regional Offices. (See order form in back of *Handbook.*)

The Bureau of Labor Statistics has published a *Counselor's Guide to Manpower Information, An Annotated Bibliography of Government Publications.* The bibliography, as the title suggests, lists major occupational and other manpower publications of Federal and State government agencies. These will be useful to counselors and others interested in trends and developments that have implications for career decisions. This bulletin, No. 1598, is available from the Superintendent of Documents, Government Printing Office, Washington, D.C., 20402, at $1 a copy.

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

Local offices of State employment services specialize in finding jobs for workers and workers for jobs. The State employment services are affiliated with the U.S. Training and Employment Service of the U.S. Department of Labor's Manpower Administration and constitute a Federal-State partnership. Employment and related services are available without charge in every State.

At each of the over 2,000 public employment service offices across the Nation, jobseekers are aided in obtaining employment, and employers are assisted in finding qualified workers.

Four basic services are provided to workers by the public employment service: (1) Job information; (2) employment counseling; (3) referral to job training; and (4) job placement.

Job Information. The personnel who staff the public employment service offices are familiar with their areas and thus know what kinds of workers are employed in local industry, what jobs are available, what the hiring requirements and the opportunities for advancement are, and the wages that are paid. The staff conduct manpower surveys to determine the area's available skills, training needs, and future occupational opportunities. Through the employment service network of offices, information is also available on job opportunities in other areas of the country.

Employment Counseling. Employment 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 understand their actual and potential abilities, their interests, and their personal traits; to know the nature of occupations; and to make the best use of their capacities and preferences in the light of available job opportunities.

The employment counselor is specially trained and has access to a large store of occupational information.

Testing. Most local offices have available testing services which the counselor may use to assist him in appraising an individual's aptitudes, interests, and clerical and literacy skills.

USTES aptitude tests are particularly helpful in relating applicant's potential abilities to the aptitude requirements of 62 broad occupational groupings and hundreds of specific occupations. A nonreading edition has also been developed for individuals with very limited education.

Referral to Training. Many individuals seek work for which they lack some qualifications. Sometimes the job requires basic education or a specific skill. Besides referring a jobseeker to a job, the public employment service may suggest training so the applicant can qualify or secure a better job.

Jobs and job requirements change. In today's fast-paced world, important considerations when selecting a vocation are the training required to perform the work, and ways that training need can be met.

Job Placement. A primary objective of the public employment service is to place workers in jobs. Regular contact is maintained with local em-

ployers to learn about their job openings. Requests are received from employers for many different kinds of workers. As a result, registered applicants have access to a variety of job vacancies with many employers, just as the employer has access to many applicants. This dual function eliminates "hit-or-miss" job hunting.

If job openings are not available locally, applicants may apply for employment elsewhere in the State, in another area, or even in a foreign country. Each State employment service prepares inventories of its hard-to-fill jobs so that other State employment services may refer local workers to out-of-area jobs for which they qualify. In addition, a national network of highly specialized professional placement offices operates within the employment service network to speed the matching of jobs and applicants in professional fields.

Special Services for Youth. The Employment Service maintains a year-round program of services to youth, including counseling, job development, placement, training and referral to other agencies. In addition, there are two special efforts. (1) In the Summer Employment Program, the Employment Service enlists the cooperation of business, Government, and other groups to develop as many employment opportunities as possible for disadvantaged youth to provide valuable summer work experience and enable them to return to school in the fall. (2) The Cooperative School Program provides employment-related services to graduating seniors, school dropouts, and potential dropouts who desire to enter the labor market. Through this program they are provided employment counseling, testing, job development, referral to jobs or training, and followup services.

Special Services for Disadvantaged Adults. Through its human resources development program, the employment service seeks to improve the employability of adults who are not in the work force because of some social or cultural disadvantage. An important part of this program is "outreach" into slum areas.

Other Special Services. Individuals with mental or physical disabilities which constitute vocational handicaps are given special consideration by the employment service.

Veterans also receive special services. Each local office has a veterans' employment representative who is informed about veterans' rights and benefits, and seeks to develop jobs for veterans.

Middle-age and older workers are assisted in making realistic job choices and overcoming problems related to getting and holding jobs. Employers are encouraged to hire individuals on their ability to perform the work. Similar attention is given to the employment problems of minority group members and all others facing special difficulties in obtaining suitable employment.

Community Manpower Service. Jobseekers, employers, schools, civic groups, and public and private agencies concerned with manpower problems are invited to utilize the service of the public employment office in their community, and avail themselves of the job information in that office. The local office is listed in the phone book as an agency of the State government.

TOMORROW'S JOBS

Young people in an ever growing and changing society are faced with the difficult task of making sound career plans from among thousands of alternatives. As the economy continues to expand, this planning process becomes more difficult. Making career plans calls for an evaluation of an individual's interests and abilities, as well as specific information on occupations. This *Handbook* provides counselors, teachers, parents, and students with occupational information on training and education requirements, employment opportunities, and the nature of the work.

Several questions are of major importance to young persons as they view the variety of occupational choices open to them. Among these questions are: What fields look especially promising for employment opportunities? What competition will other workers furnish? What type and how much training and education are required to enter particular jobs? How do earnings in certain occupations compare with earnings in other occupations requiring similar training? What types of employers provide which kinds of jobs? What are the typical environment and working conditions associated with particular occupations?

Of importance in evaluating information that answers these and related questions is knowledge of the dynamic changes that are continually occurring in our economy —the trends in the Nation's work force and its business, industrial, and occupational development. New ways of making goods, new products, and changes in living standards are constantly changing the types of jobs that become available. To throw light on the changing characteristics of occupations and to provide background for understanding the outlook in specific occupations, this chapter focuses on overall patterns of change in the country's industrial and occupational composition. It also discusses the implications of these changes on education and training in relation to occupational choice.

No one can accurately forecast the future. Nevertheless, by using the wealth of information available, extensive economic and statistical analyses, and the best judgment of informed experts, the work future can be described in broad terms. Of course, some aspects of the future can be predicted more accurately than others. For example, the number of 18-year-olds in 1980 can be estimated with a very high degree of accuracy because individuals 8 years old in 1970 are accounted for in our vital statistics, and the death rate of children between 8 and 18 is extremely low and stays about the same from year to year. On the other hand, forecasting employment requirements for automobile assemblers in 1980 is extremely difficult. Employment of these workers can be affected by the changing demand for American-made automobiles, shifts in buyer's preference (toward the compact car, for example), changes in the ways cars are made (more automation or the use of turbine engines), and unpredictable economic developments outside of the automobile industry.

To project the demand for all workers in the economy, specific assumptions have to be made about general economic movements and broad national policy. The picture of the future employment outlook reflected in the *Handbook* is based on the following fundamental assumptions:

1. Maintenance of high levels of employment and of utilization of available manpower in 1980;

2. that no major event will alter substantially the rate and nature of economic growth;

3. that economic and social patterns and relationships will continue to change at about the same rate as in the recent past;

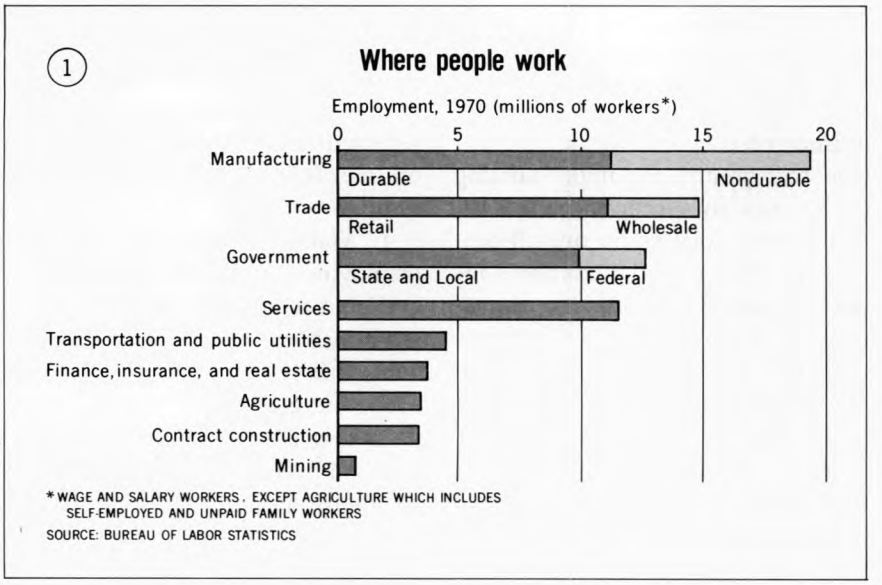
4. that scientific technological advancement will continue at about the same rate as in recent years; and

5. that the United States will no longer be fighting a war. On the other hand, a still guarded relationship between the major powers will permit no major reduction in armaments but defense expenditures can be reduced from the peak levels of the Vietnam conflict.

The *Handbook*'s assessment of 1980 industrial and occupational outlook assumes a projected total labor force of 100.7 million in 1980, an Armed Forces of 2.7 million, and a resulting civilian labor force of 98 million.

Knowledge of specific industries is necessary because employers seek a wide variety of skills, for example, many different industries employ engineers, salesmen, and secretaries. Employment patterns have shifted considerably over the years and are expected to continue to do so. These changes greatly affect employment opportunities and occupational choices.

Industry employment and occupational requirements change as a result of many factors. A new machine or a newly automated proc-



ess may require different occupational skills or may even create an entirely new occupation; a change in product demand may affect the number of workers needed; an invention may all but eliminate an industry or create a new one.

Industrial Profile

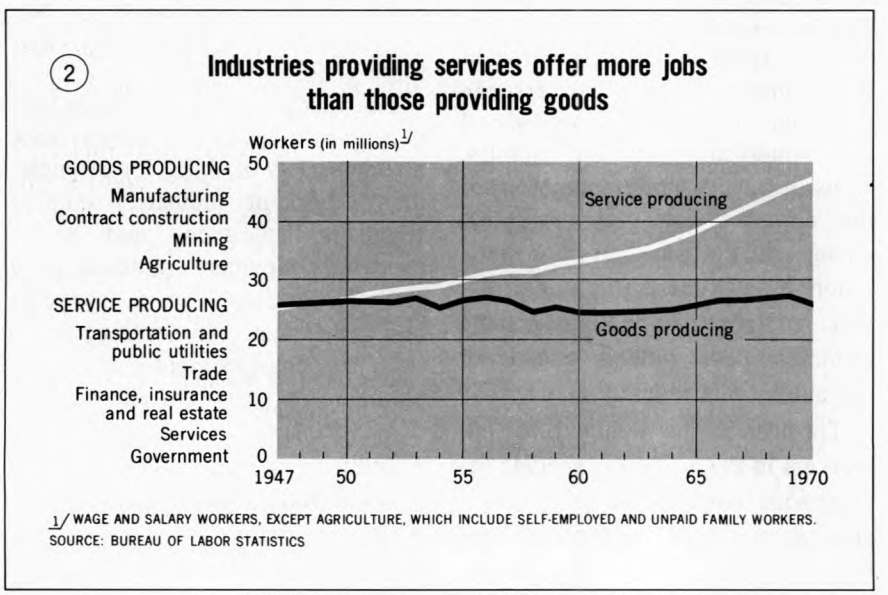
To help understand the Nation's industrial composition, industries may be viewed as either goods producing or service producing. They may further be grouped into nine major divisions according to this product or service. (See chart 1.)

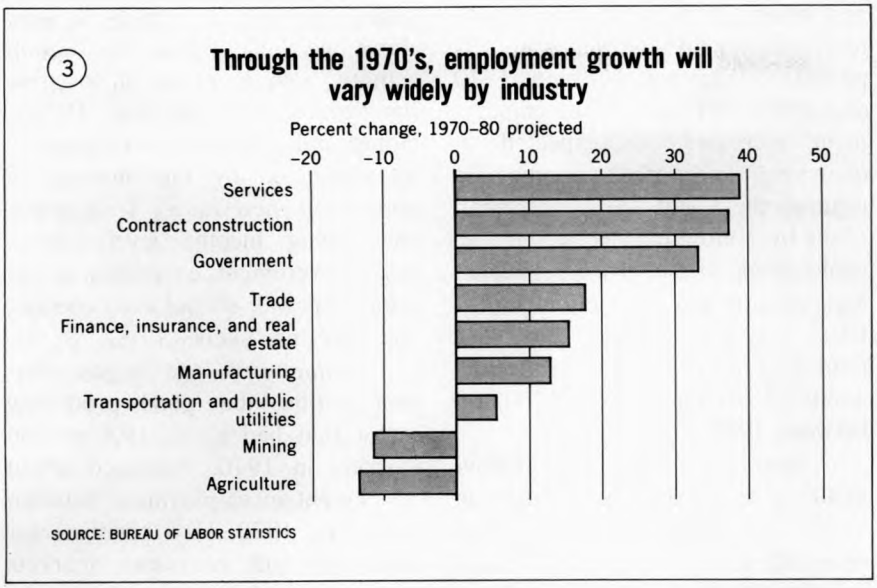
Most of the Nation's workers are in industries producing services, in activities such as education, health care, trade, repair and maintenance, and in government, transportation, and banking and insurance service. The production of goods—raising food crops, building, extracting minerals, and manufacturing of goods—has required less than half of the country's work force since the late 1940's. (See chart 2.) In general, job growth through the 1970's is expected to continue to be faster in the service-producing industries than in the goods-producing industries. However, among industry divisions within both the goods-producing and service-producing sectors, the growth pattern will continue to vary. (See chart 3.)

Service-producing industries. In 1970, about 47.3 million workers were on the payrolls of service-producing industries—trade; Government; services and miscellaneous; transportation and other utilities; and finance, insurance, and real estate—about 13.5 million greater than the number employed in 1960. The major factors underlying this rapid post World War II growth have been (1) population growth; (2) increasing urbanization, with its accompanying need for more city service; and (3) rising income and living standards accompanying demand for improved services, such as health, education, and security. These factors are expected to continue to result in rapid growth of service industries as a group, and to employ 59.5 million by 1980, an increase of about 26 percent above the 1970 level.

Trade, the largest division within the service-producing industries, has expanded sharply since 1960. Wholesale and retail outlets have multiplied in large and small cities to satisfy the need of an increasingly urban society. Employment in trade was about 14.9 million in 1970, about 31 percent above the 1960 level.

Employment in trade is expected to grow by about 18 percent between 1970 and 1980. Although an





ever-increasing volume of merchandise will be distributed as a result of increases in population and consumer expenditures, the rate of increase in manpower needs will be slowed by laborsaving technology such as the greater use of electronic data processing equipment and automated warehousing equipment, growth in the number of self-service stores, and the growing use of vending machines.

Government employment has grown faster than any other industry division, and has increased by more than one-half from 8.4 million to 12.6 million between 1960 and 1970. Growth has been mostly at the State and local levels, which combined increased by almost two-thirds. Employment growth has been greatest in agencies providing education, health, sanitation, welfare, and protective services. Federal Government employment increased about 19 percent between 1960 and 1970.

Government will continue to be a major source of new jobs through the 1970's. By 1980, employment in Government may be as much as 33 percent higher than in 1970. Most of the growth will be in State and local governments in which employment needs may rise by 1980, to 13.8 million about 40 percent higher than the 9.9 million employed in 1970. Federal Government employment is expected to rise slowly to about 3 million to 1980, 300,000 or about 11 percent above the 1970 level of 2.7 million.

Services and miscellaneous industries employment has increased rapidly since World War II as a result of the growing need for maintenance and repair, advertising, domestic, and health care services. From 1960 to 1970, total employment in this industry division rose by about two-fifths from slightly more than 8.0 million to about 11.6 million.

Service and miscellaneous industries will continue to be among the fastest growing industries through the 1970's. About two-fifths again as many workers are expected to be employed in this industry division in 1980 as in 1970. Manpower requirements in health services are expected to grow rapidly due to population growth and the increasing ability of persons to pay for health care. Business services including accounting, data processing, and maintenance also are expected to grow very rapidly.

Transportation and public utility employment in 1970 at 4.5 million was only slightly more than one-tenth higher than in 1960. Different parts of this industry, however, have experienced different growth trends. For example, air travel employment increased rapidly but the railroad industry declined.

The number of jobs in transportation and public utilities as a whole is expected to continue to increase slowly through the 1970's and widely differing employment trends will continue to be experienced among individual industries within the division. Rapid increases in employment are expected in air transportation and a decline is expected to continue in railroad employment and little or no change is expected in water transportation, and electric, gas, and sanitary services. Overall employment in this industry division is expected to increase to more than 4.7 million in 1980, 5 percent above the 1970 level.

Finance, insurance, and real estate, the smallest of the service-producing industry divisions, has grown about 38 percent since 1960, from nearly 2.7 million in 1960 to nearly 3.7 million in 1970. Employment has grown especially rapidly in banks; credit agencies; and security and commodity brokers, dealers, exchanges, and services.

Job growth in finance, insurance, and real estate will keep in step with the overall employment increases of nonfarm employment through the 1970's. Finance, insurance, and real estate employment is expected to expand to nearly 4.3 million by 1980, about 16 percent above 1970 levels. The most rapid advances will be in banking and credit agencies,

which combined account for nearly two-fifths of total employment in this industry division.

Goods-Producing Industries. Employment in the goods-producing industries—agriculture, manufacturing, construction, and mining—more than 26.9 million in 1970—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. Employment in goods-producing industries is expected to increase to about 30 million in 1980, 12 percent above the 1970 level. However, widely different patterns of employment changes have occurred and will continue among the industry divisions in the goods-producing sector.

Agriculture, which until the late 1800's employed more than half of all workers in the economy, employed only 5 percent, or 3.4 million workers, in 1970. Employment in agriculture has dropped by about two-fifths since 1960. Increases in the average size of farms, rapid mechanization, and improved fertilizers, feeds and pesticides have created large increases in output at the same time that employment has fallen sharply.

Agriculture is facing a continuing decline in manpower needs. Factors resulting in past declines will continue and the outlook is for a 1980 farm work force 15 percent lower than in 1970.

Mining employment, at about 620,000 workers in 1970, has declined by nearly 13 percent since 1960, primarily because of labor-saving technological changes and a shift to sources of power other than coal.

This trend is likely to continue and mining is the only nonagricultural industry division that is not expected to increase between 1970 and 1980. Although minor employment increases are expected in quarrying and other nonmetallic mining, they will be more than offset by continuing declines in the coal mining, and in crude petroleum and natural gas extraction industries. The job level of the entire mining group is expected to decline about 12 percent to about 550,000 between 1970 and 1980.

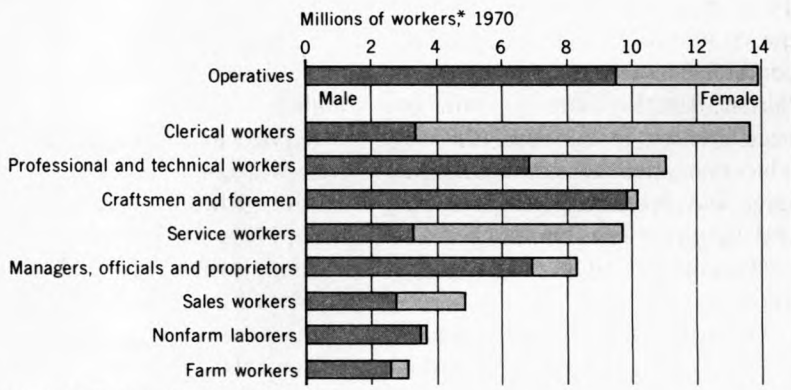
Contract construction employment, at more than 3.3 million in 1970, has increased more than one-sixth since 1960. The Nation's growing need for homes, offices, stores, highways, bridges, dams, and other physical facilities resulted in this increase in employment.

Between 1970 and 1980, contract construction is expected to grow by about two-fifths to about 4.6 million. Construction activity will be spurred by several factors. An expanding economy will result in more industrial plants and commercial establishments such as office buildings, stores, and banks. The volume of construction maintenance and repair, which is now about one-third of new construction activity, also is expected to grow significantly through the 1970's. Home and apartment building will be stimulated by the increase in population, new family formations, and higher income levels. Also, large government expenditures for urban renewal, school construction, and roads are likely.

Manufacturing, the largest division within the goods-producing sector that had about 19.4 million workers in 1970, increased about 16 percent in employment between 1960 and 1970. New products for industrial and consumer markets and the rapid growth of the defense-space market has spearheaded the post World War II growth.

Manufacturing employment is expected to increase about 13 percent through the 1970's and reach about 21.9 million in 1980. Durable goods manufacturing is projected to increase slightly faster (16 percent) and nondurable goods somewhat slower (9 percent) than the total. However, the rate of growth will vary among the individual manufacturing industries. The machinery in-

(4) **Employment in major occupational groups by sex**



* INCLUDES SELF-EMPLOYED AND UNPAID FAMILY WORKERS
SOURCE: BUREAU OF LABOR STATISTICS

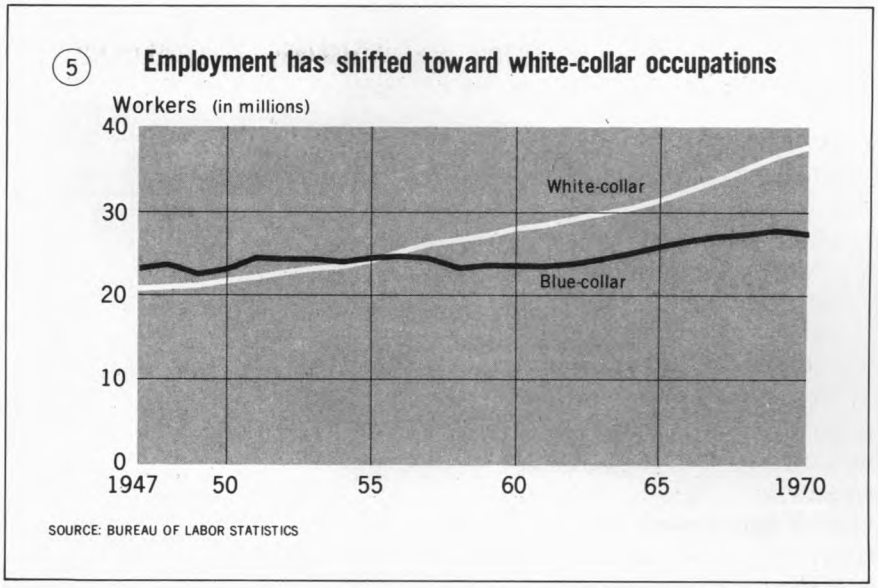
dustry is expected to have the largest need for additional people, as employment grows from nearly 2.0 million to more than 2.4 million. Producers of rubber and plastic products; furniture and fixtures; stone, clay, and glass products; and instruments, will be among other rapid growing manufacturing industries. In contrast, employment in some manufacturing industries may decline, for example, food, textile mill products, tobacco, and petroleum refining.

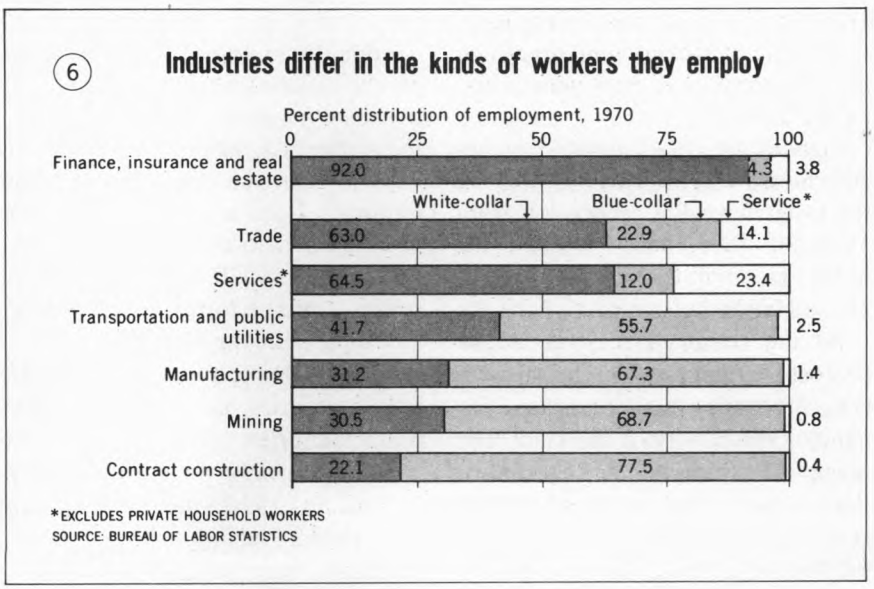
Occupational Profile

As American industries continue to grow large, more complex, and more mechanized, fundamental changes will take place in the Nation's occupational structure. Furthermore, occupations will become more complex and more specialized. Thus, an imposing and confusing number of occupational choices is provided to individuals who are planning their careers. An individual, in examining the vast number of choices should first look at broad groupings of jobs that have similar characteristics such as entrance requirements. (See chart 4.)

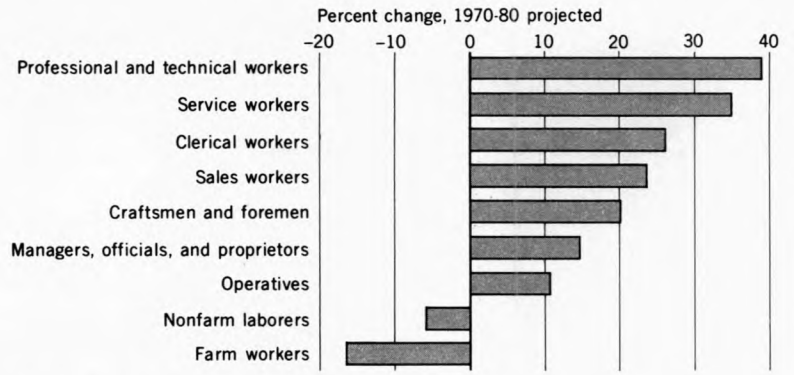
Among the most significant changes in the Nation's occupational structure has been the shift toward white-collar jobs. In 1956, for the first time in the Nation's history, white-collar workers—professional, managerial, clerical, and sales—outnumbered blue-collar workers—craftsmen, operatives, and laborers. (See chart 5.)

Through the 1970's, we can expect a continuation of the rapid growth of white-collar occupations, a slower than average growth of blue-collar occupations, a faster than average growth among service workers, and a further decline of farm workers. Total employment is expected to increase about 21 percent between 1970 and 1980. In comparison, an increase of about 27 percent is expected for white-collar jobs, and only about 12 percent for blue-collar occupations. By 1980, white-collar jobs will account for more than one-half of all employed workers compared with about 48 percent in 1970. The rapid growth expected for white-collar workers and service workers reflects continuous expansion of the service-producing industries which employ a relatively large proportion of these workers. (See chart 6.) The growing demand for workers to perform research and development, to provide education and health services, and to process the increasing amount of paperwork throughout all types of enterprises, also will be significant in the growth of white-collar jobs. The slower than average growth of blue-collar and farm





(7) **During the 1970's, growth will vary widely among occupations**



SOURCE: BUREAU OF LABOR STATISTICS

workers reflects the expanding use of labor-saving equipment in our Nation's industries and the relatively slow growth of the goods-producing industries that employ large proportions of blue-collar workers.

The following section describes in greater detail the changes that are expected to occur among the broad occupational groups through the 1970's.

Professional and technical workers, the third largest occupational group in 1970, include among more than 11.1 million workers such highly trained personnel as teachers, engineers, dentists, accountants, and clergymen.

Professional occupations will be the fastest growing occupation from 1970–80. (See chart 7.) Personnel in this area will be in great demand as the Nation puts greater efforts toward the country's socio-economic progress, urban renewal, transportation, harnessing the ocean, and enhancing the beauty of the land. The quest for scientific and technical knowledge is bound to grow and raise the demand for workers in scientific and technical specialties. The 1970's will see a continuing emphasis in the social sciences and medical services. By 1980 the requirements for professional, technical, and kindred workers may be about two-fifths greater than 1970 employment.

Managers, officials and proprietors totaled about 8.3 million in 1970. As a group they will increase about 15 percent between 1970 and 1980, somewhat slower than the rate of growth for all occupations. As in the past, requirements for salaried managers are likely to continue to increase rapidly because of the increasing dependence of business organizations and government agencies on management specialists. On the other hand, the number of self-employed managers are expected to continue to decline through the 1970's as larger businesses continue to restrict growth of the total number of firms and as supermarkets continue to replace small groceries, general stores, and hand laundries.

Clerical workers numbering 13.7 million in 1970, include workers who operate computers and office machines, keep records, take dictation, and type. Many new clerical positions are expected to open up as industries employing large numbers of clerical workers continue to expand. The trend in retail stores toward transferring to clerical workers functions that were performed by salespersons also will tend to increase employment needs of clerical workers. The demand will be particularly strong for those qualified to handle jobs created by the change of clerical occupations to electronic data processing operations. However, the use of electronic computing bookkeeping machines and other mechanical devices to do processing and repetitive work are expected to reduce the number of clerks employed in jobs such as filing, making up payrolls, keeping tract of inventories, and billing customers. The need for clerical workers as a group is expected to increase more than one-fourth between 1970 and 1980.

Sales workers, accounting for about 4.9 million workers in 1970, are found primarily in retail stores, wholesale firms, insurance companies, real estate agencies, as well as offering goods door to door. Between 1970 and 1980 sales workers are expected to increase nearly 24 percent.

Increasing sales of many new products resulting from rapid population growth, new product development, business expansion, and rising business levels will be the major reason for increasing employment of sales workers. The expected increase in residential and commercial construction and urban renewal will increase the need for real estate agents. Continued extension of such laws as workers' compensation and automobile liability insurance should boost the need for insurance salesmen. The trend of stores to remain open longer hours should in-

crease the need for retail sales persons. However, changes in distribution methods, such as self-service and automatic vending are likely to restrict the employment growth of sales workers.

Craftsmen, numbering about 10.2 million in 1970, include carpenters, tool and die makers, instrument makers, all round machinists, electricians, and type setters. Industrial growth and increasing business activity are the major factors expected to spur the growth of crafts occupations through the 1970's. However, technological developments will tend to limit the expansion of this group. Craftsmen are expected to increase nearly one-fifth, somewhat slower than the growth of all occupations.

Semiskilled workers (operatives) made up the largest major occupational group in 1970 with about 13.9 million workers engaged in assembling goods in factories; driving trucks, buses and taxis; and operating machinery.

Employment for semiskilled workers is expected to increase about 11 percent above the 1970 level, despite continued technological advances that will reduce employment for some types of semiskilled occupations. Increases in production generated by rising population and rapid economic growth, as well as the increasing trend to motor truck transportation of freight, are expected to be the major factors contributing to the increasing employment.

Laborers (excluding those in farming and mining), who numbered nearly 3.7 million workers in 1970, for the most part move, lift, and carry materials and tools in the Nation's workplaces. Employment of laborers is expected to change little between 1970 and 1980 in spite of the rises in manufacturing and construction which employ most laborers. Increased demand is expected to be offset by rising productivity resulting from continuing substitution of mechanical equipment for manual labor.

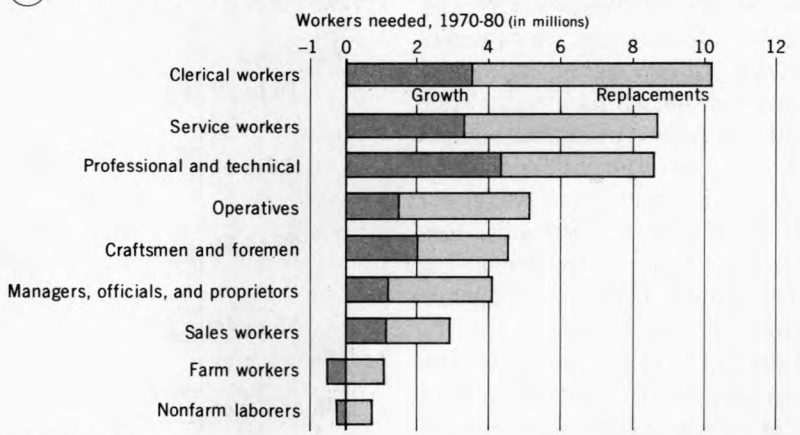
Service workers, including men and women who maintain law and order, assist professional nurses in hospitals, give haircuts and beauty treatments, serve food, and clean and care for our homes, totaled about 9.7 million in 1970. This diverse group will increase about 35 percent between 1970 and 1980 and after professional workers will be the fastest growing group. Some of the main factors that are expected to increase requirements for these occupations are the rising demand for hospital and other medical care; the greater need for protective services as urbanization continues and cities become more crowded; and the more frequent use of restaurants, beauty parlors, and other services as income levels rise and as an increasing number of housewives take jobs outside the home.

Farm workers—including farmers, farm managers, laborers, and foremen—numbered nearly 3.1 million in 1970. Employment requirements for farm workers are expected to decline to about 2.6 million in 1980. This decrease is anticipated, in part, because of continued improvement in farm technology. For example, improved fertilizers, seeds, and feed, will permit a farmer to increase production without increasing employment.

Job Openings

In considering a career, young people should not eliminate occupations just because their preferences will not be among the most rapidly growing. Although growth is a key indicator of future job outlook, more jobs will be created between 1970–80 from deaths, retirements, and other labor force separations than from employment growth. (See chart 8.) Replacement needs will be particularly significant in occupations which have a large proportion of older workers and women. Furthermore, large occupations that have little growth may offer more openings than a fast growing small one. For example, among the major

(8) **Training needs are determined by replacements plus growth**



SOURCE: BUREAU OF LABOR STATISTICS

occupational groups, openings for operatives resulting from growth and replacement combined will be greater than for craftsmen, although the rate of growth of craftsmen will be more than twice as rapid as the rate of growth for operatives.

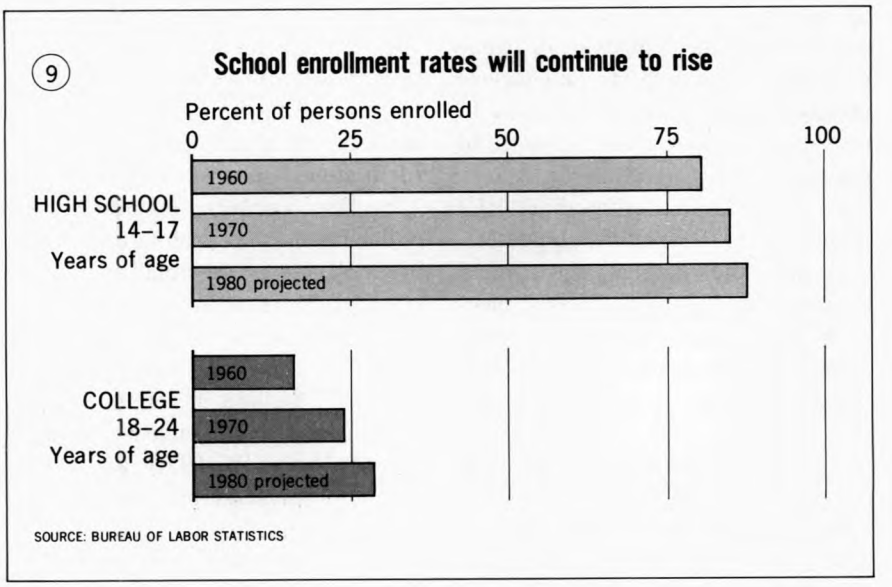
Outlook and Education

Numerous opportunities for employment will be available for jobseekers during the years ahead. Employers are seeking people who have higher levels of education because jobs are more complex and require greater skill. Furthermore, employment growth generally will be fastest in those occupations requiring the most education and training. For example, professional occupations requiring the most education will show the fastest growth through the 1970's. (See chart 7.)

A high school education has become a standard for American workers. Thus, because of personnel practices in American industries, a high school graduate is in a better competitive position in the job market than a nongraduate.

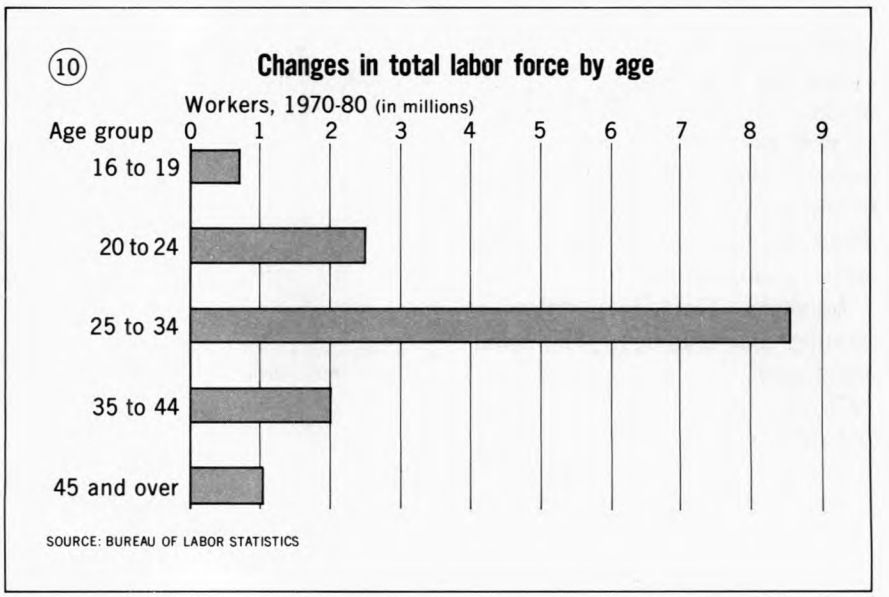
Although training beyond high school has been the standard for sometime for many professional occupations, many other areas of work require more than just a high school diploma. As new automated equipment is introduced on a wider scale in offices, banks, insurance companies, and government operations, skill requirements are rising for clerical and other office jobs. Employers increasingly are demanding better trained workers to operate complicated machinery.

In many areas of sales work, new developments in machine design, use of new materials, and the complexity of equipment are making greater technical knowledge a requirement for demonstrators; and repairmen must become familiar with even more complicated machines.



Along with the demand for greater education, the proportion of youth completing high school have increased and an even larger proportion of high school graduates pursue higher education. (See chart 9.) This trend is expected to continue through the 1970's. In 1980, high school enrollment is expected to be 21.4 million, 7 percent above the 1970 level and college degree credit enrollment is projected at 11.2 million, about 48 percent above the 1970 level of 7.6 million.

The number of persons in the labor force (including those in the Armed Forces) is a related aspect of job competition. Although the number of all workers and job-seekers will increase about 17 percent from 1970 and 1980, the growth in the labor force is really a story of



young men and women between 16–34 who will account for about four-fifths of the net increase in workers between 1970 and 1980. (See chart 10.) Thus, in the 1970's the number of young workers will increase and these workers will have more education on the average than new entrants to the labor force in previous years.

With so much competition from young people who have higher levels of education, the boy or girl who does not get good preparation for work, will find the going more difficult in the years ahead. Employers will be more likely to hire workers who have at least a high school diploma. Furthermore, present experience shows that the less education and training a worker has the less chance he has for a steady job, because unemployment falls heaviest on the worker who has the least education. (See chart 11.)

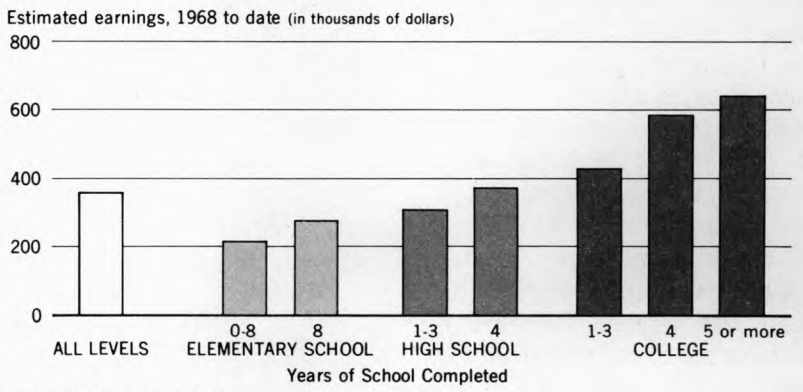
In addition to importance in competing for a job, education is highly valued in the determination of income. In 1968, men who had college degrees could expect to earn more than $600,000 in their lifetime, or nearly 3 times the $214,000 likely to be earned by workers who had less than 8 years of schooling, nearly twice that earned by workers who had 1 to 3 years of high school, and nearly one and two-thirds as much as high school graduates. Clearly the completion of high school pays a dividend. A worker who had only 1 to 3 years of high school could expect to earn only about $31,000 more than workers who had an elementary school education, but a high school graduate could look forward to a $94,000 lifetime income advantage over an individual completing elementary school. (See chart 12.)

In summary, 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 circumstance permit therefore should be a top priority for today's youth.

(11) **Unemployment rates are highest for young workers**

SOURCE: BUREAU OF LABOR STATISTICS

(12) **Estimated lifetime earnings for men tend to rise with years of school completed**



SOURCE: BUREAU OF THE CENSUS

THE OUTLOOK FOR OCCUPATIONS

PROFESSIONAL AND RELATED OCCUPATIONS

Professional occupations have many attractions for young persons choosing a career. They offer opportunities for interesting and responsible work, and in many cases, lead to high earnings. However, professional work usually can be entered only after a long period of preparation since a broad and thorough knowledge of a field is essential to success in the professions.

More than 11.1 million persons, or about 1 out of every 7 workers, were in professional or related occupations in 1970. These workers accounted for about three-tenths of all white-collar employment.

Professional occupations are of two major types. The larger group, which includes engineer, physician, and teacher, requires specialized and theoretical knowledge. Professions in this group require college graduation—and sometimes an advanced degree—or experience that provides comparable knowledge. The other group, which includes performing artists and athletes, places a high premium on skill and often on creative talent. Academic training generally is of lesser importance in this second group. Licenses are required for practice in many professions—medicine, dentistry, and pharmacy, for example; licensing authorities determine the minimum qualifications for eligibility. Professional societies set up membership standards that tend to define their respective fields.

Women find many employment opportunities in the professions. Almost two-fifths of all professional and related jobs were filled by women in 1970; women predominate in several large professions, including teaching, nursing, library work, and social work.

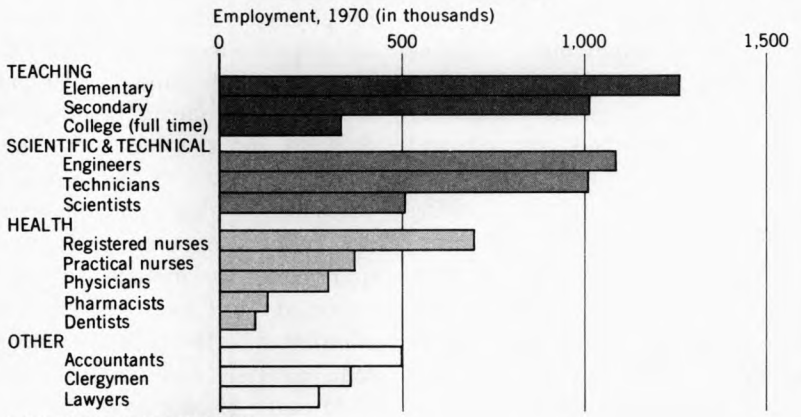
Closely related to the professions is a wide variety of technical occupations. Persons in these occupations work with engineers, scientists, mathematicians, physicians, and other professional personnel. Their job titles include those of draftsman; engineering aid; programer; and electronics, laboratory, 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 occupations in education, health, social welfare, recreation, library work, and other areas also are related to the professions. Related —and supportive—occupations in these areas include teacher assistant, medical laboratory assistant, social welfare technician, recreation assistant, and library technician. Training for many supportive jobs may be obtained in vocational and technical schools, junior colleges, or sometimes on the job.

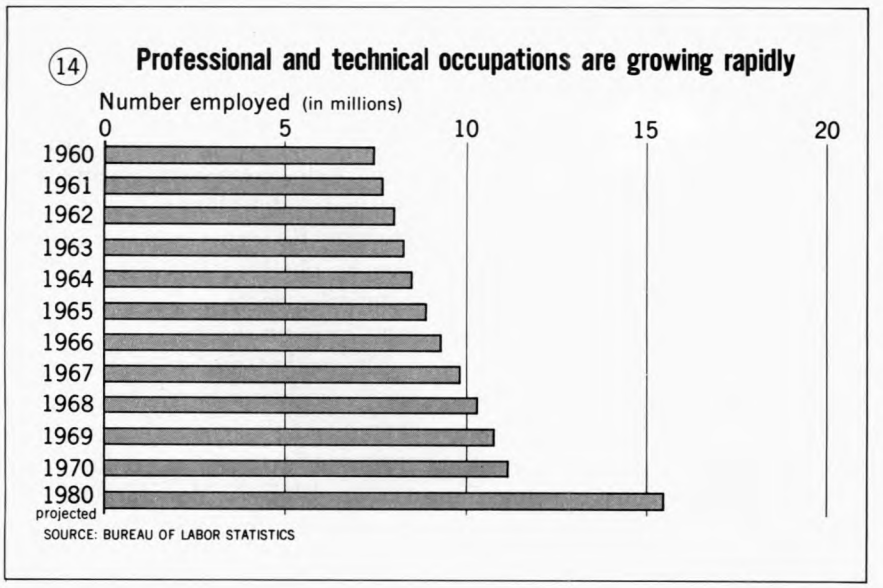
The major professional and related occupations are shown in chart 13. As a group, these workers increased by nearly 3.7 million during the 1960–70 decade. The rate of increase, almost 50 percent, was more rapid than for any other occupational group, and two and one-half times the rate for all occupational groups combined. The outlook for professional and related occupations continues to be very favorable. Between 1970 and 1980, employment in this group is expected to increase by nearly two-fifths. (See chart 14.)

The continuing very rapid growth in the professional worker group is the result of developments such as expansion in research and develop-

(13) **Elementary teaching and engineering are the largest professional occupations**



SOURCE: BUREAU OF LABOR STATISTICS



ment activities; improvements in standards of living, medical care, and education; and the growing concentration of the population in metropolitan areas—all of which stimulate requirements for highly educated workers. A unique set of factors, however, determines growth in any one occupation. To illustrate, birth rates, school attendance rates, and classroom size are the primary factors in the demand for teachers, whereas primary factors underlying engineering demand include the level of research and development activities and the complexity of industrial processes. In addition, the nature and effect of technological advances on employment requirements vary from profession to profession. Technology in education, such as programmed learning and instructional television, is expected to affect the nature of teaching rather than to exert a strong influence on the level of teacher requirements. In contrast, technological advances in the engineering field are expected to increase requirements for engineers and limit to some extent requirements for the lesser skilled among draftsmen. Although different rates of growth are expected among individual professional occupations because of the varying influence of factors underlying growth, the general tendency will be for a moderate to very rapid growth of these occupations.

Natural scientists are expected to be among the rapidly expanding professions through the 1970's. Chemists, for example, will be required in increasing numbers for research and development and for the manufacture of products such as plastics, man-made fibers, drugs, and high energy and nuclear fuels for missiles and rockets. Demands for physicists also will grow as more are required to perform highly complex research and development work and to satisfy the increasing demand for physicists on college faculties because of the growing importance of physics in engineering and other science curriculums. Requirements for mathematicians are expected to increase markedly, stimulated by the application of systems analysis and computers to a wide range of endeavors and by the use of mathematics in research in fields as diverse as economics and biology. Demands for engineers will rise rapidly in response to industrial expansion, and a variety of programs that include urban renewal, transportation, and environmental protection.

Employment of most types of health workers is also expected to increase rapidly, due to population growth, rising standards of health care, increasing emphasis on preventive medicine and rehabilitation, new drugs and techniques, and wider participation in private health insurance plans and in government programs such as Medicare and Medicaid. In contrast, the employment effect of rising standards in education will be offset partially as declining birth rates begin to affect elementary and secondary school enrollments significantly. However, employment requirements in certain areas of education, such as teachers trained in instructing physically and mentally handicapped and disadvantaged students, are expected to rise. Rapidly increasing college enrollments probably will require large increases in college and university teaching staff.

Social scientist employment is expected to grow rapidly as the solution to social problems is sought increasingly through economics, sociology, psychology, and other social sciences. College trained management personnel, such as accountants, also will be required in larger numbers to cope with the growth in the size and number of firms and their increasing complexity.

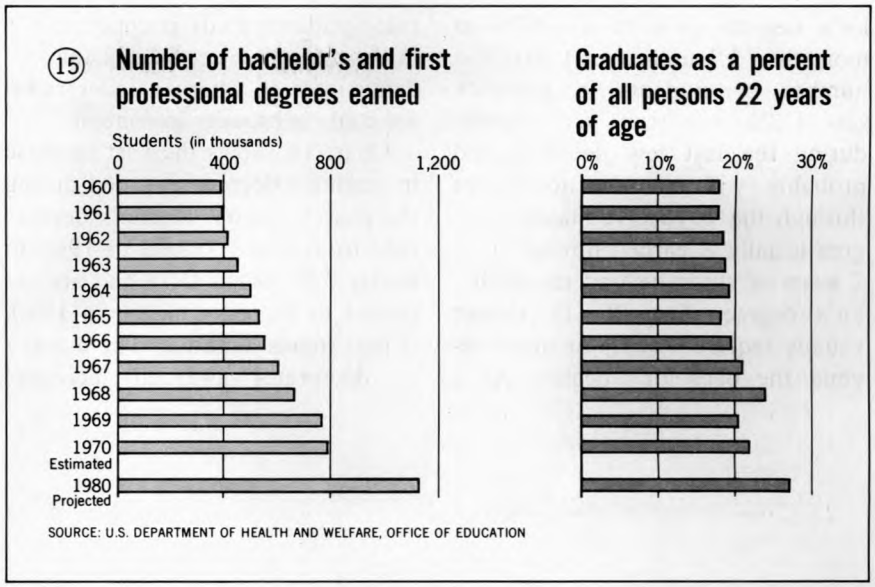
Employment of technicians and support personnel in many fields also will increase rapidly with growing emphasis on improving the utilization of professional workers by relieving them of tasks that can be performed by less highly trained personnel.

Educational Trends

Professional occupations accounted for two-thirds of all workers having a college education in 1970. The proportion of all professional workers having a degree has been increasing. In addition to the many professions for which a college education long has been an entry requirement, the demand for graduates at the entry level in other professional, administrative, and related occupations is growing. College graduates are filling many positions that formerly were held by employees who qualified through their experience and personal characteristics rather than by academic studies. Graduates also are working in many professional jobs that did not exist a few decades ago.

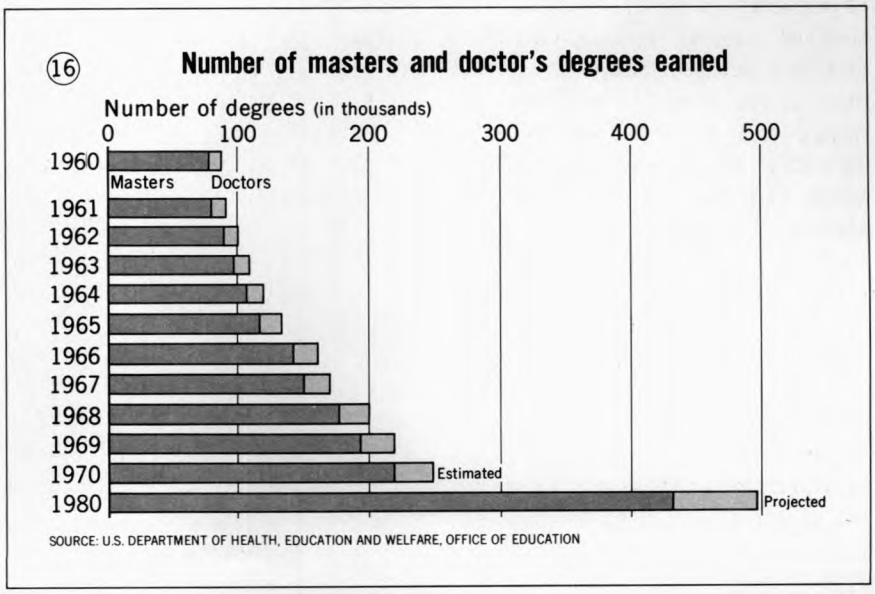
Emphasis on a college education will be reinforced in the years ahead as the growing complexity of our society constantly increases the amount of specialized knowledge required for effective performance in many professions. Finally, a college education is becoming necessary for an increasing proportion of jobs, and in many professions the amount of education needed is increasing. A great increase in the number of college graduates, which is the chief source of professionally trained workers, has accompanied the growth in the professional and related occupations. As a percent of all persons 22 years of age, the proportion of young persons completing college rose from 17 percent in 1960 to 22 percent in 1970, as shown on the inset in chart 15.

The rapid increase in the proportion of young people graduating from college reflects a number of basic social trends. Family incomes are higher, enabling more of the young to postpone going to work and to meet 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 also are available.

Since these factors probably will continue to be influential in the future, the proportion of young people who graduate from college is expected to go on increasing for many years. The college-age population also is growing. The number of persons age 18 to 21 is expected to increase by nearly 2.7 million between 1970 and 1980. These factors, considered together, indicate 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 needed to provide for the greatly increased number of students. Projections prepared by the U.S. Office of Education indicate an increase from about 785,000 bache-



lor's degrees granted in 1970 to more than 1.1 million in 1980. The number of students in graduate school also has risen very rapidly during the last few decades, and probably will continue to mount through the 1970's. A master's degree usually is earned through 1 or 2 years of study beyond the bachelor's degree. The Ph. D. degree usually require 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 during the past 10 years. Master's degrees rose from about 78,000 in 1960 to nearly 220,000 in 1970 and are expected to exceed 430,000 in 1980, if past trends continue. The number of doctorates awarded increased from 9,800 in 1960 to 29,000 in 1970, and may reach over 62,000 by 1980.

Overall analysis of the supply and demand for professional personnel indicates that the outlook for these highly trained workers continues to be excellent. Technicians and supportive personnel generally will have very favorable opportunities.

BUSINESS ADMINISTRATION AND RELATED PROFESSIONS

Many professional workers play a major role in administering businesses and a wide variety of other organizations, both private and governmental. These workers generally need a college degree to qualify for jobs in their respective fields. Though their disciplines are oriented toward business management, they perform functions which are highly specialized and varied. Whether their organizations are small or large, employing only a few people or many thousands, the decisions they make and their effectiveness in implementing these decisions contribute greatly to the success or failure of the enterprise.

This chapter describes some professional occupations that are of vital importance to the Nation's businesses—accountants, advertising workers, marketing research workers, personnel workers, and public relations workers. Workers engaged primarily in managerial duties are covered in the section on *Managerial Occupations* found elsewhere in the *Handbook*.

ACCOUNTANTS

(D.O.T. 160.188)

Nature of the Work

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 are public, management, and government accounting. Public accountants are independent practitioners who work on a fee basis for businesses and individuals, or as a member or employee of accountancy firms. Management accountants, often referred to as industrial or private accountants, handle the financial records of the particular 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, taxes, cost accounting, budgeting and control, information processing, or systems and procedures. Approximately 100 specialties now exist in the accounting field. 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 management accountants are involved in some aspect of providing management with information for decisionmaking. Sometimes they specialize in taxes, budgeting or internal auditing—that is, examining and appraising financial sys-

Accountant reviews financial report.

tems and management control procedures. Many accountants in the Federal Government are employed as Internal Revenue agents, investigators, and bank examiners, as well as in regular accounting positions.

Places of Employment

About 500,000 accountants were employed in 1970, of whom over 100,000 were Certified Public Accountants (CPA's). Accounting is one of the largest fields of professional employment for men. About 2 percent of the CPA's and less than 20 percent of all accountants are women.

More than three-fifths of all accountants do management accounting work. An additional one-fifth are engaged in public accounting as proprietors, partners, or employees of independent accounting firms. Over 10 percent work for Federal, State and local government agencies. A small 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.

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; for better positions, it may be required. Candidates having 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 also can be of great value in qualifying for 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 for teaching positions.

All States require that anyone practicing in the State as a "certified public accountant" must hold a certificate issued by the State board of accountancy. The CPA examination, administered by the American Institute of Certified Public Accountants, is used by all states to establish certification. In 1970, half the States had laws that required CPA candidates to be college graduates. In recent years, nearly 9 out of 10 successful CPA candidates have been college graduates, and a majority of the remainder have had at least 1 year of college training. Young people interested in an accounting career should be aware that recent reports by the American Institute of Certified Public Accountants indicate that, in the near future, some States may require CPA candidates to have a graduate degree. Before the CPA certificate is issued, at least 2 years of public accounting experience is required by nearly all States.

Considerably more than half the States restrict the title "public accountant" to those who are licensed or registered. Requirements for licensing and registration vary considerably from one State to another. Information on these requirements may be obtained directly from individual State boards of accountancy, or from the National Society of Public Accountants.

Inexperienced accountants usually begin with fairly routine work. Junior public accountants may be assigned to detailed work such as verifying cash balances or inspecting vouchers. They may 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 industry executives often become supervisors, managers, or partners, or transfer to executive positions in private accounting. Some become independent practitioners.

Beginners in management accounting may start as ledger accountants, junior internal auditors, or as trainees for technical accounting positions. They may rise to chief plant accountant, chief cost accountant, budget director, senior internal auditor, or manager of internal auditing, depending on their specialty. Some become controllers, treasurers, financial vice-presidents, or corporation presidents. In the Federal Government, beginners are hired as trainees and usually are promoted in a year or so. In the field of college and university teaching, those having minimum training and experience may receive the rank of instructor without tenure; advancement and permanent faculty status are 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 already may have 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. More and more accountants are studying computer operation, programing, mathematics, and quantitative methods in order to adapt accounting procedures to new methods of processing business data. Although advancement may be rapid for capable accountants, those having inadequate academic preparation are likely to be assigned to routine jobs and may find themselves handicapped in obtaining promotions.

Employment Outlook

Accounting employment is expected to expand very rapidly during the 1970's 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. As a result, opportunities for accountants are expected to be excellent. Demand for college-trained accountants will be stronger than the demand for people without this academic background, because of the growing complexity of business accounting requirements. However, graduates of business and other schools which offer thorough training in accounting also should have good job prospects. In addition, the trend toward specialization is creating excellent opportunities for persons trained in a specific phase of accounting. In addition to openings resulting from employment growth, several thousand accountants will be needed annually during this period to replace those who retire, die, or leave the occupation for other reasons.

The computer is having a major effect on the accounting profession. Electronic data processing systems are replacing manual preparation of accounting records and financial statements. As a result, the need for junior accountants at the lower level may be reduced or eliminated. On the other hand, computers can process vast quantities of routine data which will require the employment of additional accountants to analyze the data. Also, the computer is expected to cause radical changes in management information systems and decisionmaking processes in large companies. Additional highly-trained accountants will be required to prepare, administer and analyze the information made available by these systems.

Earnings and Working Conditions

Starting salaries of beginning accountants in private industry were $8,500 a year in 1970, according to a Bureau of Labor Statistics (BLS) survey. Average earnings of experienced accountants ranged between $10,500 and $15,500, depending on their level of responsibility and the complexity of the accounting system. Chief accountants responsible for directing the accounting program of a company or one of its establishments earned between $14,000 and $23,000, depending upon the scope of their authority and size of professional staff.

According to the same survey, beginning auditors averaged $9,000 a year, while experienced auditors' earnings ranged between $11,500 and $14,000.

Salaries are generally 10 percent higher for accountants holding a graduate degree or a CPA certificate. Earnings also are higher for those who are required to travel a great deal.

In the Federal Civil Service the entrance salary for junior accountants and auditors was $8,510 in 1970. Some candidates having superior academic records could qualify for a starting salary of $9,178. Many experienced accountants in the Federal Government earned more than $15,000 a year. Those having administrative responsibilities earned more.

Public accountants are likely to work especially long hours under heavy pressure during the tax season. They do most of their work in their client's offices, and sometimes do considerable traveling to serve distant clients. A few management and government accountants also do much 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.

Sources of Additional Information

Information about CPA's and the aptitude tests now given in many high schools, colleges, and 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.

National Society of Public Accountants, 1717 Pennsylvania Avenue NW., Washington, D.C. 20006.

Financial Executives Institute, 50 West 44th St., New York, N.Y. 10036.

The Institute of Internal Auditors, Inc., 170 Broadway, New York, N.Y. 10038.

ADVERTISING WORKERS

(D.O.T. 050.088, 132.088; 141.081 and .168; and 164.068 through .168)

Nature of the Work

Through advertisements, 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. Advertising workers include executives responsible for planning and overall supervision, copywriters who write the text, artists who prepare the illustrations, and layout specialists who put copy and illustrations into the most attractive arrangement possible. They also include 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 and television programs. In a very small advertising organization, one person may handle all these tasks. Large organizations employ specialists for research, copywriting, and layout work. They sometimes have staff members who specialize in writing copy for particular kinds of products or for one type of advertising media. The following are the specialized occupations most commonly found in advertising work.

Advertising managers direct a company's advertising program. They work mostly on policy questions—for example, the type of advertising, the size of the advertising budget, and the agency to be employed. They then work with the agency in planning and carrying through the program. They also may 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 concerned chiefly with selling advertising time or space; his functions are similar to those of the sales manager in other businesses.

Account executives employed in advertising agencies 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 copywriters and artists usually 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 responsible directly to agency heads.

Advertising copywriters create the headlines, slogans, and text that attract buyers. They collect information about products and the people who might use them. They use psychology and writing techniques to prepare copy especially suited for readers or listeners and for the type of advertising medium to be used. Copywriters may specialize in copy that appeals to certain groups—housewives, businessmen, scientists, engineers—or even in copy that deals with items such as packaged goods or industrial products. In advertising agencies, copywriters work closely with account executives, although they may be under the supervision of a copy chief.

Advertisers and advertising agencies employ *media directors* (or *space buyers* and *time buyers*) to determine where and when advertising should be carried 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, viewing, 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 artwork converted into printed form. They deal with printing, engraving, filming, recording, 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 work closely with advertising managers, copywriters, and other advertising personnel in planning and creating visual effects in advertisements. More information about this group appears in the separate statements on Commerical Artists and Photographers.

Places of Employment

In 1970, more than 140,000 men and women were employed in positions requiring considerable knowledge of advertising. More than one-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.

Training, Other Qualifications, and Advancement

Most employers, in hiring advertising trainees, prefer college graduates having liberal arts training or majors in advertising, marketing, journalism, or business administration. However, there is no typical educational background for success in advertising. Some successful advertising people have 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 also is 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 advertising should get some experience in copywriting or related work with their school publications and, if possible, through summer jobs 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. Some start as assistants in research or production work or as space or time buyers. A few begin as junior copywriters. One of the best avenues of entrance to advertising work for women is through advertising departments in retail stores.

Employees having initiative, drive, and talent may progress from beginning jobs to creative, research, or managerial work. Management

positions require experience in all phases of the advertising business.

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 specialities and for them advancement is to more responsible work at increased pay. Some top-flight copywriters and account executives establish their own agencies.

Employment Outlook

Employment of advertising workers is expected to increase slowly through the 1970's. Opportunities should be favorable, however, for highly qualified applicants, especially in advertising agencies, as more and more advertisers turn their work over to agencies. However, many young people attracted to advertising will face stiff competition for entry jobs in this field through the 1970's. Most openings —several thousand each year—will result from the need to replace those who retire, die, or leave the occupation for other reasons.

Earnings and Working Conditions

According to the limited information available, starting salaries for beginning advertising workers ranged from $6,500 to $8,000 a year in 1970. The higher starting salaries were paid most frequently in very large firms that recruit outstanding college graduates; the lower salaries were earned in stores and small advertising agencies.

Salaries of experienced advertising workers employed by advertising agencies vary by size of firm. The average salary paid by small agencies (those having annual billings between $250,000 and $1 million) was $11,000 a year in 1970. Advertising workers employed by large agencies (those having billings between $20 million and $40 million) averaged $26,000 a year. Salaries also vary by function. For example, account executives employed by small agencies averaged $13,000 a year, while media directors averaged less than $7,000 a year in agencies of the same size.

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

At the same time, advertising is a satisfying career for persons who enjoy variety, excitement, and a constant challenge to their creative ability, and who can meet the competition. Advertising workers have the satisfaction of seeing their work in print and on television, or hearing it over the radio, even though they remain unknown to the public at large.

Sources of Additional Information

American Advertising Federation, 1225 Connecticut Ave. NW., Washington, D.C. 20036.

American Association of Advertising Agencies, 200 Park Ave., New York, N.Y. 10017.

Association of Industrial Advertisers, 41 East 42nd Street, New York, N.Y. 10017.

A list of schools which provide training in advertising may be obtained from:

Advertising Education Publications, 3429 Fifty-Fifth Street, Lubbock, Texas 79413.

MARKETING RESEARCH WORKERS

(D.O.T. 050.088)

Nature of the Work

Marketing research workers provide businessmen with much of the information they need to make decisions about marketing new and existing goods and services. In doing this, marketing research workers collect, analyze, and interpret many different kinds of information. They prepare reports and recommendations 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 matters, they consider expected changes in subjects relevant to marketing policies such as population, income, and consumer credit policies.

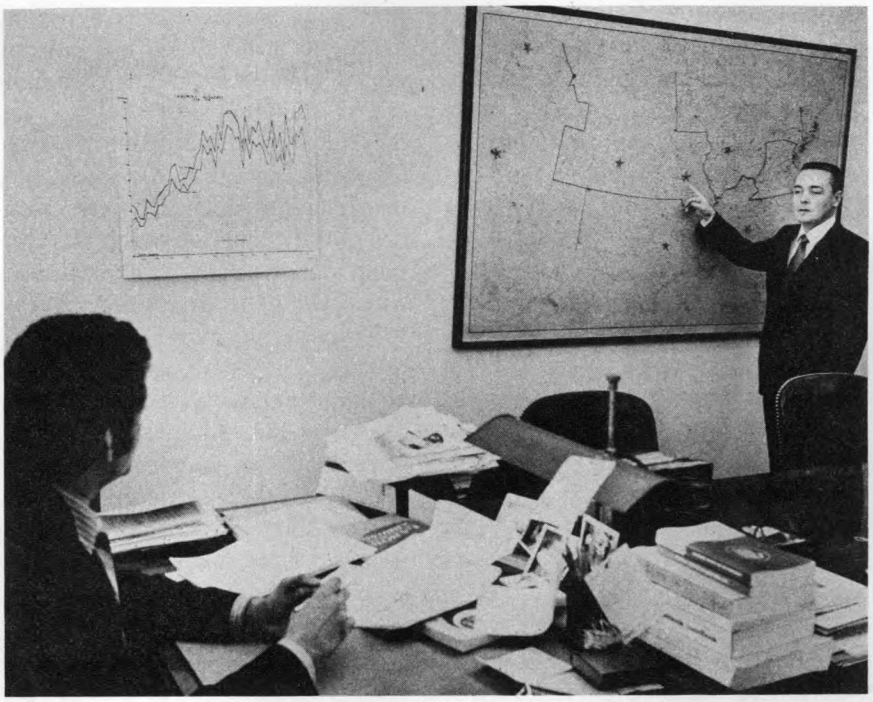
Most marketing research starts with the collection of facts from published materials, the firm's own records, and specialists on the subject under investigation. For example, marketing research workers analyzing fluctuations in their company's sales may begin by determining periodic changes in sales volume in several different cities. They may then compare these fluctuations with changes in population, income, the size of the company's sales force, and the amounts the company

has spent for advertising in each city, and thus 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 the number of company products already used in households.

Marketing research is often concerned with the opinions and likes and dislikes of customers. For example, to help management decide on the design and price of a new line of television sets, a survey of consumers may determine the price they would be willing to pay and their preferences as to color and size of the set.

Such a survey is usually conducted under the supervision of marketing research workers who specialize in research on consumer goods—that is, merchandise sold to the general public. In designing the survey, the marketing research worker may be assisted by a statistician in selecting a group (or "sample") of people to be interviewed to make sure that their opinions represent those held by most potential customers. He may also consult a "motivational research" specialist who knows how to frame questions that will produce reliable information on what motivates people to buy. Once the investigation is underway, the marketing research worker may supervise the interviewers who call on consumers to obtain answers to the questions. He may also direct the work of the office employees who tabulate and analyze the information collected. His report summarizing the survey findings also may include other information that company officials need in making decisions about marketing of old or new product lines.

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 marketing research worker (or several research workers if it is an extensive survey) often conducts the interviews. In his interviews, he not only seeks opinions about the product—existing or newly developed—but also 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.



Marketing research worker plans location of test market.

Places of Employment

More than 20,000 marketing research workers were employed full time in 1970. This number included research assistants and others in junior positions, as well as research supervisors and directors. Most of these workers were men. In addition, a limited number of other professionals (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 additional 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 are also employed by very large stores, radio and television firms, and newspapers; others work for university research centers, government agencies, and other organi-

zations which provide information for businessmen. Marketing research organizations range in size from one-man enterprises to large firms having a hundred employees or more.

The largest number of marketing research workers is 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

A bachelor's degree is the usual requirement to become a marketing research trainee. A master's degree in business administration is becoming increasingly desirable, especially for advancement to higher level positions. Many people qualify for marketing research jobs through previous experience in other research or in work related to marketing. University teachers of marketing research or statistics sometimes are sought by employers to head new marketing research departments.

College courses considered valuable as preparation for work in marketing research are marketing, statistics, English composition, speech, psychology, and economics. Candidates for some marketing research positions need specialized training in engineering or other technical subjects, or substantial sales experience and a thorough knowledge of the company's products. Knowledge of electronic data-processing procedures is becoming important because of the growing use of 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 techniques 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 data from published sources, editing and coding questionnaires, and tabulating survey returns. They also learn how to conduct interviews and how to write reports on survey findings.

As they gain 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 for marketing and sales.

Marketing research workers must have exceptional ability to recognize and define problems, and imagination and ingenuity in applying marketing research techniques to their solution. They should be able to adapt to change since they are constantly faced with new and different problems. Above all, their 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 trained in marketing research and statistics are likely to find favorable job opportunities in this occupation through the 1970's. The growing complexity of marketing research techniques will also expand opportunities for psychologists, economists, and other social scientists. Advanced degrees are becoming increasingly necessary for employment in marketing research, and as a result, job opportunities for holders of Masters and Ph. D degrees will be excellent.

The demand for marketing research services is expected to increase very rapidly through the 1970's. It is expected that existing marketing research organizations will expand and that new marketing research departments and independent research firms will be set up. Business managers will find it increasingly important to obtain the best information possible for appraising marketing situations and planning marketing policies. Furthermore, as marketing research techniques improve and more statistical data accumulate, company officials are likely to turn more often to marketing research workers for information and advice. In addition to growth needs, many openings will occur each year as persons retire, die, or leave the field for other reasons.

Earnings and Working Conditions

Starting salaries for market research trainees averaged about $8,500 a year in 1970, according to the limited data available. Persons having masters degrees in Business Administration and related fields usually started at about $12,000 a year. Those with a technical background received slightly higher salaries.

Earnings were substantially higher for experienced marketing research workers who attained positions with considerable responsibility. In 1970, earnings of senior

analysts were $15,000 a year. Marketing research directors' average salaries were about $20,000 annually; and vice-presidents in charge of marketing received salaries between $25,000 and $30,000 a year.

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.

Sources of Additional Information

Information about specialized types of marketing research is contained in a report entitled "Marketing Research Procedures, A Small Business Bibilography, Number 9" 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 Avenue, Chicago, Illinois 60601.

PERSONNEL WORKERS

(D.O.T. 166.088 through .268)

Nature of the 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 and interview job applicants, selecting or recommending 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. Other important aspects of their work involve employee-management relations, employee training, and the administration of employee benefit plans.

Some 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 at varying levels of responsibility. Usually the department is headed by a director who formulates personnel policy, advises other company officials on personnel matters, and administers his department. Within the department, supervisors and various specialists —in 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 as well as other types of duties.

Personnel workers in Federal, State, and local government agencies do much the same kind of work as 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.

Places of Employment

Personnel workers are employed in nearly all kinds of business enter-

Interviewing job applicants is an important responsibility in personnel work.

prises and government agencies. The total number employed in 1970 was estimated to be about 160,000. Well over half of all personnel workers were employed by private firms. Large numbers also were employed by Federal, State, and local government agencies. A small group of personnel workers were in business for themselves, often as management consultants or employee management relations experts. In addition, colleges and universities employed some 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. Almost 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 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 firsthand knowledge of operations. A large number of the people now in personnel work who are not college graduates entered the field in this way.

Many employers in private industry prefer college graduates who have majored in personnel administration; others prefer graduates who have a general business administration background. Still other employers consider a liberal arts education the most desirable preparation for personnel work. Young people interested in personnel work in government are advised to major in public administration, political science, or personnel administration; however, those having other college majors also are 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 employee management 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. After they have gained experience, those with exceptional ability may be promoted to executive positions, such as personnel director. Personnel workers sometimes advance by transferring to other employers having larger personnel programs or from a middle-rank position in a big organization 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 aptitude for 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 also are important.

Employment Outlook

College graduates who enter personnel work are expected to find many opportunities through the 1970's. Although employment prospects will probably be best for college graduates who have specialized training in personnel administration, positions will be available also for people having degrees in other fields. 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 very 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 workers to handle work related problems will probably continue to increase; and the growth of employee services, safety programs, other benefit plans, and personnel research also is likely to continue.

Earnings and Working Conditions

A national survey indicated that the average annual salary of trainees employed as job analysts in private industry was about $9,000 in 1970; experienced job analysts averaged about $13,000; directors of personnel generally earned between $12,500 and $22,000; and some top personnel and industrial relations executives in very large corporations earned considerably more.

In the Federal Government, inexperienced graduates having bachelor's degrees started at $6,548 a year in 1970; those having exceptionally good academic records or master's degrees began at $8,098; a few master's degree holders who ranked high in their respective classes received $9,881 a year. Federal Government personnel workers with higher levels of administrative responsibility and several years of experience in the field were paid more than $16,500; some in charge of personnel for major departments of the Federal Government earned more than $22,500 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.

Sources of Additional Information

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

American Society for Personnel Administration, 19 Church 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

(D.O.T. 165.068)

Nature of the Work

All organizations want to present a favorable image to the public. Public relations workers help an employer build and maintain such a public image. To accomplish this, they must keep themselves informed about the attitudes and opinions of customers, employees, and other groups.

Public relations workers provide information about an employer's business to newspapers and magazines, radio and television, and other channels of communication. They plan the kind of publicity that will be most effective, contact the people who may be interested in using it, and prepare and assemble the necessary material. Many newspaper items, magazine articles, and pamphlets giving various information about a company start at public relations workers' desks. These workers also arrange speaking engagements for company officials and

Public relations worker checks material for press release.

write the speeches they deliver. They often serve as an employer's representative during community projects and ocasionally may perform duties such as showing a film at a school assembly, staging a beauty contest, or planning a convention.

Public relations workers tailor their programs to an employer's particular needs. In a business firm, public relations work usually concerns an employer's relationships with employees, stockholders, government agencies, and community groups.

Public relations staffs in large firms sometimes number 200 or more. The director of public relations may share responsibility for developing overall plans and policies with a company vice president or another top executive having the authority to make final decisions. In addition to writers and research workers, public relations departments employ specialists who prepare material for the different media or write reports sent to stockholders.

Public relations workers who handle publicity for an individual, or direct public relations for a university or small business, may perform all aspects of the work. They make contacts with outsiders, do the necessary planning and research, and prepare material for publication. These workers may combine public relations duties with advertising or other managerial work; and they may be top-level officials or occupy less important positions.

Places of Employment

About 75,000 public relations workers were employed in 1970, according to the limited data available. Over one-fourth were women. In recent years, an increasing number of women have entered public relations work.

Most public relations workers are employed by manufacturing firms, stores, public utilities, trade and professional associations, and labor unions. Others are employed by consulting firms providing public relations services to clients for a fee.

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

Training, Other Qualifications, and Advancement

Although college education generally is regarded as the best preparation for public relations work, employers differ in the specific type of college background they require of applicants. Some seek graduates who have majored in English, journalism, or public relations; others prefer candidates having a background in science or another field related to the firm's business activities.

College graduates who have secretarial skills also are desired by some employers, especially in small firms, because they can combine secretarial duties with public relations work. After a few years' experience, these workers may advance to a full-time public relations position.

In 1970, 20 colleges offered a bachelor's degree in public relations, and 18 offered advanced degrees. In addition, about 300 colleges offered at least one course in public relations.

College subjects recommended as preparation for a public relations career include journalism, economics and other social sciences, business administration, psychology, public speaking, literature, and physical sciences. Extracurricular activities such as work on school publications or student government activities furnish valuable experience; part-time or summer employment in selling, public relations, or a related field such as broadcasting also are helpful.

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

Some companies—particularly those with large public relations programs—have formal training programs for new employees. In other companies, new employees learn by working under the guidance of experienced staff members. Beginners often maintain files of material about company activities, scan newspapers and magazines for appropriate articles to clip, and assemble information for speeches and pamphlets. After gaining experience, they 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, which involves developing overall plans and maintaining contacts, usually is performed by the department director and his most experienced staff members. Some experienced public relations workers establish their own consulting firms.

Employment Outlook

Employment in this field is expected to expand rapidly through the 1970's. In addition to the new jobs created as expanding organizations require more public relations specialists, openings will occur because of the need to replace workers who retire or leave the field for other reasons.

The demand for public relations workers is expected to grow through the 1970's, as population increases and the general level of business activity rises. In recent years, the amount of funds spent on public relations has increased, and many organizations have developed new public relations departments. This trend should continue in the years ahead.

Earnings and Working Conditions

Starting salaries for public relations trainees ranged from $4,600 to $7,500 a year in 1970, according to the limited data available. The highest starting salaries were paid by consulting firms in major cities to workers who were very well qualified from the standpoint of educational background and previous work. Many public relations workers having a few years of experience earn between $9,000 and $13,000 a year.

The salaries of experienced workers generally are highest in large organizations having extensive public relations programs. In 1970, directors of public relations employed by medium-size firms generally earned $14,000 to $18,000 annually; those employed by large corporations had salaries in the $15,000 to $25,000 range, according to the Public Relations Society of America. Some officials, such as vice presidents in charge of public relations, earned from $25,000 to $50,000 a year or more. Many consulting firms employ large staffs of experienced public relations specialists and often pay somewhat higher salaries than those paid by other business organizations. In social welfare agencies, nonprofit organizations and universities, salaries are somewhat lower.

The workweek for public relations personnel usually is 35 to 40 hours. Irregular hours and overtime often may be necessary, however, to prepare or deliver speeches, attend meetings and community functions, and travel out of town. Occasionally, the nature of their regular assignments or special events require public relations workers to be on call around the clock.

Sources of Additional Information

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

Service Department, Public Relations News, 127 East 80th Street, New York, N.Y. 10021.

CLERGYMEN

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 also should understand that the civic, social, and recreational activities of clergymen often are influenced, and sometimes restricted, by the customs and attitudes of the community.

The number of clergymen needed is broadly related to the size and geographic distribution of the Nation's population and 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. In addition to the clergy who serve congregations, many others teach in seminaries and other educational institutions, serve as chaplains in the Armed Forces, or work as missionaries.

Young persons considering careers as clergymen should seek the counsel of a religious leader of their faith to aid in evaluating their qualifications. The most important requisite, of course, is the desire to serve the spiritual needs of others. To deal effectively with all types of persons, clergymen need to be well-rounded and able to speak and write effectively. Emotional stability and sensitivity to the problems of others also are essential. Clergymen are expected to have high moral and ethical standards.

The size and financial status of the congregation to a large extent determines income. Usually pay is highest in large cities or prosperous suburban areas. Earnings usually rise with increased experience and responsibility. Most Protestant churches and a number of Jewish congregations provide housing. Roman Catholic priests ordinarily live in the parish rectory or their religious order provides housing. Many clergymen receive transportation allowances or other expenses. Gifts or fees for officiating at special ceremonies, such as weddings, may be an important source of additional income; however, clergymen frequently donate such earnings to charity. Some churches establish a uniform fee for special 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 that 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.

PROTESTANT MINISTERS

(D.O.T. 120.108)

Nature of the Work

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

The types of worship services that ministers conduct differ among Protestant denominations and also among congregations within a denomination. In some denominations, ministers follow a traditional order of worship; in others they adapt the services to the needs of youth and other groups within the congregation. Most services include Bible reading, hymn singing, prayers, and a sermon. Bible reading by a member of the congregation and individual testimonials may

constitute a large part of the service in some demoninations.

Ministers serving small congregations generally work on a 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.

Places of Employment

In 1970, about 295,000 ministers served over 71 million Protestants. In addition, thousands of ministers were in other occupations closely related to the parish ministry. The greatest number of clergymen are affiliated with the five largest groups of churches—Baptist, United Methodist, Lutheran, Presbyterian, and Episcopal. 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 some denominations, an increasing number of women who have not been ordained are serving as pastors' assistants.

All cities and most towns have one Protestant church or more with a full-time minister. The majority of ministers are located in urban areas. Many others live in less densely populated areas where each may serve two congregations or more. 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 Protestant ministry has a wider range than for most professions. Some religious groups have no formal educational requirements, and others ordain persons having varying amounts and types 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 a theological school following college graduation. After completion of such a course, the degree of bachelor or master of divinity is awarded.

In 1970, 112 of the theological institutions in the Nation 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 also should take courses in the natural and social sciences, religion, and foreign languages. The standard curriculum recommended for accredited theological schools consists of four major fields: Biblical, historical, theological, and practical. There is a trend toward 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. Scholarships and loans are available for students of theological institutions.

In general, each large denomination has its own school or schools of theology that reflect its particular 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.

Candidates for the ministry should be religious and dedicated; they should love and have the ability to work with people, and have high moral and ethical standards. Good health is a valuable asset.

Persons who have denominational qualifications for the ministry usually are ordained following graduation from a seminary. In denominations that do not require seminary training, clergymen are ordained at 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 that have a well-defined church organization—often are requested to serve in positions of

great administrative and denominational responsibility.

Outlook

The shortage of Protestant ministers has abated significantly in recent years. The trend toward merger and unity among denominations, combined with the closing of smaller parishes, has reduced the demand for Protestant ministers who serve individual congregations. If this trend continues, new graduates of theological schools may face increasing competition in finding positions. The supply-demand situation will vary among denominations and depend, in part, on the length of formal preparation.

Although fewer opportunities may arise for Protestant ministers to serve individual congregations, ministers may find work among youth, in family relations, welfare, religious education, on the campus, and as chaplains in the Armed Forces, hospitals, universities, and correctional institutions. Most of the demand during the 1970's, however, will result from the need to replace those who retire, die, or leave the ministry.

Sources of Additional Information

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

RABBIS

(D.O.T. 120.108)

Nature of the Work

Rabbis are the spiritual leaders of their congregations and teachers and interpreters of Jewish law and tradition. They conduct daily services, and deliver sermons at services on the Sabbath and on Jewish holidays. Rabbis customarily are available at all times to counsel 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, counseling individuals, supervising religious education programs, engaging in interfaith activities, and assuming community responsibilities—are similar to those performed by clergymen of other faiths.

Rabbis serving large congregations may spend considerable time in administrative duties, working with their staffs and committees. Large congregations frequently have an associate or assistant rabbi in addition to the senior rabbi. Many of the assistant rabbis serve as Educational Directors.

Rabbis serve congregations affiliated with 1 of the 3 wings of Judaism—Orthodox, Conservative, or Reform. 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, the use of Hebrew as the language of prayer, or the use of music. The format of the worship service and, therefore, the ritual that the rabbis use may vary even among congregations belonging to the same wing of Judaism.

Rabbis also may write for religious and lay publications, and teach in theological seminaries, colleges, and universities.

Places of Employment

About 6,500 rabbis served almost 6.0 million followers of the Jewish faith in this country in 1970. Most are Orthodox rabbis; the rest are about equally divided between the Conservative and Reform wings of Judaism. Most rabbis act as spiritual leaders of individual congregations; some serve as chaplains in the Armed Forces, in hospitals, and in other institutions. Others are admintrators or teachers in Jewish seminaries, communal schools, and other educational institutions or are employed in religious education work for organizations such as the Hillel Foundation. Still others are employed by Jewish social welfare agencies.

Although rabbis serve Jewish communities throughout the Nation, they are concentrated in those States that have large Jewish populations, particularly New York, California, Pennsylvania, New Jersey, Illinois, Massachusetts, Florida, Maryland, and the Washington, D.C. metropolitan area.

Training and Other Qualifications

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

Entrance requirements and the curriculum depend upon the branch of Judaism with which the seminary

is associated. About 15 seminaries train Orthodox rabbis in programs of varying lengths. Two of the larger seminaries require the completion of a 4-year college course for ordination. However, students who are not college graduates may spend a longer period at these seminaries and complete the requirements for the bachelor's degree while pursuing the rabbinic course. The other Orthodox seminaries do not require a college degree to qualify for ordination, although students who qualify usually have completed 4 years of college.

The Hebrew Union College—Jewish Institute of Religion is the official seminary that trains rabbis for the Reform branch of Judaism. The Jewish Theological Seminary of America is the official seminary that trains rabbis for the Conservative branch of Judaism. Both seminaries require the completion of a 4-year college course, as well as prior preparation in Jewish studies, for admission to the rabbinic program leading to ordination. Five years normally are required to complete the rabbinic course at the Reform seminary, including 1 year of preparatory study in Jerusalem. Exceptionally well-prepared students can shorten this period to a minimum of 3 years. A student having a strong background in Jewish studies can complete the course at the Conservative seminary in 4 years; for others, the course may take as long as 6 years.

In general, the curriculums of Jewish theological seminaries provide students with a comprehensive knowledge of the Bible, Talmud, Rabbinic literature, Jewish history, theology, and courses in education, pastoral psychology, and public speaking. The Reform seminary places less emphasis on the study of Talmud and Rabbinic literature and offers a broad course of study that includes subjects such as human relations and community organization.

Some seminaries grant advanced academic degrees in fields such 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, assistants to experienced rabbis, directors of Hillel Foundations, teachers in seminaries and other educational institutions, or chaplains in the Armed Forces. As a rule, the pulpits of large and well-established Jewish congregations are filled by experienced rabbis.

The choice of a career as a rabbi should be made on the basis of a fervent belief in the religious teachings and practices of Judaism, and 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

In 1970, the number of rabbis in this country was inadequate to meet the expanding needs of Jewish congregations and other organizations desiring their services. This situation is likely to persist through the 1970's. Continued growth in Jewish religious affiliation and in the number of synagogues and temples, particularly in the suburbs of cities having large Jewish communities, together with increasing demands of large congregations for assistant rabbis, are expected to create many new openings. Demand for rabbis to work with social welfare and other organizations connected with the Jewish faith also is expected to increase. Although an increase in the number of students graduating from the Jewish theological seminaries is anticipated, the number of new rabbis probably will not be adequate to fill new openings and to replace the rabbis who retire or die, or leave the rabbinate for other reasons. Immigration, once an important source of rabbis, is no longer significant. In fact, graduates of American seminaries now are in demand for Jewish congregations in other countries.

Sources of Additional Information

Young people who are interested in entering the rabbinate should seek the guidance of a rabbi. Information on the work of a rabbi and allied occupations also is available from many of the local Boards of Rabbis in large communities. Information on admission requirements of Jewish theological seminaries may be obtained directly from each seminary.

ROMAN CATHOLIC PRIESTS

(D.O.T. 120.108)

Nature of the Work

Roman Catholic priests attend to the spiritual, moral, and educational needs of the members of their church. Their duties include offering the Sacrifice of the Mass; giving religious instructions in the form of a sermon; hearing confessions; administering the Sacraments, including the sacrament of marriage; visiting and comforting the sick; conducting funeral services and consoling relatives and friends; counseling

those in need of guidance; and assisting the poor.

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 the hearing of confessions or an evening visit to a hospital or a home. 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, the type of work to which they are assigned, and the church authority to whom they are immediately subject. 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 generally work as members of a religious community in specialized activities, such as teaching or missionary work, assigned to them by the superiors of the religious order to which they belong; for example, Jesuits, Dominicans or Franciscans.

Both religious and diocesan priests hold teaching and administrative posts in 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, diocesan priests are concerned with the parochial schools attached to parish churches and with diocesan high schools. The members of religious orders do most of the missionary work conducted by the Catholic Church in this country and abroad.

Places of Employment

About 60,000 priests served more than 48 million Catholics in the United States in 1970. There are priests in nearly every city and town and in many rural communities; however, the majority are in metropolitan areas, where most Catholics reside. 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. 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. Many are stationed throughout the world as missionaries.

Training and Other Qualifications

Preparation for the priesthood requires 8 years or more of study beyond high school. More than 450 seminaries offer such education. Study may begin in the first year of high school, at the college level, or in theological seminaries after college graduation.

High school seminaries provide a college preparatory program that emphasizes English grammar, speech, literature, and social studies. Two years of Latin are required and the study of a modern language is encouraged. The seminary college offers a liberal arts program, stressing philosophy and religion; the study of man through the behavioral sciences and history; and the natural sciences and mathematics. In many college seminaries, a student may concentrate in any of these fields.

The remaining 4 years of preparation includes sacred scripture; apologetics (the branch of theology concerning the defense and proofs of Christianity); dogmatic, moral, and pastoral theology; homiletics; church history; liturgy (art of preaching); Mass; 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 given either at Catholic University of America, Washington, D.C. or at the eccelestical 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 student loans. Those in religious seminaries often are 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, the capacity to speak and write effectively, and the ability to work with people. Priests are not permitted to marry.

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. Many opportunities for

greater responsibility exist within the hierarchy of the church. Diocesan priests, for example, may rise to positions such as monsignor or bishop. Much of their time at this level is given to administrative duties. In the religious orders which specialize in teaching, priests may become heads of departments or assume other positions which include administrative duties.

Outlook

A growing number of priests will be needed in the years ahead to provide for the spiritual, educational, and social needs of the growing number of Catholics in the Nation. Although the number of seminarians has increased steadily in recent years, the number of ordained priests is insufficient to fill the needs of newly established parishes and expanding colleges and other Catholic institutions, and to replace priests who retire or die. Although priests usually continue to work longer than persons in other professions, the varied demands and long hours create a need for young priests to assist the older ones. Also, an increasing number of priests have been serving in many diverse areas—in social work, religious radio, newspaper, and television work, labor-management mediation, and in foreign posts, particularly in countries that have a shortage of priests. Continued expansion of these activities, in addition to the expected further growth of the Catholic population, will require a steady increase in the number of priests through the 1970's.

Sources of Additional 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 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 these resources will be met.

A young person seeking a career in conservation must have specialized training. An appropriate bachelor's degree generally is necessary for occupations such as forester and range manager. Short-term or on-the-job training generally is necessary for a semiprofessional position such as forestry aid.

In addition to technical knowledge and skills, the conservationist must have a sincere interest in nature and a desire to preserve it. He should be oriented toward public service because he is called upon to work increasingly with his community. A conservationist must be versatile to work at a remote camping area 1 week, speak before a community group the next, and fight a forest or brush fire the next.

This chapter describes three conservation occupations—forester, forestry aid, and range manager. Soil conservationist, a related occupation, is discussed elsewhere in the *Handbook*.

FORESTERS

(D.O.T. 040.081)

Nature of the Work

Forests are one of America's greatest natural resources. They cover about 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, the processing, utilization and marketing of forest products, and reforestation, reseeding and replanting. Foresters also safeguard forests from fire, destructive animals and insects, and diseases. Other responsibilities of foresters include wildlife protection and watershed management, and the management of camps, parks, and grazing land.

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

Places of Employment

An estimated 22,000 persons were employed as foresters in the United States in 1970. About one-third were employed in private industry, mainly by pulp and paper,

lumber, logging, and milling companies. More than one-fourth 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. Most of the remainder were employed by State and local governments, colleges and universities, and consulting firms. Others were managers of their own lands or were in business for themselves as consultants.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in forestry is the minimum educational requirement for young persons seeking professional careers in forestry. An advanced degree is generally required for teaching and research positions.

Education in forestry leading to a bachelor's or higher degree was offered in 1970 by 52 colleges and universities of which 35 were accredited by the Society of American Foresters. The curriculums in most of these schools include specialized forestry courses in ten areas: (1) Dendrology (the characteristics, distribution, and occurrence of trees in forests); (2) forest ecology (structure and operation of the forest community); (3) silviculture (methods of growing and improving forest crops); (4) forest protection (primarily against fire, insects, and disease); (5) forest economics (economic and business principles and problems involved in the management and utilization of forest resources); (6) forest measurements (measuring and estimating present and potential resources); (7) forest policy (history and current status of Federal, State, and private policies relating to forests and other natural resources); (8) forest administration (principles of administration with special reference to problems faced by both public and private agencies); (9) forest resources management (study of the interrelations among the various forest resources and basic principles of forest land management); (10) forest resources use (principles underlying the uses of forest resources for human benefit). Some colleges require that students spend one summer in a field camp operated by the college. Students also are encouraged to work during summers in jobs that will give them firsthand experience in forest or conservation work.

Forestry graduates often work under the supervision of experienced foresters before advancing to responsible positions in management of forest lands or research.

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

Requirements for foresters are expected to increase moderately through the 1970's. The number of new graduates, however, could more than meet anticipated demand if current trends continue. Therefore, new forestry graduates may face some competition for jobs. Factors underlying the anticipated demand for foresters 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. Employment also may be favorably influenced by the growing awareness of the need to conserve and replenish our forest resources, and to improve the quality of the environment.

Private owners of timberland are expected to employ increasing numbers of foresters to realize the higher 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, to develop methods of growing superior stands of trees over a shorter period of time, and to do research in genetics and fertilization. In addition, competition from metal, plastics, and other materials is expected to stimulate further research to develop new and improved wood products.

Employment opportunities for foresters in the Federal Government probably will not increase significantly through the 1970's because of the changing nature of the forester's duties. Specialized scientists —biologists, horticulturists, agronomists, chemists, etc., increasingly will be hired for the more scientific work previously performed by foresters.

Aids increasingly may perform many nonprofessional duties which could limit employment opportunities for foresters. Foresters, on the other hand, will be more concerned with the overall administration and coordination of the work of specialists and aids.

State Government agencies should continue to offer employment opportunities. Forest fire control, insect and disease protection, technical assistance to owners of forest lands and other Federal-State cooperative programs usually are channeled through State forestry organizations. Growing demands for

recreation in forest lands may result in the expansion of State parks and other recreational areas.

College teaching and research in areas such as forest genetics and forest disease are other avenues of favorable employment opportunities for foresters, but primarily for those having graduate degrees.

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

Earnings and Working Conditions

In the Federal Government in 1970, beginning foresters having a bachelor's degree could start at either $6,548 or $8,098 a year, depending on their academic record. Those having 1 or 2 years of graduate work could begin at $8,098 or $9,881; those having the Ph. D. degree, at $11,905 or $14,192. District rangers employed by the Federal Government in 1970 generally earned between $9,881 and $14,192 a year. Foresters in top level positions earned considerably more.

Beginning salaries of foresters employed by State governments vary widely; but, with a few exceptions, they tend to be lower than Federal salaries. Entrance salaries in private industry, according to limited data, are fairly comparable to Federal salary levels.

The salaries of forestry teachers are 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 and lecturing and the writing of 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 work extra hours on emergency duty, such as fire-fighting.

Sources of Additional Information

General information about the profession of forestry, lists of reading material, as well as lists of schools offering training in forestry is available from:

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

General information also is available from:

American Forest Institute, 1835 K St. NW., Washington, D.C. 20006

A booklet entitled "So You Want to be a Forester" may be obtained from:

American Forestry Association, 919 17th St. NW., Washington, D.C. 20006

Information on forestry careers in the Forest Service is available from:

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

FORESTRY AIDS

(D.O.T. 441.384)

Nature of the Work

Forestry aids, called forestry technicians at higher career levels, assist foresters in managing and caring for forest lands and their resources. (See statement on Foresters earlier in this chapter.) Their duties include scaling logs, marking trees, and collecting and recording data such as tree heights, diameters, and mortality. On simple watershed improvement projects, aids install, maintain, and collect records from rain gauges, streamflow recorders, and soil moisture measuring instruments. They may serve as rodmen, chainmen, or level instrumentmen on road survey crews.

Forestry aid uses tree injector to get herbicide into tree.

Forestry aids prevent and control fires. They instruct persons using the forest and lead fire-fighting crews if a fire does occur. After suppressing the fire, they take inventory of burned areas, and plant new trees and shrubs.

Forestry technicians supervise timber sales, recreation-area use, and road-building crews that make timber accessible for cutting.

Places of Employment

An estimated 11,100 persons were employed as forestry aids in 1970. Almost 5,500 were employed by the Federal Government; the Forest Service of the U.S. Department of Agriculture employed approximately 3,200 of these. Approximately 1,700 were working for State governments. About 3,800 were employed in private industry, primarily by lumber, logging, and paper milling companies. Forestry aids also work in tree nurseries and in forestation projects of mining, railroad, and oil companies.

Many forestry aids are employed in the heavily forested States of Washington, California, Oregon, Idaho, Utah, and Montana, as well as in the forested areas of the Great Lakes States, the Northeast, and the South.

Training, Other Qualifications, and Advancement

Young persons qualify for beginning positions through work experience, a government sponsored training program, or by completing a specialized 1- or 2-year post secondary school curriculum. In 1970, about 50 technical institutes, junior or community colleges, and ranger schools offered curriculums training forestry aids.

Among the specialized courses are forest mensuration (measurement of the number and size of trees and shrubs), wood utilization, and silviculture (methods of growing and improving forest crops). In addition, students take courses in drafting, surveying, report writing, and first aid. They also may live in a forest or camp operated by the school to gain experience.

Young people also may obtain the necessary training in programs sponsored under the Manpower Development and Training Act which are presently available in Arkansas, Colorado, Michigan, and Washington.

Persons who have not had specific training usually must have experience in forest work, such as planting trees or fighting fires, to qualify for beginning forestry aid jobs. The Federal Government requires a minimum of two seasons of related work experience. Those who have had technical experience, such as estimating timber resources, may qualify for more responsible positions.

Essential for success in this field are an enthusiasm for outdoor work, physical stamina, and the ability to carry out tasks without direct supervision. The forestry aid also should be able to work well with survey crews, users of the forestlands, forest owners, and professional foresters. Many jobs also require a willingness to work in remote areas.

Employment Outlook

Employment opportunities for forestry aids are expected to increase rapidly through the 1970's. Prospects will be especially good for those having 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 now 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 also is likely to offer increasing employment opportunities through the 1970's, mainly in the Forest Service of the Department of Agriculture. Similarly, State governments probably will increase their employment of forestry aids. Growth in Government employment will stem from factors such as increasing demand for recreational facilities and the trend toward more scientific management of forest land and water supplies.

Earnings and Working Conditions

Annual earnings of forestry aids range from about $4,500 to almost $10,000 a year; those having high earnings usually have had many years of experience. In the Federal Government, beginning forestry aids and technicians earned between $4,621 and $6,548 a year in 1970, depending on the applicant's education and experience. Beginning salaries in private industry were similar, according to limited data.

As part of their regular duties, forestry aids must spend considerable time outdoors during all weather conditions. In emergencies, such as firefighting and flood control, forestry aids work many extra hours. In addition to those employed full time, many forestry aids are hired on a seasonal basis and work 3 to 6 months a year. Climatic conditions in some areas limit year-round field work and some jobs, such as firefighting, are seasonal in nature.

Sources of Additional Information

Information about a career in the Federal Government as a forestry aid is available from:

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

For a list of schools offering training in the field, write to:

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

RANGE MANAGERS

(D.O.T. 040.081)

Nature of the Work

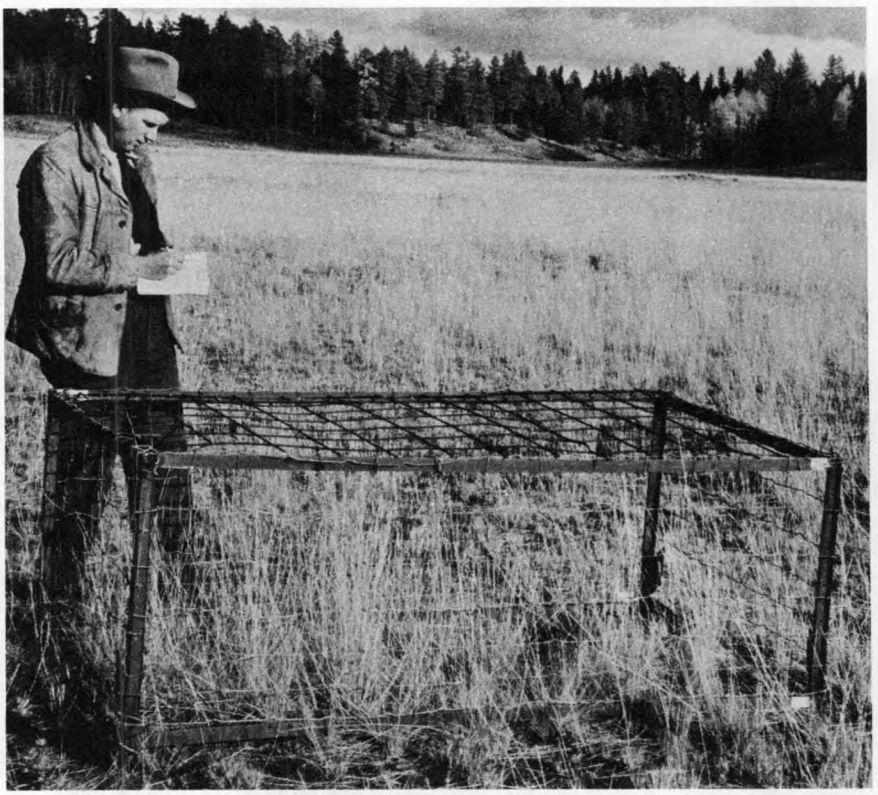
Rangelands cover more than 1 billion acres in the United States, mostly in the Southern and Western States, including Alaska. They contain many natural resources including grass and shrub forage; habitats for livestock and wildlife; facilities for water recreation; and environmental areas for scientific research. Range managers, also called *range conservationists* or *range scientists,* manage, develop, and protect these rangelands and their resources. They establish grazing plans that will yield a high production of livestock while preserving soil and vegtation for other land use requirements—wildlife grazing, recreation, growing timber, and watersheds. Range managers evaluate forage resources; 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 also are important activities of this occupation. Because of the multiple use of rangelands, the manager's work often extends into closely related fields such as wildlife and watershed management, land classification, forest management, and recreation.

The range manager may also teach, write reports, conduct research in range maintenance and improvement, and provide technical assistance to holders of privately owned grazing lands and to foreign countries.

Places of Employment

In 1970, an estimated 3,600 professional range managers were employed in the United States. The majority were employed by Federal, State, and local government agencies. In the Federal Government, most worked in the Forest Service and the Soil Conservation Service of the Department of Agriculture and in the Bureau of Land Management of the Department of the Interior.

Some range managers are employed by privately owned range livestock ranches and consulting firms. Some manage their own land. A few are self-employed consultants. Others are employed by manufacturing, sales, and service enterprises, and by banks and real estate firms which need rangeland appraisals. Colleges and universities also employ range managers in teaching and research positions.



Range manager checks enclosure used for grass growing experiment.

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 field, such as agronomy or forestry, including courses in range management and range conservation, also is accepted. Graduate degrees are generally required for teaching and research.

Training leading to a bachelor's degree specifically in range management or range science was offered in 1970 by 14 colleges and universities; 13 additional schools had programs in related fields such as forestry, botany, or agronomy, with an option or major in range management. Fourteen schools offered master's degrees in range management or range science—five in agriculture, forestry, or botany with a major in range management, and 12 schools offered the Ph. D. in range science or a related field with a range major.

The essential courses for a degree in range management are botany, plant ecology, and plant physiology; zoology; animal husbandry; soils; chemistry; mathematics; and specialized courses in range management. Desirable electives include economics, statistics, physics, geology, and watershed, and wildlife management.

Federal Government agencies—primarily the Forest Service, the Bureau of Land Management and the Soil Conservation Service—hire some 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 range managers primarily will result from the need to replace experienced range managers who die, retire, or transfer to other occupations. Employment opportunities in the Federal Government probably will decrease because of the changing nature of the range manager's duties; he will assume more administrative and managerial duties. The scientific and technical duties once performed by range managers increasingly will be performed by natural scientists. The declining employment opportunities in the Federal Government will be offset somewhat by increasing employment opportunities in the private sector.

Favorable job opportunities are anticipated in private industry, since range livestock producers and private timber operators probably will hire increasing numbers of range managers. A few openings are expected in developing countries of the Middle East, Africa, and South America.

Major factors underlying the increasing demand for range managers are population growth, increasing per capita consumption of animal products, and the growing use of rangelands for hunting and other recreation.

Earnings and Working Conditions

In the Federal Government, starting salaries for range managers having the bachelor's degree were dependent upon the applicant's college record and ranged from $6,548 to $8,098 in 1970. Beginning salaries of those having 1 or 2 years of graduate work were $8,098 or $9,881; and for those having the Ph. D. $11,905 to $14,192.

Starting salaries for range managers employed by State governments and private industry in 1970 were about the same as those paid 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 sometimes augment their regular salaries with income from part-time consulting and lecturing and from writing books and articles.

Range managers may spend considerable time away from home working outdoors in remote parts of the range.

Sources of Additional Information

For general information about a career as a range manager as well as a list of schools offering training in the field, write to:

Society for Range Management, 2120 South Birch Street, Denver, Colo. 80222.

Information about career opportunities in the Federal Government may be obtained from:

Bureau of Land Management, Denver Service Center, Federal Center

Building 50, Denver, Colorado 80225.

or

Portland Service Center, 710 NE. Holladay Street, Portland, Oregon 97208.

Forest Service, U. S. Department of Agriculture, 1621 North Kent Street, Arlington, Virginia 20415.

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

COUNSELING OCCUPATIONS

The primary objectives of professional counseling are to help persons understand themselves and their opportunities better so that they can make and carry out decisions and plans that hold potential for a satisfying and productive life. Whatever the area of counseling—personal, educational, or vocational—counselors need a concern for individuals combined with a capacity for objectivity; and a belief in the worthwhileness and uniqueness of each individual, in his right to make and accept responsibility for his own decisions, and in his potential for development.

This chapter deals, in detail, with three generally recognized specialties in the field: School counseling, rehabilitation counseling, and employment counseling.

School Counselors are the largest counseling group. They are concerned with the personal and social development of pupils and the planning and achievement of their educational and vocational goals.

Rehabilitation Counselors work with persons who are physically, mentally, or socially handicapped. Their counseling is vocationally oriented but involves personal counseling as well.

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

Young persons considering counseling careers should have an interest in helping people. The ability to understand the behavior of people is important to counselors who sometimes must do a great deal of research into the individual's background. Counselors should have the type of pleasant and strong personality that instills confidence in their clients. Sensitivity to the needs of people, patience, and an ability to communicate orally as well as in writing are important, also.

Some persons working in other professional occupations provide counseling services, as well. The occupation most closely related to counselor is counseling psychologist. Many social workers also provide counseling services. These two occupations, as well as others in which workers do some counseling but primarily work in teaching, health, law, religion, or other fields, are described elsewhere in the *Handbook*. For information on counseling services provided by college and university staff members and by personnel workers in government and industry, see the statements on "College Placement Officers" and "Personnel Workers."

EMPLOYMENT COUNSELORS

(D.O.T. 045.108)

Nature of the Work

Employment counselors (sometimes called vocational counselors) help individuals seeking aid to develop a career goal that will fulfill their potential and bring personal satisfaction. They assist clients by planning with them how to prepare for and enter careers, and how to make progress in them.

The extent of the counseling assistance available differs among agencies rendering the service. Sometimes their clients are skilled in specific occupations, and ready for immediate job placement. Sometimes they need intensive training to prepare them for jobs. The counselor may help them find appropriate training.

Counselors interview clients to obtain vocationally significant information related to their personal traits, interests, training, work experience, and work attitudes. They may assist individuals in filling out questionnaires concerning their personal history and background. Additional data on a person's general intelligence, aptitudes and abilities, physical capacities, knowledge, skills, interests, and values also are 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 the client from sources such as former employers, schools, and health or other agencies.

Counselors assist clients in evaluating and understanding their work potential, and provide them with information that they need in making plans appropriate to their talents and interests. Job requirements and employment opportunities or training programs are discussed. In some agencies, a vocational plan, or employability plan, is developed jointly by the counselor and his client and may specify a series of steps involving remedial education, vocational training, work experience, or other services needed to enhance his employability. Often in developing this plan, the employment counselor works with a team of specialists.

In many cases, employment counselors refer clients to other agencies for physical rehabilitation or for psychological or other services before, or concurrent with, counseling. Employment counselors must be familiar with the services available in the community. They

should be able to recognize what services might be beneficial to a particular client.

Counselors may help clients by suggesting feasible employment sources and appropriate ways of applying for work. In instances where a client needs further support and assistance, counselors may contact employers, although clients seeking employment usually are sent to placement interviewers after counseling. After job placement or entrance into training, counselors may follow up to determine if additional assistance is needed. The expanding responsibility of public employment service counselors for improving the employability of disadvantaged persons has increased their contacts with these persons during training and on the job. It also has led to group counseling and the stationing of counselors in neighborhood and community centers.

Places of Employment

In 1970, the largest number of employment counselors—about 6,000—worked in State employment service offices, located in every large city and in many smaller towns. The next largest number—probably about 2,000—worked for various private or community agencies, primarily in the larger cities. In addition, some worked in institutions such as prisons, training schools for delinquent youths, and mental hospitals. The Federal Government employed a limited number of employment counselors, chiefly in the Bureau of Indian Affairs and the Veterans Administration. Some people trained in employment or vocational counseling are engaged in research or graduate teaching. About half of all employment 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. Most States have adopted a three-level counselor classification system which includes a *counselor 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 counseling 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.

Although minimum entrance requirements are not standardized among private and community agencies, 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. Many private agencies prefer to have at least one staff member who has a doctorate in counseling psychology or a related field. For those lacking an advanced degree, employers usually emphasize experience in closely related work such as rehabilitation counseling, employment interviewing,

school or college counseling, or teaching.

The public employment service offices in each State provide in-service training programs for their new counselors or trainees. Their experienced counselors frequently are given additional training at colleges and universities, often leading to a master's degree in counseling and guidance. 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 in techniques of appraisal and counseling for vocational adjustment, group methods, counseling followup techniques, psychological testing in vocational counseling, educational psychology, psychology of occupations, industrial psychology, job analysis and theories of occupational choice, administration of guidance services, and some course work in research methods and statistics.

Counselor education programs at the graduate level are available in about 370 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. All 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 also require a written or oral examination, or both.

Counselors who are well qualified may advance, after experience, to supervisory or administrative positions in their own or other organizations; some may become directors of agencies or of other counseling services, or area supervisors of guidance programs; some may become consultants; and others, may become professors in the counseling field.

Employment Outlook

Employment counselors who have a master's degree, and others with recognized related experience in the field, will have very good employment opportunities in both public and community agencies through the 1970's. In addition, college graduates having a bachelor's degree and 15 hours of undergraduate or graduate work in counseling-related courses will find many opportunities in State and local employment service offices as counselor trainees.

Employment of counselors in State employment service offices is expected to increase very rapidly through the 1970's. The role of employment counselors has become increasingly important as new programs have been developed to deal with unemployment among the unskilled, minorities, and displaced persons in a complex urban labor market. Many of these programs, beginning with the Manpower Development and Training Act of 1962, deal with training and retraining of these workers for fuller utilization of their potentials. The stimulus for most of these programs was public awareness, concern, and recognition that additional services would have to be provided if individuals with limited skills were to find satisfactory employment. As a result, the emphasis of employment counseling in State employment service offices has shifted from helping unemployed persons to seek and obtain employment to providing multifaceted assistance to help both unemployed and underemployed persons obtain suitable jobs.

In addition to the counselors needed because of growth in the occupation, many will be needed each year through the 1970's to replace workers who retire, die, or leave the profession for other reasons.

Earnings and Working Conditions

Salaries of employment counselors in State employment services vary considerably from State to State. In 1970, minimum annual salaries ranged from about $6,100 to $11,600, with a mean of $7,700. Maximum salaries ranged from $7,700 to nearly $14,000, with a mean of about $9,900. More than one-third of the States listed maximum salaries of $10,000 or over. Trainees for counseling positions in some voluntary agencies in large cities were being hired at about $6,500 a year; annual salaries reported for experienced counselors ranged up to $15,000 or more in 1970.

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

Sources of Additional Information

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

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

National Vocational Guidance Association, Inc., 1607 New Hampshire

Ave., NW., Washington, D.C. 20009.

Specific information regarding local job opportunities, salaries, and entrance requirements for positions in public employment service offices may be obtained from the administrative office of the particular State employment security agency, bureau, division, or commission, which operates the service in the State in which interested. Such offices are usually in the State capital.

REHABILITATION COUNSELORS

(D.O.T. 045.108)

Nature of the Work

Rehabilitation counselors are concerned primarily with the vocational and personal adjustment of persons handicapped in various ways, either physicially, mentally, or socially. First, the counselor interviews the handicapped person to learn his abilities, interests, and limitations. Then, using such information along with other medical, psychological, and social data available, he helps the handicapped person evaluate himself—his physical and mental capacity, interests, and talents—in terms of work suited to these needs and abilities.

At this point, the counselor may work out a plan of rehabilitation with the handicapped person, along with other specialists responsible for the latter's medical care and occupational training and for other services needed to carry out the program. As this plan is put into effect, the counselor meets regularly with the disabled person to discuss the program, check on progress made, and help resolve problems. When the person is ready for employment, the counselor helps him find a suitable job, and often makes followup checks 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. Still others work with the disabled in poverty areas.

The time spent in the direct counseling of each individual varies with the person and the nature of his disability, as well as with the counselor's workload. Some rehabilitation counselors are responsible for many persons in various stages of rehabilitation; on the other hand, less experienced counselors, or specialized ones working with the severely handicapped may handle relatively few cases at a time. In ad-

dition to working with the handicapped person, the counselor also must maintain close contact with other professionals who work with handicapped persons, members of their families, other agencies and civic groups, and private employers who hire the handicapped. The counselor often is responsible for related activities, such as employer education and community publicity for the rehabilitation program.

Places of Employment

About 13,000 rehabilitation counselors were employed in 1970; more than 11,000 were full-time counselors. About three-fourths of all rehabilitation counselors were employed in State and local rehabilitation agencies financed cooperatively with Federal and State funds. The remainder were employed by hospitals, labor unions, insurance companies, special schools, rehabilitation centers, sheltered workshops, and other public and private agencies that conducted rehabilitation programs and provided job placement services for the disabled. In addition, about 400 counseling psychologists in the Veterans Administration provided rehabilitation counseling.

An estimated 30 percent of all rehabilitation counselors are women.

Training, Other Qualifications, and Advancement

The basic educational requirement for entry into this occupation is a bachelor's degree with course credits in counseling, psychology, and related fields. However, employers are placing increasing emphasis on the master's degree in vocational or rehabilitation counseling or in a related discipline such as psychology, education, or social work. Work experience in related fields, such as vocational counseling and placement, social work, psychology, education, and other types of counseling, is given considerable weight by some employers, especially when considering applicants who have only the bachelor's degree. Some agencies assist employees having bachelor's degrees to attain graduate degrees through work-study programs.

Usually, 2 years are required to qualify for 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 specified courses in other fields. The latter may include counseling theories and techniques, occupational and educational information, community resources, placement and follow-up, tests and measurements, the cultural and psychological effects of disability, and the medical and legislative aspects of therapy and rehabilitation.

To earn the doctorate in rehabilitation counseling or in counseling psychology may require a total of 4 to 6 years of graduate study. Intensive training in psychology, other social sciences, as well as research methods, is required.

In 1970, 70 colleges and universities offered financial assistance to a limited number of full-time graduate students specializing in rehabilitation counseling through training grants provided by the Rehabilitation Services Administration of the U.S. Department of Health, Education, and Welfare.

To qualify for work with a number of the State Rehabilitation Agencies applicants must comply with State civil service and merit system rules. In most cases, these regulations require applicants to pass a written competitive examination, 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 having limited experience usually are assigned the least difficult cases. As they gain experience, cases representing more difficult rehabilitation problems are assigned to them. After obtaining considerable experience, rehabilitation counselors may be advanced to supervisory positions or to top administrative jobs.

Employment Outlook

Employment opportunities for rehabilitation counselors are expected to be very good through the 1970's. In addition to openings expected to be created by the very rapid growth of the profession, several hundred counselors will be needed annually to replace those who die, retire, or leave the field for other reasons. Persons who have graduate work in rehabilitation counseling or in related fields have the best employment prospects.

The number of counselors currently being trained is below the number of new entrants that are expected to be needed during the early 1970's. During this period, therefore, opportunities in rehabilitation counseling will be favorable for persons with experience in related fields such as psychology, social work, and education.

Among the factors contributing substantially to long-run demand for the services of rehabilitation counselors will be population growth, with related increases in numbers to be served, along with extension of

vocational rehabilitation to greater numbers of the severely disabled. An additional stimulus should be the increasing support for the service in general including a growing recognition that the vocational rehabilitation approach helps the disadvantaged achieve self-support.

Earnings and Working Conditions

According to the U.S. Department of Health, Education, and Welfare, the median salaries of rehabilitation counselors employed in State agencies generally ranged from $7,800 to $10,000 a year in 1970. Counselors working with the disabled in the Veterans Administration were hired in 1970 at $13,493 or $14,665, depending upon education and experience. A small number of counselor trainees were hired at annual salaries of $9,881. For positions in VA hospitals requiring the doctorate, salaries ranged generally from $13,493 to $16,790, depending on the applicant's experience and other qualifications. The average salary for doctorate degree holders was $18,900.

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. The ability to drive a car is often necessary for field work.

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

Sources of Additional Information

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

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

American Rehabilitation Counseling Association, 1607 New Hampshire Ave. NW., Washington, D.C. 20009.

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

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, Rehabilitation Services Administration, Washington, D.C. 20201.

SCHOOL COUNSELORS

(D.O.T. 045.108)

School counselors are concerned with the educational, vocational, and social development of students. In carrying out their responsibilities, counselors work with students, both individually and in groups, as well as with teachers, other school personnel, parents, and community agencies.

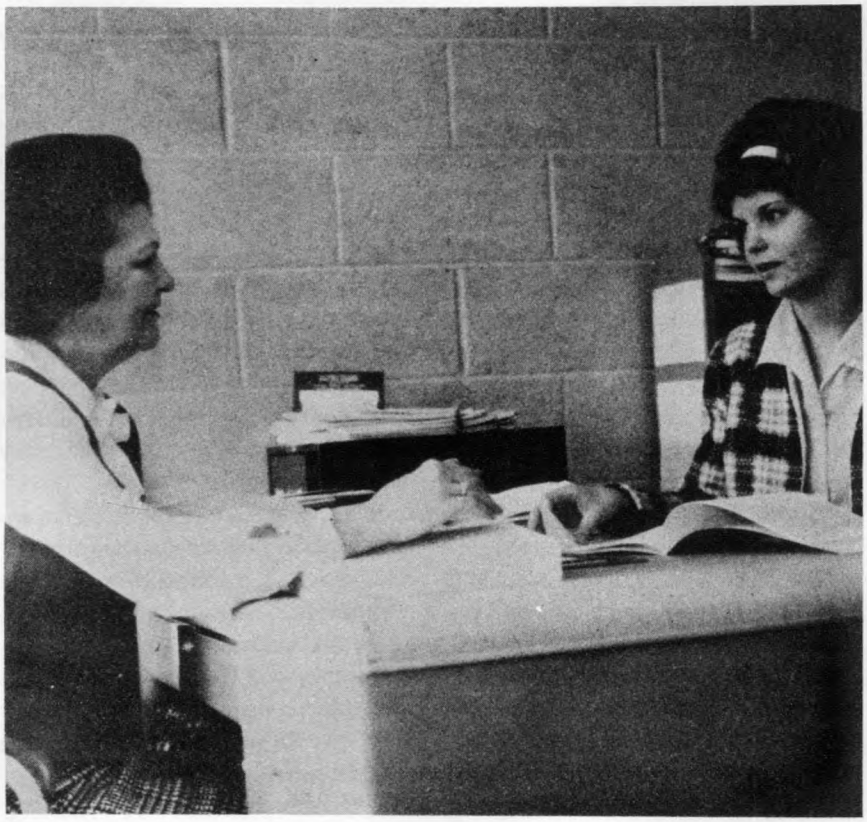
In the process of helping students find their interests and abilities to use in their educational and vocational planning, counselors in secondary schools obtain information from a variety of sources. These include talking with students, referring to their school and other records, and using tests to help assess a student's chances of success in given studies or occupations. The counselor then helps the student analyze and interpret the results, and develops with him—and sometimes with his parents, as well—a course of study and an educational plan fitting his abilities, interests, and vocational opportunities.

To acquaint a student with the nature of the work in which he has shown an interest, the counselor may provide descriptions of work, training requirements, earnings, and outlook. He may maintain files or libraries of occupational literature for both students and their parents to use. To provide a view of real work settings, he may arrange trips to factories and business firms, and show vocational films. To bring the work-place into the school, the counselor may conduct "career day" programs.

He also counsels the student about opportunities for educational and vocational training beyond high school, including those in 2- and 4-year colleges; in trade, technical and business schools; in apprenticeship programs, and in programs under the Manpower Development and Training Act of 1962.

Counselors in secondary schools may also help students find part-time work while in school, either to enable them to stay in school or to help them prepare for their vocation. Counselors may also assist students, on leaving school, in locating full-time employment themselves or in using community employment services. Some counselors also take part in studies to follow up on recent graduates and dropouts, to survey local job opportunities, or to determine the effectiveness of the educational and guidance programs.

Many secondary school counselors, in addition, help students individually with personal and social problems common to adolescence. Counselors also lead discussion



groups on topics related to student interests and problems.

Elementary school counselors help children to make the best use of their abilities by identifying these and other basic aspects of their makeup, at an early age, and by evaluating any learning problems. Methods used in counseling grade school children necessarily differ in many ways from those used with older students. Observations of classroom and play activity furnish clues about children in the lower grades. To better understand the children, elementary school counselors spend much of their time consulting with teachers and parents. They also work closely with other staff members of the school, including psychologists and social workers.

Some school counselors, particularly in secondary schools, may teach classes in occupational information, social studies, or other subjects in addition to counseling. They also may supervise school clubs or other extracurricular activities, often after regular school hours.

Places of Employment

An estimated 54,000 school counselors were employed full-time during the 1970–71 school year. More than four-fifths worked in public secondary schools. About 10 percent were employed in public elementary schools where counseling services are being steadily expanded. The others were employed in junior colleges, technical institutes, and private elementary and secondary schools.

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

Training, Other Qualifications, and Advancement

Most States require counselors to have both a counseling and a teaching certificate. (See statement on Elementary and Secondary School Teachers for teaching certificate requirements.) A counseling certificate requires graduate level work and usually from 1 to 5 years of teaching experience. A person planning to counsel should learn the specific requirements of the State in which he plans to work, since such requirements vary considerably among the States and also are changing rapidly.

Undergraduate college students interested in becoming school counselors usually enroll in the regular program of teacher education, preferably taking additional courses in psychology and sociology. In States where teaching experience is not a requirement it is possible to major in a liberal arts program. After graduating from college, they may gain the experience required, teaching or other, before or during graduate study. A few States substitute counseling internship for teaching experience. In some States, teachers who have completed part of the courses required for the master's degree are eligible for provisional certification and may work as counselors under supervision while taking additional courses.

The subject areas of the required graduate-level courses usually include appraisal of the individual student, counseling procedures for group guidance, use of information services for vocational development, development and management of overall program, professional rela-

tions and ethics, and statistics and research. Supervised field experience or internship is provided in an increasing number of programs. Counselor education programs at the graduate level are available in more than 370 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. School counselors may advance to counselor supervisors or directors of pupil personnel services or to other administrative positions within the school system.

Employment Outlook

Employment opportunities for well-trained school counselors are expected to be good through the 1970's. Job openings for counselors are expected to increase rapidly due to continued strengthening of counseling services in elementary and secondary schools. The average ratio of counselors to students 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, and other legislation.

In addition to the number of counselors needed to take care of the anticipated expansion of the occupation, many counselors also will be required, each year, to replace those leaving the profession.

Among the factors affecting the employment growth of school counselors is the increasing recognition of counseling as an essential educational service for all pupils—the average, the gifted, the slow, the disadvantaged, and the handicapped. Moreover, Federal legislation such as the Elementary and Secondary Education Act amendments of 1966, the National Defense Education amendments of 1966, and the Vocational Education amendments of 1968 has extended support of school counseling services to elementary schools, vocational and technical schools, and junior colleges.

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. This in turn, may help reduce the number of school dropouts. Students will also be seeking advice from school counselors about educational requirements for concerns such as entrance-level jobs, job changes caused by automation and other technological advances, college entrance requirements, and places of employment.

Earnings and Working Conditions

According to the National Education Association, the average annual salaries during the 1969–70 school year for school counselors having the bachelor's degree ranged from $7,300 to $10,300, and for those having the master's, from $8,300 to $12,400. School counselors having the doctorate earned as much as $18,700. 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.)

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

Sources of Additional Information

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.

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

American School Counselor Association, 1607 New Hampshire Ave. NW., Washington, D.C. 20009.

ENGINEERS

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. In addition, they design and develop consumer products such as automobiles and refrigerators. They also provide the raw materials that make all this possible.

This chapter contains an over-all discussion of engineering, followed by separate statements on several branches of the field—aerospace, agricultural, biomedical, 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. Also, unified curriculums in engineering (without specialty designation) and in engineering science are increasing in popularity. 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 the Work

Engineers develop methods for converting the raw materials and sources of power found in nature into useful products at a reasonable cost in terms of time and money. They use basic scientific principles to solve the problems involved in designing goods and services and developing methods for their production. The emphasis on the application 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 develops uses for the liquid, or economical methods for its production.

In designing or developing a new product, engineers must consider many factors. For example, in designing a space capsule, they must calculate how much heat, radiation, air pressure, and other forces the capsule must withstand during its flight to insure the safety of the occupants and prevent the malfunctioning of its instrumentation. Experiments must be conducted which relate these factors to various construction materials, as well as to the many possible capsule sizes, shapes, and weights. Equally important are the human needs and limitations of the people who must operate the equipment. 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 engage in many other activities. Many work in inspection, quality control, and other activities related to production in manufacturing industries, mines, and agriculture. Others are administrators and managers whose knowledge of engineering is important. 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. Some engineers having considerable experience work as consultants. A relatively small group, especially at the Ph. D. level, teach in the engineering schools of colleges and universities.

Most engineers specialize in one of the many branches of the profession. More than 25 engineering specialties are recognized by the profession or in engineering school curriculums. Besides these major branches—11 of which are discussed separately in this chapter—there are many subdivisions of the branches. Structural, hydraulic, 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 many fields. For example, electrical engineers may work in medicine, missile guidance, or electric power distribution. Because engineering problems are usually complex, the work in some applied fields cuts across the traditional branches. Using a team approach to solve problems, engineers in one field often work closely with specialists in other scientific and engineering occupations.

Places of Employment

Engineering is the second largest professional occupation, exceeded in size only by teaching; for men it is the largest profession. Nearly 1.1 million engineers were employed in the United States in 1970.

Manufacturing industries employed approximately 600,000 or more than half of all engineers in 1970—mostly in electrical equipment, aircraft and parts, machinery, chemicals, ordnance, instruments, primary metals, fabricated metal products, and motor vehicles industries. Over 300,000 engineers were employed in non-manufacturing industries in 1970, primarily in the construction, public utilities, engineering and architectural services, and business and management consulting services industries.

Federal, State, and local governments employed more than 150,000 engineers in 1970. Over half of these were employed by the Federal Government, chiefly by the Department of Defense. Significant numbers of engineers also were in the Departments of the Interior, Agriculture, and Transportation, 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 over 40,000 engineers in 1970, in research and teaching. 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. However, about two-thirds of all engineers in private industry are employed in 10 States, and of these almost one-third are in California, New York, and Pennsylvania. 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 having training in physics, one of the other natural sciences, or in mathematics may qualify for some beginning positions in engineering. Some persons without a degree are able to become engineers after long experience in a related occupation—such as draftsmen or engineering technicians—and some college level training.

Advanced training is emphasized for an increasing number of jobs. Graduate degrees are desirable for beginning teaching and research po-

sitions, and advancement. Furthermore, some specialities, such as nuclear engineering, are available only at the graduate level.

About 270 colleges, universities, and engineering schools offer a bachelor's degree in engineering. These educational institutions offer nearly 1,000 curricula choices. Although the larger branches of engineering are offered in most schools, some specialties are taught in relatively few institutions. A student who desires to specialize should investigate various curriculums before selecting his college. For undergraduate admission, engineering schools usually require high school courses in mathematics and the physical sciences. The quality of the applicant's high school work is emphasized.

In the typical 4-year curriculum, the first 2 years are spent mainly on basic science—mathematics, physics, and chemistry—and the humanities, social sciences, and English. The last 2 years are devoted chiefly to engineering with emphasis on a specialty. Some programs offer general training; the student chooses a specialty in graduate school or acquires one on the job.

Some engineering curriculums require more than 4 years to complete. However, the number of institutions having 5-year programs leading to the bachelor's degree is decreasing. In addition, several engineering schools now have formal arrangements with liberal arts colleges whereby a student spends 3 years in liberal arts and 2 years in engineering and receives a bachelor's degree from each. This program offers the student diversification in his studies.

Some institutions have 5- or 6-year cooperative plans under which a student alternates school and employment. Most of these plans coordinate classroom study and practical experience. In addition to gaining experience, the student may finance part of his education.

Engineering graduates usually begin work as trainees or as assistants to experienced engineers. Many large companies have special programs to acquaint new engineers with special industrial practices and to determine the specialty for which they are best suited. As they gain experience, engineers may advance to positions of greater responsibility. Those with proven ability often become administrators. Increasingly large numbers are promoted to top executive posts. Many engineers obtain graduate degrees in business administration to improve their advancement opportunities.

All 50 States and the District of Columbia have laws providing for the licensing of those engineers whose work may affect life, health, or property; or who offer their services to the public. In 1970, about 325,000 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.

Prospective engineers should be able to work as part of a team, be innovative, have initiative, an analytical mind, a capacity for detail, and the ability to make decisions. In addition, engineers should be able to communicate their ideas to specialists in areas such as marketing, and production planning. The ability to cut across various disciplines and systematically evaluate and solve problems also is important. Because of rapidly changing technologies, an engineer must be willing to continue his education throughout his career.

Employment Outlook

Employment opportunities for engineers are expected to be favorable through the 1970's. Engineering has been one of the fastest growing professions in recent years and requirements for engineers are expected to increase very rapidly through the 1970's, but at a slower annual rate of growth than during the 1960's. Engineers who are not well grounded in fundamentals and whose specialization is very narrow could be affected adversely by shifts in defense activities and rapidly changing technology. Demand probably will be strong for new graduates who have acquired recently developed techniques, including computer applications, and for engineers who can apply engineering principles to medical, biological, and other sciences. New graduates having advanced degrees should have favorable opportunities in research and teaching.

Among factors underlying the anticipated increase in demand for engineers is population growth, and the resulting expansion of industry to meet the demand for more goods and services. The need for engineers also will rise as a result of the increasingly larger amount of engineering time required to develop complex industrial products and processes and industrial automation. Increasing public emphasis on solving domestic problems such as environmental pollution and urban redevelopment also should increase requirements for engineers.

Some of the past increases in engineering employment resulted from increases in Federal research and development (R&D) expenditures

for space and defense related programs. During the 1970–80 decade R&D expenditures of Government and industry are expected to increase, although at a slower rate than during the 1960's. The anticipated slowdown in Federal R&D spending basically reflects anticipated reductions in the relative importance of the space and defense components of R&D expenditures. These trends were evidenced in the late 1960's and in 1970.

Defense expenditures are an important determinant of the demand for engineers because about 25 percent of all engineers in 1970 worked in defense related activities. The outlook for engineers presented is based on the assumption that defense activity as measured by expenditures will be somewhat higher than the level before the Vietnam buildup, approximating the level of the early 1960's. If defense activity should differ substantially from that level, the demand for engineers will be affected accordingly.

In addition to the level of defense expenditures, general business conditions, shifting National priorities, and nondefense related Federal programs and policies also influence the demand for engineers. Thus, the demand for engineers fluctuates periodically. The shortrun demand can either exceed or fall short of the number of engineers seeking professional employment. Over the longer run, however, indications are that engineers can look forward to favorable employment opportunities.

In addition to engineers for new positions, thousands will have to be trained to replace workers who transfer to other occupations, retire, or die. The preceding discussion analyzes the outlook for engineering as a whole. Various branches are discussed in statements later in this chapter.

Earnings and Working Conditions

New engineering graduates having the bachelor's degree and no experience earned an average of $10,400 a year in private industry in 1969–70 according to the College Placement Council. Master's degree graduates having no experience averaged almost $12,000 a year; Ph. D. graduates averaged about $16,000.

The accompanying tabulation shows varying starting salaries for bachelor degree graduates in 1969–70:

In the Federal Government in 1970 engineers having the bachelor's degree and no experience could start at $8,510 or $10,528 a year, depending on their college records. Beginning engineers having the bachelor's degree and 1 or 2 years of graduate work could start at $10,528 or $11,855. Those having the Ph. D. degree could begin at $13,493 or $14,665.

In colleges and universities, median salaries of engineers with the master's degree started at about $10,000 a year; and with the Ph. D. degree, $12,300 for a 9–10 month academic year. (Also see statement on College and University Teachers.)

Most engineers can expect an increase in earnings as they gain experience. For example, in 1970 according to an Engineering Manpower Commission Survey, the average (median) salary of engineers having 21 to 23 years of experience was $18,350, 78 percent higher than beginning engineers. Only 10 percent of those having 21 to 23 years of experience earned less than $13,700 a year, and 10 percent earned $25,600 or more. Some 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 outdoor location.

Starting salaries for engineers by branch, 1969–70

Branch	*Average*	*Lower decile* [1]	*Upper decile* [2]
Aeronautical engineering	$10,200	$10,000	$11,200
Chemical engineering	10,800	10,500	11,700
Civil engineering	10,000	9,400	11,000
Electrical engineering	10,400	10,000	11,300
Industrial engineering	10,200	9,700	11,100
Mechanical engineering	10,400	10,100	11,400
Metallurgical engineering	10,500	9,900	11,300

[1] 90 percent earned more than the amount shown.
[2] 10 percent earned more than the amount shown.

Sources of Additional 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.

Engineering Manpower Commission, 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 also may 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. Each can provide information about careers in the particular branch of engineering. Many other engineering organizations are listed in the following publications available in most libraries or from the publisher.

Engineering Societies Directory, published by Engineers Joint Council, 345 East 47th Street, New York, N.Y. 10017.

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), 1126 16th St. NW., Washington, D.C. 20036.

AEROSPACE ENGINEERS

(D.O.T. 002.081)

Nature of the Work

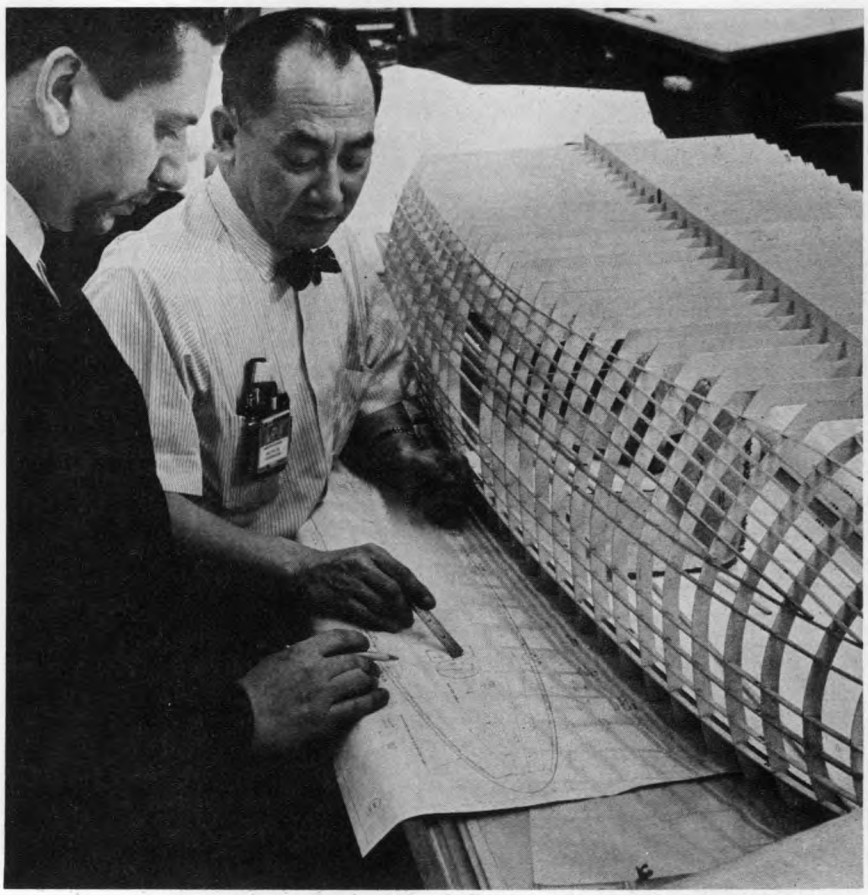
Aerospace engineers play a vital role in America's space activities. Engineers in this branch of the profession work on all types of aircraft and spacecraft including missiles, rockets, and conventional propeller-driven and jet-powered planes. They are concerned with all phases of the development of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

Aerospace engineers usually specialize in a particular area of work, such as structural design, navigational guidance and control, instrumentation and communication, simulation, propulsion, materials, testing, or production methods. They also may specialize in a particular type of aerospace product such as passenger planes, jet-powered military aircraft, rockets, launch vehicles, satellites, manned space capsules, or landing modules.

Engineers working in the aircraft field are usually called aeronautical engineers. Those in the field of missiles, rockets, and spacecraft often are referred to as astronautical engineers. However, engineers with degrees in aeronautics and astronautics are usually called aerospace engineers.

Places of Employment

More than 60,000 aerospace engineers were employed in early 1970, 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

Continuing developments in supersonic, subsonic, and vertical lift aircraft, and advancement in space and missile activities, such as the expansion of the Safeguard anti-ballistic-missile system (ABM) and space exploration followed by flights to the planets, should result in a moderate increase in requirements for aerospace engineers. Also, some aerospace firms may become active in other areas such as high speed ground transportation. Additional job opportunities also will arise from the need to replace engineers who transfer to other fields of work, retire, or die. However, engineers who are not well grounded in engineering fundamentals, and those whose specialization is very narrow, could be affected adversely by skill obsolescence caused by shifts in defense activities and by rapidly changing technology.

Employment requirements for aerospace engineers are particularly sensitive to changes in the level and mix of defense expenditures. Because of this, employment opportunities fluctuate periodically, and in the short run demand can fall short of the number of aerospace engineers seeking employment. Over the longer run, however, employment opportunities for aerospace engineers are expected to be favorable.

The outlook for aerospace engineers presented here is based on the assumption that defense activity as measured by expenditures will be reduced from the peak levels of the Vietnam conflict, although higher than the level just before the Vietnam conflict. If defense activity should differ substantially from that level, the demand for aerospace engineers would be affected accordingly. (See introductory section of this chapter for discussion on training requirements and earnings. See also chapter on Occupations in Aircraft, Missile, and Spacecraft Manufacturing.)

Sources of Additional Information

American Institute of Aeronautics and Astronautics, Inc., 1290 Avenue of the Americas, New York, N.Y. 10019.

AGRICULTURAL ENGINEERS

(D.O.T. 013.081)

Nature of the Work

Agricultural engineers use basic engineering principles and concepts to develop machinery, equipment and methods to improve the efficiency and economy of the production, processing, and distribution of food and other agricultural products. They are concerned primarily with the design of farm machinery, equipment, and structures; the utilization of electrical energy on farms and in food and feed 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.

Places of Employment

Most of the estimated 13,000 agricultural engineers in 1970 were employed in private industry, especially by manufacturers of farm equipment 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 employs about 600 agricultural engineers—chiefly in the Soil Conservation Service and Agricultural Research Service of the Department of Agriculture. Some are employed by colleges and universities and a few are employed by State and local governments.

Employment Outlook

Employment of agricultural engineers is expected to grow rapidly through the 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 expanding population—with a corresponding demand for food and fibre—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. See also chapter on Occupations in Agriculture.)

Sources of Additional Information

American Society of Agricultural Engineers, 2950 Niles Rd., St. Joseph, Mich. 49085.

BIOMEDICAL ENGINEERS

(D.O.T. 019.481)

Nature of the Work

Biomedical engineers use engineering principles to solve medical and health related problems. Most biomedical engineers do research, working with life scientists, chemists, and the medical profession to study the engineering aspects of the biological systems of man and animals. Some design and develop medical instruments and devices that now include artificial hearts and kidneys to assist medical personnel in observing, mitigating, or alleviating physical ailments or deformities. Biomedical engineers have developed lasers for surgery and cardiac pacemakers for regulating the heartbeat. Other biomedical engineers adapt the computer to medical science, for example, computers to monitor patients and process electrocardiograph data. Biomedical engineers also design and construct systems which mechanize and automate laboratory and clinical procedures. A few biomedical engineers sell medical instruments and equipment to doctors, research centers, and hospitals.

Places of Employment

In 1970 most of the estimated 3,000 biomedical engineers were teaching and doing research in colleges and universities. Some were employed by the Federal Government, primarily in the National Aeronautics and Space Administration. Some work in State institutions and a growing number are employed in private industry to develop new apparatus, processes, and techniques, or in sales related positions.

Employment Outlook

Employment opportunities for biomedical engineers are expected to be very favorable through the 1970's. Although biomedical engineering currently is a small field and has few openings compared with the larger branches of engineering, the number of graduates also is small. Thus, opportunities should be very favorable for both new graduates and qualified scientists and engineers.

M.S. and Ph. D. graduates will be in strong demand to teach and fill positions resulting from increased expenditures for research in areas such as prosthetics and cybernetics. Research could create new positions in instrumentation and systems for the delivery of health services. (See introductory sections of this chapter for a discussion on training requirements and earnings.)

Sources of Additional Information

Alliance for Engineering in Medicine and Biology, 3900 Wisconsin Ave. NW., Suite No. 300, Washington, D.C. 20016.

Biomedical Engineering Society, P.O. Box 1600, Evanston, Illinois 60204.

Foundation for Medical Technology, Mt. Sinai Medical Center, 100 St., 5th, Ave., New York, N.Y. 10029.

CERAMIC ENGINEERS

(D.O.T. 006.081)

Nature of the Work

Ceramic engineers are concerned with one of the world's oldest and yet newest technologies. They 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 to manufacture these products. Many ceramic engineers are engaged in research and development. 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); whitewares (such as porcelain and china dinnerware or high voltage electrical insulators); structural materials (such as brick, tile, and terra cotta); electronic ceramics (such as ferrites for memory systems and microwave devices); protective and refractory coatings for metals; glass; abrasives; and fuel elements for atomic energy.

Places of Employment

Most of the estimated 10,000 ceramic engineers in 1970 were employed in manufacturing industries —primarily in the stone, clay, and glass industries. Others worked in the iron and steel, electrical equipment, aerospace, and chemical in-

dustries 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 1970's. Although ceramic engineering is a small field and has few openings in a year compared with large branches of engineering, the number of graduates also is 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 whitewares and abrasives, for consumer and industrial use also will 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. Furthermore, the development of new glasses of unusual properties and the expanding use of conventional glasses in the construction and container field probably will create additional openings for ceramic engineers. (See introductory section of this chapter for discussion on training requirements and earnings.)

Sources of Additional Information

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

CHEMICAL ENGINEERS

(D.O.T. 008.081)

Nature of the Work

Chemical engineers design plants and equipment to manufacture chemicals and chemical products. They also determine the most efficient manufacturing process, which requires a knowledge of chemistry, physics, and mechanical and electrical engineering. They often design and operate pilot plants to test their work.

Chemical engineer checks water quality.

This branch of engineering is so diversified and complex that chemical engineers frequently specialize in a particular operation such as oxidation or polymerization. Others specialize in the manufacture of a specific product, such as plastics or rubber. Chemical engineers may engage in research and development, production, plant operation, design, sales, management, or teaching.

Places of Employment

Approximately four-fifths of the estimated 50,000 chemical engineers in the United States in 1970 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 moderate growth of employment in chemical engineering through the 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 a large portion of chemical engineers are employed. The growing complexity of chemical processes and the automation of these processes, will require additional chemical engineers for work related to designing, building, and maintaining the necessary plants and equipment. Chemical engineers also will be needed in many relatively new areas of work, such as environmental control and the design and development of nuclear

reactors, and in research to develop new and better solid and liquid fuels for missiles and rockets. Furthermore, new chemicals used in the manufacture of consumer goods, such as plastics and manmade fibers, probably will create additional openings. (See introductory section of this chapter for discussion on training requirements and earnings. See also the statement on Chemists and chapter on Occupations in the Industrial Chemical Industry.)

Sources of Additional Information

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

CIVIL ENGINEERS

(D.O.T. 005.081)

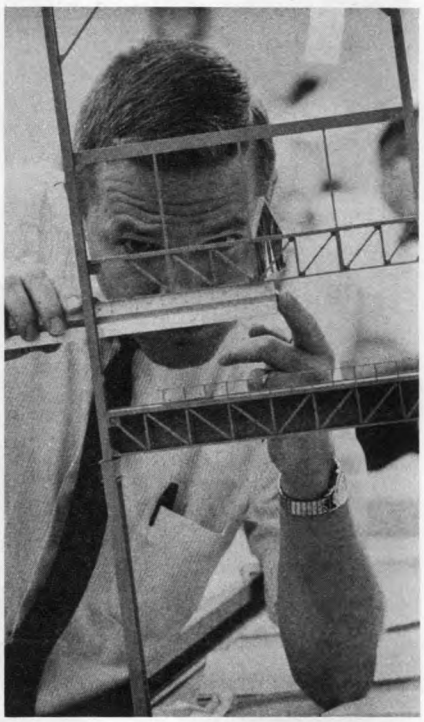
Nature of the Work

Civil engineers design and supervise the construction of roads, harbors, airfields, tunnels, bridges, water supply and sewage systems, and buildings. Major specialties within civil engineering are structural, hydraulic, sanitary, transportation (including highways and railways), and soil mechanics.

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

Places of Employment

Approximately 185,000 civil engineers were employed in the United States in 1970. 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 sometimes stationed in remote areas of the United States or in foreign countries. Furthermore, civil engineers in some positions often are 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 1970's.

The expanding employment opportunities for civil engineers will result from the growing needs for housing, industrial buildings, and highway transportation systems created by an increasing population and expanding economy. Work related to the problems of urban environment, 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 also be needed each year to replace those who retire or die. (See introductory section of this chapter for discussion on training requirements and earnings.)

Sources of Additional Information

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

ELECTRICAL ENGINEERS

(D.O.T. 003.081, .151, and .187)

Nature of the 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 applicances 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.

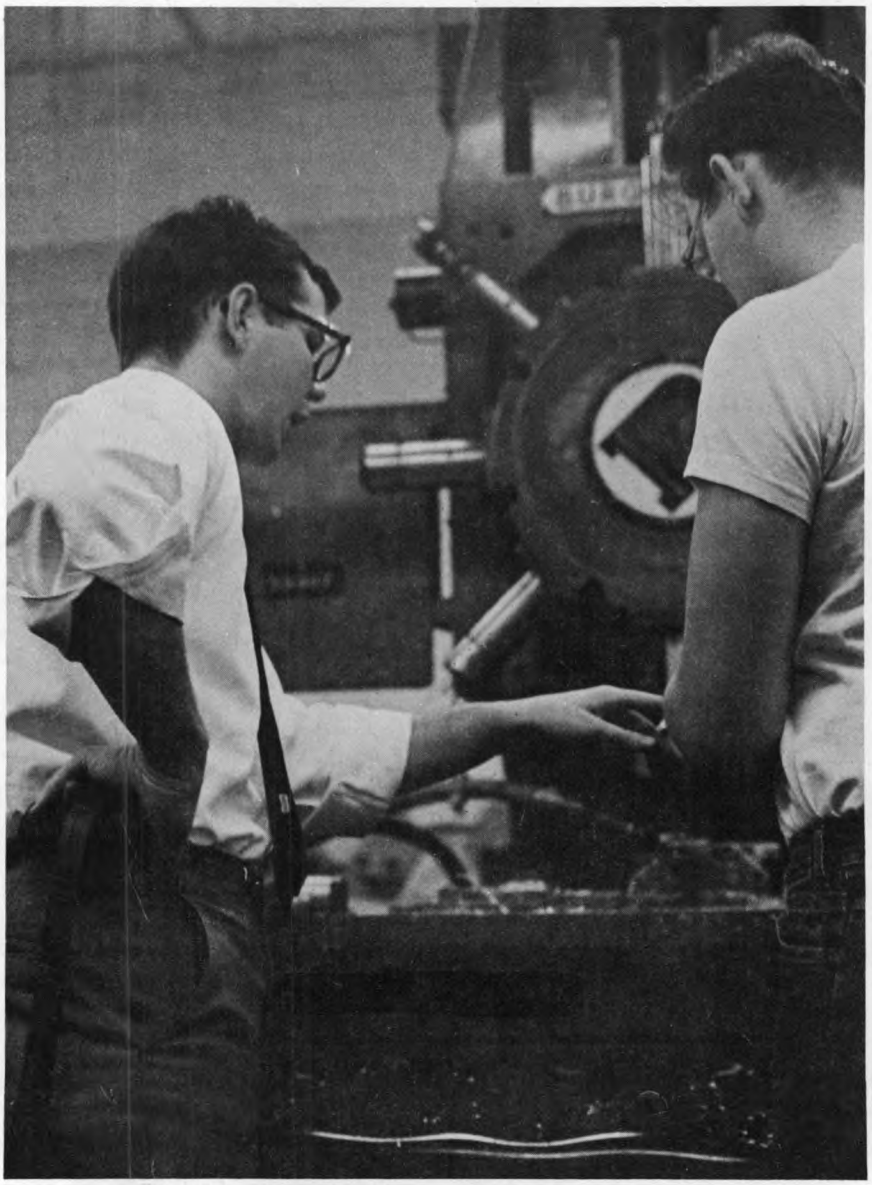
Places of Employment

Electrical engineering is the largest branch of the profession. It is estimated that more than 235,000 electrical engineers were employed in the United States in 1970 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

Employment opportunities for electrical engineers are expected to increase very rapidly through the 1970's. An increased demand for electrical equipment to automatically control production processes, using such items as computers and sensing devices, is expected to be among the major factors contributing to this growth. The anticipated growing demand for electrical and electronic consumer goods also is expected to create many job openings for electrical engineers.

The outlook for electrical engineers presented here is based on the assumption that defense activity (as measured by expenditures) will be reduced from the peak levels of the Vietnam conflict, although higher than the level just before the Vietnam conflict. If defense activity



Industrial engineer works with machine tool operator to set up production.

should differ substantially from that level, the demand for electrical engineers would be affected accordingly.

In addition to those needed to fill new positions, many electrical engineers will be needed to replace personnel who retire or die. (See introductory section of this chapter for discussions of training requirements and earnings. See also chapter on Occupations in Electronics Manufacturing.)

Sources of Additional Information

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

INDUSTRIAL ENGINEERS

(D.O.T. 012.081, .168 and .188)

Nature of the Work

Industrial engineers determine the most effective methods of using the basic factors of production—manpower, machines, and materials. They are concerned with people and "things," in contrast to engineers in other specialties who generally are concerned more with developmental work in subject fields, such as power, and mechanics.

They may design systems for data processing and apply operations research techniques to complex organizational, production, and related problems. Industrial engineers also develop management control systems to aid in financial planning and cost analysis; design production planning and control systems to insure coordination of activities and to control the quality of products; and may design and improve systems for the physical distribution of goods and services. Other activities of industrial engineers include plant location surveys, where consideration is given to sources of raw materials, availability of a work force, financing, and taxes; and the development of wage and salary administration and job evaluation programs.

Places of Employment

More than two-thirds of the estimated 125,000 industrial engineers employed in early 1970 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 and educational institutions. A few were independent consulting engineers.

Employment Outlook

The outlook is for very rapid growth of employment in this branch of the profession through the 1970's. The increasing complexity of industrial operations and the expansion of automated processes, coupled with the 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 also is expected to stimulate 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. (See introductory section of this chapter for discussion on training requirements and earnings.)

Sources of Additional Information

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

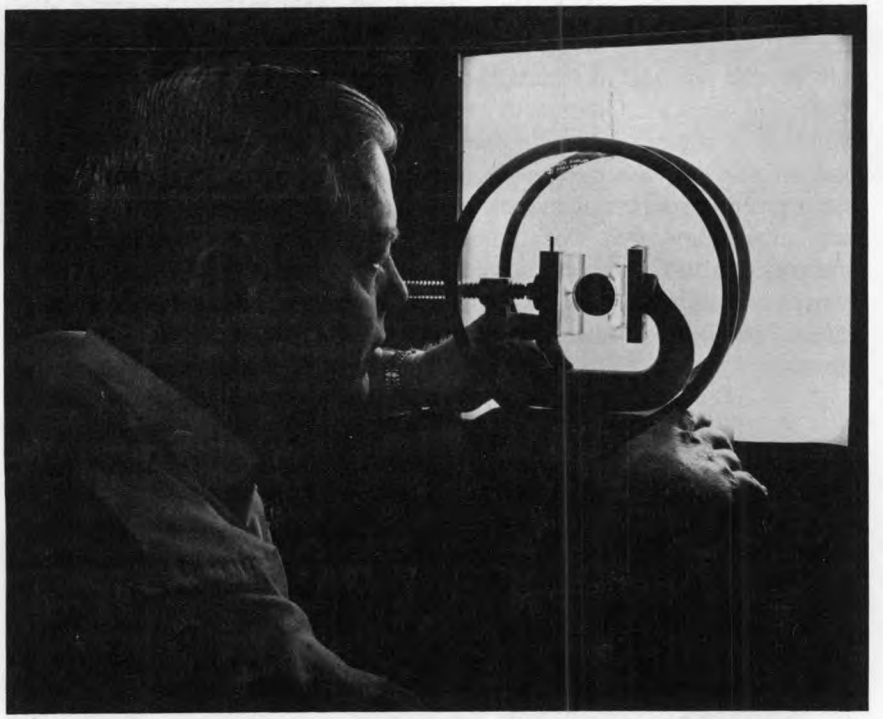
MECHANICAL ENGINEERS

(D.O.T. 007.081, .151, .168, .181, and .187; 011.081; and 019.187)

Nature of the 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, and because they are employed in nearly all industries, their specific work varies with the industry and the function performed. Among these specialties are those concerned with motor vehi-



Mechanical engineer examines model of ball bearing.

cles, 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 also are 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.

Places of Employment

About 220,000 mechanical engineers were employed in the United States in 1970. Nearly all manufacturing and nonmanufacturing industries employed some members of the profession. However, nearly three-fourths 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.

Employment Outlook

The outlook in mechanical engineering—the second largest branch of the profession—is for rapid growth through the 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 also will be a factor in the growth of this branch of the profession. Moreover, newer areas of work, such as atomic energy, aerospace development, and environmental control, 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. (See introductory section of this chapter for discussion on training requirements and earnings.)

Sources of Additional Information

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

METALLURGICAL ENGINEERS

(D.O.T. 011.081)

Nature of the 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 involves the extraction of metals from ores and their refining 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. Scien-

tists working in this field are known as metallurgists, but the distinction between scientists and engineers in this field is small. Persons working in the field of metallurgy are sometimes referred to as either materials scientists or materials engineers.

Places of Employment

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 1970. Many metallurgical engineers worked in the machinery, electrical equipment, and aircraft and parts industries. Others were employed in the mining industry, 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 1970's. Increasing numbers of metallurgical engineers will be needed by the metalworking industries to work on problems involving the development of new metals and alloys as well as the adaption of current ones 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 also will be needed to solve metallurgical problems connected with the efficient use of nuclear energy. Furthermore, as the supply of highgrade 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 discussions on training requirements and earnings. Also see chapter on Occupations in the Iron and Steel Industry.)

Sources of Additional Information

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

American Society of Metals, Metals Park, Ohio 44073.

MINING ENGINEERS

(D.O.T. 010.081 and .187)

Nature of the Work

Mining engineers find and extract minerals from the earth and prepare 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, power, communications, and maintenance of equipment. Some mining engineers work with geologists and metallurgical engineers to locate and appraise new ore deposits. Others develop new mining equipment and devise improved methods to process 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 engineering profession —Petroleum Engineering.

Places of Employment

Most of the estimated 5,000 mining engineers were employed in the mining industry in 1970. Some worked in colleges and universities or government agencies, or as independent consultants. Others worked for firms producing equipment for the mining industry.

Mining engineers are usually employed at the location of mineral deposits, often near small communities. However, those engaged in research, teaching, management, consulting, or sales are often located in large metropolitan areas.

In addition to mining engineers, many other engineers in different branches also are employed in the mining industry.

Employment Outlook

Employment opportunities for mining engineers are expected to be favorable through the 1970's. The number of new graduates in mining engineering entering the industry is expected to be fewer than the number needed to provide for the anticipated growth in requirements and to replace those who retire, transfer to other fields of work, or die.

Exploration for minerals is increasing, both in the United States and in other parts of the world. Easily mined deposits are being depleted, creating a growing need for engineers to mine newly discovered

mineral deposits and to devise more efficient methods for mining low-grade ores. Additional employment opportunities for mining engineers will arise as new alloys and new uses for metals increase the demand for less widely used ores. Recovery of metals from the sea and the development of recently discovered oil shale deposits could present major challenges to the mining engineer. (See introductory section to chapter for discussion on training requirements and earnings. See also chapter on Mining.)

Sources of Additional Information

The Society of Mining Engineers of the 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 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, is the work of large numbers of workers employed behind the scenes in other health service occupations, such as laboratory or X-ray technician. Altogether, more than 3.5 million people were employed in health related occupations in 1970. Employment in this field has increased rapidly in recent years.

Nurses, physicians, pharmacists, and dentists constituted the largest professional health occupations in 1970, and ranged from 103,000 dentists to 700,000 registered nurses. Other professional health occupations 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—1.2 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 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, radiologic technologist, medical technologist, dietitian, physical therapist, occupational therapist, speech pathologist and audiologist, dental hygienist, dental assistant, and medical record librarian. On the other hand, most 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 1970's, although the rates of growth will differ considerably among individual health occupations. The factors that are expected to contribute to an increase in the demand for health care are the following: The country's expanding population; rising standards of living; increasing health consciousness; growth of coverage under prepayment programs for hospitalization and medical care, including Medicare; 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 for women—leave the field for other reasons. Thus, many opportunities will be available for employment in the health services.

PHYSICIANS

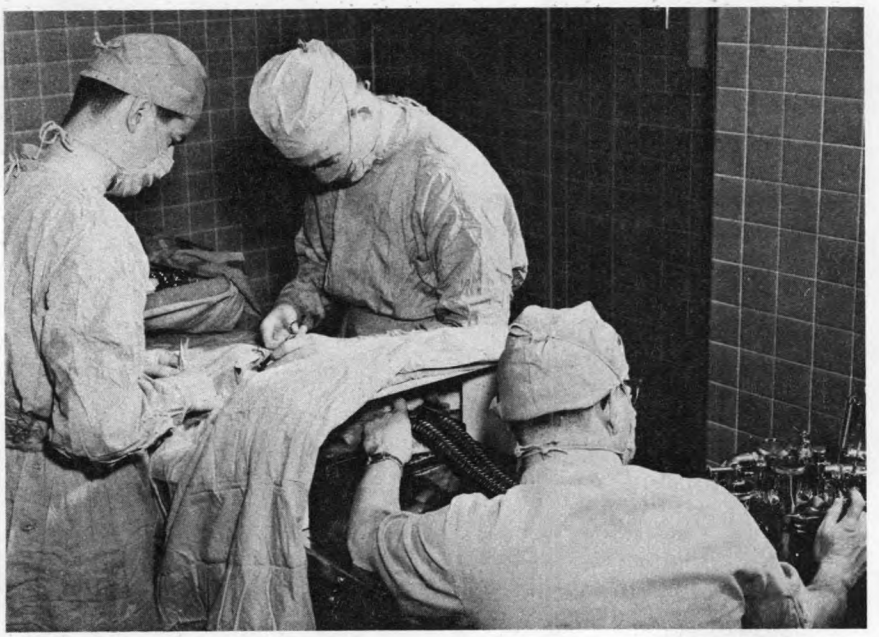
(D.O.T. 070.101 and .108)

Nature of the Work

Physicians diagnose diseases and treat people who are 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.

In 1970, one-fifth of the physicians providing patient care were general practitioners; the others specialized in 1 of the 33 fields recognized by the medical profession. In recent years, the trend has been toward specialization. Among the largest specialties are internal medicine, general surgery, obstetrics and gynecology, psychiatry, pediatrics, radiology, anesthesiology, oph-



thalmology, pathology, and orthopedic surgery.

Places of Employment

More than 305,000 physicians—of whom 7 percent were women—were professionally active in the United States in 1970. About 90 percent were primarily engaged in providing patient care services. More than 190,000, or 7 out of 10 of these, were in office based practice; nearly 83,000 were interns, residents, or full-time staff in hospitals. Nearly 32,000 physicians were working primarily in activities other than providing patient care services such as medical teaching, administration, and research.

In 1970, about 40 percent of all nonfederal physicians were in 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 33 States and the District of Columbia—serve a 1-year hospital internship. As of 1970, 16 States permitted a candidate to take the medical licensing examination upon graduation from medical school. Eleven States and the District of Columbia require candidates to pass a special 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 47 States and the District of Columbia as a substitute for State examinations. Although physicians licensed in one State usually can obtain a license to practice in another without further examination, some States limit this reciprocity.

In 1970, there were 92 approved schools in the United States in which students could begin the study of medicine. Eighty-six awarded the degree of Doctor of Medicine (M.D.) to those completing the 4-year course; 6 offered 2-year programs in the basic medical sciences to students who could then transfer to regular medical schools for the last 2 years of study. Eight additional new schools were enrolling medical students, but had not yet graduated a 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 having exceptional qualifications to begin their professional study after completing 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; and his scores on the Medical College Admission Test, which is taken by almost all applicants. Consideration also is given to the applicant's character, personality, and leadership qualities, as shown by personal in-

terviews, 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 school training generally are spent primarily 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 acquiring 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 certified 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 serve as hospital interns and residents in this country. In 1970, this group numbered about 16,000 including citizens of foreign countries as well as U.S. citizens. 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, as amended, provides Federal funds for loans and scholarships of up to $2,500 a year to help needy students pursue full-time study leading to the degree of Doctor of Medicine.

Persons considering entering the medical profession must have a strong desire to serve the sick and injured. They must be willing to study a great deal to keep up with the latest advances in medical science. Besides being one of the most exacting sciences, medicine demands that practitioners strictly adhere to high moral standards subscribed to by the profession, law, and tradition. Sincerity and a pleasant personality are assets which help physicians gain the confidence of patients. In addition, prospective physicians should be emotionally stable and able to make decisions in emergencies.

The majority of newly qualified physicians open their own offices. Those who have completed their internships and enter active military duty initially serve as captains in the Army or Air Force or as lieutenants in the Navy. Graduates of accredited medical schools are eligible for commissions as senior assistant surgeons (equivalent to lieutenants in the Navy) in the U.S. Public Health Service, as well as for Federal Civil Service professional medical positions.

Employment Outlook

Excellent opportunities are anticipated for physicians through the 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 this legislation may not be significant until the late 1970's.

Increased demand for physicians' services will result from factors such as the anticipated population growth, including rising numbers of older persons—the group requiring extensive physicians' services; the increasing health consciousness of the public; and the trend toward higher standards of medical care. The demand for physicians also will increase because of the extension of prepayment programs for hospitalization and medical care, including Medicare and Medicaid; 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. 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.

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 engaging 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 1970 had an average annual salary of $7,045 in hospitals affiliated with medical schools and $7,435 in other hospitals. Residents during 1970 earned average annual salaries of $8,250 in hospitals affiliated with medical schools and $8,750 in nonaffiliated hospitals, according to the American Medical Association. Many hospitals also provided full or partial room, board, and other maintenance allowances to their interns and residents.

Graduates employed by the Federal Government in 1970 could expect to receive an annual starting salary of about $15,200 if they had completed their internship, and about $17,800 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 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 providing patient care services was generally between $34,000 and $39,000 in 1970, according to the limited information available. 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. Self-employed physicians usually earn more than those in salaried positions, and specialists usually earn considerably more than general practitioners. Many physicians have long working days and irregular hours. Most specialists work fewer hours each week than general practitioners. As doctors grow older, they may not accept new patients and tend to work fewer hours. However, many continue in practice well beyond 70 years of age.

Sources of Additional 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, American Medical Association, 535 North Dearborn St., Chicago, Ill. 60610.

Association of American Medical Colleges, One Dupont Circle NW., Washington, D.C. 20036.

OSTEOPATHIC PHYSICIANS

(D.O.T. 071.108)

Nature of the Work

Osteopathic physicians diagnose, prescribe remedies, and treat diseases of the human body. They pay particular attention to impairments in the musculoskeletal 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, ophthalmology and otorhinolaryngology, pediatrics, anesthesiology, physical medicine and rehabilitation, dermatology, obstetrics and gynecology, pathology, proctology, radiology, and surgery.

Places of Employment

About 13,500 osteopathic physicians were practicing in the United States in 1970; approximately 7 percent were women. Nearly all of them were in private practice. Less than 5 percent had full-time salaried positions, mainly in osteopathic hospitals and colleges. A few were employed by private industry or government agencies.

Osteopathic physicians are lo-

cated chiefly in those States which have osteopathic hospital facilities. In 1970, about half of all osteopathic physicians were in Michigan, Pennsylvania, Ohio, Missouri, and Texas. Twenty-three 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 having less than 50,000 people; 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 1970, licensed osteopathic physicians were qualified to engage in all types of medical and surgical practice in 48 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; 29 States and the District of Columbia also require a period of internship in an approved hospital after graduation from an osteopathic school. All States except Alaska, California, Florida, and Mississippi 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 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, 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 80 osteopathic hospitals which the American Osteopathic Association has approved for intern training. Those who wish to become specialists must have 3 to 5 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, as amended, provides Federal funds for loans and scholarships of up to $2,500 a year to help needy students pursue full-time study leading to the degree.

Every year, more young people apply for admission to the 7 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 1970, over 90 percent 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 fields 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, persons wishing to become osteopathic physicians should study carefully the professional and legal requirements of the State in which they plan to practice. The availability of osteopathic hospitals and clinical facilities also should be considered when choosing a location.

Persons desiring to become osteopathic physicians must have a strong desire to practice osteopathic principles of healing. They should have a keen sense of touch, emotional stability, self-confidence, and perseverance. A pleasant personality, friendliness, patience, and the ability to deal with people are important.

Employment Outlook

Opportunities for osteopathic physicians are expected to be excellent through the 1970's. Greatest demand for their services probably will continue to be in States 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 through the 1970's because of factors such as the anticipated population growth, the extension of prepayment programs for hospitalization and medical care including Medicare and Medicaid, 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 1970's probably will be needed to replace osteopathic physicians 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 1970's.

Earnings and Working Conditions

In osteopathy, as in many of the other health professions, incomes usually rise markedly after the first few years of practice. Earnings of individual practitioners are determined mainly by 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 1970, ranged from $25,000 to $30,000, according to the limited data available. Specialists usually had higher incomes than general practitioners.

Many osteopathic physicians work more than 50 or 60 hours a week. Those in general practice work longer and more irregular hours than specialists.

Sources of Additional 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.

DENTISTS

(D.O.T. 072.108)

Dentists examine teeth and other tissues of the mouth to diagnose diseases or abnormalities. They take X-rays where necessary, fill cavities in the teeth, straighten teeth, and treat gum diseases. Dentists extract teeth and substitute artificial dentures especially designed for the individual patient. They also perform corrective surgery of the gums and supporting bones. In addition, they may clean teeth.

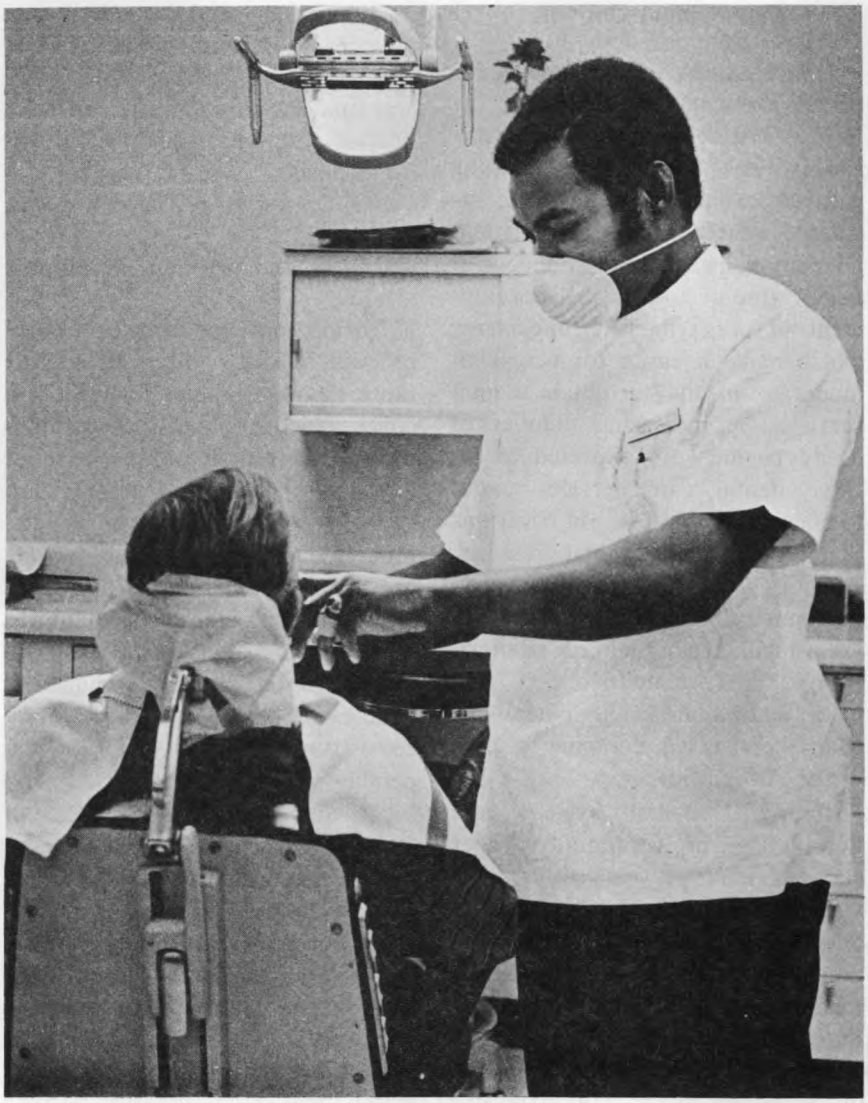
Dentists spend most of their time with patients, but may devote some time to laboratory work such as making dentures and inlays. Many dentists, however—particularly in large cities—send most of their laboratory work to commercial firms. Some dentists also employ dental hygienists to clean patients' teeth and for other duties. (See statement on Dental Hygienists.) They also may employ other assistants who perform office work and assist in "chairside" duties.

Most dentists are general practitioners who provide many types of dental care; approximately 9 percent are specialists. Nearly half of these specialists are orthodontists, who straighten teeth. The next larger number, oral surgeons, operate in the mouth and jaws. The remainder specialize in pedodontics (dentistry for children); periodontology (treating the tissues that support the teeth); prosthodontics (making artificial teeth or dentures); endodontics (root canal therapy); public health dentistry; and oral pathology (diseases of the mouth).

About 3 percent of all dentists are employed primarily in work that does not involve "chairside" practice, such as teaching, research, and administration. Many dentists in private practice, however, do this work on a part-time basis.

Places of Employment

Approximately 103,000 dentists were at work in the United States in 1970. About 9 of every 10 were in private practice. Of the remainder, about 6,500 served as commissioned officers in the Armed Forces; about 1,300 had other types of Federal Government positions—chiefly in the hospitals and clinics of the Veterans Administration and the



Public Health Service; and some 3,500 held full-time positions in schools, hospitals, or State and local health agencies. Women dentists represented only about 1 to 2 percent of the profession.

Dentists tend to be concentrated in large cities and in populous States. In early 1970, about a third of all dentists were located in 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 1970, 48 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 13 States, however, a dentist cannot be licensed as a "specialist" unless he has 2 or 3 years of graduate education, and 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.

Ordinarily, 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; 23 of the 53 dental schools in operation in the United States in 1970 required 3 years of predental study. Predental education must include courses in sciences and the humanities.

In dental college, the first 2 years are usually devoted to classroom instruction and laboratory work in basic sciences such as anatomy, microbiology, and physiology. 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 13 schools.

Competition is keen for admittance to dental schools. In selecting students, schools give considerable weight to college grades and amount of college education; more than half the students enrolling in dental schools have bachelor's degrees. In addition, all dental schools participate in a nationwide admission testing program, and scores earned on these tests are considered along with information gathered about the applicant through recommendations and interviews. Many State-sup-

ported dental schools also give preference to residents of their particular States.

Dentists interested in research, in teaching, or in becoming specialists must complete advanced dental programs operated by dental schools, hospitals, and other institutions of higher education. These programs last 2 to 4 years.

Dental education is very costly because of the length of time required to earn the dental degree. However, the Health Professions Educational Assistance Act of 1963, as amended, provides Federal funds for loans and scholarships of up to $2,500 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. The ability to instill confidence, self-discipline, 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 established dentists, 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. Graduates of recognized dental schools are eligible for Federal Civil Service positions and for commissions (equivalent to lieutenants in the Navy) in the U.S. Public Health Service.

Employment Outlook

Opportunities for dentists are expected to be very good through the 1970's. The demand for dental services is expected to increase along with an expanding population; increased awareness that regular dental care helps prevent and control dental diseases; and the development of prepayment arrangements which make it easier for people of moderate means to obtain dental service. An increasing number of needy persons are expected to receive dental care services under Medicaid programs in various States. 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. Many 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.

Newly trained dentists will be needed not only to fill new openings, but also to replace dentists who retire or die.

Despite the favorable outlook for dentists, 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. The average income of dentists in 1970 was about $29,000 a year, according to limited information available. In the Federal Government, new graduates of dental schools could expect to receive starting yearly salaries, depending on college records and other qualifications, ranging from $11,905 to $14,192.

Location is one of the major factors affecting the income of dentists who open their own offices. For example, in high-income urban areas dental services are in great demand; however, a practice can be developed most quickly in small towns where new dentists easily become known and where 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 45 hours a week, although many spend more than 50 hours a week in the office. Dentists often work fewer hours as they grow older, and a considerable

number continue in part-time practice well beyond the usual retirement age.

Sources of Additional Information

People wishing to practice in a given State should get the requirements for licensure from the board of dental examiners of that State. Lists of State boards and of accredited dental schools, as well as information on dentistry as a career, may be obtained from:

American Dental Association, Council on Dental Education, 211 East Chicago Ave., Chicago, Ill. 60611.

American Association of Dental Schools, 211 East Chicago Ave., Chicago, Ill. 60611.

DENTAL HYGIENISTS

(D.O.T. 078.368)

Nature of the Work

Dental hygienists work under the supervision of a dentist. They remove deposits and stains from the teeth and apply prescribed medicaments to teeth for the control of dental decay. While performing this work (oral prophylaxis), dental hygienists take and record medical and dental histories, prepare diagnostic tests for interpretation by the dentist, and chart conditions of decay and disease for diagnosis by the dentist. They take and develop dental X-ray films, sterilize instruments, and maintain patient records. They also may mix filling compounds and act as chairside assistants to dentists. Hygienists teach people the techniques of mouth care and proper diet.

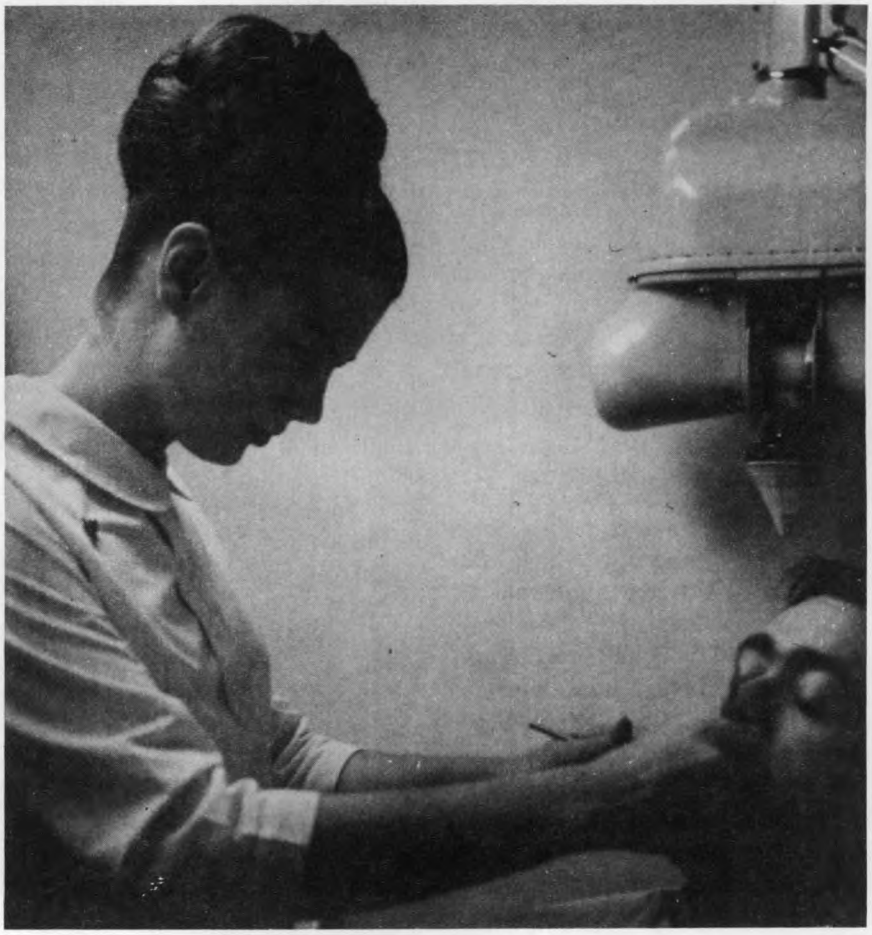
Dental hygienists working in school systems promote dental health by examining children's teeth, assisting dentists in determining the dental treatment needed, and reporting their findings to parents. They also perform oral prophylaxes and give instruction on correct care and brushing of teeth. Some 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 having advanced training may teach in schools of dental hygiene.

Places of Employment

Approximately 16,000 dental hygienists were employed in 1970; most of them were women. Many work part time. Most were employed in private dental offices. Others worked for public health agencies, school systems, industrial plants, clinics, hospitals, and dental hygiene schools. Some worked as civilian employees of the Armed Forces.

Training and Other Qualifications

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



In all States except Alabama, eligibility for a license is limited to graduates of accredited dental hygiene schools. In 1970, candidates in 48 States and the District of Columbia could complete part of the State licensing requirements by passing a written examination given by the National Board of Dental Examiners. 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 pass that State's examination.

In 1970, more than 100 schools of dental hygiene in the United States were accredited or provisionally accredited by the Council on Dental Education of the American Dental Association. Most of these schools provide a 2-year certificate or associate degree program. Some have 4-year programs leading to the bachelor's degree in dental hygiene and others offer both programs. Programs leading to a master's degree are offered in five schools.

For dental hygienists interested in practicing in a private dental office, completion of the 2-year program generally is sufficient. In order to work in research, teaching, and in public or school health programs, the completion of a 4-year program usually is 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. Many 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 subjects such as anatomy, chemistry, histology, pathology, pharmacology, and nutrition.

Young persons planning careers as dental hygienists should enjoy working with people. The ability to put patients at ease in an uncomfortable situation is helpful. Other important qualities include personal neatness and cleanliness, manual dexterity, and good health.

Employment Outlook

Employment opportunities for dental hygienists are expected to be very good through the 1970's. Despite an anticipated rise in the number of graduates from schools of dental hygiene, the demand is expected to be greater than the number available for employment.

The demand for hygienists is expected to increase as a result of the expanding population and the growing awareness of the importance of regular dental care. Increased participation in dental prepayment plans and more group practice among dentists will result in new jobs for dental hygienists. Increasing interest in dental care programs for children also may lead to more employment opportunities in this field. In addition, a great number of job openings will be created by young women leaving 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 very 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 area where the job is located. Dental hygienists working in private dental offices usually are salaried employees, although some are paid a commission for work performed or a combination of salary and commission. Those employed in research, administrative, supervisory, or teaching positions generally earn higher salaries.

Salaries of dental hygienists who were graduates of 2-year training programs averaged about $6,000 to $7,000 a year in 1970; graduates of 4-year baccalaureate programs averaged $7,000 to $8,000. The annual beginning salary for a dental hygienist employed by the Federal Government was either $5,853 or $6,548 in late 1970, depending on education and experience.

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 or more dentists.

Although most dental hygienists are employed in clean, well-lighted offices, their work may force them to stand for long periods of time. Important health protections for persons in this occupation are regular medical checkups and strict adherence to established procedures for using X-ray equipment and for disinfection.

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, retirement, and health insurance benefits as other workers in these organizations.

Sources of Additional Information

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

Division of Educational Services, American Dental Hygienists Association, 211 East Chicago Ave., Chicago, Ill. 60611.

Other material on opportunities for dental hygienists is available from:

Division of Dental Health, Public Health Service, U.S. Department of Health, Education, and Welfare, Washington, D.C. 20201.

Information concerning licensing requirements can be obtained from the State Board of Dental Examiners in each State, or from National Board of Dental Examiners, 211 East Chicago Ave., Chicago, Ill. 60611.

DENTAL ASSISTANTS

(D.O.T. 079.378)

Nature of the Work

Dental assistants work with dentists as they examine and treat patients. The assistant makes the patient comfortable in the dental chair, prepares him for treatment, and obtains his dental records. As the dentist works, the assistant hands the proper instruments and materials to him and keeps the patient's mouth clear by using suction or other devices. The dental assistant may prepare impression and restorative materials for the dentists' use. She also may expose and process dental X-ray film as directed by the dentist. In addition, she sterilizes and cares for dental instruments.

Although dental assistants spend most of their time at chairside, they also perform a variety of other duties. Some perform simple technical work in the office laboratory such as making casts of the teeth and mouth from impressions taken by the dentist. These casts are used to make prosthetic devices. Some manage the office, and may arrange and confirm appoints, receive patients, keep treatment records, send statements and receive payment, and order dental supplies and materials.

The work of the dental assistant should not be confused with that of the dental hygienist. Dental assistants, for instance, do not perform work in the patient's mouth, such as oral prophylaxis (scaling and cleaning the teeth); this is done by hygienists. (See statement on "Dental Hygienists.")

Places of Employment

Nearly 91,000 persons were employed as dental assistants in 1970; practically all were women. About 1 out of 6 assistants were employed part-time.

Most dental assistants worked in private dental offices, either for individual dentists or for groups of dentists. Many of the remainder were employed in dental schools, hospital dental departments, State and local public health departments, or private clinics.

The Federal Government employed about 1,850 dental assistants in 1970 chiefly in the Public Health

Service, the Veterans Administration, and the Department of the Army.

Training, Other Qualifications, and Advancement

Most dental assistants employed in 1970 learned their skill on the job. An increasing number of dental assistants, however, are entering the occupation through formal post high school dental assisting programs. About 170 such programs were accredited by the Council on Dental Education of the American Dental Association (ADA) in mid-1970. Some of these were supported under Federal legislation, including the Manpower Development and Training Act of 1962, the Vocational Education Act of 1963 and the Allied Health Professions Personnel Training Act of 1966.

Most post high school courses in dental assisting are given in junior and community colleges or in vocational or technical schools. More than two-thirds of these programs provide a full academic year of training leading to a certificate or diploma. Graduates of 2-year programs—offered only in junior and community colleges—earn an associate degree upon completion of specialized training and 1 year of liberal arts courses. A few schools provide both 1- and 2-year programs. Completion of high school or its equivalent is the standard admission requirement of all the approved schools that offer courses in dental assisting. Some schools also may require typing or a science or business course.

Approved dental assisting curriculums include instruction in both skills and related theory—in laboratory and classroom—and usually a general occupational orientation. Trainees receive practical experience in an affiliated dental school, in local clinical facilities, or in selected dental offices.

A correspondence course approved by the American Dental Association is available for employed dental assistants who are learning on the job, or who otherwise are unable to participate in regular dental assisting programs on a full-time basis. The correspondence program is equivalent to 1 academic year of study but generally requires about 2 years to complete. Some proprietary schools also offer a 4- to 6-month course in dental assisting, but these are not accredited by the dental profession.

Graduates of dental assisting programs approved by the American Dental Association, who successfully complete an examination administered by the Certifying Board of the American Dental Assistants Association and who meet certain experience requirements, may become Certified Dental Assistants. Certification is acknowledgment of an assistant's qualifications but is not a general prerequisite for employment.

After working 1 or 2 years, dental assistants sometimes seek to further their skills by becoming dental hygienists. Prospective dental assistants who forsee this possibility should plan carefully, since credit earned in a dental assistant program usually is not applicable toward requirements for a dental hygiene certificate.

Employment Outlook

Employment opportunities for dental assistants are expected to be excellent through the 1970's, especially for graduates of academic programs in dental assisting. Part-time opportunities also will be very favorable.

Growing awareness of the importance of regular dental care and the increasing ability of persons to pay for care are among the factors underlying an anticipated rapid growth in the demand for the services of dental assistants. Other factors affecting demand are an increased participation in dental prepayment plans, and the expansion of public programs such as Medicaid and Head Start, which extend dental care services to the disadvantaged. Another important factor in the growing need for more dental assistants is the slow increase in the supply of dentists in proportion to population growth, resulting in the greater use of auxiliary workers.

In addition to the rapid growth of the occupation, many assistants also will be needed each year to replace the large number of women who leave the field for marriage and family responsibilities.

Earnings and Working Conditions

Weekly salaries of assistants employed in private dental offices ranged from $75 to $150 in 1970 according to the limited data available. Salary depends largely on the assistant's education and experience, the duties and responsibilities attached to the particular job, and the part of the country in which the job is located.

In the Federal Government, experience and the amount and type of education govern entrance salaries. In 1970, a person who had 6 months' related experience started at $5,212 a year; graduates of an ADA-approved 1-year training program who had an additional year of general experience could expect to start at $5,853 a year.

Although the 40-hour workweek prevails for dental assistants, the schedule is likely to include work on Saturday. A 2- or 3-week paid vacation is common. Sick leave and other benefits are dependent on the individual dentist. Dental assistants employed by the Federal Government receive the same employee benefits as other workers.

Dental assistants generally work in a well-lighted, clean environment. They must exercise caution in handling X-ray and other equipment, where strict adherence to proper procedure is indispensable for safety.

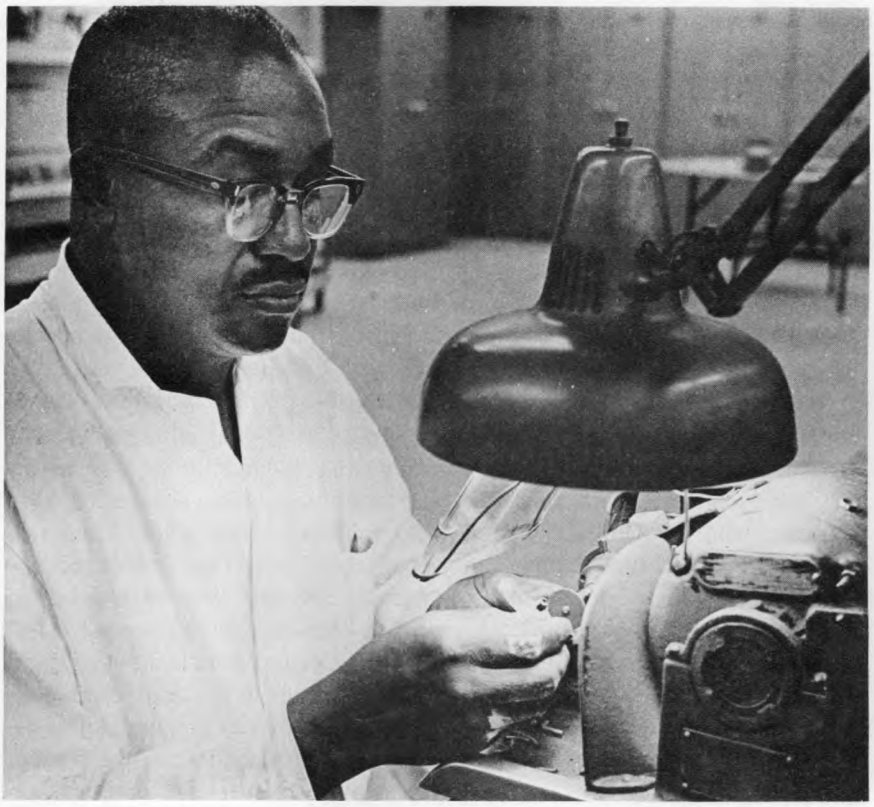
Sources of Additional Information

Information about career opportunities; scholarships; accredited dental assistant programs, including the correspondence programs; and requirements for certification may be obtained from:

American Dental Assistants Association, 211 East Chicago Ave., Chicago, Ill. 60611.

Other material on opportunities for dental assistants is available from:

Division of Dental Health, Public Health Service, U.S. Department of Health, Education, and Welfare, Washington, D.C. 20201.



DENTAL LABORATORY TECHNICIANS

(D.O.T. 712.381)

Nature of the Work

Today, dental laboratory technicians are employed to make dentures (artificial teeth), crowns, bridges, and other dental and orthodontic appliances once made by dentists. The technicians do not see patients but follow dentists' written instruction.

In making many dental appliances, the technicians form models in artificial stone (hard plaster) from impressions of patients' mouths taken by dentists. They also make metal castings for dentures, finish and polish dentures, construct metal or porcelain crowns or inlays for partially destroyed teeth, make bridges of gold and other metals, and make appliances to correct abnormalities such as cleft palates.

In beginning jobs, trainees usually perform relatively simple tasks such as mixing and pouring plaster into casts and molds. As they gain experience, they do more difficult laboratory work. Some dental laboratory technicians do all types of dental laboratory work. Others specialize in making crowns and bridges, arranging artificial teeth on dental appliances, processing plastic materials, working with dental ceramics (porcelain), or making castings of gold or nonprecious metal alloys. In performing their work, technicians use small handtools, special electric lathes and drills, high-heat furnaces, and other kinds of specialized laboratory equipment.

Places of Employment

An estimated 33,500 dental laboratory technicians were employed in 1970. Most worked in commerical laboratories, either as employees or as owners of the business. Commerical laboratories, which handle orders from dentists, usually employ

fewer than 10 technicians. However, a few large laboratories employ many technicians.

More than 7,500 dental laboratory technicians were employed full-time by individual dentists. Some worked in hospitals that provided dental services. Other were employed by the Federal Government, chiefly in Veteran's Administration hospitals and clinics and in the Department of the Army. Dental laboratory technicians also are employed by dental materials or equipment manufacturers as technical representatives or salesmen. Women, who account for about one-fifth of all full-time 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 States that have large populations.

Training, Other Qualifications, and Advancement

Although no minimum formal education is needed to enter this occupation, a high school diploma is an asset. Most dental laboratory technicians learn the craft on the job, usually in a commercial laboratory, a dental office, or a hospital offering dental services. Typically, on-the-job training lasts 3 or 4 years, depending on factors such 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, offered in a few public vocational high schools may be taken in conjunction with on-the-job training. Persons also may qualify by enrolling in 1- or 2-year programs in dental laboratory technology offered by junior colleges and other post-secondary educational institutions. Some of these training programs were supported by Federal legislation, including the Vocational Education Act of 1963, Manpower Development and Training Act of 1962, and the Allied Health Professions Personnel Training Act of 1966. Regardless of a student's educational background, employers consider actual work experience to be necessary for a person to qualify as a full-fledged technician.

In 1970, 2-year educational programs accredited by the American Dental Association were offered by 23 schools to high school graduates (or those with equivalent education). The first year of training in these schools includes formal classroom instruction in dental law and ethics, chemistry, ceramics, metallurgy, and other related subjects. During the second year, the student is provided supervised practical experience in the school or a dental laboratory. After completing the 2-year training program, the trainee generally needs an additional 3 years of practical experience in a dental office or a laboratory to become recognized as a well-qualified dental technician.

The National Association of Certified Dental Laboratories sponsors a certification program for dental laboratory technicians who can meet certain training and other requirements. Certification may become increasingly important for advancement as more employers regard it as 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 also may be given to young people who have completed high school courses in art, crafts, or sciences.

Employment Outlook

Job opportunities for well-qualified dental laboratory technicians are expected to be very good through the 1970's. The outlook for trainees also should be very favorable. In addition to an expected rapid increase in employment, many openings for dental laboratory technicians will occur because of 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 also should be able to establish laboratories of their own. A technician whose work has become known to several dentists in a community will have the best prospect of building a successful business.

Among the factors underlying the expected rapid growth in demand are the availability of new dental prepayment plans and the increasing number of older people requiring artificial dentures. Moreover, the number of dentists is not expected to keep pace with the demand for their services; hence, to devote more time to treatment of patients, dentists will send more and more of their laboratory work to commercial firms, or hire dental laboratory technicians to work directly for them.

Earnings and Working Conditions

Apprentice or trainee dental laboratory technicians employed in commercial laboratories in 1970

earned an average of $78 a week. Technicians having 10 years experience or more in commercial laboratories generally earned between $170 and $225 a week, depending on their skill level and experience. Ceramist technicians and crown and bridge technicians received the highest salaries. Foremen and managers in large dental laboratories may earn up to $300 per week. In general, net earnings of self-employed technicians are higher than those of salaried workers.

The starting salary for inexperienced dental laboratory technicians employed in the Federal Government was about $112 a week in 1970. Experienced dental laboratory technicians employed in the Federal Government generally earned between $166 and $195 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 also are 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. Most jobs in the field can be performed by handicapped workers provided they have good use of their hands and fingers.

Sources of Additional Information

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

American Dental Association, Council on Dental Education, 211 East Chicago Ave., Chicago, Ill. 60611.

Information on scholarships is available through schools conducting dental technology education programs or:

The American Fund for Dental Education, 211 East Chicago Ave., Chicago, Ill. 60611.

Information on apprenticeship programs may be obtained from:

The Dental Laboratory Conference, 1918 Pine St., Philadelphia, Pa. 19103.

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

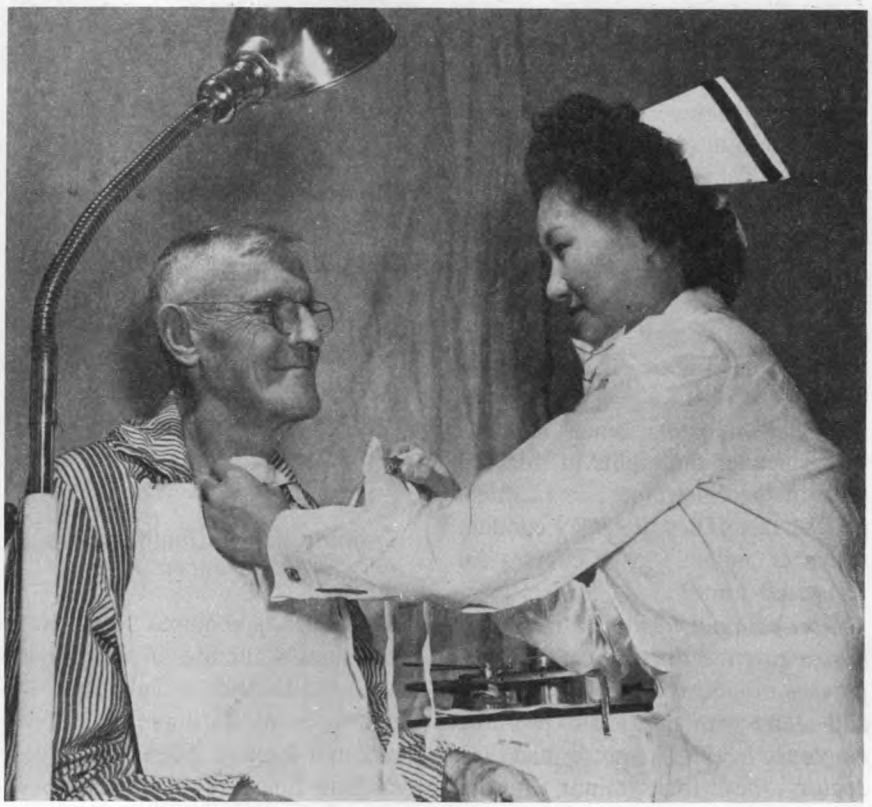
National Association of Certified Dental Laboratories, Inc., 3801 Mt. Vernon Ave., Alexandria, Va. 22305.

REGISTERED NURSES

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

Nature of the Work

Nursing care plays a major role in the treatment of persons who are ill. Registered nurses, in carrying out the medical treatment plan prescribed by physicians, administer medications and treatments; observe, evaluate, and record symptoms, reactions, and progess of patients; assist in the education and rehabilitation of patients; help maintain a physical and emotional environment that promotes patient recovery; instruct auxiliary personnel or students; and perform other duties involving care of the sick and injured, prevention of illness, and promotion of good health. Nurses may also engage in research activi-



ties or serve on the staffs of nursing and community organizations.

Hospital nurses are the largest group of registered nurses. Most are staff nurses, who perform skilled bedside nursing such as caring for a patient after an operation and giving medications. They also supervise auxiliary nursing workers. Hospital nurses usually work in a specialty area such as operating or recovery room. Others work with children, the elderly, or the mentally ill. Still others are engaged primarily in administration.

Private duty nurses give individual care to patients needing constant attention. The private duty nurse may sometimes care for several hospital patients who require special care but not full-time attention.

Office nurses assist physicians, dental surgeons, and occasionally dentists in private practice or clinics. Sometimes, they perform routine laboratory and office work.

Public health nurses care for patients in clinics or visit them in their homes. Their duties include instructing patients and families, and giving periodic care as prescribed by a physician. They instruct groups of patients in proper diet and arrange for immunizations. These nurses work with community leaders, teachers, parents, and physicians in community health education. Some public health nurses work in schools.

Nurse educators teach students the principles and skills of nursing, both in the classroom and in direct patient care. They also may 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 promote employee health. As prescribed by a doctor, they treat minor injuries and illnesses occurring at the place of employment, provide for the needed nursing care, arrange for further medical care if necessary, and offer health counseling. They also may assist with health examinations and inoculations.

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

Places of Employment

An estimated 700,000 registered nurses were employed in the United States in 1970. More than two-thirds worked in hospitals, nursing homes, and related institutions. Approximately 60,000 were private duty nurses who cared for patients in hospitals and private homes, and about 50,000 were office nurses. Public health nurses in government agencies, schools, visiting nurse associations, and clinics numbered more than 50,000; nurse educators in nursing schools accounted for about 31,000; and occupational health nurses in industry, approximately 20,000. Most of the others were staff members of professional nurse and other organizations, State boards of nursing, or were employed by research organizations.

More than one-fourth of all nurses employed in 1970 worked on a part-time basis. About 1 percent of all employed registered 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. Nurses 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 nursing. Three types of educational programs—diploma, baccalaureate, and associate degree—offer the basic education required for careers in registered 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 early 1970, more than 1,300 programs of these three types were offered in the United States. In addition, about 70 colleges and universities offered master's and doctoral degree programs in nursing.

Programs of nursing include classroom instruction and supervised nursing practice. Students take courses in anatomy, physiology, microbiology, nutrition, psychology, and basic nursing care. Under close supervision, in hospitals and health facilities, they receive clinical experience in caring for patients who have different types of health problems. Students in colleges offering bachelor's degree programs and in some of the other schools are assigned to public health agencies to 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.

Qualified students in need of financial aid may obtain a nursing scholarship or a low-interest loan

under Title II of the Health Manpower Act of 1968. Up to 50 percent of the amount of the loan may be cancelled at the rate of 10 percent for each year of full-time employment as a professional nurse in nurse training or service in any public or nonprofit institution or agency. Up to 100 percent of the loan plus interest may be cancelled at the rate of 15 percent a year for each complete year of service as a full-time professional nurse in a public or nonprofit hospital located in an area which has a substantial shortage of nurses at such hospitals. The Nurse Training Act also provides traineeship funds to cover tuition, fees, and a stipend and allowances for nurses seeking advanced training for positions as administrators, supervisors, nursing specialists, and nurse educators.

Young people planning nursing careers should have a desire to serve humanity and be sympathetic to the needs of people. Nurses must follow doctor's orders precisely and exhibit good judgment in emergencies. Good mental health is helpful in coping with human suffering and frequent emergency situations. Physical stamina may be required for staff nurses in institutions because of the amount of time spent walking and standing.

From staff positions in hospitals, experienced nurses may advance to head nurse, supervisor, assistant director, and director of nursing services. A master's degree, however, often is required for supervisory and administrative positions, as well as for positions in nursing education, clinical specialization, and research. In public health agencies, advancement is usually limited for nurses without degrees in public health nursing.

Employment Outlook

Employment opportunities for registered nurses are expected to be very good through the 1970's. For nurses who have had graduate education, the outlook is excellent for obtaining positions as administrators, teachers, clinical specialists, public health nurses, and for work in research.

The principal factors underlying the anticipated rise in the demand for nurses include a rising population; improved economic status of the population; extension of prepayment programs for hospitalization and medical care, including Medicare and Medicaid; 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 filling new positions, large numbers will be needed to replace those who leave the field each year because of marriage and family responsibilities.

Nurses wishing to return to work will find very good employment opportunities, either full or part time.

Earnings and Working Conditions

Annual starting salaries of registered nurses employed by hospitals in 1970 averaged about $7,400, according to a national survey conducted by the University of Texas Medical Branch. Registered nurses employed in nursing homes can expect to earn slightly less than those in hospitals. Salaries of industrial nurses averaged $147 a week in early 1970, according to a survey conducted by the Bureau of Labor Statistics (BLS).

Fees for private duty nurses generally were between $26 and $44 for a basic 8-hour day in early 1970, according to the American Nurses' Association (ANA).

In 1970, the Veterans Administration offered inexperienced nurses having a diploma or an associate degree an annual salary of $7,294; baccalaureate graduates were offered $8,519. Graduates of associate degree programs having 1 year of experience or those having a baccalaureate degree or diploma entered at $6,548 in other Federal Government agencies.

Most hospital nurses receive extra pay for work on evening or night shifts. Nearly all receive 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.

Sources of Additional Information

Information on approved schools of nursing, nursing careers, loans, scholarships, salaries, working conditions, and employment opportunities may be obtained from:

ANA-NLN Committee on Nursing Careers, 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.

LICENSED PRACTICAL NURSES

(D.O.T. 079.378)

Nature of the Work

Licensed practical nurses assist in caring for persons physically or mentally ill or infirm. These include medical and surgical patients, convalescents, the handicapped, the aged, and others. Under the direction of physicians and registered nurses, they provide nursing care requiring technical knowledge but not the professional training of a registered nurse. (See statement on "Registered Nurses".) In California and Texas, licensed practical nurses are known as *licensed vocational nurses*.

In hospitals, licensed practical nurses provide much of the bedside care needed by patients, such as 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.

Other duties include: Assisting physicians and registered nurses in examining patients and in carrying out complex nursing procedures; assisting in the delivery, care, and feeding of infants: and helping registered nurses in recovery rooms by reporting any adverse changes in patients. Some licensed practical nurses help in the supervision of hospital attendants. (See statement on "Hospital Attendants.")

When employed in private homes, licensed practical nurses 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 physicians, they prepare patients' meals and care for patients' comfort and morale. Licensed practical nurses also teach family members how to perform simple nursing tasks.

In doctors' offices and in clinics, licensed practical nurses help physicians by preparing patients for examinations and treatments. In addition, they make appointments and record information about patients.

Places of Employment

About 370,000 licensed practical nurses were employed in 1970. The great majority were women.

About three-fifths of all licensed practical nurses were employed in hospitals. Most of the others worked in nursing homes, clinics, doctor's offices, sanitariums, and other long-term care facilities. Public health agencies and welfare and religious organizations also employed many licensed practical nurses. Some were self-employed working in hospitals or the homes of their patients.

Training, Other Qualifications, and Advancement

All States and the District of Columbia regulate the preparation and licensing of practical nurses. Usually, licenses are issued only to those who have completed a course of instruction in practical nursing which has been approved by the State board of nursing, and who also have passed a licensing examination.

Young persons seeking to enroll in State-approved training programs usually must have completed at least 2 years of high school or its equivalent. Physical examinations are required and aptitude tests given. Some States accept candidates who have completed only the eighth or ninth grade. Other States require high school graduation. Many schools that do not require completion of high school nevertheless give preference to graduates.

In 1970, about 1,250 State-approved programs provided training in practical nursing. More than one-half were offered by public schools as a part of vocational and adult education programs. Other programs were available at junior colleges, or were sponsored by local hospitals, health agencies, and private educational institutions and were usually 1 year in length. Many of the training programs receive financial assistance under the Manpower Development and Training Act and the Vocational Education Act.

Training includes both classroom study and clinical practice. Classroom instruction covers nursing concepts and principles and related subjects such as anatomy, physiology, medical-surgical nursing, administration of drugs, nutrition, first aid, and community health. This work is supplemented by laboratory

practice and by supervised work in hospitals where students apply their skills to an actual nursing situation.

Applicants for the occupation of licensed practical nurse should have a deep concern for human welfare. Since working with sick and injured people can sometimes be upsetting, licensed practical nurses should be emotionally stable. They should be able to accept menial duties as part of their daily routine. Being part of a medical team, they must be able to follow orders and work under close supervision. Physical stamina also is an asset, since practical nurses must be on their feet a great deal. Good health is extremely important.

Opportunities for advancement are limited, unless workers take additional training. In-service educational programs enable some licensed practical nurses to prepare for work in specialized areas such as rehabilitation. Practical nurses cannot become registered nurses, however, unless they undertake additional schooling.

Employment Outlook

Licensed practical nurses are expected to be in strong demand during the years ahead. Employment is expected to continue to rise very rapidly through the 1970's, and a large number of new jobs will have to be filled each year as health facilities continue to expand. In addition, many workers will be needed annually to replace licensed practical nurses who retire or stop working for other reasons. Opportunities for part-time work are expected to be plentiful.

Factors contributing to increased employment are a greater need for health services because of population growth, the increasing ability of persons to pay for health care, and the continuing expansion of both public and private health insurance plans. Greater utilization of licensed practical nurses for work not requiring the skills of a registered nurse also is expected to continue to create many job opportunities.

Earnings and Working Conditions

Licensed practical nurses employed in hospitals and medical schools received average starting salaries of about $110 a week in 1970, according to a national survey conducted by the University of Texas Medical Branch.

Many hospitals give licensed practical nurses periodic pay increases after specific periods of satisfactory service. Some hospitals also provide free laundering of uniforms. A few institutions provide free lodging. The scheduled workweek is generally 40 hours but often it includes some work at night and on weekends and holidays. Paid holidays and vacations, and health insurance and pension plans are provided by many hospitals.

In private homes, licensed practical nurses usually are on duty for 8 to 12 hours a day and go home at night. A few, on 24-hour duty, live at the homes where they are employed. The basic 8-hour fee in 1969 ranged from $15 to $30, according to the American Nurses' Association.

Salaries of licensed practical nurses employed by public health agencies averaged about $5,750 a year in 1970. The beginning annual salary in the Federal Government for persons having completed a State-approved program of study in practical nursing was $5,212 in 1970.

Sources of Additional Information

A list of State-approved training programs and information about practical nursing may be obtained from:

ANA-NLN Committee on Nursing Careers, American Nurses' Association, 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.

Information about employment opportunities in U.S. Veterans Administration hospitals is available from:

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

MEDICAL ASSISTANTS

(D.O.T. 079.368)

Nature of the Work

Medical assistants help physicians examine and treat patients, as well as keep abreast of the reams of paperwork that flow in the wake of current medical treatment.

Medical assistants carry out routine tasks such as preparing patients for examination, medical treatment, and surgery. They may help examine patients by checking weight, height, temperature, blood pressure, and making simple laboratory tests. Medical assistants help in treatment by instructing patients about medication and self-treatment at home, administering injections, applying surgical dressings, and taking elec-

Medical assistant checks patient's record.

trocardiograms and X-rays, as well as sterilizing and cleaning instruments and other supplies. Medical assistants also perform a variety of clerical jobs. They keep patients' medical records, fill out medical and insurance forms, handle correspondence, schedule appointments, and act as receptionists. Other office duties include dictation, bookkeeping, billing, and receiving payments on bills. Medical assistants may also arrange instruments and equipment in the examining room, check office and laboratory supplies, and maintain the waiting, consulting and examination rooms in neat and orderly condition.

Places of Employment

An estimated 175,000 medical assistants were employed in 1970, almost all of whom were women. The large majority work in the offices of physicians in private practice. The remainder work in hospitals and medical clinics.

Training, Other Qualifications, and Advancement

Most medical assistants employed in 1970 qualified for the occupation through training received in physicians' offices. A small number were trained in on-the-job programs sponsored by the Manpower Development and Training Act (MDTA). Further information about MDTA opportunities is available from State Employment Services. Some were trained in vocational programs offered by high schools, or by vocational institutes and junior colleges. Others learned their skills in adult education courses provided by post-secondary schools.

In general, applicants for on-the-job training or for post-secondary school academic training must be high school graduates or have equivalent education. High school courses in mathematics, sciences, and office practices are desirable for students seeking admission to medical assistant programs.

Junior college programs for medical assistants are being established in increasing numbers. Most are 2-year programs, leading to an associate degree; the others are 1-year programs and graduates receive a diploma. The programs require completion of designated academic courses, as well as supervised on-the-job clinical experience. Among courses required are biology, chemistry, anatomy, and physiology; laboratory techniques and use of medical machines; medical assistant administrative and clinical procedures; medical terminology; medical office practices; reception of patients; and typing, shorthand, and accounting.

Students wishing to continue their education and obtain a bachelor's degree must realize that not all 4-year colleges accept the same type and amount of credits from different junior colleges. Therefore, it is important for students to apply for admission to a junior college in which they can complete the kind of courses and number of credits acceptable for transfer to a 4-year college.

Medical assistants who meet the standards of the American Association of Medical Assistants (AAMA) may apply for the title of Certified Medical Assistant. An applicant for certification must pass a written examination and have a high school education. She must also be employed as a medical assistant and have at least 3 years' experience in the field. An applicant who has an associate degree in medical assisting need have only one year of experience. Certification is not a license and is not required for

AAMA membership; however, Certified Medical Assistants are usually considered by physicians to be high-calibre workers.

Persons who wish to become medical assistants should be able to get along with people, since they will be required to work closely with a variety of people. They should also be thorough, accurate, dependable, and conscientious.

Employment Outlook

Opportunities for medical assistants are expected to be excellent through the 1970's, particularly for graduates of 2-year junior college programs. Rapid growth in the occupation is anticipated during the decade. Many more medical assistants will be needed to help doctors engaged in patient care because of the shortage of physicians in most areas of the country and the increasing complexity of medical practice combined with a growing volume of paper work that must be completed in doctors' offices. Other general factors expected to contribute to an increasing demand for medical assistants include those which underly the overall growth in medical care in the United States such as a rapidly growing population; an increasing number of older persons, the people most in need of medical care; improved standards of living including a growing demand for more and better health care; expanding coverage under prepayment programs which enable persons to pay for hospital and medical care; increasing expenditures by Federal, State, and local governments for health care services; and advances in medical technology which enable physicians to treat and cure more illnesses.

In addition to job openings resulting from growth of the profession, many openings will arise because of the need to replace workers who die, retire, or leave the occupation for other reasons.

Earnings and Working Conditions

In 1970, weekly salaries generally ranged from $90 to $125 for inexperienced medical assistants and from $125 to $160 for experienced assistants, according to limited information available. The salaries of beginners depended on their training and other qualifications. Junior college graduates generally received higher starting salaries than those paid workers without any training.

Medical assistants usually have a 40-hour workweek. Their hours, however, may be irregular. They may work evenings and Saturdays. If so, they receive equivalent time off during weekdays.

Sources of Additional Information

General information on a career as a medical assistant, and on the certification program, may be obtained from:

American Association of Medical Assistants, 200 East Ohio Street, Chicago, Ill. 60611.

Information on training programs for medical assistants may be obtained from:

American Medical Association, Council on Medical Education, 535 North Dearborn Street, Chicago, Ill. 60610.

SURGICAL TECHNICIANS

(D.O.T. 079.378)

Nature of the Work

Surgical technicians, also known as operating room technicians, work under the supervision of registered professional nurses in assisting surgeons and anesthesiologists.

They help prepare patients for surgery by washing, shaving, and disinfecting the parts of the body where the surgeons will operate. They may transport patients to the operating room, and help drape and position them on the operating table. Before the operation, surgical technicians also may obtain instruments, equipment, sterile linen, and fluids needed during an operation, such as blood, plasma, glucose and saline solution.

During surgery, these technicians provide valuable extra hands to aid the professional surgical team in passing instruments and other sterile supplies. They hold retractors, cut sutures, and help nurses count the

sponges, needles, and instruments used during the operation. Surgical technicians also assist in the preparation, care, and disposition of operative specimens taken for testing, and help with the application of dressings. Other duties include operating sterilizers, lights, suction machines, diagnostic equipment, and electro-surgical apparatus.

After the operation, surgical technicians help transfer patients to the recovery room and assist nurses in cleaning and stocking the operating room for the next operation.

The Manpower Development and Training Act (MDTA) also sponsors training programs for surgical technicians. Detailed information about these programs may be obtained from State Employment Services. Surgical technicians are trained also in adult education, technical, and vocational courses. The medic programs of the Armed Forces also are a training ground for surgical technicians. Currently, there are about 25 junior colleges which offer training for surgical technicians. Generally, these are 1-year courses leading to a certificate, although there are some 2-year curriculums offering an associate in arts degree.

Students in surgical technician programs at junior colleges and in vocational schools must complete classroom training as well as supervised clinical experience. Among the required courses are basic sciences such as anatomy, physiology, and microbiology. Students also have courses of practical application, such as care and safety of patients during surgery; use of anesthetic agents and avoidance of their hazards; related nursing procedures including observation of vital signs and post-operative patient care. They must also know principles of operating techniques including gowning and gloving, sterilization of instruments, and prevention of control of infection; as well as handling of special drugs, solutions, supplies, and equipment.

Places of Employment

Approximately 25,000 surgical technicians were employed in the United States in 1970; most were women. They worked in the operating room facilities of hospitals, which are located in small and large cities throughout the country. Many surgical technicians are members of the Armed Forces.

Training, Other Qualifications, and Advancement

An applicant for a surgical technician position usually must have a high school education or equivalent for admission to on-the-job training programs offered in hospitals. Some hospitals give preference to applicants who have had previous hospital work experience as attendants or practical nurses. Applicants may be required to pass aptitude tests and a physical examination. The length of training varies from 6 weeks to one year, depending on trainees' qualifications and the type of training given by the program.

Persons desiring to become surgical technicians should have manual dexterity since they must handle various instruments and operate many devices. Personal qualities considered desirable include cleanliness, orderliness, and emotional stability.

Employment Outlook

The surgical technician occupation is expected to grow rapidly during the 1970's, providing excellent job opportunities for applicants. Graduates of 2-year junior college programs should experience exceptionally high demands for their services.

Many more surgical technicians will be needed to assist in large numbers of surgical operations that will necessarily accompany the country's expanding population. More surgical technicians will be required to perform an increasing amount of lower level nursing tasks, thereby enabling operating room nurses to concentrate on the duties requiring their professional knowledge. Other general factors expected to contribute to an increasing demand for surgical technicians include those which underly the overall growth in medical care in the United States, such as improved standards of living; growing health consciousness; expanding coverage under prepayment programs for hospitalization and medical care; and increasing expenditures by Federal, State, and local governments for health care services.

In addition to job openings resulting from growth of the occupation, many new surgical technicians will be needed to replace workers who die, retire, or leave the field for other reasons.

Earnings and Working Conditions

In 1970, weekly salaries generally ranged from $75 to $140 for inexperienced surgical technicians, depending on their training and other qualifications, according to limited information available. Junior college graduates received higher starting salaries than those paid workers without any training for the occupation. Weekly salaries for experienced technicians ranged from about $95 to $180.

The working hours of surgical technicians are usually 8 hours a day, 5 days a week. In addition, the technicians may be required to work "on call" shifts, for which they receive compensation.

Sources of Additional Information

Additional information on a career as a surgical technician and on programs offering training for the occupation may be obtained from:

Association of Operating Room Technicians, Inc., 8085 East Prentice, The Denver Technological Center, Englewood, Colo. 80110.

EEG TECHNICIANS

(D.O.T. 079.368)

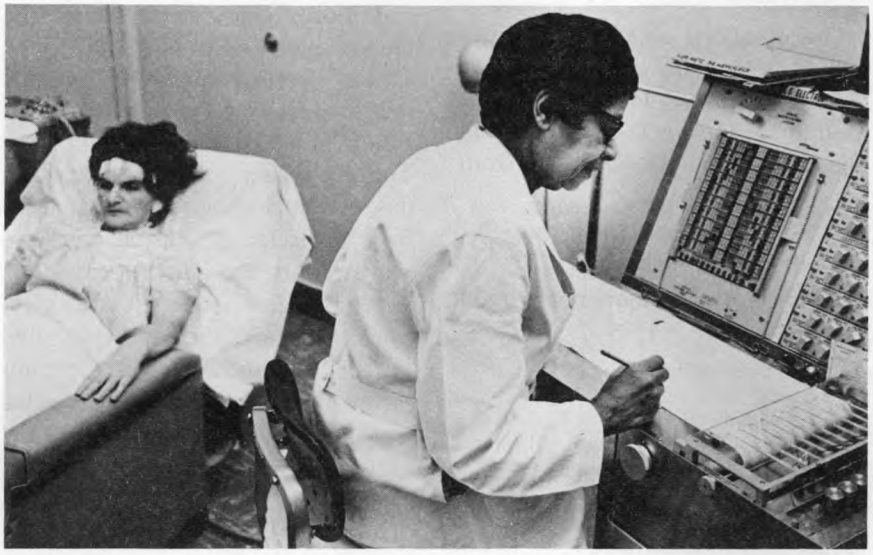
Nature of the Work

EEG (electroencephalographic) technicians fulfill an important function in diagnosing brain disease and infections through electroencephalography—a system of mechanically detecting and recording the electrical activity of the brain.

The EEG technician attaches to the patient's head electrodes leading to the electroencephalography machine that graphs (EEG's) the brain's electrical currents. The complex machine detects the electrical activity of the patient's brain; it does not emit any current of its own —a safe, painless procedure. Professional EEG personnel and neurologists interpret the electroencephalograms. However, the EEG technician must have some knowledge of medicine, anatomy, and physiology to understand the condition of the subject.

EEG's are particularly useful in diagnosing epilepsy and brain tumors, and in assessing damage and recovery after cerebral vascular strokes. EEG's have proved essential to the prognosis of patients who are in a coma. Because of its usefulness in pinpointing the time body functions stop, the recent rise in vital organ transplants has elevated the importance of EEG.

EEG technicians make simple repairs and replacements to keep equipment in good working order. They also schedule appointments and record services performed for patients.



Places of Employment

An estimated 3,000 electroencephalograph technicians were employed in 1970. EEG technicians, who are mostly women, work primarily in the neurology departments of hospitals. Some are employed in neurologist's offices; some have responsible positions in research units.

Training, Other Qualifications, and Advancement

The principal way to enter the occupation is by on-the-job training, which generally lasts from 3 to 6 months and is conducted by a neurologist or electroencephalographer and a senior technician. The minimum requirement for entrance into an on-the-job training program generally is high school graduation with science courses preferred.

Some technicians also qualify for their job through formal academic training. In 1970, 15 formal programs were offered in colleges, universities, and hospitals. These programs vary in length from 3 months to 1 year, and generally include courses in electronics, nervous system, physiology, first-aid, computer technology (to an increasing degree), and anatomy. Some of the schools require 2 years of college for entrance into the program; others require only high school.

EEG technicians who meet certain experience requirements and successfully complete a written and oral examination administered by the American Board of Registration of Electroencephalograph Technicians (ABRET) may become registered. Although not a general prerequisite for employment, registra-

tion by ABRET is acknowledgment of a technician's qualifications and will make better-paying positions easier to obtain.

As openings occur, some EEG technicians in large hospitals may advance to chief EEG technician and have larger responsibilities in laboratory management and in teaching basic techniques to new personnel. Chief EEG technicians are supervised by an electroencephalographer (a doctor specializing in the reading of EEG tracings) or a neurologist or neurosurgeon.

Manual dexterity, good vision, an aptitude for working with electronic equipment, and the ability to work with patients and other members of the hospital team are desirable personal characteristics.

Employment Outlook

Employment opportunities for EEG technicians are expected to be excellent through the 1970's. Among the principal factors underlying this demand are increased use in the diagnosis of brain diseases, and in monitoring patients; ability to determine the exact time of body function stoppage in the donor for transplant operations; and the usual factors contributing to the overall increase in health services, such as expanding population and rising living standards.

In addition to openings that will result from the rapid growth of the occupation, many will arise because of the need to replace the large number of young women who leave the field for marriage and family responsibilities.

Earnings and Working Conditions

The average monthly starting salary of EEG technicians working in hospitals in 1970 was about $455, and $470 in medical schools, according to the *National Survey of Hospital and Medical School Salaries*. Top salaries of EEG technicians ranged as high as $750 a month. Very highly qualified technicians may earn more in special training situations. Depending on general experience, the annual beginning salary for EEG technicians employed by the Federal Government was between $4,125 and $5,212 in 1970. Technicians in the Federal Government can earn as much as $9,881 a year.

EEG technicians in hospitals receive the same benefits as other hospital personnel, including hospitalization, vacation, and sick leave. Some institutions may provide tuition assistance or free courses, pension programs, uniforms, and parking.

EEG technicians generally work a 40-hour week with little after hours or Saturday work involved. The fact that a neurologist is needed to read and interpret a tracing minimizes the necessity of emergency-call duty.

Sources of Additional Information

Information about employment opportunities may be obtained from local hospitals. Additional information about the work of EEG technicians may also be obtained from:

American Hospital Association, 840 North Lake Shore Drive, Chicago, Illinois 60611.

For information on registration:

American Board of Registration of Electroencephalographic Technologists, Dr. Charles E. Henry, Cleveland Clinic, 2020 East 93rd Street, Cleveland, Ohio 44106.

EKG TECHNICIANS

(D.O.T. 078.368)

Nature of the Work

Electrocardiograms (EKG's) are pictures of a heart beat—tracings in the form of a graph produced by an instrument called an electrocardiograph. These tracings record the electronic variations in the action of the heart muscle. Physicians use electrocardiograms to diagnose irregularities in heart action and to analyze changes in the condition of a patient's heart over a period time. Some physicians order electrocardiograms as a routine diagnostic procedure for people who have reached a specified age. In some cases, the tests also are used if surgery is to be performed.

Electrocardiograph (EKG) technicians take and process electrocardiograms at the request of a physician. This is done usually at the patient's bedside, since the equipment is mobile. In taking an electrocardiogram, the technician straps electrodes to specified parts of the patient's body, manipulates selector switches of the electrocardiograph, and moves chest electrodes across the patient's chest.

The electrocardiograph records the "picture" of the patient's heart action on a continuous roll of paper. The technician clips and mounts this electrocardiogram for analysis by a physician, usually a cardiologist or heart specialist.

When technicians are taking electrocardiograms, they must be able to recognize and correct any technical errors or interferences recorded on the electrocardiograms. They also must be able to recognize any significant deviations from the norm that call for a doctor's attention.

The technician must know how to conduct EKG exercises. In these, patients exercise slightly by walking up and down a few steps and undergo EKG tests before and after the exercise. Basal metabolism tests must also be performed. These energy-measuring tests are given to patients after a period of fasting and rest. EKG technicians must be able to make photocardiograms, which record the sounds of the heart valves and blood passing through them. In addition, technicians usually schedule appointments, type doctors' diagnoses, maintain patients' EKG files, and take care of equipment.

Places of Employment

An estimated 9,500 electrocardiograph technicians were employed in 1970; most were women. Most EKG technicians were employed in cardiology departments of large hospitals. Others worked part-time in small general hospitals where workloads are usually not great enough to demand full-time technicians. Some were employed full- or part-time in clinics and doctors' offices.

Training, Other Qualifications, and Advancement

On-the-job training is the principal method of obtaining the skills of the EKG technician. Training—which may last as long as 3 months—is usually conducted by a senior EKG technician or a cardiologist. Generally, the minimum requirement for the job is high school graduation. Typing and familiarity with medical terminology are helpful.

A few colleges and universities affiliated with hospials offer EKG courses lasting a few months. The military services also provide some general training in electrocardiology. In addition, manufacturers of electrocardiographs generally provide instructions in the operation of their equipment.

In larger hospitals, EKG technicians occasionally are promoted to positions as supervisors of other EKG technicians. Advancement to jobs as junior vascular-cardio technicians is also possible in some instances. To be eligible for supervisory or other higher positions, training may be necessary in areas such as biomedical electronics. Generally, however, the number of paths to higher positions are relatively few and opportunities for advancement are limited.

Among characteristics desirable for an EKG technician's job are mechanical aptitude, the ability to follow detailed instructions and react quickly to orders and to the requirements of emergency situations; and common sense, reliability, consideration, and patience.

Employment Outlook

Employment opportunities for EKG technicians are expected to be excellent through the 1970's. The expected increase in demand is the result of increasing reliance by physicians upon electrocardiograms in the diagnosis of heart diseases and the greater use of electrocardiograph in continuous "monitoring" of patients under intensive care. Another factor contributing to the expected growth of this occupation is the general increase in demand for health services. Underlying this trend is the country's expanding population, rising living standards and improved health consciousness, extension of prepayment programs for medical care, expanding medical services resulting from new medical techniques and drugs, and expanding medical research activities.

In addition to openings resulting from growth in the occupation, vacancies will develop each year as

young women leave the field for marriage and family responsibilities.

Earnings and Working Conditions

The average monthly starting salary of EKG technicians working in hospitals in 1970 was about $407, according to the *National Survey of Hospital and Medical School Salaries,* conducted by the University of Texas Medical Branch. Top salaries, in some cases, were as high as $950 a month.

The annual beginning salary for EKG technicians employed by the Federal Government was between $4,125 and $5,212 in 1970, depending on experience; a few experienced technicians earned as much as $8,956 a year.

EKG technicians working in hospitals receive the same fringe benefits as other hospital personnel, including hospitalization, vacation, and sick leave. Some institutions provide tuition assistance or free courses, pension programs, and uniforms. Technicians generally work a 40-hour week, which may include work on Saturdays.

Sources of Additional Information

Information about employment opportunities may be obtained from local hospitals. Additional information about the work of EKG technicians is also available from:

American Hospital Association, 840 North Lake Shore Drive, Chicago, Illinois 60611.

INHALATION THERAPISTS

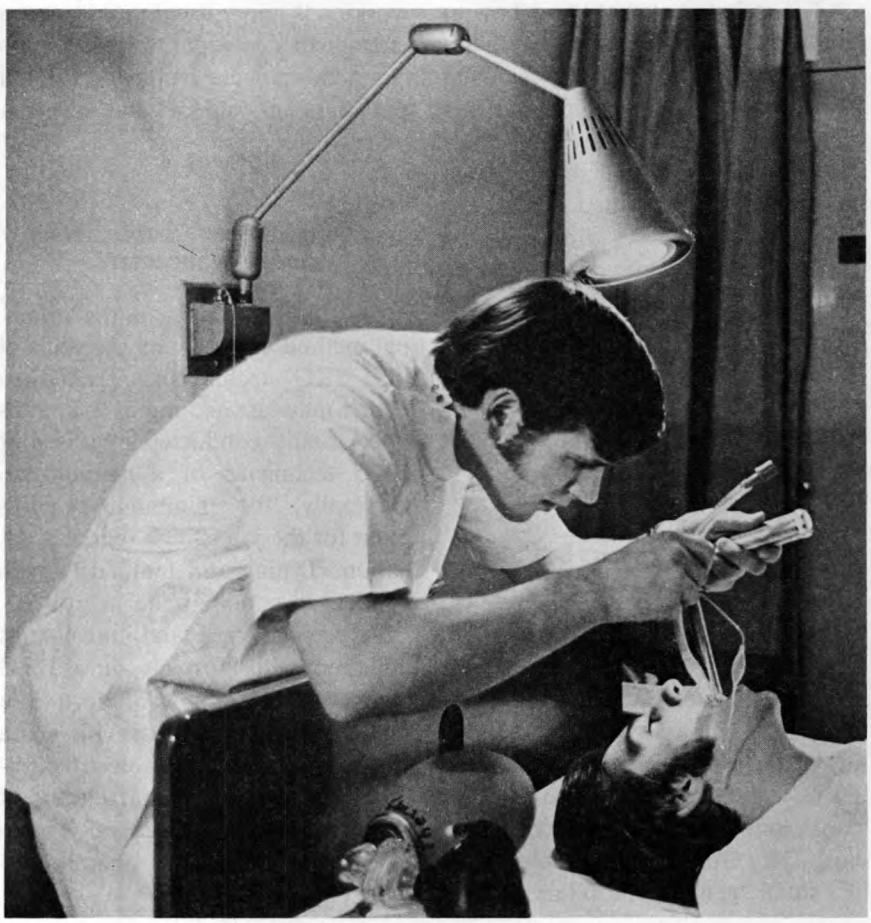
(D.O.T. 079.368)

Nature of the Work

Inhalation therapists treat patients with respiratory problems. This may range from giving relief to patients with chronic asthma or emphysema to giving emergency care in cases of heart failure, stroke, drowning, and shock.

A rapidly evolving field, inhalation therapy requires specially trained personnel to master the use of sophisticated equipment needed in treating many respiratory problems. The inhalation therapist is one of the first medical specialists called in for emergency treatment of acute respiratory conditions arising from head injury or drug poisoning. Moreover, the short span of time during which a patient can safely cease to breathe emphasizes the highly responsible role the inhalation therapist must play. If a patient does not breathe for three to five minutes, there is little chance of recovery without brain damage, and if oxygen is cut for 9 minutes he will die.

Inhalation therapists follow doctor's orders in giving medication to the patient through aerosols or using mists to help control the patient's environment. When administering gases to patients, the inhalation therapist assumes complete control over the patient's environ-



ment, including moisture and temperature.

Inhalation therapists may also be called upon to instruct physicians and nurses on the use of specialized inhalation equipment, and show patients and their families the proper use of home equipment. Other duties include keeping records of the cost of materials and charges to patients. Therapists are responsible for routine maintenance of their equipment.

Places of Employment

An estimated 10,000 inhalation therapists were employed in 1970. Most were employed in anesthesiology or pulmonary medicine departments of hospitals. Others were employed by oxygen equipment rental companies, ambulance services, nursing homes, and universities. Most therapists are men. However, an increasing number of women are entering the field. This is due, in part, to the installation of piped-in oxygen in hospitals, eliminating the need to handle heavy cylinders of gas.

Training, Other Qualifications, and Advancement

Most therapists who entered the job before the mid-1960's qualified for their job through on-the-job training. Such training generally lasts about 1 year and is conducted by the chief therapist and medical supervisor. High school graduation generally is the minimum entry requirement.

Despite the predominance of on-the-job training in the late 1960's, the trend today is toward formalized accredited training. In 1970, over 70 schools approved by the Joint Review Committee for Inhalation Therapy Education trained inhalation therapists. Courses vary in length between 18 months and 4 years and include both theory and clinical work. A bachelor's degree is awarded for completion of 4-year programs and lesser degrees are awarded for shorter courses. Basic courses are human anatomy and physiology, chemistry, physics, microbiology, and mathematics. Technical courses offered deal with procedures, equipment, and tests.

Inhalation therapists who complete formal training and 1 year of experience are eligible to be registered by the American Registry of Inhalation Therapists (ARIT). Applicants must pass oral and written examinations. In 1970, nearly 1,300 therapists had been registered. A registered inhalation therapist often can advance faster and obtain a higher position than one who is not registered. An increasing number of employers recognize registration as an acknowledgment of the therapists' qualifications.

Inhalation therapists who do not qualify or fail to pass the registry examination, may elect to take an examination to become certified inhalation therapists. To be eligible for the certification tests, an applicant must have a high school education or the equivalent, and 2 years of experience in inhalation therapy under medical supervision; or be a graduate of an inhalation therapy training program which follows the essentials for certification, plus 1 year of experience in inhalation therapy under medical supervision; or be a graduate of an Associate Degree inhalation therapy program approved by the Joint Review Committee For Inhalation Therapy Education.

Inhalation therapists can advance to positions as assistant chief, chief therapist, or instructor of inhalation therapy at the university level.

Young persons planning careers in inhalation therapy should have the ability to work with patients and understand their physical and psychological needs. Inhalation therapists must be able to pay attention to detail and follow instructions. Mechanical ability is also a necessary attribute.

Employment Outlook

Employment opportunities for inhalation therapists are expected to be excellent through the 1970's. Those completing formal training will be in demand to fill high level supervisory positions. In the future, employment of inhalation therapists is expected to increase due to the increasing demand for health services in general. The expected rapid growth will also stem from realization that among benefits arising from employing specialists in inhalation therapy is that nurses and other personnel are released to perform their primary duties.

In addition to openings that will result from the rapid growth of the occupation, many openings will arise because of the need to replace those who retire, die, or leave the labor force for other reasons.

Earnings and Working Conditions

The average monthly starting salary of inhalation therapists working in hospitals in 1970 was about $555, according to the *National Survey of Hospital and Medical School Salaries,* conducted by the University of Texas Medical Branch. Top salaries of inhalation therapists in hospitals ranged as high as $830 a month.

The annual beginning salary for

inhalation therapists employed by the Federal Government was between $4,125 and $5,212 in 1970, depending on general experience. Some therapists employed by the Federal Government in 1970 earned as much as $9,881.

Inhalation therapists working in hospitals receive the same benefits as other hospital personnel, including hospitalization, paid vacations, and sick leave. Some institutions may provide tuition assistance or free courses, pension programs, uniforms, and parking.

Therapists generally work a 40-hour week. After-hour and weekend duty is generally required since most hospitals have 24-hour coverage throughout the week. Adherence to safety precautions and proper testing of equipment minimize hazards to therapists and patients. Safety precautions include keeping sources of ignition and electrical appliances away from respiratory apparatus and elimination of oil and alcohol rubs.

Sources of Additional Information

Information concerning employment is obtainable from local hospitals. Facts are also available from:

American Association for Inhalation Therapy, 3554 9th Street, Riverside, California 92501.

Information concerning requirements and equivalents of formal education needed for registration may be obtained from:

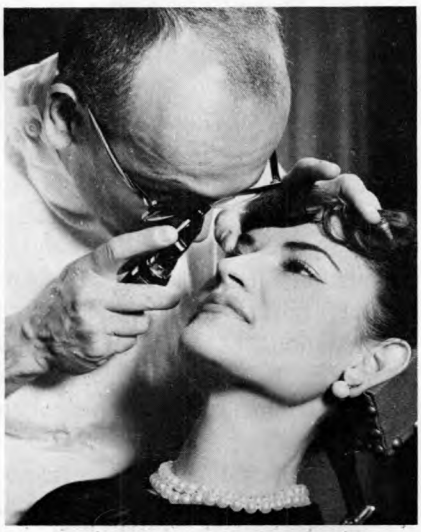
Executive Director, American Registry of Inhalation Therapists, 260 Crittenden Boulevard, Rochester, New York 14620.

OPTOMETRISTS

(D.O.T. 079.108)

Nature of the Work

Optometrists help patients improve and protect their vision. They



make tests to determine vision problems and the presence of eye diseases and other abnormal conditions. When necessary, they prescribe vision aids including regular and contact lenses; telescopic and microscopic lenses or other high magnification aids; corrective eye exercises; and other optical treatment that does not require drugs or surgery. Most optometrists supply the eyeglasses prescribed; they sometimes also do minor repair work such as straightening eyeglass frames. Some optometrists specialize in treating the vision problems of different categories of patients such as children, older patients, and partially sighted persons; other optometric specialists are concerned with the effect of industrial and environmental factors on the visual efficiency of workers. A few optometrists are engaged in teaching, research, or a combination of both.

Optometrists should not be confused with either ophthalmologists, sometimes referred to as oculists, or with dispensing opticians. Ophthalmologists are physicians who specialize in eye diseases and injuries, perform eye surgery, and prescribe drugs or other treatment, as well as lenses. Dispensing opticians fit and adjust eyeglasses according to prescriptions written by ophthalmologists or optometrists; they do not examine eyes or prescribe treatment. (See statement on Dispensing Opticians.)

Places of Employment

Approximately 18,000 optometrists were in practice in 1970; about 2 percent were women. More than four-fifths of the optometrists were self-employed; of these, most were in solo practice and the others were in partnerships or in group practices.

Several hundred optometrists served in the Armed Forces. The remainder were salaried employees who taught in colleges of optometry or worked for established practitioners, health clinics, hospitals, optical instrument manufacturers, and government agencies.

About 4 out of 10 optometrists are located 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 each State and in the District of Columbia. Reciprocity agreements among some States allow an optometrist licensed in one State to practice in another.

Applicants for licenses must be graduates of an accredited school of optometry and pass the State Board examination of the State in which they will practice. In some cases, applicants are permitted to substitute the National Board of Optometry examination for the written State examination. In 1970, there were 11 schools of optometry in the United States.

Applicants having the necessary qualifications have an excellent chance for admission to these schools. To pursue full-time study leading to a degree in optometry, needy students may obtain loans and scholarships up to $2,500 a year from Federal funds provided by the Health Professions Educational Assistance Act of 1963, as amended.

At least 6 years of college are needed to become an optometrist —2 years of preoptometry education in an approved college, followed by 4 years of training in an optometry school. In addition to the degree, Delaware and Rhode Island require a 6-month internship to qualify for a license, and Mississippi, 1 year of experience.

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 and obtain professional experience in the out-patient clinics operated by the schools. All schools of optometry award the degree of Doctor of Optometry (O.D.). 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.

Since most optometrists are self-employed, business ability, self-discipline, and the ability to deal with patients tactfully are necessary for success in this field. Manual dexterity and a mechanical aptitude also are important to the optometrist since he must work with precision equipment and occasionally make repairs.

Many beginning optometrists either set up a new practice or purchase an established one. Some, on the other hand, take salaried positions to obtain experience and the necessary funds to enter their own practice.

Employment Outlook

Employment opportunities for new optometry graduates are expected to be favorable through the 1970's. Some expansion in the seating capacity of optometry schools is anticipated as a result of Federal assistance. As a result, by the middle 1970's the number of new graduates may approximate the annual number needed for growth of the occupation as well as for replacement of those who retire, die, or stop practicing for other reasons.

Among the factors underlying the expected increase in demand for eye care services are, on the one hand, growing numbers of persons in groups most likely to need glasses —older people and white-collar workers—and, on the other, increased recognition of the importance of good vision for efficiency at work and in school. Although expanded demand will be met in part by ophthalmologists, optometrists will continue to supply a substantial proportion of all eye care services.

Optometrists usually locate in heavily populated business areas. However, opportunities to establish a new practice generally will be best in small towns and in residential areas of cities, where the new optometrist can become known easily. Many communities, especially in the South, that now have no optometric services available also will 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 ophthalmologists in the vicinity in relation to the size, occupations, age, and income level of the population in the area.

Earnings and Working Conditions

New optometry graduates who begin as solo practitioners generally have a low income during the first few years. They usually earn less than new optometrists who take salaried positions. After a few years of experience, the situation is usually reversed, since the income of independent practitioners generally exceeds the earnings of salaried optometrists.

In 1970, starting salaries of new optometry graduates ranged from about $10,000 to $12,000 a year, according to the limited information available. The average net income of experienced optometrists was about $25,000. Incomes varied greatly, depending on location, specialization, and other factors.

Most optometrists work 40 hours a week. They may occasionally work a few hours on Saturday. Since the work is not strenuous, optometrists can often continue to practice after the normal retirement age.

Sources of Additional 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.

OPTOMETRIC ASSISTANTS

(No D.O.T. Number)

Nature of the Work

Optometric assistants perform a gamut of tasks from assisting in eye examinations to bookkeeping to allow optometrists to devote more time to their professional duties.

They prepare patients for eye examinations and help optometrists test for near and distant eyesight, color blindness, and tension or pressure of the eyeball. Optometric assistants measure patients for pupillary distance and bridge width. They suggest size and shape of eye glass frames complimentary to the patient's facial features, and adjust the finished eyeglasses by heating, shaping, and bending the plastic or metal frames. They also assist the optometrist in fitting contact lenses and in giving instructions on the use and care of the lenses.

Optometric assistants help optometrists in vision training routines for patients with focusing defects, such as teaching them to move and coordinate both eyes.

In addition to caring for patients, optometric assistants work in the laboratory. They modify conventional glasses or contact lenses to assure proper fit. They cut and insert lenses in frames, repair frames, keep an inventory of optometric materials, and clean and care for the instruments.

Optometric assistants keep patients' records, schedule appointments, and handle bookkeeping, correspondence, and filing.

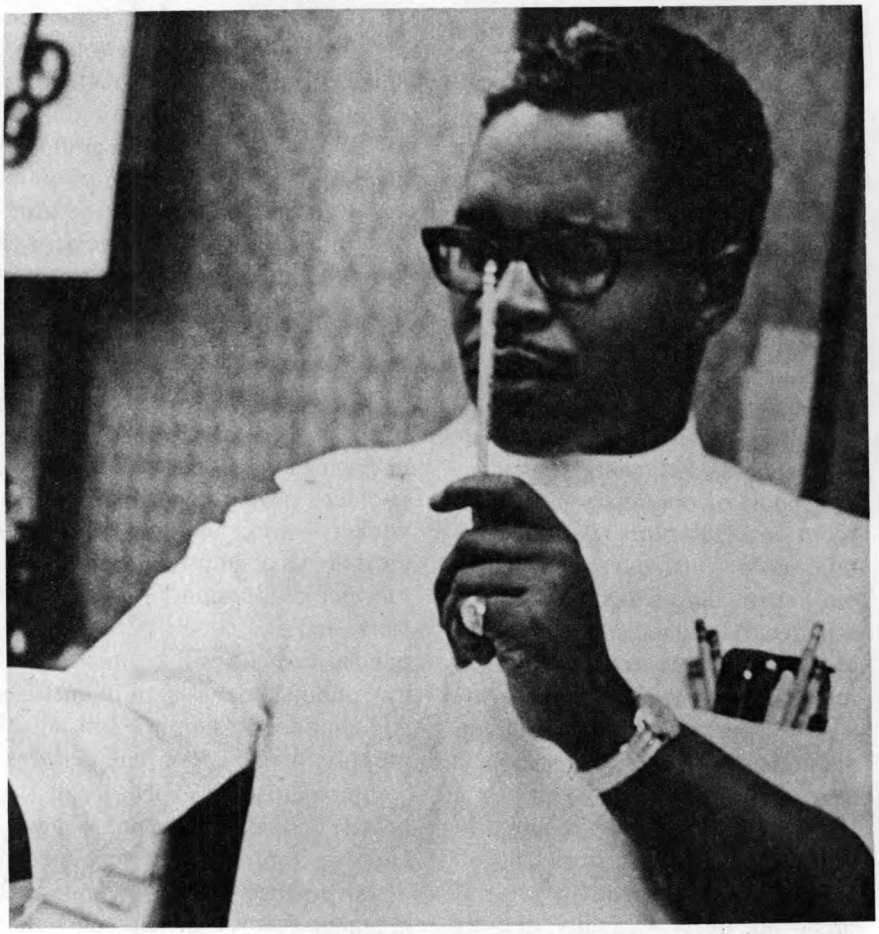
Places of Employment

An estimated 5,000 optometric assistants, most of them women, were employed in the United States in 1970. Most worked for professional optometrists in private practice. Others worked for health clinics, optical instrument manufacturers, or government agencies. Some served as assistants to optometrists in the Armed Forces.

Optometric assistants work mainly in the more densely populated areas of the country.

Training, Other Qualifications, and Advancement

Most optometric assistants are trained on the job in their employers' offices. Some complete vocational or technical school courses giving them skills needed for the occupation. In 1970, 6 schools—were training students as optometric assistants. The requirements for ad-



Optometric assistant conducts a focusing defect exercise.

mission generally consisted of high school graduation or equivalent education, including some high school courses in mathematics and office procedures.

All programs contained specialized courses such as the anatomy and physiology of the human eye; orthoptics (correction of defective vision); testing color vision and visual fields; use of the tonometer (a device used in detecting glaucoma); administering corrective eye exercises and training; measuring, preparing, and fitting lenses; verifying prescriptions; selecting eyeglass frames; cutting, edging and mounting lenses; adjusting eyewear for comfort and for optical reasons; and repairing frames. Courses were also given in secretarial and office procedures. Course programs included clinical practice, under the direct supervision of an optometrist, consisting of on-the-job experience. Graduates of 2-year community college programs can advance to the position of optometric technician.

Manual dexterity, accuracy, and the ability to distinguish shades of color are important requisites for persons planning to become optometric assistants. Because of the person-to-person work relationship between optometric assistants and patients, neat appearance, courtesy, and tact are important qualifications.

Employment Outlook

A moderate increase is expected in the employment of optometric assistants through the 1970's. Assistants will be needed to fill new openings resulting from anticipated growth in employment as well as to replace workers who die, retire, or transfer to other occupations.

Most job openings will be in industrial areas located in urban and suburban regions, where professional optometrists develop practices large enough to utilize assistants.

The factors underlying a growing demand for eye care services, including those performed by optometric assistants, are similar to the factors affecting the demand for professional optometrists. These factors include: an expanding population having larger numbers of older people and white-collar workers (the groups most likely to need glasses); and a wider recognition of the importance of good vision for efficiency at work and in school.

Earnings and Working Conditions

In 1970, salaries generally ranged from $80 to $100 a week for inexperienced optometric assistants and from $125 to $160 a week for experienced workers, according to limited information available. Earnings were highest in the East and lowest in the South. Earnings varied not only by geographical region, but also by the academic and technical qualifications of optometric assistants, as well as the specializations of the optometrists employing them.

Most optometric assistants, like their employers, work 40 hours a week. Occasionally they may work a few hours on Saturday. The work is not strenuous and the physical surroundings are usually pleasant.

Sources of Additional Information

Further information on a career as optometric assistant is available from:

American Optometric Association, 7000 Chippewa Street, St. Louis, Mo. 63119.

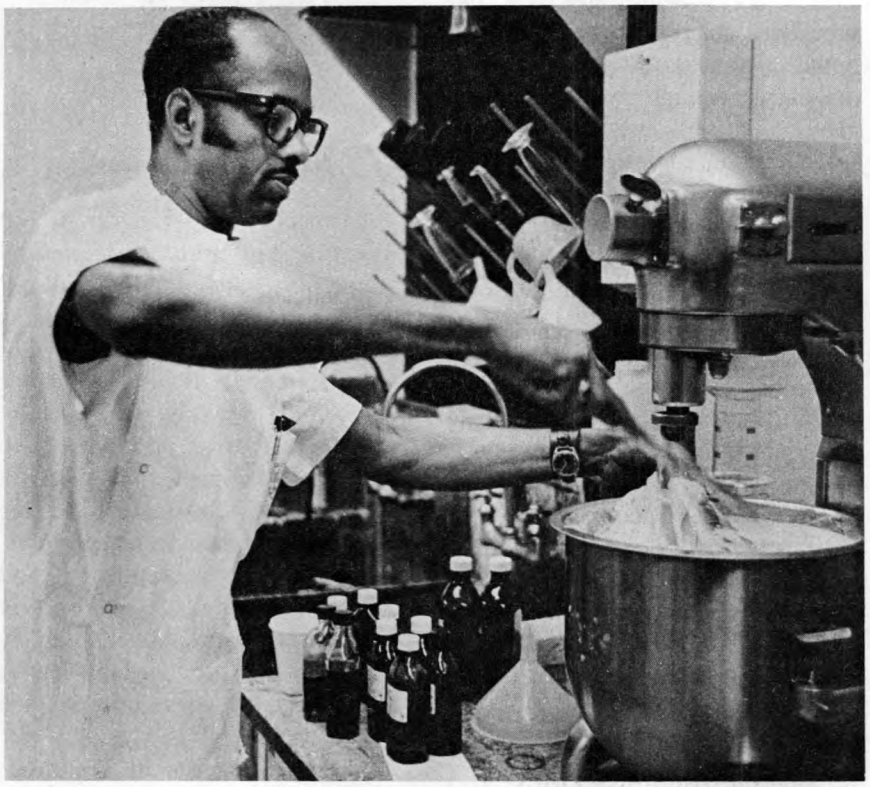
PHARMACISTS

(D.O.T. 074.181)

Nature of the Work

Pharmacists dispense drugs and medicines prescribed by medical practitioners, and supply and advise people on the use of many medicines that can be obtained without prescriptions. Pharmacists must understand the use, composition, and effect of drugs and be able to test them for purity and strength. Compounding—the actual mixing of ingredients to form powders, tablets, capsules, ointments, and solutions—is only a small part of pharmacists' work, since many drugs now are produced by manufacturers in the form used by the patient.

Many pharmacists in drugstores or community pharmacies also have other duties. Besides dispensing drugs, these pharmacists buy and sell nonpharmaceutical merchandise, hire and supervise store personnel, and oversee the general operation of the store. Some pharmacists, however, operate prescription pharmacies that dispense only drugs, medical supplies, and health accessories. Pharmacists in hospitals dispense prescriptions and advise the medical staff on the selection and effects of drugs; they also make sterile solutions, buy medical supplies, teach in schools of nursing, and perform administrative duties. An increasing number of hospital pharmacists work in patient care areas as active members of the medical team. Some pharmacists, employed as medical sales representatives or "detail men" by drug manufacturers and wholesalers, sell medicines to retail pharmacies and to hospitals, and inform practicing



Pharmacist mixes ointment.

pharmacists, doctors, dentists, and nurses about new drugs. Others teach in pharmacy colleges, do research, supervise the manufacture of pharmaceuticals, develop new drugs, edit or write articles for pharmaceutical journals, or do administrative work.

Places of Employment

Of the nearly 129,000 licensed pharmacists working in 1970, about 107,000 were in retail pharmacies. Of these retail pharmacists, almost half had their own pharmacies or owned them in partnership; the others were salaried employees. Most of the remaining salaried pharmacists were employed by hospitals, pharmaceutical manufacturers, and wholesalers. Some were civilian employees of the Federal Government, working chiefly in hospitals and clinics of the Veterans Administration and the U.S. Public Health Service. Others 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, practice in or near cities, and in those States which have the greatest populations.

Women, who represent nearly 9 percent of all pharmacists, are employed in all branches of the profession.

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 almost all States, also have a State prescribed amount of practical experience or internship under the supervision of a licensed pharmacist. All States except California, Florida, and Hawaii grant a license without examination to qualified pharmacists already licensed by another State.

In 1970, there were 74 accredited colleges of pharmacy in the United States. Some of these were not filled to capacity and qualified applicants usually could expect to be accepted. Needy students may obtain loans or scholarships up to $2,500 a year to pursue full-time study leading to a degree in pharmacy from Federal funds provided by the Health Professions Educational Assistance Act of 1963, as amended. Several scholarships are awarded annually by drug manufacturers, chain drug stores, corporations, and State and National pharmacy associations.

To graduate from a college of pharmacy and receive a Bachelor of Science (B.S.) or a Bachelor of Pharmacy (B. Pharm.) degree, one must have at least 5 years of study beyond high school. A few colleges that require 6 years award a Doctor of Pharmacy (Pharm. D.) degree at the completion of the program. A few colleges admit students directly from high school and offer all the education necessary for graduation. Most colleges provide 3 or 4 years of professional instruction and require all entrants to have completed their prepharmacy education in an accredited junior college, 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 sciences. Because entry requirements vary among colleges of pharmacy, prepharmacy students should ascertain and follow the curriculum required by colleges they plan to attend.

The bachelor's degree in pharmacy is the minimum educational qualification for most positions in the profession. 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—usually is required for research work or college teaching. Graduate study also is desirable for pharmacists planning to work in hospitals. Those interested in becoming hospital pharmacists can sometimes secure 1- or 2-year internships which combine graduate or advanced professional study and practical experience in a hospital pharmacy.

Since many pharmacists are self-employed, prospective pharmacists should have business ability as well as the ability to instill confidence in customers. Honesty, integrity, orderliness, and manual dexterity are important attributes for the profession. In addition, accuracy is needed to compound and dispense medicines, as well as keep records required by law.

Pharmacists often begin as employees in community pharmacies. After obtaining some experience and the necessary funds, they may become owners or part owners of pharmacies. A pharmacist who gains experience in a chain drugstore may advance to managerial positions and, later, to a higher executive position within the company. Hospital pharmacists having the necessary training and experience may advance to chief pharmacist or to other administrative positions.

Employment Outlook

Most new pharmacy graduates will find employment readily available through the 1970's. Most new 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; the rising standard of medical care; and the growth of Medicaid and other insurance programs that provide for payment of prescription drugs. Many community pharmacies may hire additional pharmacists because of a trend towards shorter working hours. Employment in hospitals probably will rise with the construction of additional facilities and the more extensive use of pharmacists for hospital work. Continued expansion in the manufacture of pharmaceutical products and in research are expected to provide more opportunities for pharmacists in production, research, distribution, and sales. Pharmacists with advanced training will be needed for college teaching and laboratory research.

Earnings and Working Conditions

Beginning pharmacists generally received salaries ranging from $10,000 to $14,000 a year in 1970, according to limited information available. The entrance salary in the Federal Civil Service in 1970 for new graduates was $9,881 or $11,905 depending on college records and other qualifications.

Experienced pharmacists practicing in community pharmacies in 1970 generally were paid annual salaries of between $12,000 and $17,000, according to limited data available. Owners and managers earn more.

Community pharmacists generally work more than the standard 40-hour workweek. Drugstores often are 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, 44 hours is still the basic workweek for many salaried 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 usually receive paid vacations, health insurance, and other fringe benefits.

Sources of Additional Information

General information on pharmacy as a career can be obtained from:

American Pharmaceutical Association, 2215 Constitution Ave. NW., Washington, D.C. 20037.

American Association of Colleges of Pharmacy, 8121 Georgia Ave., Silver Spring, Md. 20910.

Information about student financial aid and chain drug stores may be obtained from:

National Association of Chain Drug Stores, 1911 Jefferson Highway, Arlington, Va. 22202.

Information about retail pharmacies may be obtained from:

National Association of Retail Druggists, 529 14th St., NW., Washington, D.C. 20004.

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 or from:

National Association of Boards of Pharmacy, 77 West Washington St., Chicago, Ill. 60602.

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

PODIATRISTS

(D.O.T. 079.108)

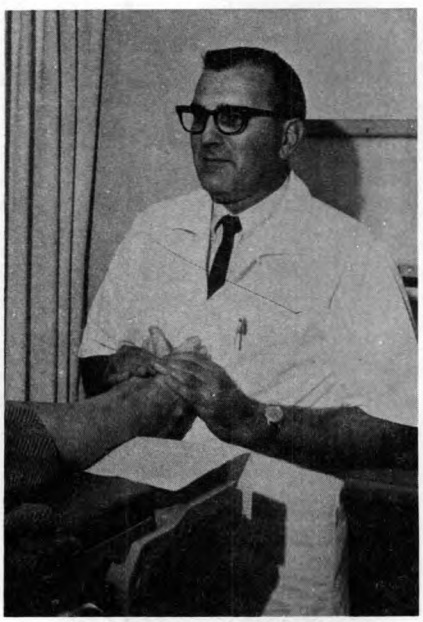
Nature of the Work

Podiatrists (sometimes called *chiropodists*) diagnose and treat diseases and deformities of the feet. They perform foot surgery, prescribe and use drugs and physical therapy, prescribe proper shoes, and fit corrective devices. To help in diagnoses, they take X-rays and perform or prescribe blood and other pathological 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 that may be evidence of medical disorders—such as arthritis, diabetes, or heart or kidney disease.

As a rule, podiatrists provide complete foot care. Some, however, specialize in foot surgery, orthopedics (bone, muscle, and joint disorders), podopediatrics (children's foot ailments), or podogeriatrics (foot problems of the elderly).

Places of Employment

Approximately 7,000 podiatrists were actively engaged in the profession in 1970; about 5 percent were women. Nearly all podiatrists were self-employed. The few who had full-time salaried positions worked mainly in hospitals, podiatric colleges, or for other podiatrists. Small numbers were employed by the Veterans Administration or were commissioned officers in the Armed Forces.



Podiatrists practice mainly in large cities. In early 1970, nearly half were located in four of the most heavily populated States—New York, Pennsylvania, Illinois, and California. 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 an accredited 4-year program in a college of podiatric medicine and must pass a State board examination. In addition, three States—Michigan, New Jersey, and Rhode Island—require applicants to serve a 1-year internship in a hospital or clinic after graduation from a college of podiatric medicine. Three-fourths of the States grant licenses without further examination to podiatrists already licensed by another State.

The five colleges of podiatric medicine in the United States admit only students who have already completed at least 2 years of college. This education must include courses in English, chemistry, biology or zoology, physics, and mathematics.

The first 2 years of podiatry education are chiefly in classroom instruction and laboratory work in basic sciences such as anatomy, bacteriology, chemistry, pathology, physiology, and pharmacology. During the final 2 years, students concentrate on obtaining clinical experience. The degree of 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. Needy students may obtain loans and scholarships up to $2,500 a year to pursue full-time study leading to a degree in podiatry from Federal funds provided by the Health Professions Educational Assistance Act of 1963, as amended.

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 also is important.

Most newly licensed podiatrists set up their own practices. Some purchase established practices. Others begin by obtaining salaried positions 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 1970's. Opportunities for new graduates to establish their own practices, as well as to enter salaried positions, should continue to be favorable.

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 number of older people. This age group, the one needing most foot care, is entitled to certain podiatrists' services under Medicare. Furthermore, the trend toward providing preventive foot care for children is increasing. In addition, more podiatrists will be needed to furnish services in hospitals, extended care facilities, and public health programs.

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. Starting salaries of new podiatrists ranged from $10,000 to $12,000 in 1970, according to limited information available. The average net income of experienced podiatrists was about $21,500. Income was generally higher in large cities.

Podiatrists usually work 40 hours a week. They may set their hours to suit their practice.

Sources of Additional 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.

A list of colleges of podiatric medicine, entrance requirements, curriculums, and scholarships are available from:

American Association of Colleges of Podiatric Medicine, 20 Chevy Chase Circle NW., Washington, D.C. 20015.

Additional information on podiatry as a career may be obtained from:

American Podiatry Association, 20 Chevy Chase Circle NW., Washington, D.C. 20015.

CHIROPRACTORS

(D.O.T. 079.108)

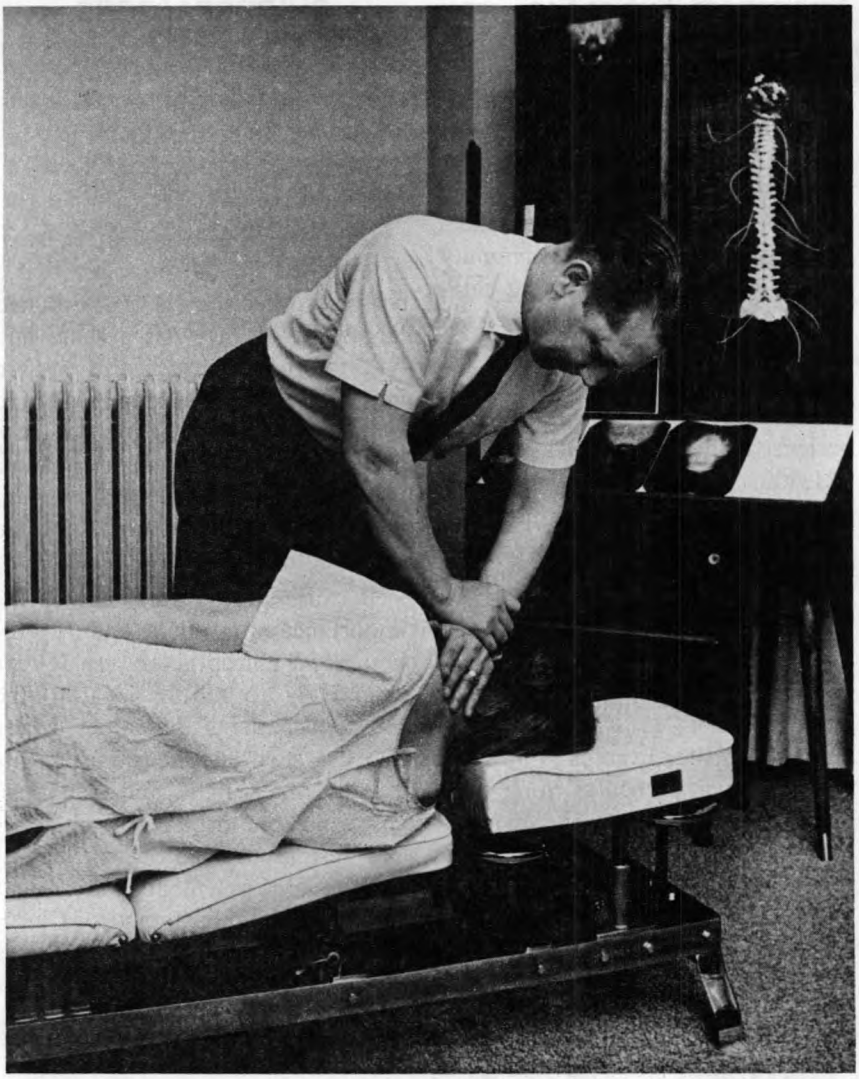
Nature of the Work

Chiropractic is a system of treatment based on the principle that a person's health is determined largely by his nervous system, 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.

Because of the emphasis of the importance of the spine and its position, most chiropractors use X-rays extensively to aid in locating the source of patients' difficulties. Many also use such supplementary measures as water, light, and heat therapy, and prescribe diet, exercise, and rest. Some State laws restrict the type of supplementary treatment permitted in chiropractic. Chiropractic as a system for healing does not include the use of drugs or surgery.

Places of Employment

About 16,000 chiropractors were employed in the United States in 1970; about 9 percent were women. Most chiropractors were engaged in independent private practice. Some were salaried assistants of established practitioners or worked for chiropractic clinics and industrial firms. Others taught or conducted research at chiropractic colleges. More than two-fifths of all chiropractors were located in California, New York, Texas, Missouri, and Pennsylvania.



Chiropractor treats patient's spine.

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 1970, the States of Louisiana and Mississippi did not regulate the practice of chiropractic or issue licenses.

Most States require successful completion of a 4-year chiropractic course following high school graduation. About three-quarters of the States also require 1 or 2 years of preparatory college work before chiropractic training. Nearly two-fifths of the States also require that chiropractors pass a basic science examination. Chiropractors licensed in one State may obtain a license in another State by reciprocity.

Some of the 11 chiropractic colleges in the United States in 1970 emphasized courses in manipulation and spinal adjustments. Others offered a broader curriculum, including such subjects as physiotherapy and nutrition. In most chiropractic colleges, 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 colleges' clinics. The degree of Doctor of Chiropractic (D.C.) is awarded to students completing 4 years of chiropractic training.

Chiropractic requires considerable hand dexterity but not unusual strength or endurance. Among personal qualities considered desirable in dealing effectively with patients are sympathy and understanding.

Most newly licensed chiropractors either set up a new practice or purchase an established one. Some start as salaried chiropractors to acquire experience and funds needed 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 1970's, though only a slight increase in demand for chiropractic services is expected. However, the anticipated small number of new graduates of chiropractic colleges probably will be insufficient to fill openings created by growth, as well as to replace 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 having 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 health care. Opportunities also should be good for those who wish to enter salaried positions in chiropractic clinics, chiropractic colleges, 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 health care of various types, including chiropractic treatment.

Women are expected to have good opportunities in chiropractic, since some women and children prefer to be treated by women chiropractors.

Earnings and Working Conditions

In chiropractic, as in other types of independent practice, earnings are relatively low in the beginning but rise after the first few years. Incomes of chiropractors vary widely. Experienced chiropractors generally had average yearly incomes ranging from $14,000 to $28,000 in 1970, according to the limited data available.

Sources of Additional 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., Des Moines, Iowa 50312.

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

OCCUPATIONAL THERAPISTS

(D.O.T. 079.128)

Nature of the Work

Occupational therapists plan and direct educational, vocational and recreational activities designed to help mentally and physically disabled patients become self-sufficient. They work as members of a medical team which, in addition to physicians may include physical therapists, vocational counselors, nurses, social workers, and other specialists.

About one-third of the total number of occupational therapists work with emotionally handicapped patients, and the rest with persons having physical disabilities. These patients represent all age groups and varying degrees of illness.

The treatment or training goals for patients referred for occupational therapy may include regaining physical, mental or emotional stability; 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 for adults, occupational therapists teach manual and creative skills, such as weaving and leatherworking, and business and industrial skills such as typing and using power tools. In programs for children, they initiate and direct activities appropriate to the child's maturation level. Therapists may design and make special equipment or splints to aid disabled patients.

In addition to patient care, occupational therapists supervise student therapists, occupational therapy assistants, volunteers, and auxiliary nursing workers. The chief occupational therapist in a hospital may teach medical and nursing students the principles of occupational therapy. Many therapists are administrators and direct occupational therapy programs, coordinate patient activities, or act as consultants to local and State health departments and mental health authorities. Some teach in colleges and universities.

Places of Employment

About 7,500 occupational therapists were employed in 1970; more than 9 out of 10 were women. More than three-fourths of all occupational therapists work in hospitals.

Most of the remainder are employed in rehabilitation centers, custodial care and nursing homes, schools, outpatient clinics, community mental health centers, and research centers. Some work in special workshops, sanitariums, camps for handicapped children and in State health departments. Others are employed in home-care programs for patients unable to attend clinics or work shops. Still others are members of the Armed Forces.

Training, Other Qualifications, and Advancement

The minimum requirement for entry into the profession is a degree or certificate in occupational therapy. In 1970, 36 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. All of these schools offer a bachelor's degree program for high school graduates or transfer students who have completed 2 years of college. Some of the schools also offer shorter programs leading to a certificate in occupational therapy for students having a bachelor's degree in another field.

The academic work in a 4-year program emphasizes the physical, biological, and behavioral sciences and the application of occupational therapy skills. In addition to the academic work, the training includes 6 to 9 months of supervised clinical experience in hospitals or health agencies. Some programs give part of the clinical experience 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).

Eight universities offer a program for occupational therapists leading to a master's degree in occupational therapy. The master's degree also is offered at six universities as the first professional degree for persons holding a baccalaureate degree in related fields. A graduate degree often is required for teaching, research, or administrative work.

Newly graduated occupational therapists generally 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, such as program coordinators and consultants, also are available in large institutions and agencies.

Personal qualifications needed in this profession include emotional stability and a sympathetic but objective approach to illness and disability. An ability to teach, ingenuity, and imagination also are needed.

Employment Outlook

Employment opportunities for occupational therapists are expected to be excellent through the 1970's. Despite anticipated increases in the number of graduates of occupational therapy programs, the demand for therapists is expected to exceed the supply as public interest in the rehabilitation of disabled persons and the success of established occupational therapy programs increases. Many occupational therapists will be needed to staff the growing number of community health centers and extended care facilities. There will continue to be numerous opportunities to children, and aged persons, as work with psychiatric patients, well as with persons suffering from cerebral palsy, tuberculosis, and heart disease. In addition to openings that will result from growth, 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. Opportunities for experienced women who wish to return to work part time after rearing their children should be excellent.

Earnings and Working Conditions

Annual salaries of staff and senior occupational therapists ranged from $8,000 to $10,000 in 1970, according to the American Occupational Therapy Association. Directors of services, coordinators, consultants, and others in top administrative positions generally earned annual salaries of $13,000 to $18,000 in 1970.

In the Federal Government, the beginning annual salary for inexperienced occupational therapists was $7,294 in 1970. More than one-fifth of all occupational therapists in the Federal Government earned $10,500 or more a year.

Most occupational therapists work an 8-hour day, 40-hour week, including 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.

Sources of Additional Information

American Occupational Therapy Association, 251 Park Avenue South, New York, N.Y. 10010.

OCCUPATIONAL THERAPY ASSISTANTS

(D.O.T. 079.368)

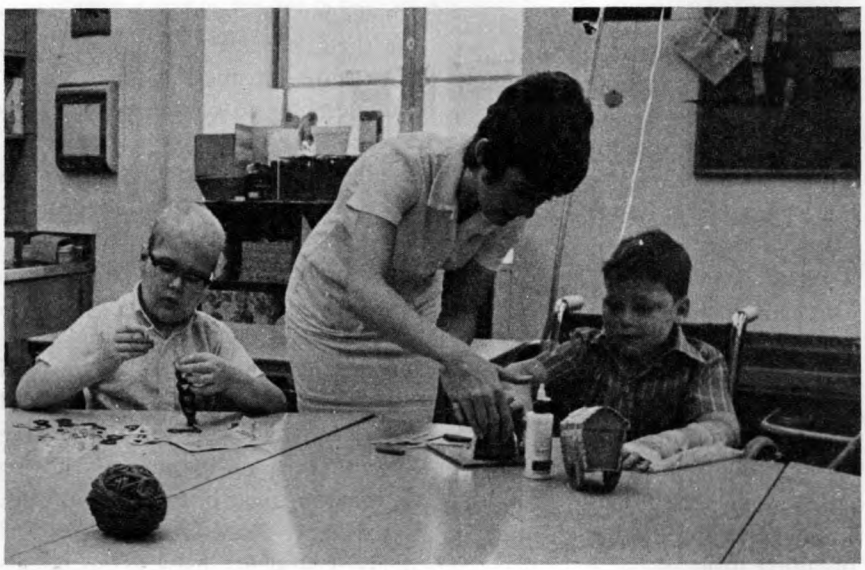
Nature of the Work

Occupational therapy assistants work under the supervision of professional occupational therapists to help rehabilitate patients who are physically and mentally disabled. Through educational, vocational, and recreational activities, they help carry out programs designed to strengthen their patients' muscle power; increase their joint motion and coordination; and develop self-sufficiency in overcoming disabilities.

These rehabilitational activities are usually carried out through instruction in creative skills such as woodworking, ceramics, and graphic arts, or in work-related recreational and social functions such as games, dramatics, and gardening, or in self-care skills such as eating, dressing, and shaving.

The widely varying patients require that assistants be capable of teaching a broad range of skills. They may work either with groups or with individual patients, including those confined to bed. Generally, when treating patients ill with diseases, assistants work under the supervision of professional occupational therapists. In some situations, by contrast, they may work largely independently, with only periodic consultation with professionals—as in activities designed to meet the normal health needs of handicapped persons living in institutions.

Occupational therapy assistants also have a variety of tasks other than working directly with patients. They may order supplies, prepare work materials, and help maintain tools and equipment. At times, they perform clerical duties such as keeping patients' records and preparing clinical notes.



Places of Employment

Approximately 6,000 occupational therapy assistants were employed in the United States in 1970; most were women. The majority of occupational therapy assistants worked in general and specialized hospitals, in occupational therapy departments. Others were employed in rehabilitation centers, homes for the aged, convalescent and nursing homes, schools for handicapped children, day care centers, facilities for the mentally retarded, special workshops, and out-patient clinics. A small number were members of the Armed Forces.

Training, Other Qualifications, and Advancement

Most occupational therapy assistants employed in 1970 qualified through on-the-job training received in hospitals and other health care facilities. Some learned their skills in vocational, technical, and adult education programs or received training in programs sponsored by the Manpower Development and Training Act (MDTA). Detailed information about MDTA-sponsored training is available from State Employment Services. Other assistants were graduated from one- or two-year junior college programs.

Applicants for training programs must be high school graduates or the equivalent. Preference is given to applicants who have taken courses in science and crafts and have previous experience as nursing aides.

Directors of approved programs may recommend that graduates be certified by the American Occupational Therapy Association (AOTA) and receive the title of Certified Occupational Therapy As-

sistant (C.O.T.A.). In 1970, about 2,000 employed occupational therapy assistants were C.O.T.A.'s. About 25 occupational therapy assistant training programs had AOTA approval in 1970.

AOTA certifies graduates of approved programs, drawn from three categories: (1) hospital-based programs lasting about 25 weeks; (2) one-year vocational school programs; and (3) two-year junior college programs. Each approved program requires completion of designated courses and supervised practical experience. Courses include the history and philosophy of occupational therapy; structure and function of the human body; growth and development from childhood to old age; the effect of illness and injury on patients; and skills, crafts, and activities of daily living and their applications to physical and mental disabilities. Although these basic subjects are common to all categories of approved programs, graduates of junior colleges in addition earn some credits that may be transferred to 4-year colleges.

Young people looking to careers as occupational therapy assistants should have good physical and mental health, a sincere liking for people, and the ability to establish and maintain effective personal relationships. Manual and finger dexterity, to handle tools and materials while instructing patients, as well as good color perception when using colored arts and crafts materials, are also valuable talents for work in occupational therapy.

Employment Outlook

Opportunities for occupational therapy assistants are expected to be excellent through the 1970's, particularly for C.O.T.A.'s. The anticipated growing demand is linked to the factors underlying the rising demand for professional occupational therapists. Public interest in the rehabilitation of disabled persons is increasing. Many assistants will be needed to staff community health centers established under the Mental Retardation Facilities and Community Mental Health Centers Construction Act of 1963.

In addition, many openings will arise because of the need to replace workers who leave the occupation —particularly young women with marriage and family responsibilities. After rearing their own children, experienced women wishing to do so will have good opportunities to re-enter the occupation.

Earnings and Working Conditions

In 1970, weekly salaries generally ranged from $95 to $120 for inexperienced occupational therapy assistants and from $125 to $150 for experienced assistants. Workers who completed training programs approved by the AOTA received higher starting salaries than those paid to beginners without any training.

Occupational therapy assistants generally work indoors although, weather permitting, they may engage patients in suitable outdoor activities. Work hours are usually 8 hours daily, 5 days a week; occasionally, there may be evening and weekend assignments.

Sources of Additional Information

Additional information on a career as an occupational therapy assistant and on programs offering training for the occupation may be obtained from:

The American Occupational Therapy Association, 251 Park Avenue South, New York, N.Y. 10010.

PHYSICAL THERAPISTS

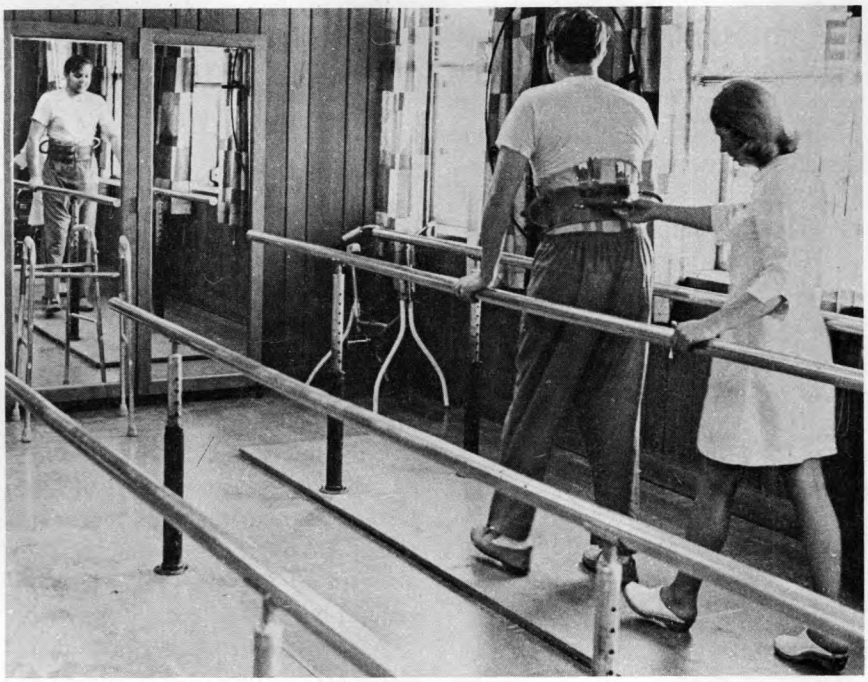
(D.O.T. 079.378)

Nature of the Work

Physical therapists help persons with muscle, nerve, joint, and bone diseases or injuries to overcome their disabilities. They use exercises, mechanical apparatus, massage and applications of heat or cold, light, water, or electricity to treat patients. Most of their patients are accident victims, crippled children, and disabled older persons.

To develop programs for treatment, physical therapists perform muscle, nerve, and other functional 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 and adjust to their physical handicaps. They also show members of the patients' families how to continue treatments at home.

Physical therapists are members of a health care team that is directed by a physician and may include a nurse, clinical social worker, occupational therapist, 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 having amputations, arthritis, or paralysis. They also may instruct physical therapy students, as well as students



of related professions and other health workers.

Places of Employment

Approximately 15,000 licensed physical therapists were employed in 1970. About two-thirds of all therapists were women.

About three-fourths of all physical therapists work in general hospitals; in hospitals that specialize in the care of pediatric, orthopedic, psychiatric, or chronically ill patients; and in nursing homes.

Most of the remainder 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 having 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. Others serve as consultants in government and voluntary agencies. In addition, a few hundred are members of the Armed Forces.

Training, Other Qualifications, and Advancement

A license is required to practice physical therapy in 49 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 Texas and Missouri, employers require a degree or certificate from an approved school of physical therapy. In 1970, 52 schools of physical therapy (including the Army Medical Service School) were approved by the American Medical Association and the American Physical Therapy Association. Most of the schools are part of large universities; a few are operated by hospitals, which usually have university affiliations.

Most of the approved schools of physical therapy offer bachelor's degree programs. Some schools provide 1- to 2-year programs for students who have completed some college courses. Other schools accept those who already have a bachelor's degree and give a 12- to 16-month course leading to a certificate in physical therapy. 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, hydrotherapy, massage therapeutic exercise, and administration. 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 function of a therapist's job is to help patients and their families understand the treatments and adjust to their handicaps, therapists must have patience, tact, resourcefulness, and emotional stability. 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 be excellent through the 1970's.

The demand for physical therapists is expected to increase very rapidly through the 1970's as the result of increased public recognition of the importance of rehabilitation. Many new positions for physical therapists are expected to be created as programs to aid crippled children and rehabilitation activities are expanded to serve the increasing number of disabled people who require physical therapy. Rapid growth in the number of nursing homes also should result in the need for many more physical therapists to work as staff members. 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 combine work and family responsibilities.

Increased demands for physical therapy services also will result in greater opportunities for physical therapy assistants who generally obtain their training in junior colleges or on the job in hospitals and other institutions.

Earnings and Working Conditions

New physical therapy graduates received starting salaries ranging between $8,000 and $10,000 in 1970, according to the American Physical Therapy Association. Annual salaries of experienced therapists generally ranged from $14,000 to $20,000. Physical therapists in consultative, educational, or administrative positions earned salaries of $15,000 to $25,000.

In 1970, beginning therapists employed by the Federal Government received annual starting salaries of $7,294; those having high academic standing, however, were offered $8,098. About one-fifth of all physical therapists employed by the Federal Government were earning salaries of $11,905 or more a year.

Most physical therapists work 40 hours a week. Almost all receive 2 weeks of vacation or more, and the majority receive sick leave and other fringe benefits.

Sources of Additional Information

American Physical Therapy Association, 1156 15th St., NW., Washington, D.C.

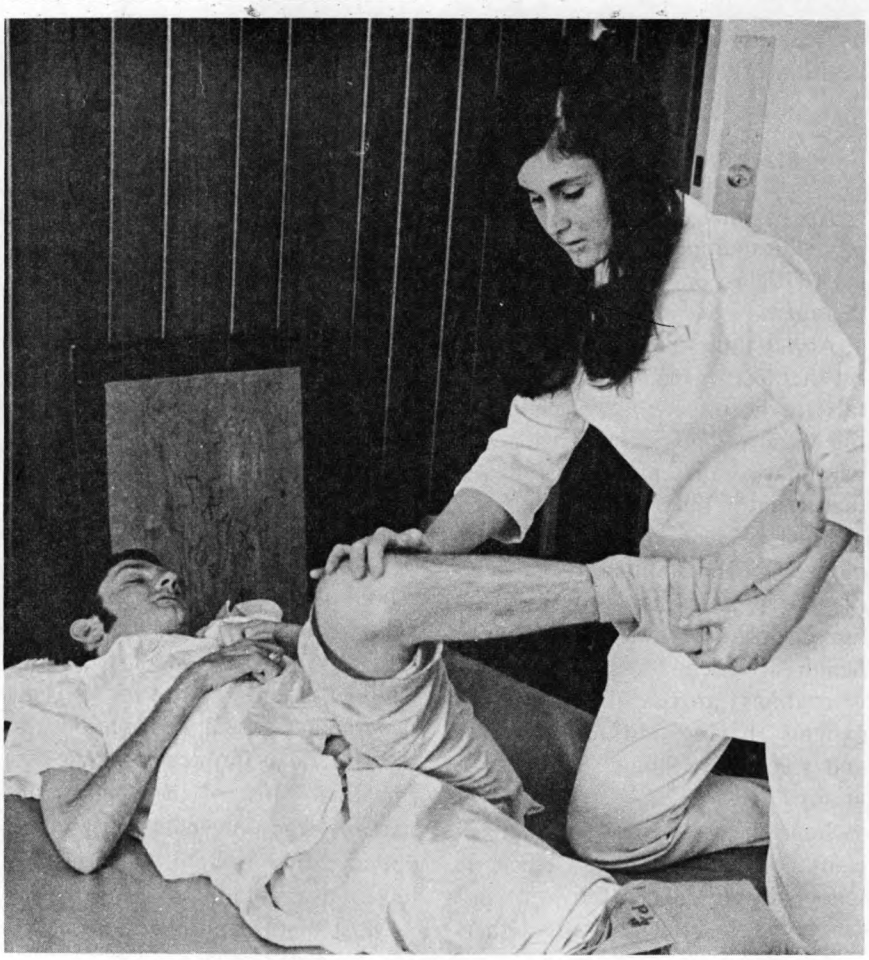
PHYSICAL THERAPY ASSISTANTS

(D.O.T. 355.878)

Nature of the Work

Physical therapy assistants work under the supervision of professional physical therapists to rehabilitate disabled persons so that they may again lead useful and productive lives. To do this, the assistants must work to restore physical functions in the patients and prevent disability from injury or illness. They also try to improve their patients' general health and strength.

Assistants help physical therapists perform tests on patients to de-



termine the desired treatment and assist in administering it. They position patients for treatment; use special therapy equipment to apply heat, cold, light, sound, and massage; watch closely patients and equipment during treatment and report their findings to supervisors or professionals. Treatments also include helping patients do therapeutic exercises and functional activities such as walking and climbing stairs.

Physical therapy assistants help patients to dress and undress for treatment, and may remove and replace for the patients such devices as braces, splints, and slings, and transport patients to and from treatment areas.

Physical therapy assistants work with patients in the fitting of artificial limbs, braces, and splints, and in instructing them in how to use these prosthetic devices.

Assistants are responsible also for the care and assembling of physical therapy treatment equipment, such as hydrotherapy tanks, as well as cleaning equipment and maintaining a safe environment for the disabled. In addition, assistants do clerical work such as keeping patients' records, making appointments, and acting as receptionists.

Places of Employment

Approximately 10,000 physical therapy assistants were employed in the United States in 1970—about half of them were women. The majority worked in physical therapy departments of general and specialized hospitals. Others were employed in rehabilitation centers, nursing homes for the chronically ill and elderly, community and government agencies providing health services, schools for crippled children, facilities for the mentally retarded, and physicians' or physical therapists' offices and clinics. A small number were members of the Armed Forces.

Training, Other Qualifications, and Advancement

Most physical therapy assistants employed in 1970 qualified for the occupation through training received on the job in hospitals and other health care facilities. Some workers were trained in on-the-job programs sponsored by the Manpower Development and Training Act.

The duration and content of on-the-job programs vary widely, depending on factors such as the level of duties assistants are permitted to perform, the particular services required by different patients when the program is in progress, and the amount of time professional physical therapists can allocate for teaching trainees. Applicants admitted to on-the-job training programs for physical therapy assistants generally must be high school graduates or the equivalent. Employers usually prefer applicants with additional qualifications, such as high school science courses and previous hospital experience as nurse aides.

Other physical therapy assistants learned their skills in vocational, technical, or adult education programs. A small number were trained in 2-year college programs for physical therapy assistants. In the past few years, junior college programs have been established in increasing numbers. In 1970, 25 physical therapy assistant programs were in the planning stage or had been started.

Junior college programs are recommended by the American Physical Therapy Association because they train high-calibre physical therapy assistants. The programs require completion of designated courses, as well as supervised clinical experience. Among the prescribed courses are history and philosophy of rehabilitation; structure and function of the human body; human growth and development; psychology; physical therapy assisting procedures; functional anatomy; and ethics and departmental procedures.

Personal qualifications needed for those planning a career as a physical therapy assistant include: good physical and mental health; manual dexterity to adjust equipment; body coordination to assist in positioning patients; and a sincere interest in helping the physically handicapped.

Employment Outlook

Job opportunities for physical therapy assistants are expected to be excellent through the 1970's particularly for graduates of a 2-year junior college program. Anticipated demand for physical therapy assistants will accompany the growing demand for professional physical therapists. Growth factors include increasing public awareness of the importance of rehabilitation (evidenced by about a threefold growth in the number of persons rehabilitated by Federal and State funds between 1960 and 1970); a growing number of nursing homes which provide therapeutic services to the elderly; and expanded physical therapy services planned by hospitals, nursing homes, schools for crippled children, facilities for mentally retarded, and other health and rehabilitation centers.

In addition, many openings will

arise because of the need to replace workers who die, retire, or leave the occupation for other reasons.

Earnings and Working Conditions

In 1970, weekly salaries generally ranged from $80 to $110 for inexperienced physical therapy assistants and from $110 to $150 for those with experience. Workers who completed 2-year junior college programs received higher starting salaries than those paid beginners without any training.

Physical therapy assistants work indoors in hospitals, clinics, and other health care facilities. They also may work in patients' homes. Working hours are usually 8 hours a day, 5 days a week.

Sources of Additional Information

Additional information on a career as a physical therapy assistant and on programs offering training for the occupation may be obtained from:

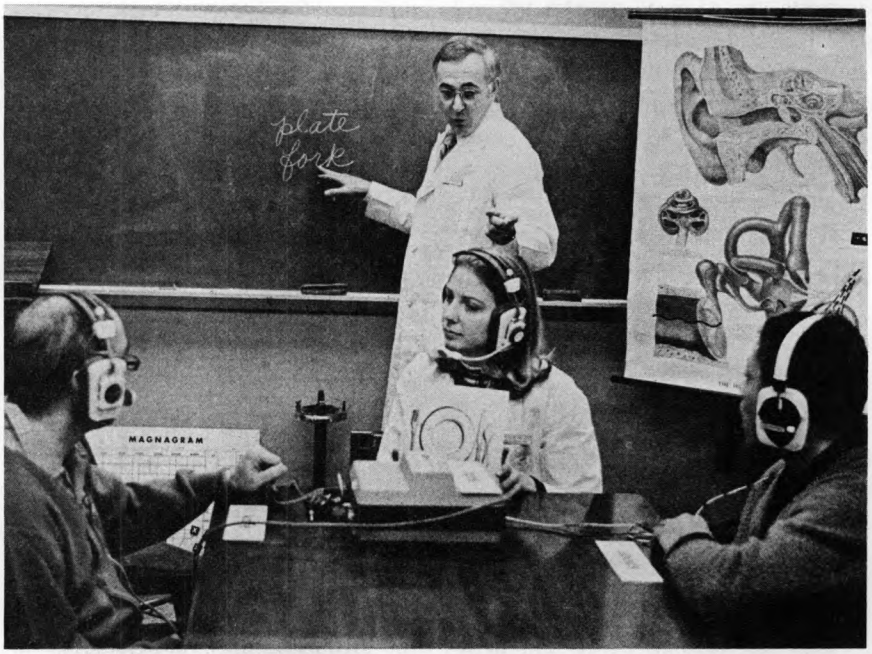
The American Physical Therapy Association, 1156 15th St. NW., Washington, D.C. 20005.

SPEECH PATHOLOGISTS AND AUDIOLOGISTS

(D.O.T. 079.108)

Nature of the Work

The inability to speak or hear clearly is a severe hardship to persons of all ages. Children who have difficulty speaking or hearing usually are unable to play freely with others or to participate fully in normal classroom activities. Adults suffering from speech or hearing impairments often face problems of job adjustment. Speech pathologists and audiologists help persons having such disorders by identifying and evaluating their problems and by providing treatment. In addition, they may conduct research in the speech and hearing field. Some are engaged in training programs in speech pathology and audiology at colleges and universities.



Speech pathologists are concerned primarily with speech and language disorders and audiologists with hearing problems. Speech and hearing, however, are so interrelated that 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 speech, language and voice problems resulting from brain injury, cleft-palate, mental retardation, emotional problems, foreign dialect, or other causes. The audiologist also works with children and adults, but 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 identify and 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 as physicians, psychologists, social workers, physical therapists, counselors, and teachers. Some perform research work, which may consist of investigating communicative disorders and their causes and improving methods for clinical services. Others may supervise clinical activities or perform other administrative work.

Speech pathologists and audiologists working in colleges or universities provide instruction in the

principles and bases of communication, communication disorders, 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.

Places of Employment

Approximately 22,000 persons were employed as speech pathologists and audiologists in 1970. Women represented about three-fourths of total employment. The majority of speech pathologists and audiologists work in public school systems. Colleges and universities employ the next largest number of these specialists in classrooms, clinics, and research centers. The remainder are distributed among hospitals, rehabilitation and community speech and hearing centers, State and Federal Government agencies, industry, and private practice.

Training, Other Qualifications, and Advancement

Although only a few States presently have such a requirement, a master's degree in speech pathology or audiology or its equivalent is being stressed increasingly as the minimum educational standard for employment in public school systems. In addition, many Federal programs, such as Medicare and Medicaid, require that speech and hearing services be given by, or under the supervision of a speech pathologist or audiologist holding a master's degree.

Undergraduate training in speech pathology and audiology should include course work in anatomy, biology, physiology, physics, and in other related areas such as linguistics, semantics, and phonetics. Some specialized course work in speech and hearing, as well as in child psychology and psychology of the exceptional child, also is helpful. This training is usually available at colleges and universities offering a broad liberal arts program.

Graduate education in speech pathology and audiology was offered at 203 colleges and universities in 1970. 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. Rehabilitation Services Administration, the Maternal and Child Health Service, the U.S. Office of Education, and the National Institutes of Health allocate funds for teaching and training grants to colleges and universities offering graduate study in speech and hearing. The Veterans Administration and the Rehabilitation Services Administration provide stipends for predoctoral training.

Speech pathologists and audiologists 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 emotional stability.

Employment Outlook

Employment opportunities for speech pathologists and audiologists who have completed graduate study are expected to be good through the 1970's. Although some positions will be available for individuals having only the bachelor's degree, the increasing emphasis being placed on the master's degree by Federal agencies and State governments will limit opportunities at the bachelor's level.

Many speech pathologists and audiologists will be needed annually through the 1970's to staff new and expanding programs in schools, clinics, colleges and universities, and hospitals. In addition, many will be needed to replace those who die, retire, or leave the profession for other reasons.

Several factors are expected to increase demand for the services of speech pathologists and audiologists during the 1970's: 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 having speech and hearing problems that are common to later life; a rapid expansion in expenditures for medical research; the growing public interest and awareness of the serious problems connected with speech and hearing dis-

orders, as illustrated by the Elementary and Secondary Education Act, as amended, which provides for the education of handicapped children; and expanded Federal programs such as Medicare and Medicaid.

Earnings and Working Conditions

Median salaries of speech pathologists and audiologists employed in colleges and universities ranged from $9,200 to $17,200 for a 9- to 10-month contract period in 1970, according to the American Speech and Hearing Association. Median salaries may be as much as $4,700 higher for an 11- to 12-month contract. Many experienced speech pathologists and audiologists in educational institutions supplement their regular salaries by incomes from consulting, special research projects, and writing books and articles.

The average annual salary for speech pathologists and audiologists in elementary and secondary schools in 1970 was about $10,700 according to an American Speech and Hearing Association survey of members employed in these schools.

In 1970 the annual starting salary in the Federal Government for speech pathologists and audiologists who had completed all requirements for the master's degree was $9,881. Those having doctoral degrees were eligible to start at $13,493.

Most speech pathologists and audiologists work 40 hours a week; however, personnel engaged in research may work longer hours. Almost all employment situations provide fringe benefits such as paid vacations, sick leave, and retirement programs.

Sources of Additional 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.

A listing of college and university programs and a booklet on student financial aid as well as general career information can be obtained from:

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

MEDICAL LABORATORY WORKERS

(D.O.T. 078.128; .168; .281; and .381)

Nature of the Work

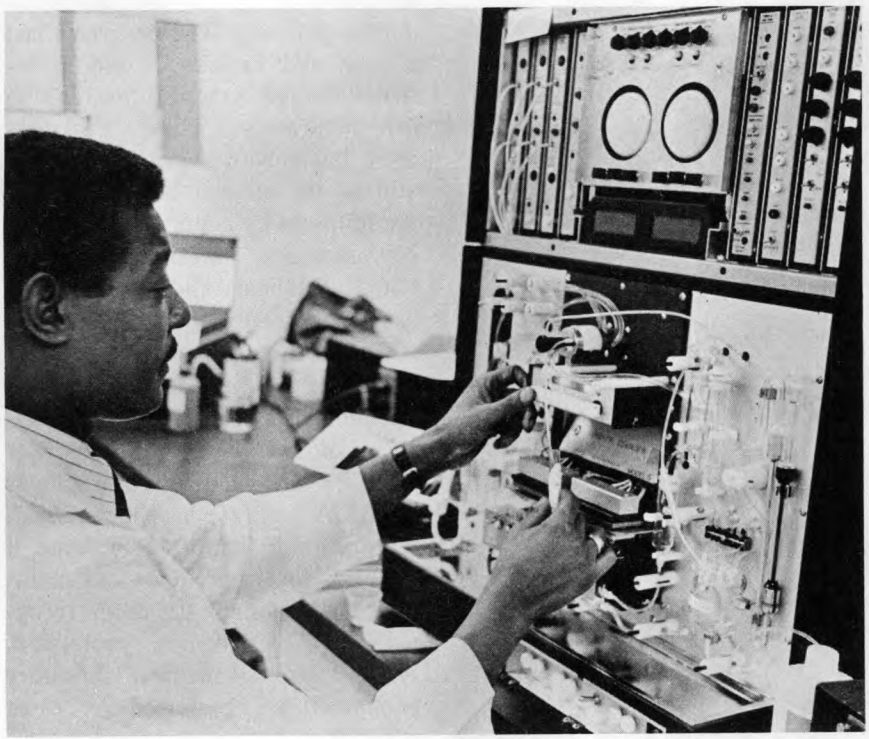
Laboratory tests play an important part in the detection, diagnosis, and treatment of cancer, tuberculosis, diabetes, meningitis, and other diseases. Medical laboratory workers, often called clinical laboratory workers include three levels: medical technologists, technicians, and assistants. They perform tests under the direction of pathologists (physicians who specialize in diagnosing the causes and nature of disease), other physicians or scientists specializing in clinical chemistry, microbiology, or the other biological sciences. Medical laboratory workers use precision instruments, such as microscopes and automatic analyzers, to analyze the blood, tissues, and fluids in the human body. Results of such tests help physicians treat patients.

Medical technologists, who require 4 years of post-secondary training, perform the more complicated chemical, microscopic, and bacteriological tests. These tests may include chemical tests to determine blood cholesterol level, or microscopic examination of the blood to detect the possibility of leukemia. Other body fluids may be examined microscopically; cultured to determine the presence of bacteria, parasites, or other microorganisms; and analyzed for chemical content or reaction. Technologists also may type and crossmatch blood samples. Technologists in small laboratories often perform many types of tests. Those in large laboratories usually specialize in several kinds of related tests in areas such as microbiology, parasitology, biochemistry, blood banking, hematology (the study of blood cells), histology (tissue preparation), cytology (analysis of body cells), and nuclear medical technology (the use of radioactive isotopes to help detect diseases).

Most medical technologists conduct tests related to the examination and treatment of patients. However, some do research on new drugs or on the improvement of laboratory techniques. Others teach or perform administrative duties.

Medical laboratory assistants, who generally do not have college training, assist the medical technologist in routine tests and related work that can be learned in a relatively short time.

Medical laboratory assistants in large laboratories may concentrate in one of several areas. Laboratory assistants working in bacteriology, serology, and parasitology prepare and stain slides for study, apply sensitivity disc to culture plates and record results; and prepare specimens for microscopic studies. Those in hematology collect and perform blood counts and tests to determine



Medical technologist operates automatic blood cell counting machine.

bleeding time, coagulation time, sedimentation rate, and prothrombin time. In clinical chemistry, assistants help analyze samples of body fluids to diagnose and treat diseases. Assistants in the blood bank carry out slide and test tube procedures to identify blood groups and keep blood-bank records. They assist in laboratory techniques such as centrifuging urine samples and preparing the samples for microscopic study.

In basal metabolism and electrocardiography work, they prepare patients for tests as well as operate and maintain testing equipment. In small laboratories, medical laboratory assistants generally work in many areas.

In addition to performing routine tests, assistants may store and label plasma; clean and sterilize laboratory equipment, glassware, and instruments; prepare solutions following standard laboratory formulas and procedures; keep records of tests; and identify specimens.

Medical laboratory technicians generally have a higher level of skill than assistants, but not the technical knowledge of highly-trained technologists. Like technologists and assistants, they may work in several areas or specialize in one field.

Places of Employment

An estimated 110,000 medical laboratory workers were employed in 1970—two-fifths were medical technologists. Approximately 80 to 90 percent of all medical laboratory workers were women. However, the number of men in the field has been increasing in recent years.

About four-fifths of all medical laboratory workers are employed in hospitals. Other places of employment include independent laboratories, physicians' offices, clinics, public health agencies, pharmaceutical firms, and research institutions.

In 1970, about 1,200 medical technologists and about 1,500 medical laboratory technicians and assistants worked in the hospitals and laboratories of the Veterans Administration. Others were employed by the Armed Forces and the U.S Public Health Service.

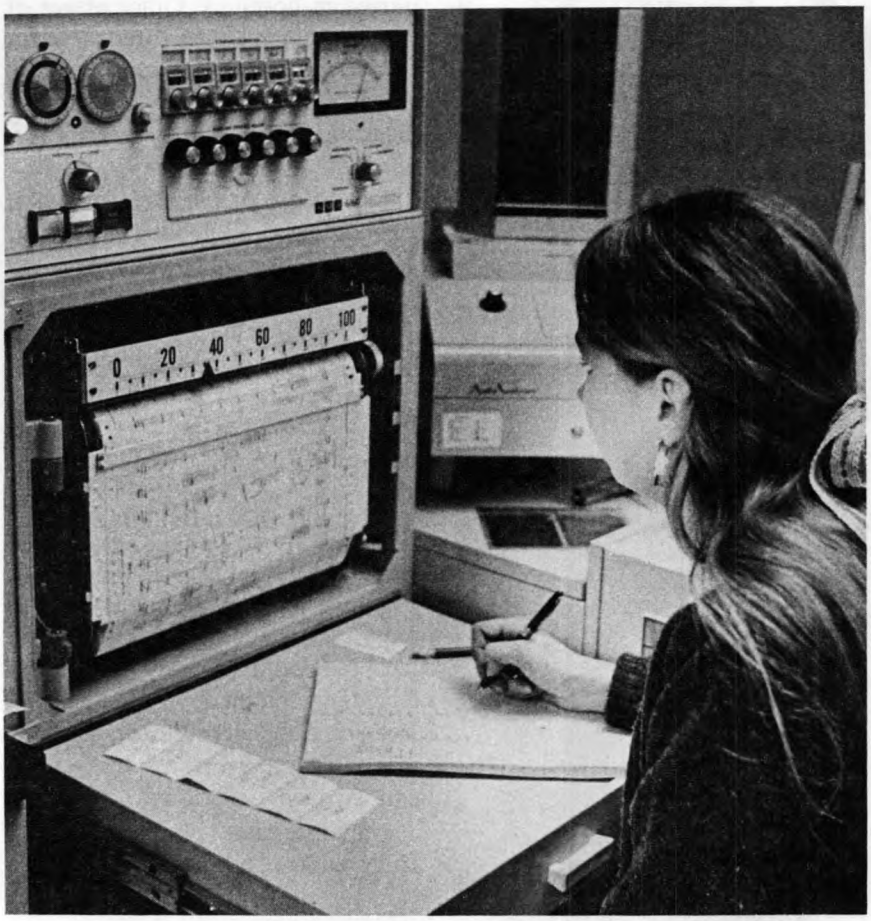
Training, Other Qualifications, and Advancement

The usual minimum educational requirement for beginning medical technologists is 4 years of college including completion of a specialized training program in medical technology approved by the American Medical Association.

Undergraduate work must include courses in chemistry, biological science, and mathematics. Such studies give the technologist a broad understanding of the scientific principles underlying laboratory work. The specialized training usually requires 12 months of study and includes extensive laboratory work. In 1970, such training was given in about 800 hospitals and schools, most of which were affiliated with colleges and universities. A bachelor's degree is often awarded upon completion of the college affiliated program. A few schools require a bachelor's degree for entry into the program.

Many universities also offer advanced degrees in medical technology and related subjects for technologists who plan to specialize in the laboratory or in teaching, administration, or research.

Medical laboratory technicians



Medical technician uses automated chemistry machine.

employed in 1970 had obtained their training in a variety of educational settings. Many had received one or more years of post-secondary education in junior or 4-year colleges and universities. Some technicians have attended private schools, which offer 12- to 18-month programs to high school graduates. Some technicians have gained experience in the Armed Forces. The Navy, for example, conducts a 14-month program to train clinical laboratory and blood bank technicians and the Army has a 50 week "senior medical laboratory specialist" program. A few technicians received training in nonprofit vocational and technical schools.

Most medical laboratory assistants employed in 1970 received their training on the job. In recent years, however, an increasing number have received their training in academic programs conducted by hospitals or vocational schools and junior colleges in cooperation with hospitals. In the future, academic training probably will be required by most employers. Hospitals offer the greatest number of training programs, some of which were established under the Manpower Development and Training Act and the Vocational Education Act. For entry into these programs, graduation from high school with courses in science and mathematics is required generally. The programs last a year and include classroom instruction and practical training in the laboratory. These programs often begin with a general orientation to the clinical laboratory and are followed by courses in bacteriology, serology, parasitology, hematology, clinical chemistry, blood banking, and urinalysis.

Certification examinations, administered by the Board of Medical Technologists of the American Society of Clinical Pathologists (ASCP), are available to graduates of AMA approved schools. Such registration is important because it indicates that a graduate has maintained educational standards recognized by the medical profession. ASCP-registered medical laboratory personnel are preferred by most employers.

In California, Florida, Hawaii, Tennessee, New York City, and Puerto Rico, medical technologists and technicians also must be licensed.

Technologists may be promoted to supervisory positions in certain areas of laboratory work or, after several years' experience, to chief medical technologist in a large hospital. Graduate education in one of the biological sciences or chemistry usually speeds advancement in all areas. Technicians and assistants may have difficulty advancing to medical technologists unless they continue their education and obtain a bachelor's degree in biology or chemistry, or a degree or certificate in medical technology.

Personal characteristics important for medical laboratory work include accuracy, dependability, and the ability to work under pressure. Manual dexterity and the ability to discriminate colors accurately are highly desirable.

Young people interested in a

medical laboratory career should select a training program with considerable care. Information should be obtained about the kinds of jobs obtained by graduates, educational costs, the length of time the training program has been in operation, instructional facilities, and faculty qualifications.

Employment Outlook

Employment opportunities for medical laboratory workers are expected to be excellent through the 1970's. New graduates having a bachelor's degree in medical technology will be sought for entry technologist positions in hospitals. A particularly strong demand is anticipated for technologists having graduate training in biochemistry, microbiology, immunology, and virology. Employment opportunities for medical laboratory technicians and assistants also are expected to be very favorable.

Employment opportunities for medical laboratory personnel 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 the demand for these workers. Other factors affecting growth in this field include the country's expanding population; rising standards of living; increasing health consciousness; expanding medical services resulting from new medical techniques and drugs; expanding medical research activities; and extension of prepayment programs for medical care, including Medicare.

Advances in technology in general are expected to stimulate the demand for workers in this occupation. Many new technological developments permit greater numbers and more varieties of tests to be performed. Newly developed automated equipment is not expected to limit the growth of medical technologists. However, the development of new automated equipment that reduces the need for personnel to do simple repetitive tasks may tend to partially offset the growth in demand for the services of medical laboratory assistants.

In addition to medical laboratory workers who will be needed to fill openings resulting from the rapid growth of this field, large numbers also will be needed as replacements because many workers are young women who may leave their jobs for marriage and family responsibilities. Opportunities for part-time employment will continue to be available. Opportunities also should be good for qualified older workers and handicapped persons.

Earnings and Working Conditions

Salaries of medical laboratory workers vary by employer and geographic location of employment. In general, medical laboratory workers employed on the West Coast and in large cities received the highest salaries.

The average starting salary for medical technologists was about $7,500 in 1970, according to limited data available. Beginning salaries for medical laboratory assistants generally ranged from $150 to $250 a month less than those paid medical technologists. Technicians received salaries ranging between those paid technologists and assistants.

Newly graduated medical technologists at the baccalaureate level employed by the Federal Government in 1970 received $6,548. Those having experience, superior academic achievement, or a year of graduate study entered at $8,098. Depending on the amount and type of education and experience, medical laboratory assistants and technicians in the Federal Government earned starting salaries ranging from $4,621 to $5,853 a year in 1970.

Medical laboratory personnel generally work a 40-hour week. In hospitals, they can expect some night or weekend duty. Hospitals generally provide vacation and sick leave benefits; some have retirement plans.

Laboratories are in general well lighted and clean. Although unpleasant odors and specimens of many kinds of diseased tissue often are present, few hazards exist if proper methods of sterilization and handling of specimens, materials, and equipment are used.

Sources of Additional Information

Information about education and training for medical technologists, technicians, and laboratory assistants meeting standards recognized by the medical profession and the U.S. Office of Education as well as career information on these fields of work may be obtained from:

Registry of Medical Technologists of the American Society of Clinical Pathologists, 710 S. Wolcott Ave., Chicago, Ill. 60612.

American Society of Medical Technologists, Suite 1600, Hermann Professional Bldg., Houston, Tex. 77025.

Information about technician training programs offered in private schools may be obtained from:

American Medical Technologists, 710 Higgins Road, Park Ridge, Ill. 60068.

International Society of Clinical Laboratory Technologists, 805 Ambassador Building, 411 North Seventh St., St. Louis, Mo. 63101.

Information about employment opportunities in government clinical and research hospitals may be obtained from the Department of Medicine and Surgery, Veterans Administration, Washington, D.C. 20421, and the Clinical Center, National Institutes of Health, Bethesda, Md., 20014.

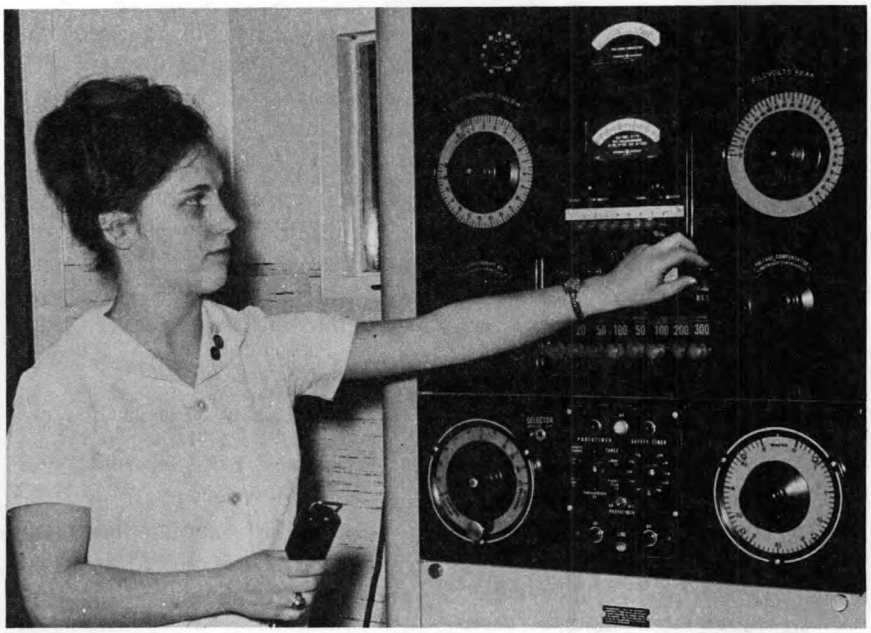
RADIOLOGIC TECHNOLOGISTS

(D.O.T. 078.368)

Nature of the Work

Medical X-rays play a major role in the diagnostic and therapeutic fields of medicine. Radiologic technologists, also called medical X-ray technicians, operate X-ray equipment under the direction of physicians who are usually radiologists (specialists in the use of X-rays).

Most radiologic technologists perform diagnostic work, using X-ray equipment to take pictures of internal parts of the patient's body. They may prepare chemical mixtures, such as barium salts, which the patient swallows to make specific organs appear clearly in X-ray examinations. The technician utilizes proper radiation protection devices and techniques that safeguard against possible radiation hazards. After determining the correct voltage, current, and desired exposure time, the technician positions the patient and makes the required number of radiographs to be developed for interpretation by the physician. The technician may use mobile X-ray equipment at a patient's bedside and in surgery. The technician also is usually responsible for keeping treatment records.



Radiologic technologist determines proper voltage current and exposure time before taking X-ray.

Some radiologic technologists perform radiation therapeutic work. They assist physicians in treating diseases, such as certain cancers, by administering prescribed doses of X-ray or other forms of ionizing radiation to the affected areas of the patient's body. They also may assist the radiologist in measuring and handling radium and other radioactive materials.

Other technicians work in the field of nuclear medicine in which radioactive isotopes are used to diagnose and treat diseases. They assist the radiologist in preparing and administering the prescribed radioisotope and operating special equipment for tracing and measuring radioactivity.

Places of Employment

An estimated 80,000 radiologic technologists were employed in 1970; about two-thirds were women.

Approximately one-third of all radiologic technologists were employed in hospitals; most of the remainder worked in medical laboratories, physicians' and dentists' offices or clinics, Federal and State health agencies, and public school systems. A few worked as members of mobile X-ray teams, engaged mainly in tuberculosis detection.

Training, Other Qualifications, and Advancement

Training programs in X-ray technology are conducted by hospitals or by medical schools affiliated with hospitals. A program in X-ray technology usually takes 24 months to complete. A few schools offer 3- or 4-year programs, and 11 schools award a bachelor's degree in X-ray technology. Also, some junior col-

leges coordinate academic training with work experience in hospitals in 3-year X-ray technician programs and offer an Associate of Arts degree. In 1970, about 1,200 schools of X-ray technology were approved by the American Medical Association (AMA). In addition to training programs in approved schools, training also may be obtained in the military service. Some courses in X-ray technology are offered by vocational or technical schools.

All of the approved schools accept only 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.

X-ray technology programs usually include courses in anatomy, 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 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. To become certified in radiation therapy or nuclear medicine, technicians must have completed an additional year of combined classroom study and work experience.

As openings occur, some technicians in large X-ray departments may advance to chief X-ray technician and qualify as instructors in X-ray techniques.

Good health and stamina are important qualifications for this field.

Employment Outlook

Employment opportunities for radiologic technologists are expected to be very good through the 1970's. Part-time opportunities also will be very favorable.

Very rapid growth is expected in the profession, primarily as a result of the anticipated expansion in the use of X-ray equipment in diagnosing and treating diseases; more workers also will be needed to help administer radiotherapy as new knowledge of the medical benefits of radioactive material becomes widespread. 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 radiologic technologists needed for new jobs, replacement demands are expected to be high because of the large number of women who leave their jobs each year for marriage or family responsibilities.

Earnings and Working Conditions

Beginning salaries of radiologic technologists employed in hospitals ranged from about $110 to $190 a week in 1970, according to the limited information available.

New graduates of AMA-approved schools of X-ray technology employed by the Federal Government received an annual salary of $5,853 in 1970.

Full-time technicians generally work 8 hours a day and 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.

Precautionary measures to protect radiologic technologists from the potential hazards of radiation exposure include the use of safety devices such as individual instruments that measure radiation, lead aprons, leaded gloves, and other shieldings.

Sources of Additional Information

The American Society of Radiologic Technologists, 645 North Michigan Ave., Chicago, Ill. 60611.

The American Registry of Radiologic Technologists, 2600 Wayzata Blvd., Minneapolis, Minn. 55405.

MEDICAL RECORD LIBRARIANS

(D.O.T. 100.388)

Nature of the Work

Medical records contain medical and surgical information on each patient, including case histories of illnesses or injuries, physical examination findings, reports on X-rays and laboratory tests, physicians' orders and notes, and nurses' notes. These records are necessary for correct and prompt diagnosis and treatment. In addition, they 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.

Medical information found in hospital records also is used to plan community health centers and programs and in hospital and health care administration.

Medical record librarians plan, prepare, maintain, and analyze records and reports on patients' illness 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; make summaries or "abstracts" of medical records; develop systems for documenting, storing and retrieving medical information; direct the activities of the medical record department; and train auxiliary personnel. They usually represent their department at hospital staff meetings and may be called to testify in court.

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. 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 should not be confused with the medical librarians who work chiefly with books, periodicals, and other publications. (See statement on Librarians.)

Medical record librarian operates mechanized locator file.

Places of Employment

About 13,000 medical record librarians were employed in 1970. Of these, about 4,200 were Registered Record Librarians, according to the American Medical Record Association. In addition, about 41,000 other medical record personnel were working in this field. Most medical record librarians were employed in hospitals. The remainder worked in clinics, medical research centers, nursing homes or other extended care facilities, the medical departments of insurance companies and industrial firms, and in local and State health departments. Although most medical record librarians are women, the number of men in the occupation is growing.

Training, Other Qualifications, and Advancement

In 1970, 28 schools approved by the American Medical Association offered training in medical record library science or medical record administration. These schools are located in colleges and universities and in hospitals.

Most approved medical record librarian educational programs last 4 years and lead to a bachelor's degree in medical record administration. The concentration in medical record administration begins in the third or fourth year of study. One year certificate programs also are available for those who already have a baccalaureate degree and specified courses in the liberal arts and biological sciences.

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, ethics, management, hospital organization and administration, health law, statistics, and data processing. 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 experience with medical record systems for the X-ray, pathology, outpatients, and other hospital departments.

Graduates of approved schools in medical record science are eligible for the national registration examination, given by the American Medical Record Association. Upon passing this examination, they receive professional recognition as Registered Record Librarians.

Medical record librarians must be accurate and interested in detail. They also must be able to communicate clearly in speech and writing. Because medical records are confidential, they must be discreet in processing and releasing information. Administrators and supervisors must be able to organize and analyze work procedures and to work effectively with other hospital personnel.

Medical record librarians frequently are supervisors or administrators. They may be assistant directors, directors of a single department, or coordinator of medical record departments of several hospitals. Others may become faculty

members of colleges and universities.

Employment Outlook

Employment opportunities for graduates of approved medical record librarian programs are expected to be excellent through the 1970's. In addition to the positions created by growth, many openings will occur as young women leave the field for marriage and family responsibilities. High school graduates will have many opportunities to become medical record technicians to assist librarians.

The increasing number of hospitals and the volume and complexity of hospital records will contribute to a growing demand for medical record librarians.

The importance of medical records will continue to grow rapidly, due to the increased demand for clinical data for research and the use of new drugs. Special interest in the care of the aged has necessitated recording data on conditions of persons in nursing homes and home care programs. More consultants also will be needed to standardize records in these and other areas where medical record librarians are not available. The increasing use of computers to store and retrieve medical information should increase the demand for medical record librarians.

Earnings and Working Conditions

The salaries of medical record librarians are influenced by the location, size, and type of employing institution, as well as by the duties and responsibility of the position. The average salary for chief medical record librarians (registered) in 1970 was $9,000 a year, according to the American Medical Record Association.

Newly graduated medical record librarians employed by the Federal Government generally started at $6,548 a year in 1970; those having bachelor's degrees and high academic records were eligible to begin at $8,098.

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

Sources of Additional Information

Information about approved schools and employment opportunities may be obtained from:

The American Medical Record Association, 875 N. Michigan Ave., Suite 1850, Chicago, Ill. 60611.

DIETITIANS

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

Nature of the Work

Dietitians plan nutritious and appetizing meals to help people maintain or recover good health. Their work includes planning general and modified menus that meet nutritional requirements for health or for medical treatment, supervising the personnel who prepare and serve the meals, managing purchases and

Dietitians discuss patient's menu.

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 supervise the service of meals to meet the nutritional needs of patients. They discuss food likes and dislikes with patients and note their intake of food. Other duties of therapeutic dietitians include calculating modified diets, conferring with doctors regarding patients' diets, instructing patients and their families on the requirements and 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 having chronic diseases, or space travelers.

Places of Employment

About 30,000 dietitians were employed in 1970—less than 10 percent were men. More than two-fifths of all dietitians worked in hospitals and related institutions, including nearly 1,000 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 operated 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 dietitians is a bachelor's degree with a major in foods and nutrition or institution management. This degree can be obtained in about 400 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 after graduation of internship programs or 2 years of pre-planned experience. The programs and experience must be approved by the Association. Many employers prefer to hire dietitians who have completed an internship. An important phase of the intern's education is clinical experience; the remainder of the internship is devoted to classroom study of menu planning, budgeting, management, other advanced subjects, and to special projects. In 1970, 80 internship programs were approved by The American Dietetic Association. Students in a few schools can complete a coordinated education program, also approved by the Association, which qualifies them to practice immediately after graduation, without further internship.

Experienced dietitians may advance 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.

Young persons planning to become dietitians should have supervisory ability to manage programs and be able to work well with others. They also should be neat and in good health.

Employment Outlook

Opportunities for qualified dietitians on both a full- and part-time basis are expected to be very good through the 1970's.

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 also will 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 probably will 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.

In an effort to provide the dietetic services demanded, employers increasingly are hiring workers to assist dietitians. Opportunities will be favorable in these positions for college graduates who have majored in fields such as chemistry or the life sciences.

Earnings and Working Conditions

In 1970, hospitals offered new graduates of approved internship programs annual salaries ranging from $8,900 to $9,750, according to The American Dietetic Association. New graduates without internship generally received lower starting salaries. Experienced dietitians in hospitals were paid between $10,200 and $17,000 a year. Beginning staff dietitians employed by college and school food services received annual salaries ranging from $8,900 to $14,000; experienced dietitians received $11,200 to $16,300.

The entrance salary in the Federal Government in 1970 for those who had completed internship was $8,098 a year. Beginning dietitians who had a master's degree could start at $9,881 a year. Most experienced dietitians employed by the Federal Government earned between $11,000 and $16,000 a year; a few earned over $16,000. Dietitians employed by State and local governments in 1970 received yearly salaries ranging from about $9,200 to $11,800, 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 commercial food service 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.

Sources of Additional 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

(D.O.T. 187.118)

Nature of the Work

Hospital administrators hold the highest executive positions in hospitals; they manage all administrative activities. They usually receive general guidance from a hospital governing board with which they work closely in developing plans and policies.

Administrators direct and coordinate the many varied activities of the hospital. They work closely with the medical and nursing staffs and make available to them needed auxiliary personnel and equipment. They are responsible for hiring and training workers; 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 trained either in hospital administration or in specialized managerial skills.

Under the direction of the gov-

Hospital administrator confers with member of staff.

erning board, administrators may carry out large projects to expand or develop the hospital's services. They may, for example, organize fund-raising campaigns or plan new medical care, research, or educational programs.

Administrators meet regularly with their staff to discuss progress, make plans and solve problems concerning the functioning of the hospital. Working with the medical staff and department heads, they may develop and maintain teaching programs for nurses, interns, and other hospital staff members. Administrators also may address community gatherings, organize community health campaigns, and participate in planning community health care programs.

Places of Employment

About 17,000 hospital administrators were employed in hospitals and related institutions in 1970. About two-thirds worked in nonprofit or private hospitals and institutions, and the remainder generally worked in Federal, State, and local government hospitals. Of those employed by the Federal Government, most were in Veterans Administration, Armed Forces, and Public Health Service hospitals. About 15 percent of all administrators and their assistants were women; many were members of religious orders.

Training, Other Qualifications, and Advancement

Educational requirements for hospital administrators vary. Most employers prefer applicants with at least a master's degree in hospital administration from an accredited graduate program. Others prefer formal training in social or behavioral sciences, industrial engineering, or business administration, along with extensive experience in the health field. A few require their administrators to be physicians or registered professional nurses. Specialized hospitals (such as mental or orthopedic hospitals) may prefer physicians whose medical specialty is the same as that of the hospital. Hospitals run by religious groups may seek administrators of the same faith.

In 1970, 29 colleges and universities in the United States offered master's degree programs in hospital administration. To enter these programs, applicants must have a bachelor's degree, including courses in natural sciences, psychology, sociology, statistics, accounting, and economics. The programs vary in time allocated to academic study and to administrative residency in hospitals or health agencies but they generally last 2 years. The minimum amount of required academic study is about a year; residency requirements range up to a year.

The curriculum may include courses such 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 hospital activities under the supervision of the administrator or his assistant. A Ph. D. in hospital administration, offered in several universities, is especially helpful for those interested in teaching and research.

The American College of Hospital Administrators provides financial loans and scholarships to a limited

number of students for graduate work in hospital administration. Some Federal Government awards for graduate training in hospital administration also are available.

New graduates with a master's degree in hospital administration usually enter the field as assistant administrators or department heads and occasionally as administrators in small hospitals. Some persons without a master's degree in hospital administration enter the field 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, to assistant administrator, and eventually to administrator. The position of hospital administrator, especially in a large hospital, represents a career goal, and these positions generally are filled by promotion from within.

Personal qualifications needed for success as a hospital administrator include initiative, vitality, and interest in helping the sick. Skills in working with people, organizing and directing large-scale activities, and public speaking are important assets.

Employment Outlook

Employment opportunities for new graduates having the master's degree in hospital administration are expected to be very good through the 1970's. Applicants without graduate education will find it increasingly difficult to enter this field. Some positions as administrator are likely to continue to be filled by physicians, nurses, or persons experienced in a specialized administrative area.

The number of positions in hospital administration is expected to grow rapidly through the 1970's. As health facilities are expanded to provide additional health services to an increasing population, more positions are likely to be created for hospital administrators, and for administrative assistants, in charge of specific functions or departments. Graduates of programs of hospital administration also will find increasing employment opportunities in related facilities such as nursing homes and other long-term care institutions, rehabilitation facilities, public health centers, health care planning agencies, and hospitalization and health insurance programs.

Earnings and Working Conditions

Salaries of hospital administrators depend on factors such as size, type, and location of the hospital, and size of its administrative staff and budget. Starting salaries for new hospital administration graduates in private hospitals generally ranged from $10,000 to $13,000 a year in 1970. Salaries of experienced administrators generally ranged from $14,000 to $30,000, according to limited data available. New graduates employed in Veterans Administration (VA) hospitals started at $9,881 a year in 1970. Salaries of experienced VA hospital administrators, many of them physicians, ranged from $26,547 to $33,627 a year.

Commissioned officers in the Armed Forces working as hospital administrators hold ranks ranging from second lieutenant to colonel or from ensign to captain. Commanding officers of large Armed Forces hospitals are physicians who may hold higher ranks. Hospital administrators in the U.S. Public Health Service are commissioned officers, holding ranks ranging from lieutenant (junior grade) to captain in the Navy.

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. He also may be called on to attend meetings held at various locations outside the hospital. Fringe benefits usually include paid vacations and holidays, sick leave, and pension and insurance coverage.

Sources of Additional Information

Additional information about hospital administration and a list of colleges and universities offering this training may be obtained from:

American College of Hospital Administrators, 840 North Lake Shore Dr., Chicago, Ill. 60611.

Association of University Programs in Hospital Administration, 1 Dupont Circle, NW., Washington, D.C. 20036.

Information on Federal Government awards for graduate training in hospital administration may be obtained from:

Bureau of Health Professions Education and Manpower Training, National Institutes of Health, Bethesda, Md. 20014.

SANITARIANS

(D.O.T. 079.118)

Nature of the Work

Sanitarians are specialists in environmental health. To assure the cleanliness and safety of the food

people eat, the liquids they drink, and the air they breathe, sanitarians perform a broad range of duties. They inspect food manufacturing and processing plants, dairies, water supplies, hotels and restaurants, nursing homes, hospitals and schools, waste disposal plants, swimming pools and other recreation facilities, housing, and other places for health hazards. They seek compliance with local regulations and with State and Federal laws relating to public health. They also plan and conduct sanitation programs, administer environmental health programs, and promote the enactment of health regulations and laws.

Sanitarians entering the profession usually begin in public health or agriculture departments, or private industry. They inspect facilities and may collect samples of food, air, and water to test for safety. When necessary, they recommend corrective action according to 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 having supervisory duties analyze reports of inspections and investigations made by other environmental health specialists, and advise on difficult or unusual sanitation problems. They also may conduct investigations and give evidence in court cases involving public health regulations. In addition, they promote health laws and engage in health education activities, sometimes teaching classes in hygiene and speaking before student assemblies, civic groups, and other organizations. Those in top management 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 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 or agriculture 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, institutional sanitation, and insect and rodent control. In rural areas and small cities, they may be responsible for a wide range of environmental health activities.

The professional sanitarian may be assisted by a sanitarian technician during investigations to determine compliance or lack of compliance with health regulations and laws. The technician takes samples for testing and often performs the required tests.

Increasing numbers of sanitarians are being employed outside government agencies. Many work in industry to prevent or minimize contamination hazards and see that clean, healthful, and safe working conditions exist. For example, in a food processing plant, the sanitarian is concerned with the proper disposal of refuse; the cleaning of plant equipment; the control of micro-organisms; and the proper maintenance of buildings, equipment, and employee facilities.

Sanitarians discuss plan of sewage system.

Where Employed

An estimated 12,000 of the approximately 15,000 professional sanitarians employed in 1970 worked for Federal, State, and local governments. Most of the remainder worked 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 public 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.

In addition to professional sanitarians, about 5,000 sanitarian technicians and aides were employed in 1970.

Training, Other Qualifications, and Advancement

A bachelor's degree in environmental health is the preferred preparation for a beginning job as a professional sanitarian, although a bachelor's degree in a basic science generally is acceptable. High level positions usually require a graduate degree in some aspect of public health. In some cases, sanitarian technicians having 2 years of college and work experience can advance to professional sanitarian positions. However, as hiring standards are raised, it will become harder for persons without a degree to enter the profession.

A typical curriculum leading to a bachelor of science degree in environmental health includes background courses in the humanities, social sciences, mathematics, chemistry, physics and biology. Core courses include microbiology (environmental), biostatistics, epidemiology, community health education, public health organization and administration, environmental health, and field work.

Thirty-six colleges and universities offered undergraduate programs in environmental health in 1970; graduate training in environmental health was available in about 100 universities. Some stipends are available under Federal programs for graduate study in this field.

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 practice and learn to evaluate conditions and recommend corrective action. After a few years of experience, they may be promoted to minor supervisory positions with more responsibilities. Increased responsibilities usually come with additional experience; sometimes specialization begins at this level, especially in large local health offices. Further advancement is possible to top supervisory and administrative positions.

To keep abreast of new developments and to supplement their academic training, many sanitarians take specialized short-term training courses in subjects such as occupational health, water supply and pollution control, air pollution, radiological health, milk and food protection, metropolitan planning, and hospital sanitation.

In 1970, 35 States had laws providing for registration of sanitarians; in some States, registration is required to practice. Although requirements for registration vary considerably among the States, the minimum educational requirement usually is a bachelor's degree, with emphasis on the biological, physical, and sanitary sciences.

Among the personal qualities useful to sanitarians is the ability to communicate effectively, since it is necessary to write detailed reports and to deal with persons tactfully concerning the correction of unsanitary conditions. A mechanical aptitude also is helpful, since sanitarians may operate various testing devices.

Employment Outlook

Employment opportunities for sanitarians are expected to be very favorable through the 1970's. Young people without a college degree in one of the physical or biological sciences or in sanitary science will face increasing difficulty in obtaining professional positions in this field.

Employment of sanitarians is expected to increase very rapidly through the 1970's, as State and local health agencies expand their activities in the field of environmental health. Radiological health, occupational health, food protection, solid waste management, and water and air pollution are expected to require the services of more trained personnel as health dangers grow under the stimulus of an expanding, highly technological society.

Air pollution is one example of an existing environmental hazard that has attracted widespread public concern. The discomfort and danger of air pollution and the possible relationship between it and respiratory ailments have attracted attention to the problem. Government on all levels has responded by enacting extensive legislation in environmental quality control. Legislation

which regulates the quantity of sulfates or other chemical compounds that can be emitted into the air will increase the demand for professional sanitarians.

The expanding population is another factor intensifying the demand for more trained sanitarians. The migration of people from rural to urban areas, along with the growth of industries, will place a greater strain on the food-service, housing, and water-disposal facilities of urban communities. Some increase in demand for sanitarians is expected in private industry, primarily in the food industry.

Earnings and Working Conditions

Beginning sanitarians having a college degree usually earned from $7,000 to $7,500 in 1970, according to the National Environmental Health Association. Salaries of experienced professional sanitarians generally ranged from $10,000 to $14,000 a year; environmental health directors often earned from $14,000 to $30,000. Sanitary aides and technicians without a college degree generally earned from $5,000 to $8,000 in 1970.

Professional sanitarians employed in the Federal Government began at $6,548 or $8,092 in 1970, depending on their academic records. Experienced sanitarians in the Federal service generally earned from $9,881 to $14,192.

Sanitarians spend considerable time away from their desks. Some come in contact with unpleasant physical surroundings, such as sewage disposal facilities and slum housing. Transportation or gasoline allowances frequently are given, and some health departments provide an automobile.

Sources of Additional Information

Information about careers as sanitarians is available from the following associations:

American Public Health Association, 1790 Broadway, New York, New York 10019.

International Association of Milk, Food and Environmental Sanitarians, Blue Ridge Road, P.O. Box 437, Shelbyville, Indiana 46176.

National Environmental Health Association, 1600 Pennsylvania Street, Denver, Colorado 80203.

Information on stipends for graduate study is available from:

Division of Allied Health Manpower, Bureau of Health Professions Education and Manpower Training, National Institutes of Health, 9000 Rockville Pike, Bethesda, Maryland 20014.

VETERINARIANS

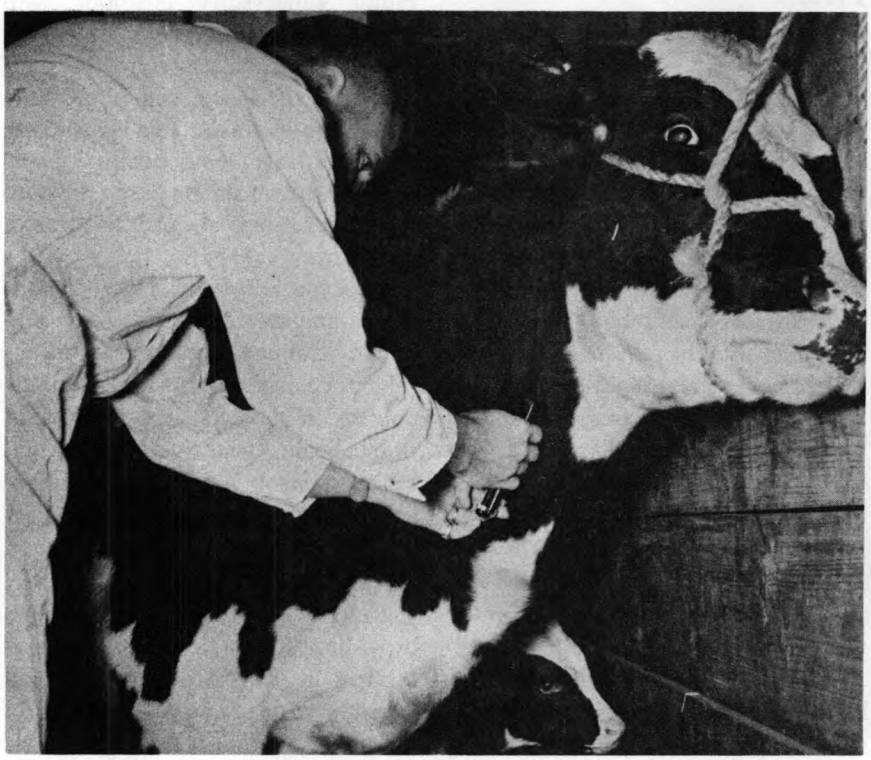
(D.O.T. 073.081 through .281)

Nature of the Work

Veterinarians (doctors of veterinary medicine) diagnose, treat, and control numerous diseases and injuries among animals. Their work is important for the Nation's food production and for public health. Veterinarians perform surgery on sick and injured animals, and prescribe and administer drugs, medicines, serums, and vaccines.

Their work is vital to public health because it helps to prevent the outbreak and spread of diseases among animals. Many of these diseases can be transmitted to human beings.

Veterinarians treat animals in veterinary hospitals and clinics, or on the farm and ranch. In addition,



veterinarians 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 or pets. Some specialize in the health care of cattle, poultry, sheep, swine, or horses. Many veterinarians inspect meat, poultry, and other foods as a part of Federal and State public health programs. Still others serve on faculties of veterinary colleges. Some do research related to animal diseases, foods, and drugs, or may act as part of a medical research team, to seek knowledge about prevention and treatment of human disease.

Places of Employment

About 25,000 veterinarians were working in 1970; only 2 percent were women. Almost two-thirds of all veterinarians were in private practice. The Federal Government employed about 2,400 veterinarians, chiefly in the U.S. Department of Agriculture; some worked for the U.S. Public Health Service. About 1,000 more 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 employed by colleges of veterinary medicine, agricultural colleges, medical schools, research and development laboratories, large livestock farms, animal food companies, and pharmaceutical companies manufacturing drugs for animals.

About two-fifths of all veterinarians in the United States were in seven States—California, New York, Texas, Illinois, Iowa, Ohio, and Pennsylvania. Veterinarians in rural areas chiefly treat farm 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 to practice veterinary medicine in all States and the District of Columbia. To obtain a license, an applicant must have the degree of Doctor of Veterinary Medicine (D.V.M. or V.M.D.) awarded upon graduation from a veterinary school approved by the American Veterinary Medical Association. He also must 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 research or teaching, an additional master's or Ph. D. degree is usually required in a field such as pathology, physiology, or bacteriology.

Minimum requirements for the D.V.M. or V.M.D. degree are 2 years of preveterinary college work followed by 4 years of study in a college of veterinary medicine. However, most candidates complete 3 or 4 years of a preveterinary curriculum (emphasizing the physical and biological sciences). Veterinary college training includes considerable practical experience diagnosing and treating animal diseases and performing surgery and laboratory work in anatomy, biochemistry, and other scientific and medical subjects.

There were 18 colleges of veterinary medicine in the United States in 1970. Some of the qualifications considered by these colleges in selecting students were scholastic record, amount and character of preveterinary training, health, and an understanding and affection for animals. Since veterinary colleges are largely State supported, residents of the State in which the college is located usually are 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, colleges which accept a certain number of students from other States usually give priority to applicants from nearby States without veterinary schools. The number of women students in veterinary colleges is relatively small; about 9 percent of the students in 1970 were women.

Needy students may obtain loans and scholarships of up to $2,500 a year to pursue full-time study leading to the degree of Doctor of Veterinary Medicine under provisions of the Veterinary Medical Education Act of 1966 and the Health Manpower Act of 1968. 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.

Some veterinarians begin as assistants to, or partners of, established practitioners. Many start their own practice with a modest financial investment in drugs, instruments, and an automobile. A more substantial financial investment is required to open an animal hospital or purchase an established practice. Newly qualified veterinarians may enter the Army and Air force as commissioned officers, or qualify for Federal positions as meat and poultry inspectors, disease-control workers, epidemiologists, or research assistants.

Veterinarians should have physical strength and courage to handle animals who may become aggressive because of pain or injury. They should be able to work independently and keep abreast of the advances in the profession.

Employment Outlook

Veterinarians are expected to have good employment opportunities through the 1970's. Although an increase in the demand for their services is anticipated, the number of veterinarians will be restricted by the limited capacity of schools. However, some expansion in veterinary school facilities is expected because of passage of the Veterinary Medical Education Act of 1966 which provides for funds to assist in the construction of new educational facilities for veterinary colleges. Nevertheless, most veterinarians who receive degrees will be needed to replace those who retire or die. As a result, the demand for veterinarians will probably exceed the supply during the 1970's.

Among the factors underlying increasing need for veterinary services are the following: An increase in number of livestock and poultry 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 growth in domestic and international public health and disease-control programs also will probably add to the opportunities for veterinarians.

Earnings and Working Conditions

Veterinarians beginning their own practice generally can cover their expenses the first year and often add to their earnings by working part time for government agencies. As they gain experience, their incomes usually increase substantially.

Newly graduated veterinarians without experience earned $10,539 in the Federal Government in 1970. Those who had demonstrated superior ability in their studies started at $11,905. Summer trainees in the U.S. Department of Agriculture received $155 each week they worked (representing a rate of $8,098 a year) in 1970. Experienced veterinarians working for the Federal Government generally earned between $13,500 and $26,700 a year. The income of veterinarians in private practice usually is higher than that of other veterinarians, according to the limited data available.

Veterinarians sometimes may be 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 farms and may have to work outdoors in all kinds of weather. Veterinarians can continue working well beyond normal retirement age because of many opportunities for part-time work.

Sources of Additional Information

Additional information 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, Hyattsville, Md. 20782.

Consumer and Marketing Service, U.S. Department of Agriculture, 536 South Clark St., Chicago, Ill. 60605.

MATHEMATICS AND RELATED FIELDS

Mathematics is both a profession and a tool essential for many kinds of work. As a tool, mathematics, in the form of mathematical language and methods, has been fundamental to understanding and expressing ideas in science, engineering, and human affairs. The application of mathematical methods in these fields has increased greatly because of the widespread use of electronic computers in the natural sciences, medicine, engineering, and management and administration. As a result, employment opportunities for persons trained in mathematics expanded rapidly through the 1960's.

A young person considering a career in mathematics should be able to concentrate for long periods of time. He should enjoy working independently with ideas and solving problems, and must be able to present his findings in finished reports.

This chapter includes descriptions of the occupation of mathematician and the two closely related occupations of statistician and actuary. Entrance into any of these fields requires college training in mathematics. For many types of work, graduate education is necessary.

In addition to professions covered in this chapter, many other workers such as natural scientists and those in data processing, discussed elsewhere in the Handbook, use mathematics extensively.

Secondary school teachers of mathematics are not covered in this chapter but are included in the statement on Secondary School Teachers.

MATHEMATICIANS

(D.O.T. 020.088)

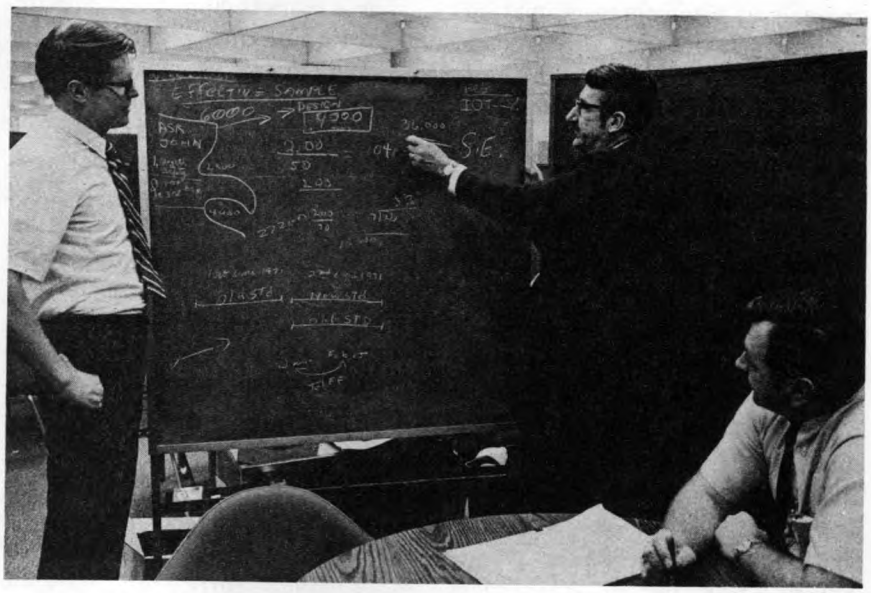
Nature of the Work

Mathematics, one of the oldest and most basic sciences, is also one of the most dynamic and rapidly growing professions. Mathematicians today are engaged in a wide variety of activities, ranging from the creation of new theories to the translation of scientific and managerial problems into mathematical terms.

Mathematical work may be divided into two broad classes: pure or theoretical mathematics; and applied mathematics, which includes mathematical computation. Theoretical mathematicians develop principles and discover relationships among mathematical forms. They seek to increase basic knowledge without necessarily considering its use. Yet, this pure and abstract 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 in applied work develop theories, techniques, and approaches to solve problems in the physical, life, and social sciences. They analyze a problem and describe the existing relationships in mathematical terms. Their work ranges from the analysis of vibrations and stability of rockets in outer space to studies of the effects of new drugs on disease.

Some mathematicians or mathematical statisticians—as they are often called, use mathematical theory to design and improve statistical methods for obtaining and interpreting numerical information. They develop statistical tools in areas such as probability, experimental design, and regression analysis. They frequently work with statisticians when planning and designing experimental surveys.



Mathematicians analyze problem.

In applied mathematics, mathematical knowledge and modern computing equipment are used to obtain numerical answers for specific problems. Some work in this area requires a very high level of mathematical knowledge, skill, and ingenuity. However, much of the work may not require the advanced training and inventiveness of the mathematician. (See statements on Programers and Systems Analysts.)

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, in recent years, John Von Neumann developed the theory of games of strategy to improve the methods of analyzing conflicts between competing interests, such as those occurring in war and economics.

Approximately one-fourth of all mathematicians work in research and development. Nearly one-third are primarily college teachers, many of whom do research part-time. A little less than one-third are in management and administration—about one-half of whom manage and administer research and development programs. Most of the remainder are concerned chiefly with operations research or production and inspection (quality control) of manufactured products.

Places of Employment

An estimated 75,000 mathematicians (including more than 5000 engaged in actuarial work) were employed in the United States in 1970; about 10 percent were women. More than one-half of all mathematicians worked in private industry, primarily in independent research and development firms, and in the ordnance, aircraft, machinery, and electrical equipment industries. Other mathematicians were employed as consultants.

Colleges and universities employed more than one-third of all mathematicians, some of whom have few or no teaching duties. Others were employed by the Federal Government, mostly by the Department of Defense. A few worked for nonprofit organizations and State and local governments.

Mathematicians were employed in all States. However, they were concentrated in States having large industrial areas and sizable college and university enrollments. Nearly half of the total were in seven States —California, New York, Massachusetts, Pennsylvania, Illinois, Maryland, and New Jersey. One-fifth reside in three metropolitan areas— New York, N.Y.; Washington, D.C.; and Los Angeles-Long Beach, Calif.

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 —such as physics or engineering— and a minor in mathematics. For many entrance positions, particularly in research or teaching, graduate training in mathematics is required. Graduate study is also valuable for advancement to more responsible positions in all types of work.

The bachelor's degree in mathematics is offered by over 1,200 colleges and universities throughout the country. The undergraduate mathematics curriculum typically includes courses in analytical geometry, calculus, differential equations, probability and statistics, mathematical analysis, and modern algebra.

Advanced mathematics degrees are conferred by more than 300 colleges and universities. In graduate school, the student builds upon the basic knowledge acquired in the undergraduate curriculum. He usually concentrates on a specific field of mathematics, such as algebra, mathematical analysis, statistics, applied mathematics, or topology, by conducting intensive research and taking 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 having the bachelor's degree assist senior mathematicians by performing computations and solving less advanced mathematical problems in applied research. Others work as graduate teaching or research assistants in colleges and universities while working toward an advanced degree.

Advanced degrees are required for an ever-increasing number of jobs in industry and Government— in research and in many areas of applied mathematics. The Ph. D. degree is necessary for full faculty status at most colleges and universities, as well as for advanced research positions.

For work in applied mathematics, training in the field to which the mathematics will be applied is very important. Fields in which applied mathematics is used extensively include physics, engineering, and operations research; other fields include business and industrial management, economics, statistics, chemistry, the life sciences, and the behavioral sciences. Training in numerical analysis and programing is

especially desirable for mathematicians working with computers.

Employment Outlook

In addition to opportunities resulting from the very rapid growth expected in this field, several thousand mathematicians will be needed each year to replace those who transfer to other fields of work, retire, or die.

As in the 1960's, there will be strong demand for mathematicians holding the Ph. D. degree for teaching and research positions in colleges and universities. Not only is the number of students majoring in mathematics expected to increase sharply, but the number of students majoring in other fields and taking mathematics courses will rise also. Thus, colleges and universities will continue to provide most of the employment opportunities for theoretical mathematicians.

Mathematicians also will be required in substantial numbers to solve an increasingly wide variety of complex research and development problems in engineering, natural and social sciences, military sciences, operations research, and business management. This work requires a high degree of mathematical competence and a broad knowledge of one of these fields of application. Expenditures to support these research and development activities have increased steadily through the 1960's and are expected to continue to rise, although more slowly than in the past.

Between 1970 and 1980, the number of new graduates having degrees in mathematics is expected to at least double. Thus, the number of persons seeking professional mathematics employment is expected to rise sharply, and competition for entry positions may intensify. Graduates who have advanced degrees should find favorable employment opportunities. Those who have only the bachelor's degree, however, probably will face keen competition for entry positions.

The education and training necessary for a degree in mathematics is also an excellent foundation for a number of other occupations, particularly in fields that rely heavily on the application of mathematical theories and methods. Thus, increasing numbers of mathematics graduates are likely to be hired for jobs in high school teaching, statistics, actuarial work, computer programing, systems analysis, economics, engineering, physics, geophysics, and life sciences. Employment opportunities in these related fields probably will be best for those students who combine their mathematics major with a minor in one of these disciplines.

Earnings and Working Conditions

Annual starting salaries in private industry for mathematicians and mathematical statisticians having the bachelor's degree were between $9,300 and $9,600 in 1970, according to limited available information. New graduates having the master's degree received starting salaries which ranged between $2,200 and $2,600 a year higher. Yearly salaries for new graduates having the Ph. D. degree, most of whom had some experience, averaged over $16,000 in 1970.

Depending on their college records, mathematicians having bachelor's degrees and no experience could start in the Federal Government in 1970 at either $7,856 or $9,718. Beginning mathematicians who had completed all requirements for the master's degree could start at $9,718 or $11,526; those having the Ph. D. degree could begin at either $13,096 or $14,192 a year.

According to the American Mathematical Society, college and university teachers in 1970 were paid median salaries which ranged from $8,700 (instructors) to $18,000 (professors) for 9 months of teaching. Some were paid over $30,000 annually. Mathematicians in educational institutions often supplement their regular salaries with income from summer teaching, special research projects, consulting, and writing.

The average (median) annual salary for mathematicians in the National Science Foundation's National Register of Scientific and Technical Personnel was $14,300 in 1970. Only 10 percent earned less than $9,000 a year, and about 10 percent earned $25,000 or more a year.

Sources of Additional Information

General information on the field of mathematics—including career opportunities, professional training, colleges and universities having degree-credit programs, and earnings—may be obtained from *Professional Training in Mathematics,* 25¢, available from:

American Mathematical Society, P.O. Box 6248, Providence, R.I. 02904.

Professional Opportunities in Mathematics, 35¢, and *Guide Book to Departments in the Mathematical Sciences,* 75¢, both available from:

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

Specific information on careers in applied mathematics and electronic

computer work may be obtained from:

Association for Computing Machinery, 1133 Avenue of the Americas, New York, N.Y. 10036.

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

Information on careers in mathematical statistics may be obtained from:

Institute of Mathematical Statistics, Department of Statistics, California State College at Hayward, Hayward, Calif. 94542.

Federal Government career information may be obtained from any regional office of the U.S. Civil Service Commission or from:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St. NW., Washington, D.C. 20415.

Other sources of information on related occupations, such as Statisticians, Actuaries, Programers, and Systems Analysts may be found elsewhere in the *Handbook*.

STATISTICIANS

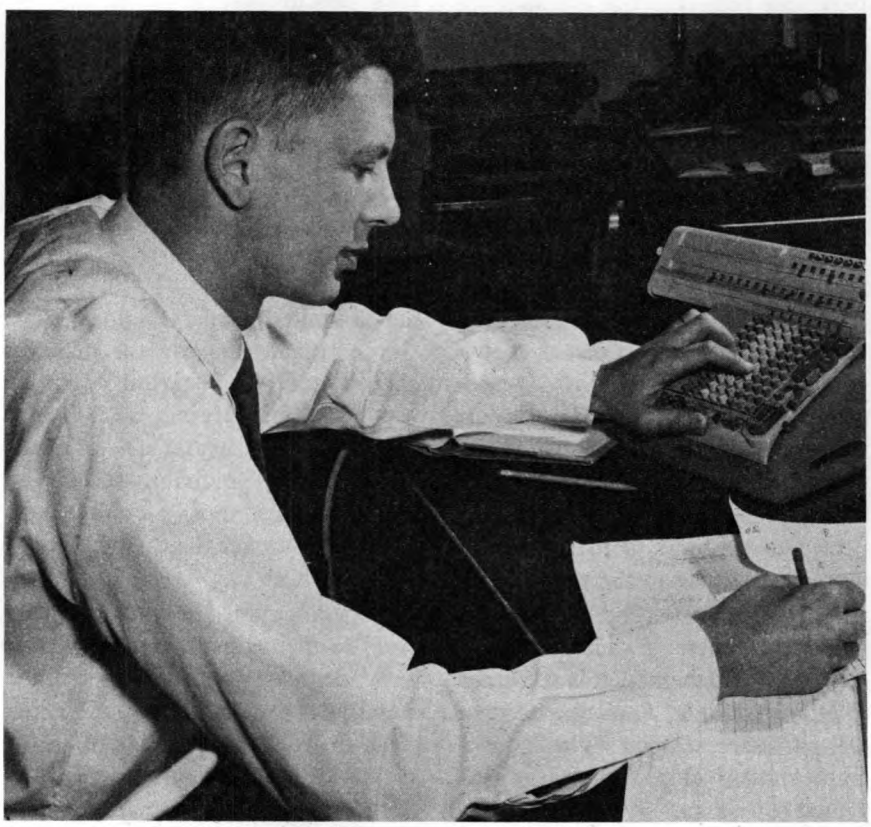
(D.O.T. 020.188)

Nature of the Work

More than ever before, the characteristics of the world and its inhabitants are being described in numerical terms. Statisticians collect, develop, analyze, and interpret these data based on their knowledge of statistics and of a particular field, such as economics, demography, behavioral science, education, life science, physical science, or engineering. They may forecast population growth or economic conditions, predict and evaluate the results of new programs, develop quality control tests for manufactured products, or help decision-makers select from alternative choices. Their studies provide government and business officials with the statistical information needed to make decisions and establish policy. Statisticians sometimes work closely with mathematicians and mathematical statisticians. (See statement on Mathematicians elsewhere in this chapter.)

Many statisticians plan surveys, design experiments, or analyze data. Those who plan surveys select the data sources, determine the type and size of the sample groups, and develop the survey questionnaire or reporting form. They prepare the instructions for those who will collect or report the information and for the workers who will code and tabulate the returns. Statisticians who design experiments prepare mathematical models that will test a particular theory. Those in analytical work interpret collected data and summarize their findings in tables, charts, and written reports. Another large group of statisticians chiefly administer statistical programs. A few combine research with teaching. The remainder are involved in other activities such as quality control, operations research, production and sales forecasting, and market research.

Because statistics has such a wide use, it is sometimes difficult to distinguish statisticians from those subject-matter specialists making a limited use of statistics. For example, a statistician working with data on economic conditions may have the title of economist.



Places of Employment

Approximately 24,000 statisticians were employed in 1970; more than one-third were women. Statisticians are employed in nearly all industries; about two-thirds of all statisticians were employed by private industry.

Federal, State, and local Government agencies employed more than one-fourth of all statisticians. The Departments of Commerce; Agriculture; Defense; and Health, Education, and Welfare employed most of those in the Federal Government. Others were employed by colleges and universities, nonprofit organizations, and research institutes.

Although statisticians were employed in all States and areas, about one-third of them worked in three metropolitan areas—New York, N.Y.; Washington, D.C.; and Los Angeles–Long Beach, Calif.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in statistics or mathematics is the minimum educational requirement for many beginning positions in statistics. For other beginning positions in statistics, however, a bachelor's degree with a major in economics or some other subject-matter field and a minor in statistics is preferable. A graduate degree in mathematics or statistics is essential for faculty positions at most colleges and universities, as well as being an asset for advancement to top administrative and consulting positions. Advancement in analytical and survey work usually requires graduate training in the subject-matter field as well as in statistics.

Fewer than 100 colleges and universities offer training leading to a bachelor's degree with a major 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 important courses cover sampling correlation and regression analysis, experimental design, probability theory, and computer uses and techniques. For many quality control positions, training in engineering and in the application of statistical methods to manufacturing processes is desirable. For many market research, business analysis, and forecasting positions, courses in economics, business administration, or a related field are helpful.

Graduate degrees in statistics were conferred by about 60 colleges and universities in 1970, and many other schools offered one or two graduate level statistical courses. Entrance into a graduate program in statistics usually requires a bachelor's degree with a good background in mathematics. The student should attend a school where he can do research in his subject-matter field, as well as take advanced courses in statistics.

Beginning statisticians who have only the bachelor's degree often spend much of their time performing routine statistical work. Through experience, they usually advance to positions of greater technical and supervisory responsibility. Those who have exceptional ability and interest may be promoted to top management positions.

Among the personal qualifications needed by statisticians are an interest and facility in mathematics, and the ability to translate problems into statistical terms.

Employment Outlook

Employment opportunities for well qualified statisticians are expected to be favorable through the 1970's. In addition to new positions resulting from the rapid growth expected in the profession, hundreds of statisticians will be needed annually to replace those who retire, die, or transfer to other fields of work.

Statisticians will be required in increasing numbers by private industry in quality control work in manufacturing. Those having a knowledge of engineering and physical sciences will be needed to work with scientists and engineers in research and development. Business firms are expected to rely more heavily on statisticians to forecast sales, analyze business conditions, modernize accounting procedures, and solve other management problems.

Government agencies will need statisticians for on-going and new programs in fields such as social security, health, education, and economics. Others will be required to teach the anticipated growing numbers of college and professional school students, especially as the more widespread application of statistical methods makes such courses increasingly important to non-mathematics majors.

Along with the expected growth in demand for statisticians, a steady increase in the number of statistics graduates is expected. However, in recent years, the number of these graduates was barely enough to replace those statisticians who retired or died. Thus, employment opportunities for new college graduates

who have degrees in statistics are expected to be very good through the 1970's.

Earnings and Working Conditions

Starting salaries for new college graduates employed as statisticians in private industry generally averaged between $7,000 and $8,500 a year in 1970, according to the limited information available. Salaries for beginning statisticians having the master's degree averaged about $1,500 a year more than for those having only the bachelor's degree.

In the Federal Government service in 1970, statisticians who had the bachelor's degree and no experience could start at either $6,548 or $8,098 a year, depending on their scholastic records. Beginning statisticians who had completed all requirements for the master's degree could start at $8,098 or $9,881. Those having the Ph. D. degree could begin at $11,905 or $14,192.

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 earn extra income from outside research projects, consulting, and writing.

Sources of Additional Information

General information on career opportunities in statistics may be obtained from:

American Statistical Association, 810 18th St., NW., Washington, D.C. 20006.

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

Information on Federal Government careers may be obtained from:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St. NW., Washington, D.C. 20414.

A list of reading materials on career opportunities in the data processing field may be obtained from:

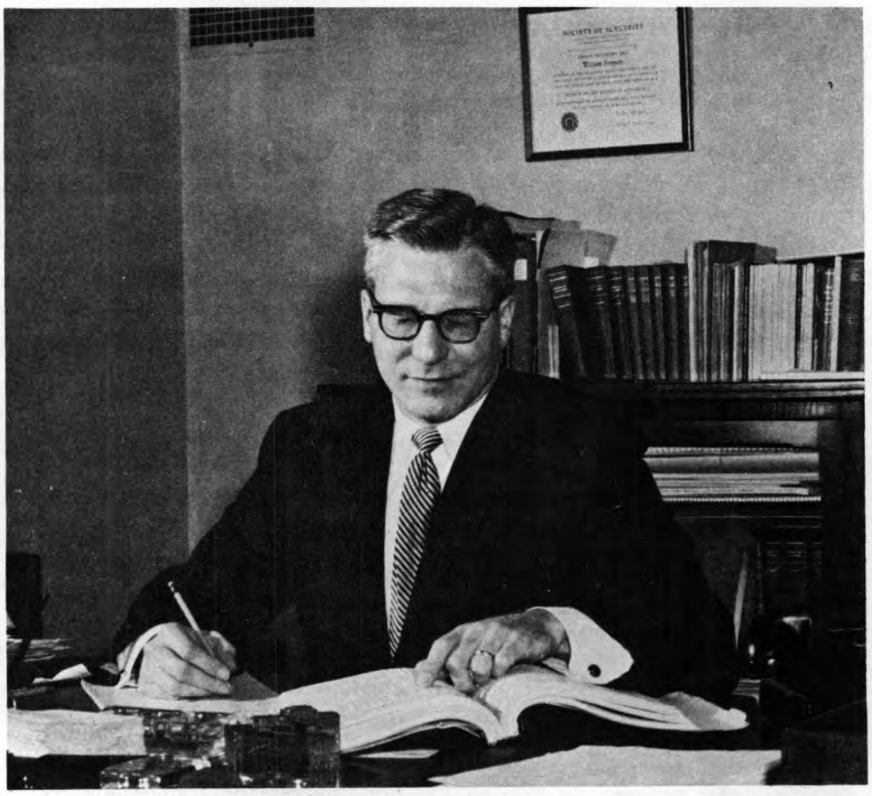
Association for Computing Machinery, 1133 Avenue of the Americas, New York, N.Y. 10036.

ACTUARIES

(D.O.T. 020.188)

Nature of the Work

Actuaries are responsible for designing insurance and pension plans and for maintaining these programs on a sound financial basis. They are concerned with rates of mortality (death), morbidity (sickness), injury, disability, unemployment, retirement, and property loss from accident, theft, fire, and other potential hazards. Actuaries use statistical data and other pertinent information to construct tables on the probability of insured loss. They develop and analyze estimates of the insurer's future earnings and investment income, expenses, and policyholder



Actuary works with tables showing sickness and death rates.

claims. Taking all these factors into consideration, actuaries determine the premium rates and policy contract provisions for each type of insurance offered. Most actuaries specialize in either life and health insurance or property and liability (casualty) insurance.

To perform their duties effectively, actuaries must keep abreast of general economic and social trends and legislative, health, and other developments that may affect insurance practices. Because of their broad knowledge of insurance, actuaries frequently work on problems arising in investment, underwriting, group insurance, and pension sales and service departments. Actuaries in executive positions may help determine general company policy. In that role, they explain complex technical matters to a variety of laymen, such as other company executives and government officials. They also testify before public agencies on proposed legislation affecting the insurance business or justify intended changes in premium rates or contract provisions.

Actuaries employed by the Federal Government usually deal with a particular 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 supervise and regulate insurance companies, the operation of State retirement or pension systems, and problems connected with unemployment insurance or workmen's compensation. Consulting actuaries set up pensions and welfare plans and make periodic evaluations of these plans for private companies, unions, and government agencies.

Places of Employment

Approximately 5,200 persons were engaged in actuarial work in the United States in 1970. Over 1,700 had full professional status. Less than 3 percent of all actuaries were women. About one-half of all actuaries were employed in the three States that are the major centers of the insurance industry—New York, Connecticut, and Illinois.

Private insurance companies employed about four-fifths of all actuaries. Most worked for life insurance companies; the remainder worked for property and liability (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. Small companies may have only a few actuaries on their staffs or rely instead on rating bureaus or consulting firms. Consulting firms and rating bureaus (associations that supply actuarial data to member companies) employed most of the remainder. Several hundred actuaries worked for private organizations administering independent pension and welfare plans or for Federal or State Government agencies. A few taught in colleges and universities.

Training, Other Qualifications, and Advancement

A bachelor's degree with a thorough foundation in calculus, probability, and statistics is required for entry into actuarial work. The new graduate having a major in fields such as mathematics, statistics, economics, or business administration can usually qualify for beginning actuarial positions. The prospective actuary should take courses in 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. English and other courses which help develop communication skills also are recommended. Although only 17 colleges and universities offer training specifically designed for actuarial careers, several hundred institutions offer some of the necessary courses.

It usually takes from 5 to 10 years after entering a beginning actuarial position to complete the entire series of examinations required for full professional status. These examinations cover general mathematics, specialized actuarial mathematics, and all phases of the insurance business. Those considering an actuarial career should take the beginning examinations covering general mathematics while still in college. Success in passing these first examinations helps the beginner to evaluate his potential as an actuary. Those who pass these examinations usually have better opportunities for employment and a higher starting salary. The advanced examinations, usually taken by those in junior actuarial positions, require extensive home study and experience in insurance work.

The 10 actuarial examinations for the life insurance and pension field are given by the Society of Actuaries, and the nine for property and liability (casualty) insurance by the Casualty Actuarial Society. Since the first two parts of the examination series of either Society are the same, the student may defer the selection of his insurance specialty until he becomes familiar with the field. "Associate" membership is awarded after completion of five examinations in either specialty; the

designation of "Fellow" is conferred after the successful completion of the entire series of examinations.

Employers frequently prefer applicants who have passed one or more actuarial examinations, or who have gained actuarial experience in special summer training programs for college students offered by some insurance companies. A beginning actuary usually rotates among different jobs to learn various actuarial operations and to become familiar with different phases of insurance work. At first, his work may be rather routine, such as preparing calculations or tabulations for actuarial tables or reports. As he gains experience, he may supervise actuarial clerks and prepare correspondence and reports.

Advancement to more responsible work as assistant, associate, and chief actuary depends largely upon the individual's on-the-job performance and the number of actuarial examinations he has successfully completed. Many actuaries, because of their broad knowledge of insurance and related fields, qualify for administrative positions in other company activities, particularly in 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 excellent through the 1970's. New graduates who have the necessary mathematical education and have passed some actuarial examinations will be in particular demand as trainees.

Actuarial employment is expected to grow rapidly primarily because of the rising numbers of insurance policies of all kinds which result, in part, from the existence of an affluent and more insurance-conscious population and business community. Actuaries will be needed to solve the growing number of problems arising from continuously changing and increasingly complex insurance and pension coverage. The expanding number of group health and life insurance plans and pension and other benefit plans will require actuarial services. Additional actuaries will be needed by government regulatory agencies. Demand will continue to be strong for actuaries capable of working with electronic computers. Some actuaries also will be needed each year to replace those who retire, die, or transfer to other occupations.

Earnings and Working Conditions

Depending on the individual's college records and experience, a new college graduate entering actuarial work as a trainee in an insurance company was paid from $8,000 to $9,500 in 1970. Most insurance companies paid $200 to $600 a year more if the trainee had completed his first actuarial examination and another $600 to $1,100 when he completed the second examination.

Depending on their college records, new graduates with the bachelor's degree entering actuarial work started at either $8,074 or $9,718 a year in the Federal Government in 1970. Those with the master's degree started at $11,526.

Beginning actuaries can look forward to a marked increase in earnings as they gain professional experience and successfully complete either Society's series of examinations. In insurance companies, merit pay increases are given to those who pass one or a group of the examinations. Fellows of either the Society of Actuaries or the Casualty Actuarial Society earn over $18,000 a year and many actuaries earn more than $25,000 a year. Those in executive positions in large companies earn over $35,000.

Sources of Additional Information

Information on professional opportunities and qualifications may be obtained from:

Casualty Actuarial Society, 200 East 42d St., New York, N.Y. 10017.

Society of Actuaries, 208 South LaSalle St., Chicago, Ill. 60604.

NATURAL SCIENCE OCCUPATIONS

The natural sciences are concerned with the physical world and the living things in it. These sciences may be divided into three broad groups—physical, life, and environmental sciences—all of which are discussed in this chapter. Mathematics, often considered 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; about 250,000 physical scientists were employed in 1970. Chemistry is the largest of the physical science specialties; more than 135,000 chemists were employed in 1970. Smaller numbers were employed as physicists (50,000) and as astronomers (1,400). There were more than 20,000 other physical scientists; more than half were metallurgists.

An estimated 180,000 life scientists specialized in 1 of 3 broad fields—agriculture, biology, or medicine. The largest number, more than 70,000, worked in biological sciences. Nearly 50,000 were employed as agricultural scientists, and over 60,000 worked on problems related to medical science.

The environmental sciences are relatively small fields of scientific employment. In 1970, the number of environmental scientists totaled about 42,000. Of these, the largest group were geologists (23,000). Smaller numbers were employed as geophysicists (8,200), oceanographers (6,200), and meteorologists (4,600).

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 many fields, advanced degrees are needed for most positions.

Employment in the natural sciences has grown rapidly in recent years and the outlook is for continued growth through the 1970's. Much of the past employment growth resulted from increases in Federal research and development (R&D) expenditures for space, health, and defense related programs. During the 1970–80 decade R&D expenditures are expected to increase, although at a slower rate than during the 1960's. The anticipated slowdown in Federal R&D spending basically reflects anticipated reductions in the relative importance of the space and defense components of research expenditures. These trends were evidenced in the late 1960's and in 1970. 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 increased science enrollments expected in college and universities, requiring more teachers.

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. Included are engineering, mathematics, and health service occupations, which are described elsewhere in the *Handbook*.

Environmental Scientists

The environmental sciences are concerned with the history, composition, and characteristics of the earth's land, water, interior, atmosphere, and its environment in space. A large group of the scientists in this field—mainly geologists—explore for new sources of mineral fuels and ores. Some scientists perform basic research to increase scientific knowledge. Others work mainly in applied research; they use knowledge gained from basic research to solve practical problems. Meteorologists, for example, apply scientific knowledge of the atmosphere to forecast weather conditions for specific localities and times. Some of these environmental scientists teach in colleges and universities. Others may administer scientific programs and operations. Environmental scientists also have an important role in solving the problems of a polluted environment.

Many environmental scientists specialize in one particular branch of their broad occupational field. This chapter discusses the specialties and the employment outlook for four environmental science occupations—geologists, geophysicists, meteorologists, and oceanographers.

GEOLOGISTS

(D.O.T. 024.081)

Nature of the Work

Geologists study the structure, composition, and history of the earth's crust. Many geologists spend a large amount of their time in field

work. They examine rocks, minerals, and fossils to determine the distribution and relationship both at and beneath the earth's surface. They also gauge the thickness, direction, and slope of rock layers under the earth's surface through rock cores and cuttings by drilling deep into the earth. Geologists also search for natural resources such as coal and water. Exploration usually requires special skills in rock and mineral identification, surveying, map making, data gathering, and technical note taking. Geologists also spend considerable time in laboratories where they examine items or specimens obtained from field work under controlled temperature and pressure conditions. Research includes analysis of physical and chemical properties of minerals, experiments with the flow of water and oil through rocks of various kinds, and study of fossil remains of animal and vegetable life. 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 rock formations and modifications by earth processes. Common tools used by many field geologists include plane tables, levels, transits, well logs, gravity meters, seismographs, magnetometers, aneroid barometers, hammers, cameras, and pocket lenses.

Geologist makes photo micrographs of rock.

Some geologists administer research and exploration programs. Others teach and work on research projects in colleges and universities. Geologists usually specialize in one or a combination of three general areas—earth materials, earth processes, and earth history.

Geologists concerned with earth materials search for and develop mineral and fuel resources (oil, water, coal, and gas) and examine and classify rocks and fossils according to their chemical and physical properties. They also try to determine the origin, distribution, and migration of certain materials in or on the earth's crust. *Economic geologists* find and sometimes supervise the development of mineral and solid fuel resources. *Petroleum geologists* specialize in the discovery and recovery of liquid fuels—oil and natural gas. Some petroleum geologists spend much time near drilling sites, while others interpret regional geologic data to provide a broad framework of petroleum-related geologic knowledge. *Engineering geologists* apply geological knowledge to engineering problems in the construction of roads, airfields, tunnels, dams, and other large structures. They determine, for example, whether underground rock layers will bear the weight of various structures and buildings, and advise industrial and residential planners. *Petrologists* classify and determine the origin of rock masses. *Mineralogists* examine, analyze, and classify minerals and precious stones according to composition and structure. *Geochemists* study the chemical composition and changes in minerals and rocks to understand better the distribution and migration of elements in the earth's crust.

Ground-water geologists specialize in the sources, movement, quality reserves, and availability of subsurface water for human consumption and for industry and agriculture.

Geologists investigating earth processes determine the nature and origin of landforms and their constituents such as rock masses and sedimentary deposits. They also are concerned with eruptive forces such as volcanoes, and the effects of atmospheric conditions producing erosion or glaciation. *Volcanologists* study active and inactive volcanoes, lava flows, and other eruptive activity. They also try to determine the composition of the earth and the elements composing its core. *Sedimentologists* investigate sedimentary rocks to determine their characteristics and formation processes such as erosion, and deposition. *Geomorphologists* study landforms on the earth's surface and its change, including erosion and glaciation, which cause or change them.

Geologists specializing in earth history try to understand and explain the earth's development by determining the age, position, and nature of its fossils. *Paleontologists* trace the evolution and development of past life by studying fossilized remains of plants and animals in geologic formations. *Geochronologists* determine the ages of rocks, ore deposits, or various landforms by radioactive decay of one element or more. *Stratigraphers* study the distribution and relative arrangement of sedimentary rock layers by analyzing their fossil and mineral content.

Increasing numbers of geologists specialize in new fields that require a detailed knowledge of both geology and one or more other sciences. Among these specialists are *Astrogeologists* who are concerned with the geology of extra-terrestrial bodies. They work with lunar maps, and apply knowledge of the earth's geology in studies of conditions on the Moon and the planets. *Computer geologists* use computers and statistical analysis to solve geologic problems. *Geological oceanographers* study the sedimentary and other rocks on the ocean floor and continental shelf. (See statements on Oceanographers and Mining.)

Places of Employment

Approximately 23,000 geologists were employed in the United States in 1970, almost 4 percent were women. Nearly three-fifths of all geologists worked for private industry, mostly for petroleum and natural gas producers. A number of the employees of American petroleum companies worked in foreign countries. Geologists also are employed by mining and quarrying companies. Some geologists specialized in problems related to the construction of dams, bridges, buildings, and highways. Still other geologists worked as independent consultants offering specialized services to industry and government.

The Federal Government employed more than 1,700 geologists, two-thirds of whom worked for the Department of the Interior in the U.S. Geological Survey, the Bureau of Mines, and the Bureau of Reclamation. State agencies also employed geologists, some of whom worked on surveys conducted in cooperation with the U.S. Geological Survey. Although a few positions were in foreign countries, most Federal jobs were in the United States.

Colleges and universities employed more than 6,000 geologists. A few others worked for nonprofit research institutions and museums.

Training, Other Qualifications, and Advancement

Young people seeking professional careers in geology should plan to earn an advanced degree. The master's degree is required for beginning research and teaching and for most positions in exploration. Advancement in college teaching as well as in high-level research and administrative posts usually requires the Ph. D. degree. The bachelor's degree is considered adequate training for only a few entry jobs, primarily in exploration work.

More than 330 colleges and universities offer the bachelor's degree in geology. In the typical undergraduate curriculum, students devote about one-fourth of their time to geology courses, including historical geology, structural geology, mineralogy, petrology, and invertebrate paleontology. About another third of the work is in mathematics, the related natural sciences—such as physics and chemistry—and in engineering; the remainder is in general academic subjects. Statistics and computer usage also are recommended.

More than 160 universities award advanced degrees in geology. Graduate students take advanced courses in geology and specialize in one branch of the science.

Geologists usually begin their careers on field projects, which includes field mapping, or some type of field exploration. Some begin in laboratories as research assistants. After suitable experience, they can be promoted to project leaders, program managers, or other positions in management or research.

The student planning a career in exploration geology should like outdoor activities and have the physical stamina for geological field work. An increasing amount of the work,

formerly done in the field, is now accomplished by photogeology, a technique involving the use of color film, infrared and radar imagery to map general geologic features. In addition, a growing number of specialities are laboratory-oriented.

For the most part, geologists work as a team. A curious and analytical mind is necessary in working with complex geological problems. Geologists should be able to adapt to changes brought about by travel to distant points. The ability to express oneself orally and in writing also is important.

Employment Outlook

Employment opportunities for geologists having advanced degrees are expected to be favorable through the 1970's. However, those having a bachelor's degree probably will face keen competition for entry positions, and may have to enter semiprofessional positions, such as technician or surveyor.

Demand for geologists is expected to grow moderately in Federal agencies, particularly the U.S. Geological Survey. College and university employment probably will rise slightly, mainly for those having Ph. D. degrees capable of performing high-level research.

Good opportunities exist for those with training in geology outside the field. For instance, geologists may take training to qualify as science teachers in secondary schools. These positions probably will increase very rapidly in the next decade.

Replacement of geologists who are promoted to managerial positions, or who transfer to other fields, die, or retire, however, are expected to be the chief source of openings.

As world population expands and nations become more industrialized, demand for petroleum and minerals will rise, and increasing numbers of geologists will be required to locate these resources. Geologists also will be needed to devise techniques for exploring deeper within the earth's crust and to work with engineers to develop more efficient methods of recovering natural resources. Increased construction activity demands sand, gravel, and other materials, as well as good building sites. Geologists also will be needed to help find and maintain adequate water supplies, and to develop waste disposal methods which do not contaminate water. Increased emphasis on the environment by urban societies also should affect requirements for geologists. For example, pollution control, land use and reclamation, and highways and other large construction programs all require the assistance of geologists.

Space activities will require geologists to analyze data from the Moon and planets. They also will play an important role in setting up computer systems to store and retrieve geologic data.

The nature of domestic petroleum exploration may alter the need for geologists from year to year, and short-run demand can either exceed or fall short of the number available. However, indications are that employment prospects in petroleum and mineral extraction will be less favorable in the future than they have been in the past.

Earnings and Working Conditions

The average (median) annual starting salary for new geology graduates who have a bachelor's degree was $8,650 in private industry in 1970 according to the American Geological Institute's annual survey. New graduates who have a master's degree averaged $10,500 a year to start. Starting salaries for those who have doctor's degrees averaged $12,000 a year.

Depending on their college records, new graduates who have a bachelor's degree could begin at either $8,510 or $9,448 a year in 1970 in the Federal Government. Those who have a master's degree could start at $9,448 or $10,539 and those who have the Ph. D. degree, at $11,905 or $14,192.

According to the National Science Foundation's National Register of Scientific and Technical Personnel, the average (median) annual salary of earth scientists in 1970 was $14,900. Only 10 percent of the earth scientists earned less than $10,000 and about 10 percent earned more than $23,100.

Teachers often supplement their regular salaries with income from research, consulting, or writing. Extra allowances generally are paid geologists for work outside the United States.

The work of geologists is often active and sometimes strenuous. When their work is outdoors, geologists may be exposed to all kinds of weather. Many geologists travel a great deal and may do field work away from home for long periods. Their hours of work often are uncertain because their field activities are affected by weather and travel.

Sources of Additional Information

General information on career opportunities, training, and earnings for geologists may be obtained from:

American Geological Institute, 2201 M St. NW., Washington, D.C. 20037.

Information on Federal Government careers may be obtained from:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St. NW., Washington, D.C. 20415.

GEOPHYSICISTS

(D.O.T. 024.081)

Nature of the Work

Geophysics is an overall term covering a number of sciences concerned with the composition and physical aspects of the earth—its size and shape; interior; surface; atmosphere; the land and bodies of water on its surface and underground; and the environment of the earth in space. Geophysicists study the earth's physical characteristics, such as its electric, magnetic, and gravitational fields; the earth's interior heat flow, vibrations, and solar radiation. To conduct their investigations, geophysicists apply the principles and techniques of physics, geology, meteorology, oceanography, geodesy, 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 earthquake waves or 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. Many tests are conducted in outer space by satellites or interplanetary space probes. In geophysical exploration, increasing use is made of electronic computers to collect and process pertinent data.

Geophysicist uses seismograph to study earth vibrations.

Geophysicists usually specialize in one of three general phases of the science—solid earth, fluid earth, and upper atmosphere.

Geophysicists engaged in work related to the solid earth are concerned with the location of oil and mineral deposits, accurate mapping of the earth's surface, and the behavior of the earth's crust and its properties under the great pressures from its interior.

Exploration geophysicists search for oil and mineral deposits, using the knowledge of earthquake vibrations, the magnetic field, gravitational attraction, and other basic geophysical techniques. Others conduct research, usually to develop new or improved techniques and instruments for prospecting.

Seismologists study the structure of the earth's interior and the vibrations of the earth caused by earthquakes and 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. Seismologists also play an important role in interpreting data received from the seismograph set up on the moon during the Apollo 12 mission.

Geodesists study the size, shape, and gravitational field of the earth. Their principal task is the accurate mapping of the earth's surface. With the aid of orbiting satellites, geodesists study the earth's surface by determining the positions, elevations, and distances between points on or near it, measure the intensity and direction of gravitational attraction, and determine the distribution of mass within the earth. As man penetrates deeper into space, this task will be extended to other celestial bodies.

Hydrologists are concerned primarily with the fluid earth phase. They study the surface and underground waters in the land areas of the earth, with regard to their occurrence, circulation, distribution, and physical properties. Hydrologists measure rivers and streams, study rainfall, and investigate glaciers, snow, and permafrost. In practical application, some hydrologists are concerned with water supplies, irrigation, flood control, and soil erosion. (Oceanographers, sometimes classified as geophysical scientists, are described elsewhere in this chapter.)

Geophysicists involved in the upper-atmosphere phase investigate the forms and properties of the earth's magnetic and electric fields, and its upper and outer atmosphere. In doing so, some compare and contrast the composition and atmosphere of the Moon, the Sun, and the planets to that of the composition and atmosphere of the earth. *Geomagneticians and Aeronomists* are concerned with the earth's magnetic field—its variations, courses, and forms in space—and with many aspects of space science. *Paleomagneticians* learn about past magnetic fields from rocks or lava flows that captured the earth's magnetism when they solidified. *Tectonophysicists* study the structure of mountains and ocean basins, the properties of materials forming the earth's crust, and the physical forces that formed the mountains and the ocean basins. *Planetologists* study the composition and atmosphere of the Moon, planets, and other massive bodies in the solar system. They depend on the findings of deep space probes manned by astronauts or equipped with geophysical instruments. Geophysicists studying solar-planetary relationships are concerned not only with the Sun's warming rays and visible light but also with its radio, infrared, ultraviolet, X-ray, and energetic particle radiations. These phenomena are investigated by means of radio beams from the earth's surface, and by instruments on satellites and deep space probes. Meteorologists, sometimes classified as geophysical scientists, are discussed separately in this chapter, as is the closely related occupation of geologists. (See also the statement on "Mining".)

Places of Employment

More than 8,000 geophysicists were employed in the United States in 1970. Private industry employed the majority, chiefly in the petroleum and natural gas industry. Other geophysicists were employed by mining companies, exploration and consulting firms, and research institutions. A few were in business for themselves as consultants and provided services on a fee or contract basis to companies and individuals engaged in prospecting or other activities using geophysical techniques.

Geophysicists in private industry were employed mainly in the southwestern and western sections of the United States, including the Gulf Coast, 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.

In 1970, Federal Government agencies employed nearly 1,900 geophysicists, geodesists, and hydrologists, mainly in the U.S. Geological Survey; the National Oceanic and Atmospheric Administration (NOAA); the Army Map Service; and the Naval Oceanographic Office. Colleges and universities, State governments, and nonprofit research institutions employed small numbers of geophysicists.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in geophysics or in one of the geophysical specialties qualifies young persons for many beginning jobs in exploration geophysics. A bachelor's degree in a related science or in engineering also is adequate preparation for many beginning jobs, especially in geophysical exploration. However, this study should include courses in geophysics, physics, geology, mathematics, chemistry, and engineering. Some background in electronic data processing is useful.

For geophysical specialties other than exploration, and for the more responsible positions in exploration work, graduate education in geophysics or in a related physical science usually is required. A doctor's degree with a major in geophysics, or in a related science with advanced courses in geophysics, generally is required for teaching careers. The Ph. D. is required frequently for positions involving fundamental research and for advancement in most types of geophysical work.

The bachelor's degree in geophysics is awarded by more than 55 colleges and universities. 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 degree and Ph. D. in geophysics are granted by about 70 universities. For admission to a graduate program, a bachelor's degree and a good background in geology, mathematics, physics, or engineering, or a combination of these subjects are 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 having 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.

Generally, young geophysicists begin their careers in the field, engaged in either field mapping or exploratory activities. Others may assist senior geophysicists in a research laboratory. Advancement may be to project leader, program manager, or another management or top research position.

The prospective geophysicist 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 a geophysicist may be required to move from place to place in the course of his employment. Young students planning careers as geophysicists should be adaptable to these changes.

Geophysicists generally work as part of a team. A curious and analytical mind is necessary in working with complex geophysical problems. The ability to express oneself both orally and in writing also is important.

Employment Outlook

Employment opportunities for new graduates having degrees in geophysics are expected to be good through the 1970's. Opportunities will be best for those having the master's or doctor's degree. There also should be favorable opportunities in geophysical work for well-qualified people having degrees in other sciences if they have had some formal training in geophysics.

Very rapid growth is expected in this profession through the 1970's. Federal Government agencies will need specialists for new or expanded geophysical programs. The petroleum and mining industries will need geophysicists for exploration activities, which are expected to expand in the 1970's. Several hundred new geophysicists also will be needed each year to replace those who leave the profession, retire, or die.

Although the number of job openings for geophysicists is not expected to be large in any 1 year, the number of new graduates having degrees in the science also is expected to be small. As in past years, the number of geophysics graduates who are seeking work as geophysicists probably will be insufficient to meet employers' needs, and well-trained persons having degrees in related sciences and in engineering probably will continue to be hired for geophysical positions.

Over the long run, further growth in the profession is expected. As increasing population leads to more demand for petroleum and mineral products, both the mining industry and the petroleum industry indicate plans to increase their employment of geophysicists. They will be needed to operate highly sophisticated electronic equipment to find the more concealed fuel and mineral deposits, in the face of anticipated slow-downs in conventional exploration activities.

In addition, persons with advanced training in hydrology, seismology, geodesy, and other geophysical specialties will be needed for increasingly important basic research as well as for development of new techniques and instruments. In the Federal Government, more geophysicists will be needed to study problems of the Nation's water supply and mineral resources and to work on both flood control, and air-pollution control and abatement measures. They may be needed also to do research into radioactivity and cosmic and solar radiation as well as to help with exploration of the outer atmosphere and space, through the use of vehicles such as sounding rockets and artificial satellites. Geophysicists also will be needed to establish workable systems for information storage and retrieval for geophysical libraries.

Earnings and Working Conditions

In private industry in 1970 new graduates having bachelor's degrees typically received average starting salaries of $8,650 a year, according to the American Geological Institute's annual salary survey. New graduates having master's degrees averaged $10,500 a year to start. Beginning salaries for those who

have doctor's degrees averaged $12,000 a year. In private industry, geophysical scientists working outside the United States usually received bonuses and allowances.

In the Federal Government in late 1970, graduates having bachelor's degrees and no experience could enter most types of geophysical work at either $8,292 or $10,258 a year, depending upon their college records. Those who had completed all requirements for the master's degree could start at $10,258 or $11,526; those having the Ph. D. could start at $13,096 or $14,192. In the Federal Government as in industry, geophysicists stationed outside the United States are paid an additional amount.

According to the National Science Foundation's National Register of Scientific and Technical Personnel, the average (median) annual salary of earth scientists in 1970 was $14,900. Only 10 percent of the earth scientists earned less than $10,000 and about 10 percent earned more than $23,100.

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 consulting, writing, or research activities.

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 frequently are determined by the requirements of field activities.

Sources of Additional Information

General information on career opportunities, training, and earnings for geophysicists may be obtained from:

American Geophysical Union, 2100 Pennsylvania Ave. NW., Washington, D.C. 20037.

Society of Exploration Geophysicists, P. O. Box 3098, Tulsa, Okla. 74101.

Information on Federal Government careers may be obtained from:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St. NW., Washington, D.C. 20415.

METEOROLOGISTS

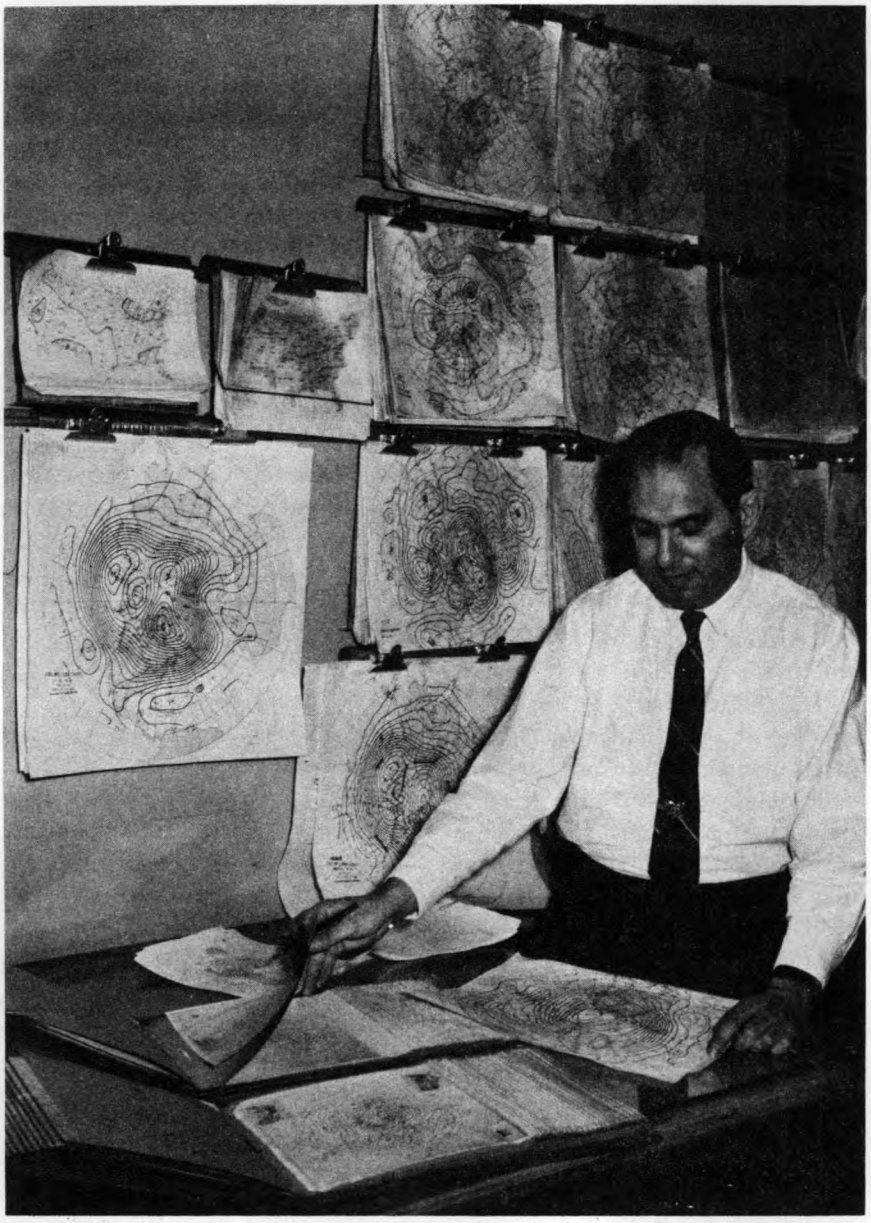
(D.O.T. 025.088)

Nature of the Work

Meteorology is the study of atmospheric phenomena—not only of the earth, but of all celestial bodies. Meteorologists attempt to describe and understand the atmosphere's constituents, motions, processes, and influences. Their knowledge helps solve many practical problems in agriculture, transportation, communications, health, defense, and business.

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 radiosondes and weather satellites. They use their interpretations to make short- and long-range forecasts for specific regions. Some forecasters still prepare and analyze weather maps, but most interpret data directly from computers. *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. *Paleoclimatologists* study historical climate conditions. Such studies are useful in planning heating and cooling systems, designing structures, and aiding in effective land utilization. *Dynamic meteorologists* investigate the physical laws governing atmospheric motions. These motions range from the great global atmospheric circulations around the earth and other planets, to restless eddies (contrary movements of air). *Physical meteorologists* study the physical nature of the atmosphere, including its chemical composition and electrical, acoustical, and optical properties. They study also the effect of the atmosphere on transmission of light, sound, and radio waves, as well as factors affecting formation of clouds, precipitation, and other weather phenomena. *Meteorological instrumentation specialists* develop the devices that measure, record, and evaluate data on atmospheric processes. For example, some of these instruments are used to measure size and number of droplets in a cloud, structure of winds, and pressure, humidity, and temperature miles above the earth.

Specialists in applied meteorology, sometimes called *industrial meteorologists,* study the relationship between weather and specific human activities, biological processes, and agricultural and industrial operations. For example, they make weather forecasts for individual companies, attempt to induce rain or snow in a given area, and work on problems such as



Meteorologist compares predicted circulation patterns with those of previous years.

smoke control and air pollution abatement.

Almost one-third of all civilian meteorologists are engaged in research and development. They are concerned, for example, with devising mathematical models of atmospheric motion as an aid to changing weather conditions, or in carrying out experiments designed to modify the formation of rain. Approximately one-third are engaged primarily in weather forecasting, and about one-fourth manage or administer forecasting and research programs. In both weather forecasting and research, meteorologists use electronic computers to tabulate and file large amounts of data.

A number of meteorologists teach or do research—frequently combining the two activities—in universities or colleges. In colleges without separate departments of meteorology, they may teach geography, mathematics, physics, chemistry, or geology, as well as meteorology.

Places of Employment

Nearly 4,400 civilian meteorologists were employed in the United States in 1970; approximately 2 percent were women. The National Oceanic and Atmospheric Administration (NOAA), which includes the National Weather Service, employed by far the largest number of civilian meteorologists—nearly 2,000—at 300 stations in all parts of the United States, the polar regions, Puerto Rico, Wake Island, and other Pacific area sites. A few worked for other Federal Government agencies. The Armed Forces employed more than 300 civilian professional meteorologists.

More than 800 meteorologists worked for private industry. Commercial airlines employed several hundred to forecast weather along flight routes and to brief pilots on atmospheric conditions. Others worked for private weather consulting firms, which provided special weather information for a fee, for companies that designed and manufactured meteorological instruments, and for large firms in aerospace, insurance, utilities, and other industries.

Colleges and universities employed more than 1,000 meteorologists in research and teaching. Several hundred others worked for

State and local governments and for nonprofit organizations.

In addition to these civilian meteorologists, more than 2,400 officers and 1,500 enlisted members of the Armed Forces were engaged in forecasting and other meteorological work in 1970.

Although meteorologists are employed in all States, nearly two-fifths were located in just two States—California and Maryland. More than one-tenth of all meteorologists were employed in the Washington, D.C. metropolitan area.

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 Federal Government's minimum requirement for beginning positions is a bachelor's degree, at least 20 semester hours of study in meteorology (6 hours each in synoptic meteorology and dynamic meteorology) and additional training in physics and mathematics, including calculus.

For research and teaching and for many top-level positions in other meteorological activities, an advanced degree is essential, preferably in meteorology. However, persons having graduate degrees in other sciences also may qualify if they have taken advanced meteorology, physics, mathematics, and chemistry.

About 55 colleges and universities in 1970 offered degree-credit programs in meteorology or specialized meteorological disciplines; 32 of these schools granted advanced degrees in the atmospheric sciences. Many other institutions offered courses in meteorology.

Meteorology training is given or supported by the Armed Forces. In 1970, more than 500 commissioned officers received university training in meteorology at either the undergraduate or graduate level. In addition, over 200 enlisted personnel were being sponsored in college and university programs leading to an undergraduate degree and commission. Ex-servicemen who have experience as meteorologists frequently are qualified for civilian meteorologist positions, not only with the Armed Forces, but with other employers as well.

The NOAA has an in-service training program under which some of its meteorologists are attending college for advanced or specialized training. Some college students preparing for careers in meteorology may obtain summer jobs with this agency. Promotions for regular full-time employees are made according to U.S Civil Service Commission regulations. (See chapter on Occupations in Government.)

Meteorologists in the Federal Government generally begin their careers in 2-year training positions at weather stations. Duties include making weather observations, briefing pilots, and disseminating weather forecasts. Advancement is to assistant forecaster, and forecaster.

Airline meteorologists have somewhat limited opportunities for advancement. However, after considerable work experience, they may advance to flight dispatcher or to various supervisory or administrative positions. A few well-trained meteorologists having a background in science, engineering, and business administration may establish their own weather consulting services.

Employment Outlook

The employment outlook for civilian meteorologists is expected to be favorable through the 1970's. In addition to job opportunities resulting from the rapid growth expected in this profession, several hundred new meteorologists will be needed each year to replace those who transfer to other fields, retire, or die.

Meteorologists having advanced degrees will be in demand to conduct research, teach in colleges and universities, and engage in management and consulting work. The advent of weather satellites, manned spacecraft, world-circling weather balloons, new international cooperative programs, and the use of electronic computers to make weather forecasts have expanded greatly the boundaries of meteorology. These advances have opened new fields of activity in the study of weather on a global scale. Meteorologists will be in demand to develop and improve instruments used to collect and process weather data.

Employment opportunities for meteorologists with commercial airlines, weather consulting services, and other private companies also are expected to increase, as the value of weather information to all segments of our economy receives further recognition. This recognition also may create opportunities in research positions with private research organizations and colleges and universities. The number of teaching positions for meteorologists also should rise, primarily because of anticipated increases in

total college enrollments and in meteorology programs.

In addition, there will be a continuing demand for meteorologists to work in existing programs, such as weather measurements and forecasts, storm and flood forecasts, and research on the problems of severe storms, turbulence, and air pollution.

Earnings and Working Conditions

In 1970 meteorologists with the bachelor's degree and no experience could start in Federal Government service at $8,292 or $10,258 a year, depending on their college records. Meteorologists who had completed all requirements for the master's degree could start at $10,258 or $11,526; those having the Ph. D. degree could begin at $13,096 or $14,192. Workers stationed outside the United States were paid an additional amount. Employee benefits for Federal Government meteorologists were the same as for other civil service workers. (See chapter on Occupations in Government.)

Airline meteorologists received a starting salary ranging from $9,700 to $12,300 a year in 1970 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 1970 was $15,200. Only 10 percent of the meteorologists earned less than $10,000 and about 10 percent earned more than $22,300.

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. Meteorologists generally work alone in smaller weather stations, and as part of a team in larger ones.

Sources of Additional Information

General information on career opportunities, educational facilities, and professional development in meteorology may be obtained from:

American Meteorological Society, 45 Beacon St., Boston, Mass. 02108.

American Geophysical Union, 2100 Pennsylvania Ave., NW., Washington, D.C. 20037.

Information on employment opportunities with the NOAA National Weather Service and on its student-assistance program may be obtained from:

Personnel Division AD42, National Oceanic and Atmospheric Administration, 6010 Executive Blvd., Rockville, Md. 20852.

Information on the Air Force meteorological training programs may be obtained from the nearest USAF recruiting office or from:

Commander, USAF Recruiting Service, Wright-Patterson AFB, Ohio 45899.

OCEANOGRAPHERS

(D.O.T. 024.081 and 041.081)

Nature of the Work

The ocean, which covers more than two-thirds of the earth's surface, provides man with valuable foods, fossil fuels, and minerals. It also influences the weather, serves as a "highway" for transportation, and offers many varieties of recreation. Oceanographers study the ocean—its characteristics, movements, physical properties, and plant and animal life. The results of their studies not only extend basic scientific knowledge but also contribute to development of practical methods for forecasting weather, fisheries development, mining ocean resources, and National defense.

Some oceanographers perform tests, make observations, and conduct surveys and experiments from ships or stationary platforms in the sea. They may collect and study data on the ocean's tides, currents, waves, mountain ranges and valleys. They also may study its temperature, density, and acoustical properties; its sediments; its sub-bottom; its shape; its interaction with the atmosphere; and marine plants and animals.

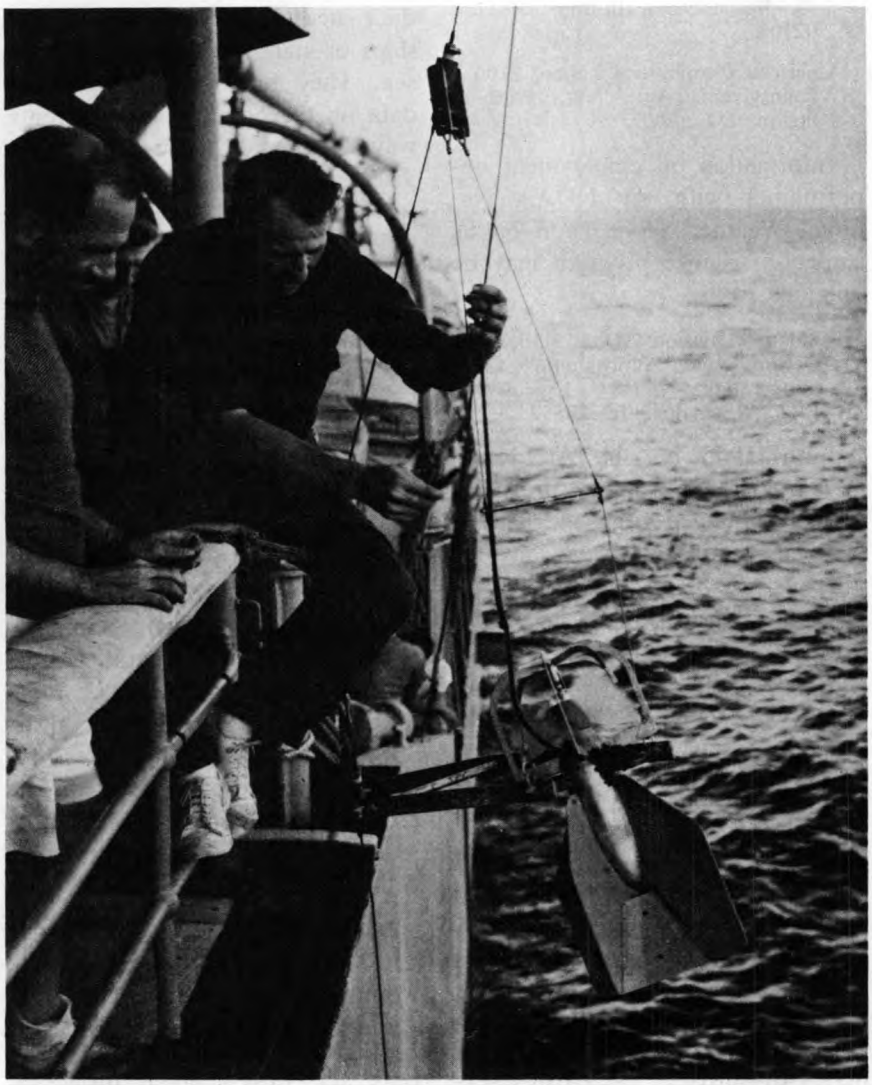
Other oceanographers perform equally important functions in laboratories on land. For instance, in some research laboratories, fish are measured and photographed, and their stomach contents analyzed; exotic sea specimens dissected, catalogued, and bottled; and plankton (floating microscopic plants and animals) identified, separated, and sometimes counted. At other laboratories, data collected from measuring and detecting devices are plotted on maps or fed to electronic computers to test theories such as sea-floor spreading and continental drift. To present the results of their studies, oceanographers prepare charts, tabulations, reports, and manuals, and write papers for scientific journals.

In developing and carrying out tests and observational programs, oceanographers use the principles

and techniques of the natural sciences, mathematics, and engineering.

Current exploration techniques involve the use of instrumented probes from surface ships and low-flying aircraft. Oceanographers use instruments such as current meters that reveal the circulation of very deep water; echo sounders; the magnetometer and gravimeter that measure the earth's magnetic and gravity fields; heat probes that determine the flow of heat from the earth's interior; and sediment corers to extract samples from the ocean's floor. They also employ instruments to test temperature and chemical composition of the water. Specially developed cameras equipped with strong lights are used to photograph marine organisms and the ocean floor. Sounding devices are vital to the oceanographer for communicating with teammates above the water, and for measuring, mapping, and locating ocean materials.

Future oceanographers may rely on instrumented buoys to record data at all depths, satellites to observe the ocean's surface, and deep research vessels (DRV's)—small, versatile submersibles to provide "aquanauts" with a closer view of the underwater world.



Oceanographer lowers current meter to study circulation of deep waters.

Most oceanographers are specialists in one of the branches of the profession. *Biological oceanographers* (marine biologists) study the ocean's plant and animal life and the environmental conditions affecting them. For instance, they investigate marine animals that generate light and electricity (photoluminescence), study the effects of ocean organisms on manmade materials, search for ways to extract drugs from seaweeds or sponges, and determine the effects of radioactivity and pollution on the growth of fish. *Physical oceanographers* (physicists and geophysicists) study the physical properties of the ocean, such as its density, temperature, and ability to transmit light and sound; the movements of the sea; and the relationship between the sea and the atmosphere which may lead to control over the weather. *Geological oceanographers* (marine geologists) study the topographic features, rocks, and sediments of the ocean floor. They also help determine the location and availability of deposits of mineral, oil, and gas on the ocean floor. *Chemical oceanographers* investigate the chemical composition of ocean water and sediments, as well as chemical reactions that occur in the sea. For example, they are concerned with processes such as desalination (removing salt from sea water). *Marine meteorologists* study the interaction of the atmosphere and the ocean, and the processes by which weather over the ocean is generated. *Oceanographic engineers* and *electronic specialists*

design and build the systems, devices, and instruments used in oceanographic research and operations. Other tasks include laying cables, supervising underwater construction, and locating sunken ships and recovering their cargos.

About 3 out of 4 oceanographers are engaged primarily in performing or administering research and development activities. A number teach in colleges and universities; a few are engaged in technical writing or consulting and in the administration of activities other than research.

Places of Employment

An estimated 5,400 oceanographers and closely related technical personnel were employed in the United States in 1970. About four-fifths were employed by the Federal Government and colleges and universities. Those Federal agencies employing substantial numbers of oceanographers were the Naval Oceanographic Office, and the National Oceanic and Atmospheric Administration (NOAA), a newly created agency combining several Federal oceanographic-related offices such as the Bureau of Commercial Fisheries, and the Environmental Science Services Administration.

A number of oceanographers work in private industry for firms that design and develop instruments and vehicles for oceanographic research. 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, biology, a geo-science, one of the other basic sciences, mathematics, or engineering. To qualify for professional positions in research and teaching as well as for advancement to high-level positions in most types of work, graduate training in oceanography or one of the basic sciences usually is required.

Undergraduate training in oceanography, marine science, ocean engineering, or fisheries was offered by only about 24 colleges and universities in 1970. Only nine institutions offered the bachelor's degree with a major in oceanography. However, since oceanography is an interdisciplinary field, training in the related basic sciences, when coupled with a strong interest in oceanography, is adequate preparation for most beginning positions or for entry into graduate school.

Important undergraduate courses for the prospective oceanographer are in the fields of mathematics, physics, chemistry, geophysics, geology, meteorology, and biology. In general, the student should specialize in the particular science field which is closest to his area of interest in oceanography. For example, students interested in chemical oceanography should obtain a degree in chemistry.

In 1970 about 22 colleges and universities offered advanced degrees in oceanography, and about 21 other institutions offered advanced courses in fisheries, marine science, or oceanographic engineering. The academic work of the graduate student in oceanography consists primarily of extensive training in a basic science combined with further training in oceanography. The graduate student usually works part of the time aboard ship, doing oceanographic research for his dissertation and acquiring familiarity with the sea and techniques used to obtain oceanographic information. A variety of summer courses is offered also by universities at the various marine stations along our coasts. These are intended for both undergraduate and graduate students and are recommended particularly for students from inland universities.

The beginning oceanographer with the bachelor's degree usually starts as a research or laboratory assistant, or in routine data collection, analysis, or computation. Most new oceanographers receive on-the-job training related to the specific work at hand. The nature and extent of the training vary with the background and needs of the individual. Thus, the new graduate who has a degree in a basic science rather than in oceanography usually can be provided enough understanding of oceanographic principles to enable him to perform adequately in this field.

Beginning oceanographers having advanced degrees usually can qualify for research and teaching positions. Experienced oceanographers may be selected for administrative positions in which they may supervise a research laboratory or direct specific survey or research projects.

Most oceanographers work part of the time aboard oceanographic ships at sea. These voyages may last from a few days to several months. A few oceanographers work nearly all of the time aboard ship. On the other hand, some oceanographers never go to sea; they analyze data collected by other scientists or pursue mathematical or theoretical studies ashore.

Employment Outlook

Employment opportunities for those having advanced degrees in oceanography—especially the Ph. D. degree—are expected to be favorable through the 1970's. Well-trained persons with bachelor's degrees in oceanography and related sciences will find opportunities mainly as research assistants in routine analytical positions.

The outlook is for very rapid growth in this profession through the 1970's. 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 years ahead, improving the Nation's defenses against submarines and surface vessels will require oceanographic research into underwater sound, surface and subsurface currents, and configuration of the ocean's floor. Oceanographers will be needed too for weather and iceberg forecasting and to study air-sea interaction in long-range forecasts. They will be needed to develop new technologies for discovering and mining the fuel and mineral resources of the ocean's floor, and to protect waters from damage by pollution and land from damage by waves and tides. Other oceanographers may improve methods of taking foods and pharmaceuticals from the oceans, manage fisheries, and develop economical means of harnessing the ocean for energy and of providing fresh water from the sea.

The demand for oceanographers qualified to teach in colleges and universities also is expected to expand. As interest in oceanography grows and more courses in oceanography are offered, more teachers in the science will be needed.

Replacement of oceanographers who transfer to other fields, retire, or die also will provide some opportunities.

Since oceanography is a relatively small profession, job openings will not be numerous in any 1 year. On the other hand, the number of new graduates having advanced degrees in this science is small and is expected to remain so. As a result, these new oceanography graduates should continue to have favorable employment opportunities.

Earnings and Working Conditions

In the Federal Government service in 1970, oceanographers having the bachelor's degree and no experience could begin at $8,292 or $10,258 a year, depending on their college records. Beginning oceanographers who had completed all requirements for the master's degree could start at $10,258 or $11,526; those having the Ph. D. degree could begin at $13,096 or $14,192. Scientists in geological and biological specialties had somewhat lower starting salaries.

In private industry in 1970, new graduates having bachelor's degrees received median starting salaries of $8,650 a year, according to a salary survey conducted by the American Geological Institute. New graduates having master's degrees averaged $10,500 a year, and those holding doctor's degrees averaged $12,000 a year to start in 1970. According to the National Science Foundation's National Register of Scientific and Technical Personnel, the average (median) annual salary of earth scientists in 1970 was $14,900. Only 10 percent of the earth scientists earned less than $10,000 and about 10 percent earned more than $23,100.

Beginning oceanographers in educational institutions receive 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 earn extra income from consulting, lecturing, and writing activities.

Oceanographers engaged in research requiring sea voyages are frequently away from home for weeks or months at a time, sometimes living and working in cramped quarters. Young persons who like the sea, however, may find these voyages very satisfying.

Sources of Additional Information

General information about oceanography—including career opportunities, professional training, colleges and universities having applicable degree-credit programs, earnings, and the economic significance of oceanographic activities—may be obtained from:

International Oceanographic Foundation, 1 Rickenbacker Causeway, Virginia Key, Miami, Fla. 33149.

National Oceanography Association, 1900 L St. NW., Washington, D.C. 20036.

National Oceanic and Atmospheric Administration, Room 218, Bldg. 5, 6010 Executive Blvd., Rockville, Maryland 20852.

Federal Government career information may be obtained from any regional office of the U.S. Civil Service Commission or from:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St. NW., Washington, D.C. 20415.

The bulletin *University Curricula in the Marine Sciences and Related Fields* may be obtained from:

Marine Sciences Affairs Staff, Bldg.

159E, Rm. 476, Washington Navy Yard, Washington, D.C. 20390.

The booklet, *Oceanography Information Sources '70,* lists the names and addresses of industrial organizations involved in oceanography and publishers of oceanographic educational materials, journals, and periodicals. Copies may be purchased from:

Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Ave. NW., Washington, D.C. 20418.

The bulletin, *Marine Science Affairs—Selecting Priority Programs (April 1970),* contains information on the national oceanography program. Copies may be obtained from:

Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

Some information on oceanographic specialties may be obtained from professional societies listed elsewhere in the *Handbook.* (See statements on Geologists, Geophysicists, Life Scientists, Meteorologists, and Chemists.)

Life Science Occupations

Life scientists study all living organisms and the processes that determine the nature of life. They are concerned with men and microbes, plants and animals, and health and disease, as well as how these organisms relate to their environment.

Some scientists in these fields perform research to expand our understandings of living things. Others, who teach, pass this knowledge on to students. Many scientists pursue both activities. Still others apply scientific concepts and principles to the solution of practical problems, such as the development of new drugs or varieties of plants, and seek solutions to problems of pollution.

This chapter discusses life scientists as a group since they receive comparable basic training and have similar employment and earning prospects. Brief descriptions are provided about the nature of the work of a number of life scientists —including botanists, zoologists, microbiologists, biophysicists, ecologists, pathologists, and pharmacologists. This chapter also contains a separate statement on biochemists. More detailed statements for other professional workers in the life sciences—soil scientists, soil conservationists, foresters, and range managers—are discussed elsewhere in the *Handbook.*

LIFE SCIENTISTS

(D.O.T. 040.081, 041.081, 070.081, and 077.128)

Nature of the Work

Life scientists study living organisms, their structure, evolutionary development, behavior, and life processes. They emphasize the relationship between animals, plants, and micro-organisms and their environments. The number and variety of plants and animals are so vast and the life processes so varied and complex that life scientists must specialize in one of three broad areas—agriculture, biology, medicine.

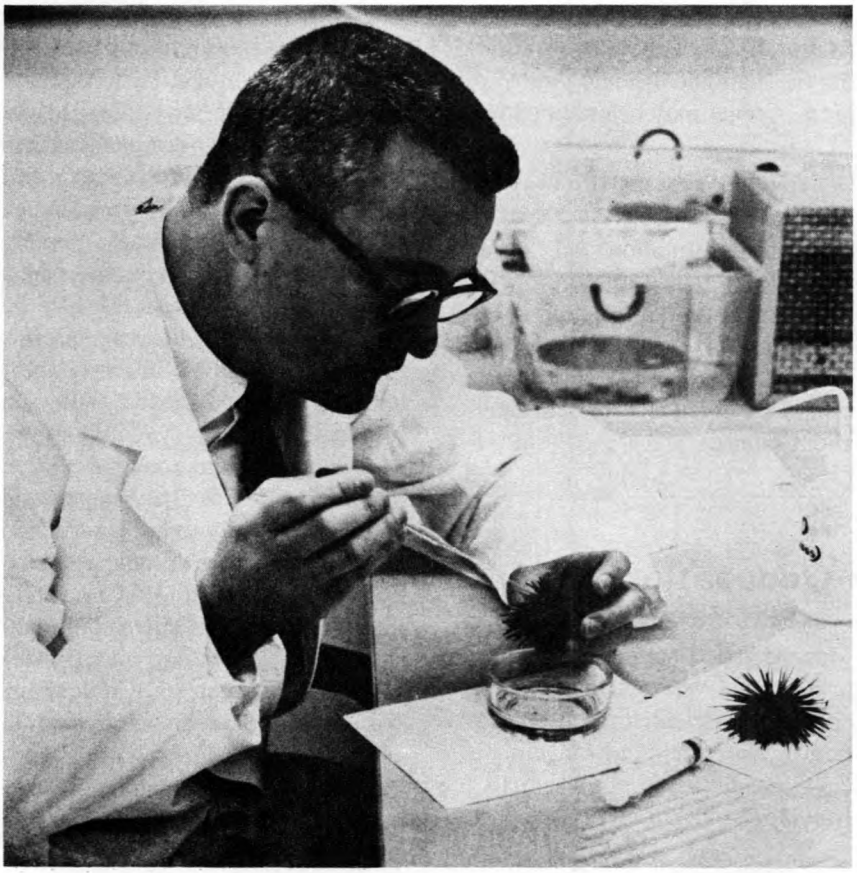
Two-fifths of all life scientists are engaged in research and development. Many conduct basic research, which is aimed at adding to our knowledge of living organisms with only secondary regard to its application. Nevertheless, the development of insecticides, disease-resistant crops, and antibiotics have resulted from this type of research.

Research in the life sciences 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; likewise, an entomologist in a laboratory tests various chemical insecticides for effectiveness and possible hazards to human and animal life.

Life scientists must be familiar with fundamental research techniques and the use of light and electron microscopes and other complex laboratory equipment. Advanced techniques and principles from chemistry and physics are applied widely. Knowledge of mathematical and statistical procedures, as well as of the operation of electronic computers, often is needed in experiments.

Teaching in a college or university is the major function of nearly one-fourth of all life scientists. Many teachers combine independent research with their regular teaching duties, and in some large educational institutions, use the major portion of their time on research.

More than one-fourth of all life 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 provide liaison between the Federal Gov-



Life scientist induces sea urchin to shed eggs for experiment.

ernment and the agricultural experiment stations at State universities, assisting in the planning, development, and evaluation of research programs at these stations.

The remaining life scientists 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, zoos, and botanical gardens.

Life 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 microorganisms.

Botanists study all aspects of plant life. Plant taxonomists identify and classify plants. Plant ecologists study the interrelationships between environmental elements and plant life and distribution. Other botanists include plant morphologists, concerned with the structure of plants and plant cells; plant physiologists, interested in the life processes of plants; and plant pathologists, engaged in determining the cause and control of plant diseases.

Zoologists 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. Some zoologists conduct experimental studies with live animals, and in some cases, study them in their natural environment. Others work mainly in laboratories dissecting animals and examining them under the microscope. Zoologists who specialize in the study of certain classes of animals may use titles that indicate the kind of animal studied, such as ornithologists (birds), herpetologists (reptiles and amphibians), ichthyologists (fishes), and mammalogists (mammals).

Microbiologists investigate the growth, structure, and general characteristics of bacteria, viruses, molds, and other organisms of microscopic or submicroscopic size. Although the terms bacteriology and microbiology are sometimes used interchangeably, microbiology, the broader term, is preferable when referring to the study of all microscopic organisms. Microbiologists isolate and make cultures of these organisms in order to examine them with a variety of highly specialized equipment. Some microbiologists pursue 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 soil microorganisms and their relation to soil fertility), virology (the study of viruses), immunology (the study of the mechanisms that fight infection), or serology (the study of animal and plant fluids, including blood serums).

Life scientists also may be classified according to the type of approach used—some of which are wholly within 1 of the 3 major

groupings, and others which may be found in all 3 groups. Some life scientists are classified according to the specific type of organism studied. Some life scientists whose work cuts across more than one of these major groupings, as often in the case of college and university teachers, simply may call themselves biologists. A description of the work of some life scientists follows.

Agronomists are concerned with improving crops and the soil. Those working with the soil analyze it, map the soils of an area, or develop and apply new methods for increasing acreage yields. They also study ways to conserve water and to decrease erosion. Agronomists involved in crop science develop new methods of growing crops for improved quality, higher yield, and more efficient production. They seek new, hardier varieties of crops and better methods of controlling disease, pests, and weeds.

Anatomists study the form and structure of organisms. Those who specialize in the structure of cells are known as cytologists, whereas those who specialize in the structure of tissues and organs are known as histologists. Anatomists may examine 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.

Biochemists, who are trained in both chemistry and biology, study the chemical processes of living things. A more detailed description of their work is contained in a separate statement elsewhere in this chapter.

Biological oceanographers, or marine biologists, study the plant and animal life in the oceans and the environmental conditions affecting them. (See separate statement on Oceanographers elsewhere in the *Handbook*.)

Biophysicists who are trained in both physics and biology, investigate the physical principles of living cells and organisms, and their responses to physical forces, such as heat, light, radiation, sound, and electricity. They may use the electron microscope to make tissues visible down to the smallest units and they may use nuclear reactors to study the effect of radiation on cells and tissues.

Ecologists study the mutual relationship among organisms and between them and their environment. They are interested in the effects of environmental influences such as rainfall, temperature, and altitude on these organisms. For instance, ecologists extract samples of phytoplankton, microscopic plants which produce most of the world's atmospheric oxygen, from bodies of water to determine the effects of pollution on their growth, or measure the radioactive content of fish by tracing tagged elements as they pass through their systems.

Embryologists study the development of an organism from fertilization of the egg through the hatching process or gestation period. They investigate the physiological, biochemical, and genetic mechanisms that control and direct the processes of development, how and why this control is accomplished, and the causes of abnormalities in development.

Entomologists are concerned with insects and their relation to plant and animal life. They identify and classify the enormous number of different kinds of insects. Some entomologists seek to control harmful insects through the use of chemicals, predatory birds, or other methods. Others develop ways to encourage the growth and spread of beneficial insects, such as honeybees.

Geneticists explore the origin, transmission, and development of hereditary characteristics. Geneticists engaged primarily in improving plant and animal breeds of economic importance—such as cereal and tobacco crops or dairy cattle and poultry—may be classified as plant or animal breeders, agronomists, or animal science specialists. Theoretical geneticists search for the mechanisms that determine inherited traits in plants, animals, or humans.

Horticulturists work 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 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) conduct research on the breeding, feeding, management, and diseases of domestic farm animals to improve the health and yield of these animals.

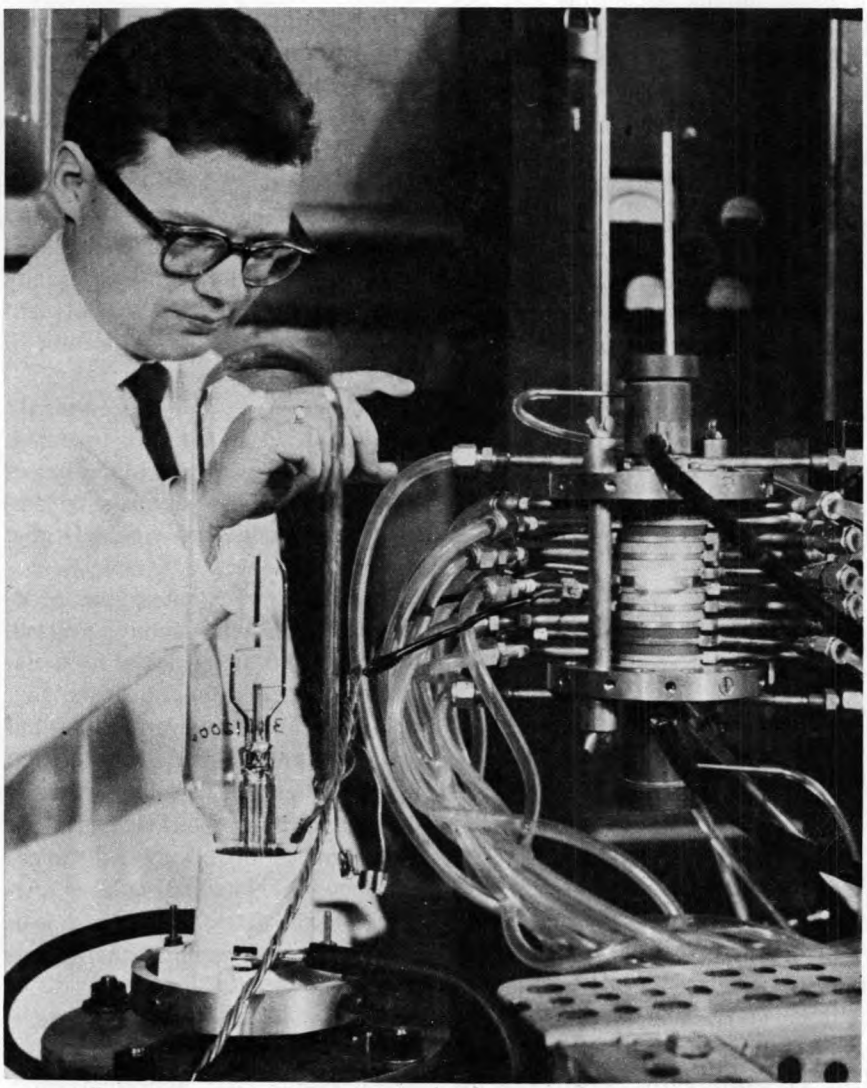
Nutritionists examime the processes through which food is utilized, the kinds and quantities of food elements—such as minerals, fats, sugars, vitamins, and proteins—that are essential to build and repair body tissues and maintain health, and how these food elements are transformed into body substances and energy. Nutritionists also analyze food to determine its composition in terms of essential ingredients or nutrients.

Pathologists study the nature, cause, and development of disease, degeneration, and abnormal functioning in humans, in animals or in

plants. Many specialize in the study of the effects of diseases, parasites, and insect pests on cells, tissues, and organs. Others investigate genetic variations and other abnormal effects caused by drugs. The term "pathologist" 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 conduct tests with animals such as rats, guinea pigs, and monkeys to determine the effects of drugs, gases, poisons, dusts, and other substances on the functioning of tissues and organs, and relate their findings with medical data. They may develop new or improved chemical compounds for use in drugs and medicines.

Physiologists study the structure and functions 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, or reproductive systems. The knowledge gained in such research often provides the basis for the work of many other specialists, such as biochemists, pathologists, pharmacologists, or nutritionists.



Life scientist observes plasma through filter glass.

Places of Employment

An estimated 180,000 persons were employed in the life sciences in 1970. About 10 percent were women. Of this total, nearly 48,000 worked in agricultural science, more than 71,000 worked in biological science, and about 61,000 worked on problems related to medical science.

Nearly three-fifths of the total were employed by colleges and universities in teaching and research positions. Medical schools and their associated hospitals employed particularly large numbers of life scientists in the medical field. State agricultural colleges and agricultural experiment stations operated by universities in cooperation with Federal and State Governments employed sizable numbers of agronomists, horticulturists, animal husbandry specialists, entomologists, and other agriculture-related specialists.

The Federal Government in 1970 employed more than 25,000 life scientists, two-thirds of whom were employed in the Department of Agriculture. The Department of the Interior employed nearly all the fish and wildlife biologists in the Federal Government. Other large numbers of life scientists were employed by the Department of the Army and the National Institutes of Health.

State and local governments, combined, employed about 21,000 biologists—mostly fish and wildlife specialists, microbiologists, and entomologists—for work in conservation, detection and control of diseases, and plant breeding.

Approximately 26,000 life scientists worked for private industry in 1970. Among the major industrial employers were manufacturers of pharmaceuticals, industrial chemicals, and food products. A few were self-employed. More than 5,000 life scientists worked for privately financed research organizations and other nonprofit foundations.

Although life scientists were employed in all States, nearly one-third were located in five States—California, New York, Pennsylvania, Illinois, and Maryland. More than one-tenth of all life scientists were located in only two metropolitan areas—Washington, D.C., and New York, N.Y.

Training, Other Qualifications, and Advancement

Young people seeking professional careers in the life 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 life sciences may be adequate preparation for some beginning jobs, but promotional opportunities for those without graduate training are generally limited to intermediate level positions.

The Ph. D. degree generally is required for higher level college teaching positions and for independent research. It is also necessary for many positions involving the administration of research programs.

New graduates having a master's degree may qualify for most entry positions in applied research and for some types of positions in college teaching.

Those having a bachelor's degree may qualify for positions involving testing, production and operation work, technical sales and service, and duties connected with the enforcement of government regulations. They also may obtain positions as advanced technicians, particularly in the medical area. Some graduates having a bachelor's degree may take courses in education and choose a career as a high school teacher of biology rather than one as a life scientist. (See statement on Secondary School Teachers.)

Training leading to a bachelor's degree with a major in one of the life science specialties is offered by nearly all colleges and universities. Courses differ greatly from one college to another, and it is important that a student determine which college program best fits his interests and needs. In general, liberal arts colleges and universities emphasize training in the biological sciences and medical research. State universities and land-grant colleges offer special advantages to those interested in agricultural sciences because their agricultural experiment stations provide many opportunities for practical training and research work.

Prospective life scientists should obtain the broadest undergraduate training possible in all branches of biology and in related sciences, particularly biochemistry, organic and inorganic chemistry, physics, and mathematics. Courses in statistics, calculus, biometrics and computer programming analysis are becoming increasingly essential. Training and practice in laboratory techniques, in the use of laboratory equipment, and in fieldwork are also important.

Advanced degrees in the life sciences also are 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.

Young people planning careers as life scientists should be able to work independently, or as part of a team. The ability to express oneself both orally and in writing also is important. Physical stamina and an inquiring mind are necessary for those interested in research in remote places.

Employment Outlook

Employment in the life sciences is expected to increase rapidly through the 1970's. In addition to those needed to fill openings resulting from growth, thousands of life scientists will be needed to replace those who transfer to other fields of work, die, or retire. However, along with the growing number of job openings, the number of life science graduates also is projected to increase rapidly. As a result, keen competition is expected for the more desirable positions. Those holding advanced degrees, especially the Ph. D., should experience less competion than bachelor's degree recipients for jobs. Opportunities for those holding only undergraduate degrees will probably be limited to research assistant or technician positions.

One of the major factors which will tend to increase the employment of life scientists is the anticipated continued growth in research and development, particularly in medical research programs sponsored by the Federal Government and voluntary health agencies. For example, the Federal Government

is expected to allocate additional millions of dollars for cancer research during the next few years. Other areas of concentrated medical study include heart disease and birth defects. Research in such relatively new areas as space biology, radiation biology, environmental health, biological oceanography, and genetic regulation also will probably increase.

Industry also is expected to increase its spending for research and development in the biological sciences. Furthermore, the stringent health standards of the Federal regulatory agencies are likely to result in a heightened demand for additional life scientists in industry to perform research and testing before new drugs, chemicals, and processing methods are made available to the public.

Another factor which should increase employment of life scientists is the substantially larger college and university enrollments expected during the 1970's. Although the resulting rise in demand for teachers will be to a large extent for Ph. D.'s, there may be some openings for qualified people holding master's degrees, especially in community colleges.

Earnings and Working Conditions

In the Federal Government in 1970, life scientists having a bachelor's degree could begin at $6,548 or $8,098 a year, depending on their college records. Beginning life scientists having the master's degree could start at $8,098 or $9,881, depending upon their academic records. Those having the Ph. D. degree could begin at $11,905 or $14,192.

Life scientists in colleges and universities earned median salaries between $15,800 and $16,500 a year in 1970, according to the limited information available. (For further information, see statement on College and University Teachers.) Life scientists in educational institutions sometimes supplement their regular salaries with income from writing, consulting, and special research projects.

According to the National Science Foundation's Register of Scientific and Technical Personnel, agricultural scientists earned about $12,800 a year in 1970; about 10 percent received less than $8,800 a year, while 10 percent earned at least $19,500. The average (median) annual salary for biological scientists was $15,000 in 1970, according to the Register; only 10 percent earned less than $8,700 a year, and about 10 percent earned $26,100 or more. In general, life scientists in private industry tend to have higher salaries than those in either colleges and universities or Government employment.

Sources of Additional Information

General information on careers in the life sciences may be obtained from:

American Institute of Biological Sciences, 3900 Wisconsin Ave. NW., Washington, D.C. 20016.

American Society of Horticultural Science, 615 Elm Street, St. Joseph, Michigan 49085.

American Physiological Society, 9650 Rockville Pike, Bethesda, Maryland 20014.

Ecological Society of America, Connecticut College, New London, Connecticut 06320.

Specific information on Federal Government careers may be obtained from:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St. NW., Washington, D.C. 20415.

BIOCHEMISTS

(D.O.T. 041.081)

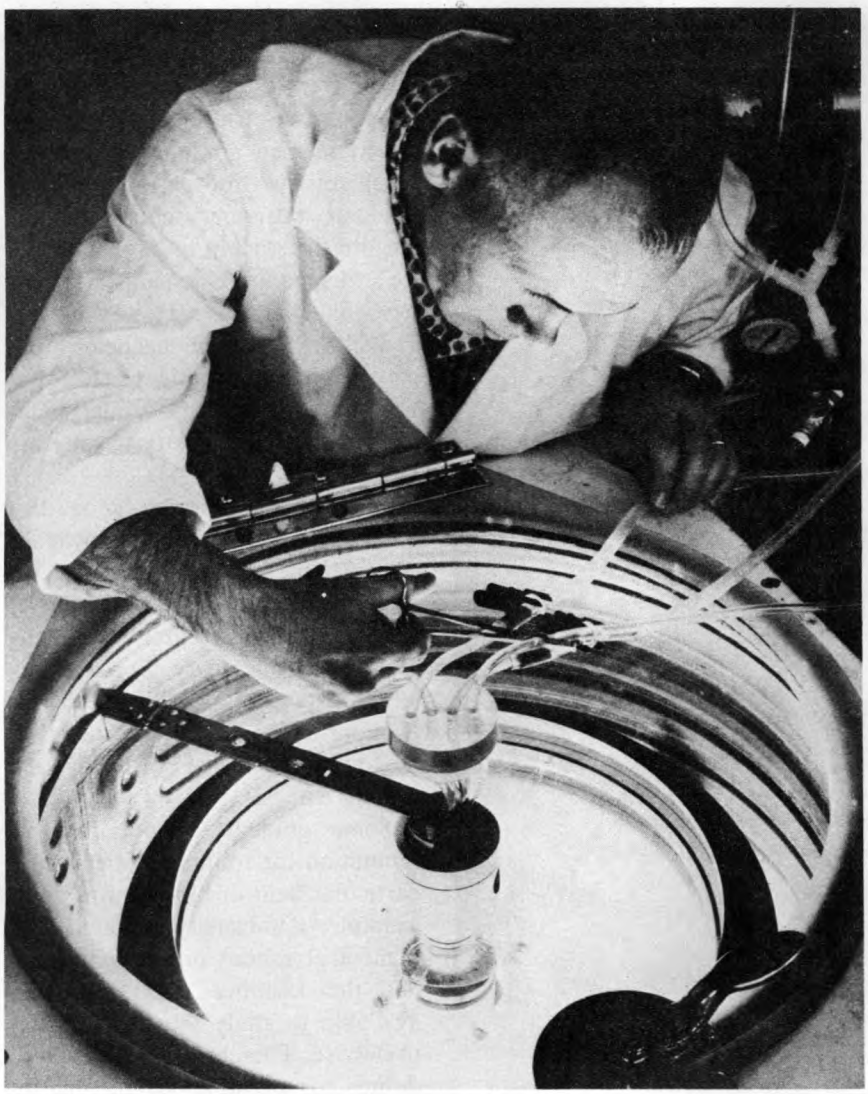
Nature of the Work

The biochemist has an important role in modern science's search for the basis of life and the factors that sustain it. His professional interests range from what determines heredity to how living things react to space travel.

Biochemists study the chemical composition of living organisms. They identify and analyze the chemical processes related to biological functions, such as muscular contraction, reproduction, and metabolism. Biochemists investigate the effects on organisms of such chemical substances as foods, hormones, and drugs. They study the chemical changes in living tissue caused by genetic and environmental factors.

Biochemists study a wide variety of substances, ranging from very small molecules to giant macromolecules. They analyze chemical compounds such as minerals and sugars. Biochemists deal with problems in genetics, enzymology, hormone action, bioenergetics, and the phenomena of biochemical control.

Foremost among the areas of application of biochemistry are medicine, biomedicine, nutrition, and agriculture. In the medical field, biochemists may investigate the causes and cures of disease or develop diagnostic procedures. In the biomedical area, they contribute to our understanding of genetics, he-



Biologist isolates granules from heart tissue.

redity, brain function, and physiological adaptation. In the nutritional field, they may identify the nutrients necessary to maintain good health and the effects of specific deficiencies on various kinds of performance, including the ability to learn. In agriculture, biochemists investigate soils, fertilizers, and plants, and undertake studies to discover more efficient methods of crop cultivation, storage, and utilization, and the design and use of pest-control agents.

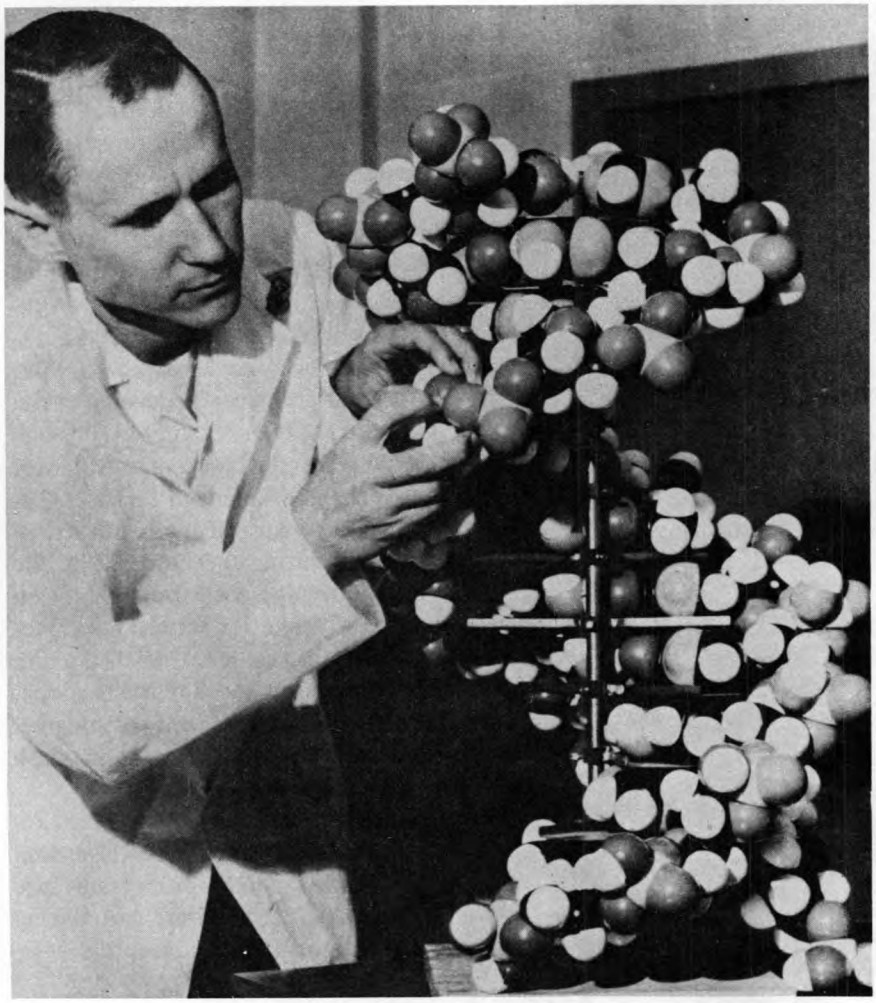
Biochemists apply the principles and procedures of chemical and physical analysis to their research problems. Routine laboratory tasks include weighing, filtering, distilling, drying, and culturing substances or materials. Some experiments require more sophisticated tasks such as designing and constructing chemical apparatus or performing tests using radioactive tracers. Biochemists use a variety of instruments including electron microscopes and radioactive isotope counters, and devise new instruments and analytical techniques as needed. They usually report the results of their research in scientific journals and sometimes lecture before scientific groups.

More than 3 out of 4 biochemists are engaged in research. The vast majority pursue basic research. A small group working in applied research use the discoveries of basic research to solve practical problems or develop useful products. For example, through basic research, biochemists discover 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; biochemists may engage in both types of work.

Some biochemists combine research with teaching in colleges and universities. Small proportions are engaged in production and testing activities or private consulting.

Places of Employment

Approximately 11,000 biochemists were employed in the United States in 1970. The number of women in biochemistry is not known. However, almost one-third of all advanced degrees in biochemistry in recent years have been awarded to women. More than half of all biochemists were employed by colleges and universities in 1970. Many of these scientists were teaching and performing research in university-operated laboratories and hospitals. Another 700 biochemists worked for nonprofit organizations, such as research institutes and foundations.



Biochemist constructs molecular model.

Private industry employed more than one-fifth of all biochemists. The largest group of these worked in the chemical industry, primarily for manufacturers of drugs, insecticides, and cosmetics.

Several thousand biochemists worked for Federal, State, and local government agencies. Most of these scientists were employed by Federal agencies concerned with health or agriculture.

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 also is needed for advancement to most high-level positions in all types of work.

Approximately 40 schools award the bachelor's degree in biochemistry. However, nearly all colleges and universities offer a major in biology or chemistry. The prospective biochemist should take undergraduate courses in chemistry, biology, biochemistry, mathematics, and physics.

More than 100 colleges and universities offer graduate degrees in biochemistry. For entrance into a graduate program, schools usually require the student to have a bachelor's degree in biochemistry, biology, or chemistry. However, students who have the bachelor's degree in another basic science but who have had several undergraduate courses in chemistry usually are admitted.

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. For the doctoral degree, he usually specializes in a particular field of biochemistry by doing intensive research and writing a thesis.

Some graduate schools have a reputation for training students in a particular field of biochemistry. For example, a university affiliated with a medical school or hospital often has the facilities and equipment available to study the biochemistry of disease. Therefore, a student who desires to specialize should investigate the specialties of the various schools and make his selection carefully.

New graduates having the bachelor's degree usually begin work as research assistants. These positions involve testing and analysis. In the drug industry, for example, research assistants analyze the ingredients of a product to verify and maintain its purity or quality. Some graduate students become research or teaching assistants in colleges and universities.

Beginning biochemists having advanced degrees usually qualify for research or teaching positions.

Some experienced biochemists who have Ph. D. degrees advance to high-level administrative positions and supervise research programs. Other highly qualified biochemists, who prefer to devote their time to research, often become leaders in a particular field of biochemistry.

Young people planning careers as biochemists should be able to work independently or as part of a team. Preciseness, keen powers of observation, and mechanical aptitude also are important. Prospective biochemists should have analytical and curious minds while possessing the patience and perseverance needed to complete hundreds of experiments to solve one problem.

Employment Outlook

The employment outlook is likely to be good for biochemists through the 1970's. In addition to new opportunities resulting from the very rapid growth expected in this field, several hundred will be needed each year to replace workers who transfer to other fields of work, retire, or die.

Although biochemistry is a relatively small profession and job openings will not be numerous in any one year, the number of graduates who have degrees in this science also is fairly small and is expected to remain so. Thus, the employment outlook should continue to be favorable for biochemistry graduates.

The greatest demand will be for the biochemist who has the Ph. D. degree, to conduct independent research or to teach.

The major factor underlying the anticipated growth is the continued increase in expenditures for research and development in life sciences.

The greatest growth in employment of biochemists is expected in expanding areas of medical research. For instance, the Federal Government is expected to allocate millions of dollars for cancer research during the next few years. Other areas of concentrated medical study include heart disease, muscular dystrophy, and mental illness. Also, an increasing number of biochemists will be needed to work in clinical laboratories associated with hospitals. Additional biochemists will be needed to implement the more stringent drug standards that have been established by Congress and the Federal regulatory agencies. Biochemistry also is becoming important in other fields, such as environmental studies.

Growing college enrollments, especially of students majoring in chemistry and the life sciences, will strengthen the demand for biochemists qualified to teach in colleges and universities.

Earnings and Working Conditions

Starting salaries paid to biochemists employed by colleges and universities are comparable to those for other professional faculty members. Biochemists in educational institutions often supplement their income by engaging in outside research or consulting work.

In 1970, the average (median) earnings for all biochemists who had a bachelor's degree was $10,800; for those having a master's degree, $12,500; and for those having a Ph. D., $15,800.

Sources of Additional Information

General information on careers in biochemistry may be obtained from:

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

Physical Scientists

The physical sciences deal with the basic laws of the physical world. Many physical scientists conduct basic research designed to increase man's knowledge of the properties of matter and energy. Others conduct applied research and use 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. Physical scientists also teach in colleges and universities and supervise research and development programs.

This chapter describes three major physical science occupations —chemist, physicist, and astronomer—and food scientists, who apply scientific principles to the processing of food. Engineers, life scientists, and earth scientists also require a background in the physical sciences; these occupations are described in separate chapters elsewhere in the *Handbook*.

CHEMISTS

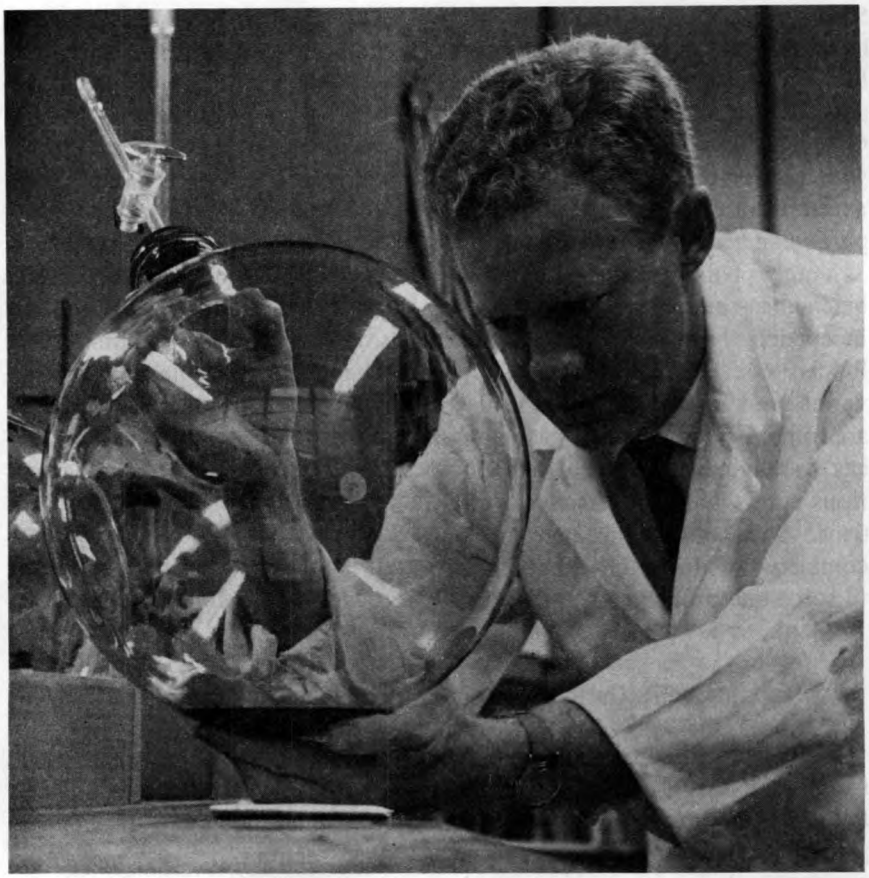
(D.O.T. 022.081, .168, .181, and .281)

Nature of the Work

The clothes we wear, the food we eat, the houses in which we live—in

fact, most of the things which help to make our lives more comfortable, healthy, and productive—have resulted, in part, from the chemist's continuing search for new knowledge. Although the day-to-day activities of chemists generally receive little notice, some of their discoveries have led to the creation of whole new industries, such as the plastics, frozen foods, and manmade fibers industries.

Chemists investigate the properties and composition of matter, and the laws that govern the combination of elements in a seemingly endless variety of forms. They search for new knowledge about substances and try to utilize this knowledge for practical use. In conducting studies, they apply scientific principles and techniques and use a variety of specialized instruments to measure, identify, and evaluate changes in matter. Chemists maintain accurate records of their work and prepare clear and concise reports showing results of tests or experiments. They often present their findings in scientific publications or in lectures before scientific groups.



Chemist checks fire-resistant compound.

The activities of chemists are varied. Some chemists develop new substances such as rocket fuels, solids for transistors, or vaccines. Other chemists, by observing how light is absorbed by a substance or how X-rays or beams of electrons are affected when passed through it, determine the chemical composition of a substance and the atomic makeup of its molecules. Other chemists are interested in bulk properties rather than individual molecules of matter; they examine the behavior of solids, liquids, and reactions on surfaces. Another group of chemists study the rate at which matter undergoes changes in composition, ranging from the combustion in a jet engine to the growth of a living organism. A sizable number of chemists make qualitative and quantitative measurements of the properties of matter and develop analytical instruments and techniques. Biochemists challenge the problems related to the chemistry of life processes. (See separate statement on Biochemists elsewhere in the *Handbook*.)

Nearly two-fifths of all chemists are engaged in research and development. Many research chemists work on applied research projects to create new products or improve or find 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 manmade fibers. Many other chemists work on basic research to extend scientific knowledge rather than to solve immediate practical problems. Results of basic research frequently apply immediately to practical problems. For example, basic research on polymerization—how and why small molecules unite to form giant molecules—resulted in the development of synthetic rubber, nylon, and plastics.

More than one-fourth of all chemists are employed in management and administration—especially research and development activities. Approximately one-tenth of all

chemists devote most of their time to teaching, often combining it with research. 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 initial development to final production. Nearly one-fifth of all chemists are engaged in production and inspection activities which may insure, for instance, the quality of final products or the improvement of products and processes. Others work as marketing experts or sales representatives of chemical companies and other manufacturers in positions where the employee must be familiar with the technical aspects of products. Some chemists work as private consultants to private industry firms and government agencies.

Places of Employment

Chemistry is by far the largest field of employment in the physical sciences. Nearly 137,000 chemists were employed in the United States in 1970; about seven percent were women.

Approximately three-fourths of all chemists were employed by private industry in 1970. The chemicals manufacturing industry employed almost half of these chemists. Relatively large numbers of other chemists were found in the industries manufacturing food, scientific instruments, petroleum, rubber, paper, textiles and apparel, electrical equipment, and primary metals products. Independent laboratories and research institutes providing consulting services and distributors of chemical, pharmaceutical, food, and petroleum products also employed significant numbers of chemists.

Colleges and universities employed more than 25,000 chemists. A smaller number worked for nonprofit research organizations. A number of chemists were employed by Federal Government agencies, chiefly the U.S Departments of Defense; Health, Education, and Welfare; Agriculture; and Interior. Small numbers worked for State and local governments, primarily in agencies concerned with health or agriculture.

Chemists were employed in all States, in small as well as large cities. However, they were usually concentrated in large industrial areas. Nearly one-fifth of all chemists were located in four metropolitan areas—New York, Chicago, Philadelphia, and Newark. About half of the total worked in six States —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 by about 1,000 colleges and universities throughout the country. In addition to the required chemistry courses in analytical, inorganic, organic, and physical chemistry, the undergraduate chemistry major also takes courses in mathematics (especially analytical geometry and calculus) and physics.

Advanced degrees in chemistry are awarded by 300 colleges and universities, many of which offer financial assistance to 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 vary by institution, but usually include a thesis based on independent research.

New graduates having the bachelor's degree usually qualify for beginning positions in analysis and testing, quality control, technical service and sales, or assist senior chemists in research and development work. Most chemists having only the bachelor's degree start their careers in industry or government. In industry, employers often have special training programs for new chemistry graduates. These programs supplement college training with specific industry techniques and help determine the type of work for which the new employee is best suited. Some chemists who have the bachelor's degree teach or do research in colleges and universities while working toward advanced degrees. They also may qualify as secondary school teachers.

Chemists having the master's degree often qualify for applied research positions in government or private industry. They also may qualify for some teaching positions in colleges and universities and in 2-year colleges.

The Ph. D. degree generally is required for basic research, for higher level faculty positions in a college or university, or for advancement to top-level positions in administration and in other activities.

Students planning careers as chemists should enjoy studying science and mathematics, and working with their hands to build scientific apparatus and perform experiments. Perseverance and the ability to con-

centrate on detail and work independently are essential to the prospective chemist. Other desirable assets include an inquisitive mind, good memory, and imagination. The ability to write is important in preparing reports on experiments. Chemists also should have good eye-hand coordination and eyesight.

Employment Outlook

The employment outlook for chemists is expected to be favorable through the 1970's. In addition to new opportunities resulting from the rapid growth expected in the profession, thousands of new chemists will be needed each year to replace those who retire, die, or transfer to other occupations.

Chemists will continue to be needed to perform research and development work. Through the 1970's, research and development (R&D) expenditures of Government and industry are expected to increase, although at a slower rate than during the 1960's. The anticipated slowdown in Federal R&D spending basically reflects anticipated reductions in the relative importance of the space and defense components of R&D expenditures. These trends were evidenced in the late 1960's and in 1970.

R&D expenditures not only create jobs for chemists in research and development, but also produce new products that result in new positions for chemists in other types of work.

Another factor increasing the opportunities for chemists is the growing demand for industrial products. These include plastics, manmade fibers, drugs, fertilizers, and high energy and nuclear fuels for missiles and space ships.

Chemists also will be required to teach at colleges and universities through the 1970's to accommodate larger enrollments expected at these institutions. The greatest demand in colleges and universities will be for those who have Ph. D. degrees, but many openings, especially in 2-year colleges, also should arise for chemists who have master's degrees. (See statement on College and University Teachers.)

New graduates also will find openings in high school teaching, provided they have completed the professional education courses and other requirements for a State teaching certificate. However, they usually are regarded as teachers rather than as chemists. (See statement on Secondary School Teachers.)

Earnings and Working Conditions

Inexperienced chemistry graduates having a bachelor's degree had an average (median) starting salary of about $9,400 a year in private industry in 1970, according to a survey conducted by the American Chemical Society. Inexperienced graduates having the master's degree averaged about $11,000 a year and those having the Ph. D. degree, about $15,000.

In academic institutions, the average (median) annual starting salary for the few entrants having the bachelor's degree and no experience was about $6,600, according to the American Chemical Society. The average salary for inexperienced graduates having the master's degree was about $8,000, and for those having the Ph. D degree, $11,200. Many experienced chemists in educational institutions supplement their regular salaries with income from consulting, lecturing, and writing. Depending on the individual's college records, the annual starting salary in the Federal Government in 1970 for an inexperienced chemist having the bachelor's degree was either $8,292 or $10,258. Beginning chemists who have 1 year of graduate study could start at $10,258 and those who have 2 years of graduate study at $11,526. Chemists having the Ph. D. degree could start at $13,096 or $14,192.

The average (median) annual salary for all chemists was $15,300 in 1970, according to the National Science Foundation's National Register of Scientific and Technical Personnel. Only 10 percent of all chemists earned less than $9,600 a year, and about 10 percent earned $24,000 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, when safety regulations are followed, health hazards are negligible.

Sources of Additional Information

General information on career opportunities and earnings for chemists may be obtained from:

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

Manufacturing Chemists' Association, Inc., 1825 Connecticut Ave. NW., Washington, D.C. 20009.

Specific information on Federal Government careers may be obtained from:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St. NW., Washington, D.C. 20415.

For additional sources of infor-

mation, see statements on Biochemists, Chemical Engineers, and Industrial Chemical Industry. Information on chemical technicians may be found in the statement on Technician Occupations.

PHYSICISTS

(D.O.T. 023.081 and .088)

Nature of the Work

The flight of astronauts through space, the probing of the oceans' depths, or even the safety of the family car depend on research by physicists. By determining basic laws governing phenomena such as gravity, electromagnetism, heat flow, and radioactivity, potential difficulties can be anticipated and overcome.

Physicists observe and analyze various forms of energy, the structure of matter, and the relationship between matter and energy. From their research, physicists develop theories and discover fundamental laws that describe the behavior of the forces at work within the universe. Their studies have continued to broaden man's understanding of the physical world and have enabled him to make increasing use of natural resources. Physicists have contributed to scientific progress in recent years in areas such as nuclear energy, electronics, communications, and aerospace.

Physicist examines hydrogen detection material.

Nearly three-fifths of all physicists are engaged in research and development. Some conduct basic research to increase scientific knowledge with only secondary regard to its practical applications. Some of these, called theoretical physicists, attempt to describe in mathematical terms interactions between matter and energy. Others, called experimental physicists, make careful systematic observations and perform experiments to identify and quantify these interactions. For example, they try to identify and measure the lifetime of tiny particles of matter which may exist within the nucleus of the atom. Experimental physicists use apparatus such as particle accelerators, X-ray spectrometers, microwave devices, lasers, and phase and electron microscopes. They may design new kinds of instruments. 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 who are engineering-oriented engage in applied research and development. They use the knowledge gained from basic research to solve practical problems or to develop new or improved products. For example, the work of physicists specializing in solid-state physics led to the development of transistors and microcircuits, which have replaced vacuum tubes in many types of electronic equipment ranging from hearing aids to guidance systems for missiles.

About one-fifth of all physicists teach in colleges and universities. Approximately another fifth are engaged in management and administration, especially research and development programs. A small number work in activities related to the

production of industrial products such as inspection and quality control. Some physicists do consulting work.

Most physicists specialize in one or more branches of the science—mechanics, thermal phenomena, high energy physics, 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, emerging knowledge continually opens new areas of research. For example, the development of lasers and masers has led to new experimentation in optics and other fields. However, since all physics specialties rest on the same fundamental principles, the physicist's work often overlaps 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. Growing numbers of scientists specialize in fields that combine physics and a related science. Thus, a number of specialties have developed on the borderline between physics and other fields—astrophysics, biophysics, chemical physics, and geophysics. (Information on these occupations is continued elsewhere in the *Handbook*.) Furthermore, the practical applications of physicists' work have increasingly merged with engineering.

Places of Employment

Approximately 48,000 physicists were employed in the United States in 1970; nearly 4 percent were women. Private industry employed more than 18,000; two-fifths of whom worked in the electrical equipment, ordnance, and chemicals industries. Commercial laboratories and independent research institutes employed more than one-fourth of the physicists in private industry.

In 1970, colleges and universities employed almost 22,000 research or teaching physicists, many of whom combined both activities. Federal government agencies employed approximately 6,600 physicists in 1970, more than three-fourths of whom worked for the Department of Defense. The National Bureau of Standards and the National Aeronautics and Space Administration also employed significant numbers of physicists. Nonprofit organizations employed more than 1,500 physicists.

Physicists were employed in all States. However, their employment was greatest in those areas having industrial concentrations and large colleges and universities. Nearly one-fourth of all physicists were employed in four metropolitan areas—Washington, D.C., Boston, New York, and Los Angeles-Long Beach. More than one-third of the total were employed in three States —California, New York, and Massachusetts.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in physics is generally 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 usually is required for full faculty status at colleges and universities. Also, the doctorate generally is needed for employment in positions involving responsibility for research and development with any type of employer.

Physicists having master's degrees qualify for many research jobs in private industry, educational institutions, and government. Some also instruct in colleges and universities. Usually, graduate students working toward a doctor's degree are assigned to teach elementary college courses, conduct laboratory sessions, or assist senior faculty members on research projects.

Physicists having bachelor's degrees 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 having a bachelor's degree in the sciences do not work as physicists but enter nontechnical work, other sciences, or engineering.

Over 800 colleges and universities offer training leading to the bachelor's degree in physics. 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 atomic and molecular physics. In addition, courses in chemistry and mathematics are required.

Approximately 250 colleges and universities offer advanced degrees

in physics. In graduate school, the student, with faculty guidance, usually works in a specific field. The graduate student, especially the candidate for the Ph. D. degree, spends a large portion of his time in research.

Students planning a career in physics should have an inquisitive mind, good memory, and imagination. Perseverance and the ability to concentrate on detail also are important. The occupation requires constant study and the ability to work independently. Prospective physicists should also possess good eye-hand coordination and eyesight.

Employment Outlook

Employment opportunities for physicists are expected to be favorable through the 1970's. In addition to opportunities resulting from the rapid growth expected in this field, other physicists will be needed each year to replace those who transfer to other fields of work, retire, or die.

Graduate training is increasingly the hallmark of full professional status in physics. As in recent years, a demand is expected for physicists who have advanced degrees to teach in colleges and universities. Among the factors contributing to the demand for physics teachers are the rapid increase in graduate enrollments and the growing need for physics training in other science and engineering programs.

Physicists also will be required in substantial numbers to do complex research and development work related to physics, engineering, or other natural sciences. Through the 1970's, research and development (R&D) expenditures of Government and industry are expected to increase, although at a slower rate than during the 1960's. The anticipated slowdown in Federal R&D spending basically reflects anticipated reductions in the relative importance of the space and defense components of R&D expenditures. These trends were evidenced in the late 1960's and in 1970.

New graduates also will find opportunities in other occupations that utilize their training. For example, they may become high school teachers, provided they complete the required professional educational courses and obtain a State teaching certificate. However, they are usually regarded as teachers rather than as physicists. (See statement on Secondary School Teachers elsewhere in the *Handbook*.)

Earnings and Working Conditions

Starting salaries for physicists having bachelor's degrees were usually about $9,900 a year in private industry in 1970, according to the limited information available. Physicists having master's degrees received starting salaries about $1,900 higher than those having bachelor's degrees. Depending on specialty and experience, graduates having Ph. D. degrees generally received entrance salaries of around $15,000 annually, although some were paid considerably less.

Depending on their college records, physicists having bachelor degrees and no experience could start work in the Federal Government in 1970 at either $8,292 or $10,258. Beginning physicists who had completed all the requirements for the master's degree could start at $10,258 or $11,526. Physicists having the Ph. D degree could begin at $13,096 or $14,192.

Starting salaries for physicists having the Ph. D. degree on college and university faculties averaged $1,000 per month in 1970. (For further information, see statement on College and University Teachers.) Many faculty physicists supplement their regular incomes and satisfy their professional interests through consulting work and special research projects.

The average (median) annual salary for physicists was $15,900 in 1970, according to the National Science Foundation's Register of Scientific and Technical Personnel. Only 10 percent earned less than $10,000 a year, and about 10 percent earned $25,000 or more.

Sources of Additional Information

General information on career opportunities in physics may be obtained from:

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

Information on Federal Government careers may be obtained from:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St. NW., Washington, D.C. 20415.

ASTRONOMERS

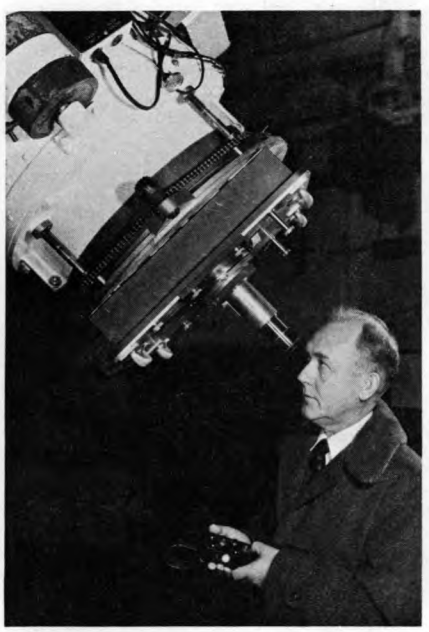
(D.O.T. 021.088)

Nature of the Work

Astronomy often is considered the most theoretical of all sciences, although it has many practical applications. Astronomers study the structure, extent, and evolution of the universe. They collect and ana-

lyze data on the sun, moons, planets, and stars, and attempt to determine the sizes, shapes, surface temperatures, chemical composition, and motions of these bodies and make studies of the gases and dust between them. They compute the positions of the planets; calculate the orbits of comets, asteroids, and artificial satellites; make statistical studies of stars and galaxies and study the origin and nature of cosmic radiation. Astronomers also study the size and shape of the earth and the properties of its upper atmosphere. Astronomical observations are valuable to navigation and the accurate measurement of time.

In making detailed observations of the heavens, astronomers use complex photographic techniques, light-measuring instruments, and other optical devices. Astronomers actually spend a limited amount of time at the telescope, the major instrument used for observation. Devices for making specialized observations are usually attached to the telescope. Other methods of observation include the use of rockets, balloons, and satellites carrying various measuring devices. In processing and analyzing the vast amounts of data derived from their observations, astronomers often use electronic computers and spectrophotometers.



Astronomer uses telescope to determine position of stars.

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 dynamical astronomy, one of the oldest fields of astronomy that has recently acquired new importance. This branch 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 a technique used to study the source and nature of celestial radio waves by means of radio telescopes. Among the many other specialties are *astrometry* (measurement of angular 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 two-thirds of all astronomers are engaged in research activities. Nearly a fifth are employed in colleges and universities, primarily as teachers. In some schools 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 administration of research programs, development and design of astronomical instruments, and consultation in areas to which astronomy is applied.

Places of Employment

Astronomy is one of the smallest of the physical sciences; in 1970, the total number of astronomers in the United States was estimated to be about 1,300. Nearly three-fourths of all astronomers were employed by colleges and universities. Many of these worked in university-operated observatories, where they usually devoted most of their time to research. Other astronomers worked for observatories financed by nonprofit organizations.

The Federal Government employed more than 100 astronomers in 1970. Most of these were employed by the Department of Defense, mainly by the U.S. Naval Observatory and the U.S. Naval Research Laboratory. A couple hundred astronomers were employed in private industry, many by firms in the aerospace field. A few astronomers worked for museums and planetariums.

Training, Other Qualifications, and Advancement

Young people seeking professional careers in astronomy should obtain an advanced degree—preferably the Ph. D. The doctorate usually is 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 that

opportunities for promotion are limited.

Undergraduate curriculums leading to the bachelor's degree in astronomy are offered by only about 40 colleges and universities. The undergraduate work of the prospective astronomer is weighted heavily with courses in physics and mathematics. Courses in chemistry, statistics, and electronics also are useful. A few of the courses often taken by astronomy undergraduates are mechanics, electricity and magnetism, introductory courses in astronomy and 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 having a bachelor's degree in physics or mathematics with a physics minor usually are able to enter and pursue graduate programs in astronomy without difficulty.

Programs leading to the doctorate in astronomy are available at about 30 institutions located in various sections of the country. The graduate student takes advanced courses primarily in astronomy, physics, and mathematics. A few graduate schools offer celestial mechanics, galactic structure, radio astronomy, stellar atmospheres and interiors, theoretical astrophysics, and binary and variable stars. Some schools require that graduate students spend several months in residence at an observatory. In most institutions, the program of work leading to the doctorate is flexible and allows the student to take the courses which will be of most value in his particular area of interest.

New graduates having a bachelor's or master's degree in astronomy usually begin as assistants in observatories, planetariums, large departments of astronomy in colleges and universities, Government agencies, or industry. Some persons having 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 having the doctorate can usually qualify for college teaching positions and for research positions in educational institutions, Government, and industry.

Young persons planning a career in astronomy should have inquisitive minds, imagination, and they should like working with ideas. Perseverance, the ability to concentrate on detail and to work independently also are important.

Employment Outlook

Employment opportunities for astronomers having the Ph. D. degree are expected to be favorable through the 1970's. Well-qualified persons with only bachelor's or master's degrees in astronomy will have favorable 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 having the doctorate.

The outlook is for a rapid growth of this small profession through the 1970's. However, because astronomy is a small profession, the number of job openings in any 1 year will not be large. On the other hand, because relatively few college students are expected to receive advanced degrees in astronomy each year, those who do should have good 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 analyze the data collected by rockets and spacecraft. They also will be needed to plan and give direction to the astronomical observations that can only be carried out 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.

Earnings and Working Conditions

In 1970, beginning astronomers having the Ph. D. were eligible to enter Federal Government service at a salary of $13,096 or $14,192 a year, depending on their college record. Astronomers having the bachelor's degree could start at $8,292 or $10,258 a year; those having a bachelor's degree and some graduate study could begin at $10,258 or $11,526.

According to the National Science Foundation's National Register of Scientific and Technical Personnel, the average (median) annual salary of all astronomers having the Ph. D. degree was $15,100 in 1970. Those with master's degrees averaged $13,100 and bachelor's degree holders also averaged $13,100 in 1970.

Some astronomers make visual

photographic or photoelectric observations at night. Others make observations only 4 or 5 nights each month, or even only a few nights a year, and study and analyze 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 can be met by a reasonably healthy person.

Sources of Additional Information

General information on careers in astronomy may be obtained from:

American Astronomical Society, 211 FitzRandolph Rd., Princeton, N.J. 08540.

Specific information on Federal Government career opportunities may be obtained from:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St. NW., Washington, D.C. 20415.

FOOD SCIENTISTS

(D.O.T. 022.081, 040.081, 041.081)

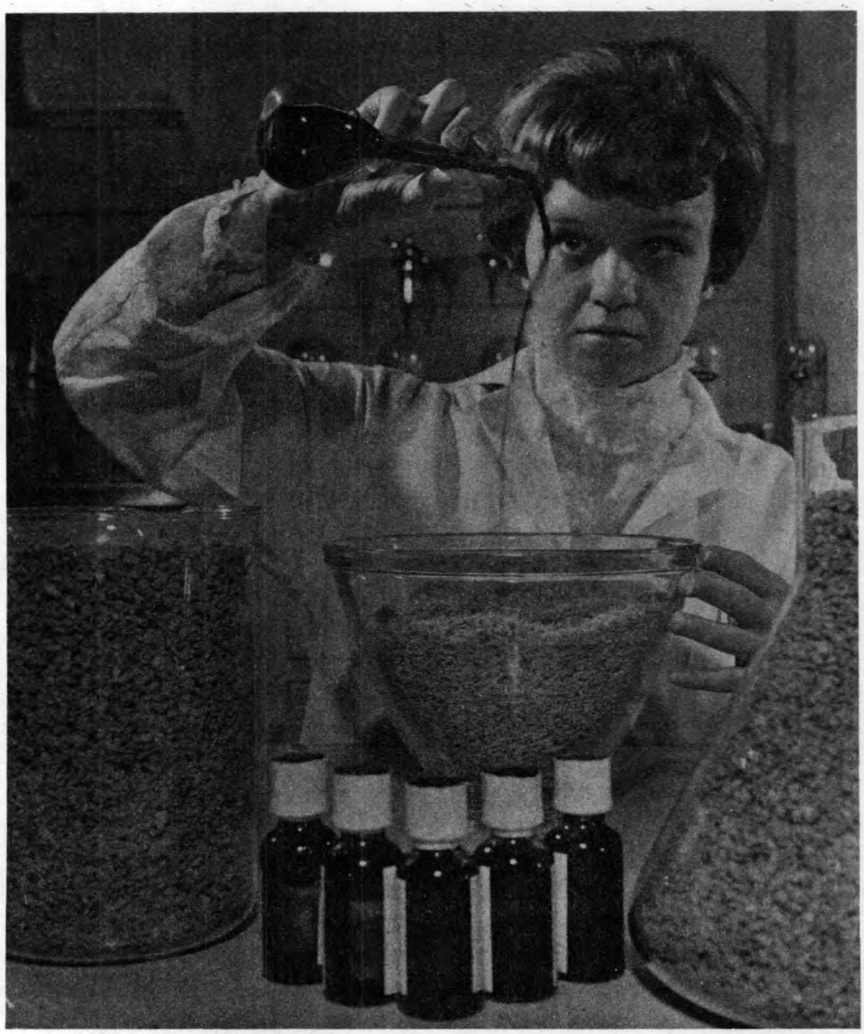
Nature of the Work

Someone has estimated that the average family of four consumes over 5,000 pounds of food a year. In the past, most food processing was done at home but today, almost all food is processed by industry. Although people in many different occupations are employed in food processing, this statement is concerned with only the food scientist or *food technologist*.

Food scientists investigate the fundamental chemical, physical, and biological nature of food and apply this knowledge to processing, preserving, and storing an adequate, nutritious, and wholesome food supply. About two-fifths of all scientists in food processing are employed in basic or applied research, and development. Others work in a quality assurance laboratory, or in the production or processing area of a food plant. Some teach or do basic research in colleges and universities.

Food scientists in basic research study the structure and composition of foods and their changes in processing or storage. For example, they may be interested in developing new sources of proteins, studying the effects of food processing on microorganisms, or searching for factors that affect the flavor, texture, or appearance of foods.

In applied research and development, food scientists create new



Food scientist adds flavor to enhance product.

foods and develop processes for new products. They also improve existing foods by making them more nutritious and enhancing their flavor, color, or texture. They may formulate an idea for a new product or modify an existing item. The idea is submitted to management and, if accepted, a new research project is begun.

The scientist must ensure that each new product will retain its characteristics and nutritive value during storage. He also may conduct chemical and microbiological tests to see that products meet both industry and government standards. Other food scientists test additives for purity, investigate changes that take place during processing or storage, or develop mass-feeding methods for food service institutions. Food scientists also maintain records of their work and prepare reports showing results of tests or experiments.

Food scientists in quality control laboratories check raw ingredients to note freshness, maturity, or suitability for processing. For example, the product may be tested for tenderness by using machines that gauge the amount of force necessary to shear or puncture the item. Periodically, they inspect processing-line operations and perform chemical and bacteriological tests during and after processing to insure conformity with established industry and government standards. These tests vary according to the product and processing method. Canned goods, for example, may be tested for sugar, starch, protein, fat, and mineral content. In a frozen food plant, the scientist must determine that various enzymes are inactive after the product has been processed so that the food does not lose its flavor during storage. Other scientists are concerned with packaging materials that maintain shelf life and product stability.

Whether in research or quality control, food scientists must be familiar with fundamental research techniques and standard testing equipment, such as vacuum gauges and reflectance meters.

Food scientists in quality control laboratories often supervise technicians who assist in product testing. (See statements on Food Processing Technicians.)

Food scientists engaged in production and processing schedule processing operations, prepare production specifications, maintain proper temperature and humidity in storage areas, and supervise sanitation, including the efficient and economical disposal of wastes. Food scientists are responsible for ways to increase processing efficiency. For example, they may advise management on the purchase of equipment and recommend new sources of materials.

Places of Employment

Approximately 7,300 food scientists were employed in the food processing industry in 1970. Less than 10 percent were women. Food scientists are employed in all sectors of the food industry and in every State, particularly California, Illinois, New York, Pennsylvania, Texas, Ohio, New Jersey, Wisconsin, Michigan, and Iowa.

Some food scientists are employed in research by Federal Government agencies such as the Food and Drug Administration, and the Departments of Agriculture and Defense. A few are employed by private consulting firms and international organizations. Some teach or do research in colleges and universities. (See statement on College and University Teachers.)

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in food science or one of the physical or life sciences such as chemistry and biology is the usual minimum educational requirement for a beginning food scientist. Graduate training is essential for many positions, particularly research and college teaching, and for many management level jobs in industry.

Nearly 40 colleges and universities throughout the U.S. offer training leading to the bachelor's degree in food science. Undergraduate courses generally include food chemistry, analysis, microbiology, engineering, and processing. Undergraduate courses include other physical sciences such as physics and mathematics, the social sciences and humanities, and business administration.

Advanced degrees are offered by most of those colleges and universities that provide undergraduate food science programs. In graduate school, students usually specialize in a particular area of food science. Requirements for the master's or doctor's degree vary by institution, but usually include laboratory work and a thesis.

A food scientist with a bachelor's degree might start work in production as a quality assurance chemist or an assistant production manager. After obtaining sufficient experience, the food scientist in production could advance to more responsible management positions. The scientist also might begin as a junior food chemist in the applied research and development laboratory of a food company and be

promoted to section head or other research management positions.

Graduates who have a master's degree might begin as senior food chemists in research and development. Graduates who have the Ph. D. probably would begin their careers doing basic research.

Young persons planning careers as food scientists should like technical work and have analytical minds oriented toward detail. Flexibility and innovativeness are important in meeting food needs for an expanding population.

Employment Outlook

Employment opportunities for graduates of food science programs at all degree levels are expected to be favorable through the 1970's. In addition to the scientists needed to fill new positions, several hundred will be needed each year to replace those who retire or die. Among the factors underlying the anticipated increase in requirements for food scientists is an expanding population that is demanding a greater variety of quality convenience foods. Food-service institutions that supply outlets, such as airlines and restaurants, also require many types of convenience foods. An increasing number of scientists also will be required in research and product development. Expenditures for research and development in the food industry have shown moderate increases in recent years and probably will continue to rise. Research could produce new foods from modifications of wheat, corn, rice, and soybeans. For example, some of the "meat" in the future will be manufactured to resemble beef, pork, and chicken. Additional food scientists will be needed in production and quality control because of the complexity of products and processes and the application of higher processing standards.

Earnings and Working Conditions

Inexperienced food science graduates (and graduates of other scientific disciplines) with a bachelor's degree had starting salaries of about $760 per month in 1970, based on limited data. Inexperienced graduates having the master's degree averaged about $940 per month, and those having the Ph. D. degree, about $1,200 per month.

The average (median) salary for all food scientists was $16,000 in 1970, according to the National Science Foundation's National Register of Scientific and Technical Personnel.

Most food scientists work in modern, well-lighted and ventilated laboratories. However, food scientists may face a slight hazard from slippery floors in pilot or processing plants.

Sources of Additional Information

Information on a variety of careers in food science, and a list of schools offering programs in food science may be obtained from:

The Institute of Food Technologists, Suite 2120, 221 North LaSalle Street, Chicago, Illinois 60601.

PERFORMING ARTISTS AND OTHER ART RELATED OCCUPATIONS

The performing arts include music, acting, singing, and the dance. In these fields, the number of talented persons seeking employment generally greatly exceeds the number of full-time positions available. As a result, many performers supplement their incomes by teaching, and others work much of the time in different types of occupations.

The difficulty of earning a living as a performer is one of the facts young persons should bear in mind in considering an artistic career. They should consider, therefore, the possible advantages of making their art a hobby rather than a profession. Aspiring young artists usually must spend many years in intensive training and practice before they are ready for public performances. They need not only great natural talent but also determination, a willingness to work long and hard, and an overwhelming interest in their chosen field.

The statements which follow this introduction give detailed information on musicians, singers, actors, and dancers.

ACTORS AND ACTRESSES

(D.O.T. 150.028 and 150.048)

Nature of the Work

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

Only a few of the approximately 15,000 actors and actresses in the United States in 1970 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 frequently are cast in supporting roles. However, most of these workers are struggling for a toehold in the profession, and are glad to pick up parts wherever they can.

New actors generally start in "bit" parts, where they speak only a few lines. If successful, they may progress to larger, supporting roles, of which there are several in most stage, television, and screen productions. Actors who have minor parts in stage productions also may serve as understudies for the principals. If a leading player misses a performance, the understudy has a chance to demonstrate his acting ability.

Actors who prepare for roles either on the stage, in television, or in the movies spend many hours in rehearsal. They must memorize their lines and know their cues. 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.

In addition to the actors with speaking parts, "extras," who have no lines to deliver, are used in almost every motion picture and many television shows and theatre

productions. In spectacular productions, a large number of extras take part in crowd scenes.

Some actors find alternative jobs as dramatic coaches or become directors of stage, television, radio, or motion picture productions. A few teach in schools of acting or in the drama departments of colleges and universities.

Places of Employment

Stage plays, motion pictures (including films made especially for television), and commercials are the largest fields of employment for actors, although some are employed by "live" television and radio.

In the winter, most employment opportunities on the stage are in New York and other large cities. In the summer months, stock companies in suburban and resort areas throughout the Nation provide many opportunities for employment. In addition many cities now have "little theaters," repertory companies and dinner 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 City with casts selected there.

Although employment opportunities in motion pictures and film television are centered in Hollywood, a few studios are in New York City; Miami, Fla.; and other parts of the country. In addition, many films are shot on location, providing employment for nonprofessionals who live in the area as "extras." An increasing number of American-produced films are being shot in foreign countries. In live television and radio, most opportunities for actors are at the headquarters of the major networks—in New York, Los Angeles, and, to a lesser extent, Chicago. A few local television and radio stations occasionally employ actors.

Training and Other Qualifications

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 is increasingly necessary. Such training can be obtained at special schools of the dramatic arts, located chiefly in New York, and in over 500 colleges and universities throughout the country. 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. From these, the student develops an appreciation of the great plays 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.

Acting demands patience and total commitment since aspiring actors and actresses must wait for parts or filming schedules, must work long hours, and often must do much traveling. Flawless performances require long rehearsal schedules and the tedious memorizing of lines. The actor needs stamina to withstand the heat of stage or studio lights, or the adverse weather conditions which may exist "on location." Above all, young persons planning a career in acting must have talent and the creative ability to portray different characters. They must have poise, stage presence, and aggressiveness to project themselves to the audience. At the same time, the ability to follow directions is important.

In all media, the best way to start is to use local opportunities and to build on the basis of such experience. Many actors who are successful in local 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 especially difficult to enter, and employment often results from previous experience on Broadway.

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 has 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 work almost indefinitely. On the other hand, employment opportunities become increasingly limited by middle age, especially for those who become typed in romantic, youthful roles.

Employment Outlook

Overcrowding has existed in the acting field for many years and it is expected to persist. In the legitimate theater and also in motion pic-

tures, radio, and television, numbers of job applicants greatly exceed the jobs available. Moreover, many actors are employed in their profession for only a small part of the year.

The development of motion pictures, radio, and TV has greatly reduced employment opportunities for actors in the theater. Although a motion picture production may use a very large number of actors, they are employed only during filming and the films are widely distributed and may be used for years. Also, the increasing number of American-produced films being shot in foreign countries will reduce employment opportunities for American actors. Radio uses few actors. The number of filmed TV dramas and commercials using actors is increasing, but not enough to offset the decline in 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 many times.

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. The recent growth of summer stock companies, repertory companies, and dinner theaters also has increased employment. Further increases also are likely in the employment of actors on television due partly to the expanding Public Broadcasting System and UHF stations. In addition, increased employment opportunities are expected as a result of the expanded use of cable TV (pay TV). Also, the development and wider use in the future of video cassettes will result in more employment opportunities.

In the acting field as a whole, however, employment opportunities are expected to change little through the 1970's. The number of new entrants to the profession is expected to outnumber employment opportunities. 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 Broadway productions was about $165 in 1970. Those appearing in small "off-Broadway" theaters received a minimum of $75 a week. For shows on the road, the minimum rate was about $220 a week. Earnings for rehearsal time were about $165 a week in Broadway shows and much lower in small "off-Broadway" theaters. (All minimum salaries are automatically, by union contract, adjusted upward commensurate with 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 $120 in 1970. For extras, the minimum rate was about $33 a day. Actors on network television received a minimum program fee of about $180 for a single half-hour program and 10 hours of rehearsal time; actors on radio received about $50 for a half-hour performance, including one rehearsal hour. To encourage more stable employment on radio and TV, minimum guarantees for those actors with contracts for a series of programs are sometimes discounted below the single program guaranteed fee. Because of the frequent periods of unemployment characteristic of this profession, annual earnings may be low for many of the lesser known performers. In all fields, many well-known actors and actresses have salary rates above the minimums. Salaries of the few top stars are many times the figures cited.

Eight performances amount to a week's work on the legitimate stage, and any additional performances are paid for as overtime. The basic workweek after the opening of a show is 36 hours, including 12 hours for rehearsals. Before the opening, however, the workweek usually is 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 on weekends and holidays. When plays are on the road, traveling over the weekend often is necessary.

Most actors are covered by a pension fund and a growing number have hospitalization insurance to which their employers contribute. All equity members have paid vacations and sick leave. Most stage actors get little if any unemployment

compensation solely from acting, since they seldom have enough employment in any State to meet the eligibility requirements. Consequently, when a show closes, they often have to take any casual work obtainable while waiting for another role.

DANCERS

(D.O.T. 151.028 and 151.048)

Nature of the 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 the 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.

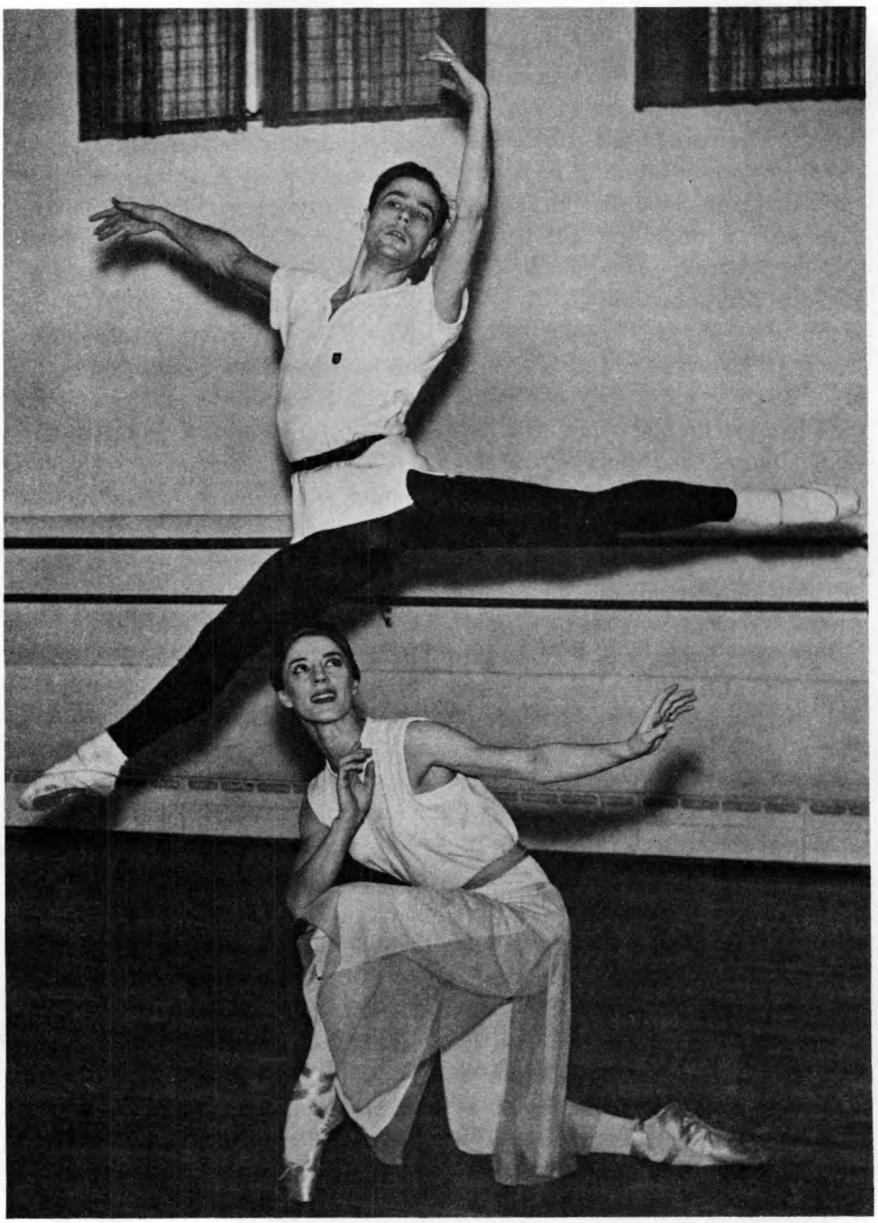
Many dancers combine teaching with their stage work or teach full time in schools of the dance or in colleges and universities. The few dancers who become choreographers create new ballets or dance routines. Others are dance directors who train dancers in new productions.

(This statement does not include instructors of ballroom and other social dancing.)

Places of Employment

In 1970, there were approximately 23,000 dancers and dancing teachers in the United States. More than half of this number were teachers employed at schools of the dance and in other schools and colleges. Most of the other dancers were performers on the stage, screen, and television. A few teachers trained in dance therapy were employed by hospitals to work in the treatment of mental disorders. About 90 percent of all dancers are women, but in some types of dance, particularly ballet and modern, women constitute about one-half of the performers.

Dancing teachers are located



chiefly in large cities, but 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 most large cities.

Training and Other Qualifications

Serious training for a dancing career traditionally begins by age 12 or earlier. For example, girls wishing to become ballet dancers should begin taking lessons at the age of 7 or 8. From 2 to 3 years of prior preparation is needed before the young girl should start dancing "en pointe." Professional training in ballet typically takes from 10 to 12 lessons a 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.

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 include subjects such as music, literature, and history to aid him in his interpretation of dramatic episodes and music.

About 200 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 students 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.

A college education is an advantage in obtaining employment as a teacher of professional dancing or choreography. However, dancers who postpone their first audition for openings in classical ballet until graduation may compete at a disadvantage with younger dancers.

A teaching position in professional schools usually requires experience as a performer; in colleges and conservatories graduate degrees are generally required, but experience as a performer often may be substituted. Maturity and a broad educational background are also important for teaching positions.

The dancer's life is one of rigorous practice, perfecting of the art, and self-discipline. Good health and physical stamina are necessary, both to keep in good condition and to follow the rugged travel schedule imposed on many dancers.

Height and body build should not vary much from the average. Good feet and normal arches are also required. Above all, one must have a natural aptitude for dancing, a creative ability to express oneself through dance.

Seldom does a dancer perform unaccompanied. Therefore, young persons considering a dancing career should be able to function as part of a team. They also should be prepared to face the anxiety of unstable working conditions brought on by show closings, audition failures, and the like.

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 persons would in most other occupations.

Employment Outlook

Opportunities in this field will be limited both by the small number of full-time jobs available and the relatively large supply of applicants seeking full-time work. The supply of trained dancers has exceeded the demand for many years. The irregular employment that has persisted for many years is expected to continue despite a few recent union-management 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. Few stage shows run more than 26 weeks and many "fold" after the first week.

On the other hand, the number of shows being produced is increasing, and there is a growing trend toward using professional dancers at industrial exhibitions, such as auto shows. Also, some new professional dance companies are being developed around the country, and television will offer some additional employment opportunities. Civic and community dance groups are in-

creasing 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.

Earnings and Working Conditions

Dancers who perform professionally are members of one of the unions affiliated with the Associated Actors and Artists of America (AFL-CIO). Dancers who perform in opera ballets, classical ballet, and the modern dance belong to the American Guild of Musical Artists, Inc.; those 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 be members of 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. The separate contract signed by each dancer with the producer of the show may be more favorable than the basic agreement regarding salary, hours of work, and working conditions.

The minimum salary for dancers in ballet and other stage productions was about $155 a week in 1970. The minimum rate for rehearsal time was about $135 a week. Dancers performing on tour receive a small allowance to defray the cost of room and board. The rate of per diem in 1970 was $11. The employer pays the cost of transportation. If a dancer signs a contract for a brief appearance in 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.

Some dancers qualified to teach in 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 take place, 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.

Sources of Additional Information

Information on colleges and universities and conservatories of music which give 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, compiled by the American Association for Health, Physical Education and Recreation, a division of the National Educational Association, 1201 16th St. NW., Washington, D.C. 20036.

Information on wages and working conditions may be obtained from:

American Guild of Musical Artists, 1841 Broadway, New York, N.Y. 10023.

MUSICIANS AND MUSIC TEACHERS

(D.O.T. 152.028 and 152.048; 090.168; 091.168; and 092.228)

Nature of the Work

Professional musicians—whether they play in a symphony orchestra, dance band, rock group, or "jazz combo"—generally have behind them many years of study and in-

tensive practice. As a rule, musicians specialize in either popular or classicial music; only a few play both types professionally.

Musicians who specialize in popular music usually play the trumpet, trombone, clarinet, saxophone, organ, or one of the "rhythm" instruments—the piano, string bass, drums, or guitar. Dance bands play in nightclubs, restaurants, and at special parties. The best known bands, jazz groups, rock groups, and solo performers sometimes give concerts and perform on television.

Musicians specializing in classical music play in opera and theater orchestras, symphony orchestras, and for other kinds of performances requiring orchestral accompaniments. The instruments played by most of these musicians are the strings, brass, and wood winds. Some form small groups—usually a string quartet or a trio—to give concerts of chamber music.

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. A few exceptionally brilliant musicians become well-known concert artists. They give their own concerts and appear as soloists with symphony orchestras. Both classical and popular musicians often make recordings, either individually or as members of a group.

A very high proportion of all musicians teach in the Nation's schools and colleges. These teachers may be members of the faculty of music schools or conservatories or of colleges which offer instruction in instrumental and vocal music. Some are music teachers in elementary or secondary schools where they direct vocal and instrumental music programs, teach general classroom music appreciation, and give group instruction on an instrument. Private lessons are given by many teachers employed by school systems, and by performing musicians, either in their own studios or in pupils' homes.

A few musicians work in the field of music therapy in hospitals, and in music libraries.

Places of Employment

About 210,000 musicians and music teachers were employed in 1970. Most professional musicians who perform work in cities, where the Nation's entertainment and recording activities are concentrated such as New York, Chicago, Los Angeles, Nashville, Miami Beach, and New Orleans. Music teachers in elementary and secondary schools, as well as in colleges and universities, are employed all over the country. Moreover, almost every town and city has at least one private music teacher. Dance bands and civic orchestras also are located in many communities, although in the smaller towns, their members

usually are part-time musicians with other regular jobs.

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.

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 which has 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 college or university school of music, an audition frequently is necessary. Many teachers in these schools are accomplished artists who will train only promising young musicians.

Over 550 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 usually are 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, they take lessons with private teachers when young, and seize every opportunity to play in amateur or professional performances. Some groups of young people form their own small dance bands or rock groups. 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.

Young persons considering careers in music should have both musical talent and creative ability. They should also have poise and stage presence for facing large audiences. Since quality of performance requires constant study and practice, self-discipline is vital. Moreover, musicians must have the stamina for considerable travel in meeting concert and nightclub engagements, as well as rugged time schedules, often including long night hours.

Employment Outlook

As a field of employment, music performance has been overcrowded for many years, and it is expected to remain so through the 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 more than sufficient to give instruction to all the young people seeking lessons, and will probably continue to be. Although many opportunities can be expected for single and short-term engagements, playing popular music in night clubs, theaters, and other places, the supply of qualified musicians seeking such jobs is likely to remain greater than the demand. On the other hand, 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; this has

resulted, in part, from the greatly increased use of recorded music. Some additional employment opportunities are expected to result from the expanded use of cable TV (pay TV). Also, the development and wider use, in the future, of video cassettes will result in some employment opportunities.

The employment outlook in music education for people who are qualified as teachers as well as musicians is better than for those qualified as performers only. The number of schools with music programs is growing and interest in music as an avocation also is rising. 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 1 of the 28 major symphony orchestras in the United States had minimum salaries ranging from about $5,100 to $16,500 a year in 1970 according to the American Symphony Orchestras League, Inc. Six orchestras—New York, Boston, Philadelphia, Cleveland, Cincinnati, and Chicago—have year-round seasons and minimum salaries ranging from $10,900 to $16,500. The remaining 22 orchestras have seasons ranging from 32 to 49 weeks. Instrumentalists who were members of small ensembles reportedly received as much as $200 a concert. Those who played in dance bands were paid from $60 to $300 a week in 1970, 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 lessons are uncertain and vary according to the musician's reputation, the number of teachers in the locality, the number of students desiring lessons, and the economic status of the community.

Musicians who are performers customarily work at night and on weekends. They must also spend considerable time in regular daily practice and in rehearsal of new scores.

Many musicians, primarily those employed by symphony orchestras, work under master wage agreements, which guarantee them a season's work lasting up to 52 weeks. Musicians in other areas, however, may face relatively long periods of unemployment between jobs and, thus, the overall level of their earnings generally is lower than that of 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 Musicial Artists, Inc. (AFL-CIO).

Sources of Additional Information

Information about wages, hours of work, and working conditions for professional musicians is available from:

American Federation of Musicians (AFL-CIO), 641 Lexington Ave., New York, N.Y. 10022.

Information about 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, One Dupont Circle, NW., Washington, D.C. 20036.

Further information about music teaching in elementary and secondary schools is available from:

Music Educators National Conference, The National Education Association, 1201 16th St. NW., Washington, D.C. 20036.

SINGERS AND SINGING TEACHERS

(D.O.T. 152.048 and .028; 090.168; 091.168; and 092.228)

Nature of the Work

Professional singing is an art that usually requires not only a fine voice but also a highly developed technique and a broad knowledge of music. A small number of singing stars make recordings or go on concert tours in the United States and abroad. Somewhat larger numbers of singers obtain leading or supporting roles in operas and popular music shows, or secure engagements as solists in oratorios and other types of performances. Most

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. 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 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, in music conservatories, or in colleges and universities with schools or departments of music.

Places of Employment

In 1970, about 75,000 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., a major center for country and western music, is one of the most important places for employment of singers for both "live" performances and recordings. Persons trained as singers who teach music in elementary and secondary schools, colleges, universities, and conservatories of music are employed throughout the country. Many singers are employed part time, chiefly as church singers and choir masters.

Training and Other Qualifications

Young persons who want to perform professionally as singers should acquire a broad background in music, including its theory and history. The ability to dance may be helpful, since singers are sometimes required to dance. In addition, those 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 started—it is important that a prospective singer have great determination. It is also important to 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, or a school or department of music connected with a college or university, or by taking private voice lessons. These 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 550 colleges and universities throughout the country. College teachers usually are 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, perseverance, an outstanding personality, an attractive appearance, and good contacts, good luck often is required to achieve a singing career. Singers also may be required to have stamina for traveling to concert and night club engagements. They must be able to adapt to rigorous time schedules, often working night hours.

Employment Outlook

The employment situation for singers will probably remain highly competitive through the 1970's. Competition among popular singers will continue to be especially keen. A great number of short-term jobs are expected in the entertainment field—the opera and concert stage, movies, theater, nightclubs, radio and television, dance bands, and other places—but not enough to provide steady employment for all qualified singers.

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 popular music and commercials for both radio and television advertising. Some additional employment opportunities are expected from the expanded use of cable TV (pay TV). Also, the development and wider use in the future of video cassettes will result in more employment opportunities.

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 better than for performers. 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. In addition, music teachers will be needed to replace those who will transfer to other fields of work, retire, or die.

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. Due to these circumstances, singers may be subject to unstable employment conditions and the pressure of unreliable financial circumstances.

Earnings and Working Conditions

Except for a few well-known concert soloists, opera stars, top recording artists of popular music, and some singers regularly employed by dance bands and the motion picture industry, most 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. The fees that private music teachers charge depend 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; private voice teachers often give lessons after school or business hours or on weekends. Work in the entertainment field is seasonal and few performers have steady jobs.

Singers who perform professionally usually belong to one branch or another of the AFL-CIO union, the Associated Actors and Actresses of America. Singers who perform 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.

Sources of Additional Information

Information about accredited schools and departments of music may be obtained from:

National Association of Schools of Music, One Dupont Circle, NW., Washington, D.C. 20036.

Further information about music teaching in elementary and secondary schools is available from:

Music Educators National Conference, The National Education Association, 1201 16th St. NW., Washington, D.C. 20036.

Information concerning salary and working conditions in opera and concert fields is available from:

American Guild of Musical Artists, 1841 Broadway, New York, N.Y. 10023.

COMMERCIAL ARTISTS

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

Nature of the Work

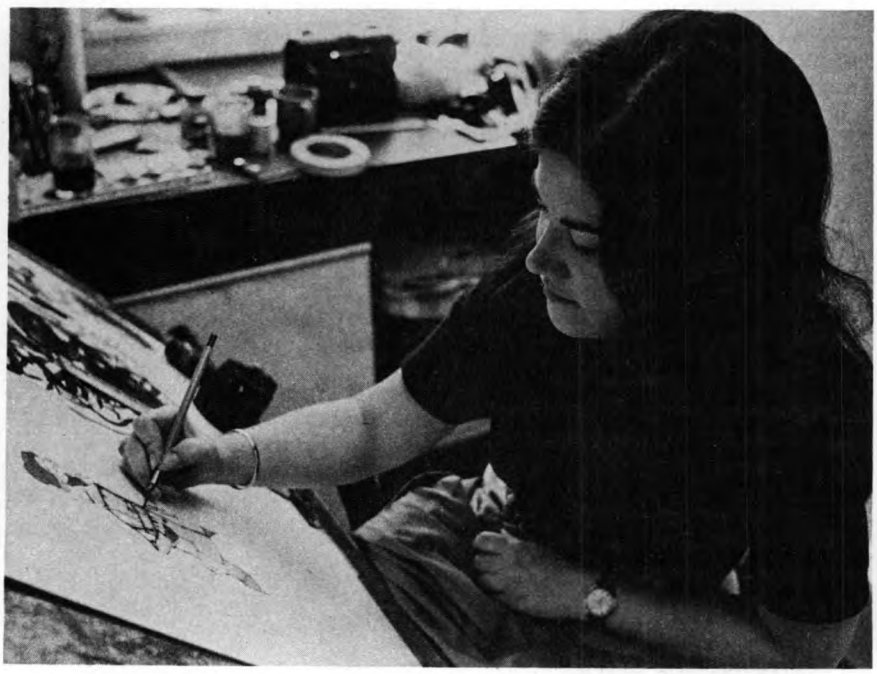
A team of commerical artists often creates the artwork in newspapers and magazines and on billboards, brochures, catalogs, and television commericals. The art director supervises this team of artists having varying skills and specializations. He may develop the art aspects of an advertising plan which he turns over to a layout man for further refinement. The *layout artist* constructs or arranges elements of the advertisement, selects and lays out illustrations, photographs, and typography, and determines color and other elements of design. He then prepares a "rough visual" or sketch. After consulting with the director, he may change the visual and complete a more comprehensive layout for the customer.

Working with the layout man in turning out the finished product are a variety of specialists, including *renderers,* who make rough magic marker drawings; *letterers,* who execute appropriate lettering either freehand or with mechanical aids; *illustrators,* who sketch and draw in more finished form; and *paste-up* and *mechanical men,* who cut and paste basic parts of the advertisement or other artwork by using a ruling pen and other drafting tools. Some workers, called *general boardmen,* spend nearly all their time at the drawing board performing many of these specializations. Often supporting the general boardmen or other specialists are apprentices, who primarily do routine jobs such as separating colors and cutting mats.

In a small office, the art director may perform the layout and boardwork with the aid of apprentices. In a large office, the art director develops concepts with the copywriter; sets standards; deals with clients; and purchases needed photographs, illustrations, lettering, and other art work from freelancers or art services.

Advertising artists create the concept and artwork for a wide variety of promotional items or "collateral material" including direct mail advertising, catalogs, and counter displays to supplement newspaper and magazine ads or television commercials. They also prepare slides, film strips, and other visual aids.

Commercial artists also create the formats of magazines and other publications, by 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, or in technical drawings for industry.



Places of Employment

An estimated 60,000 commercial artists were employed in 1970; about two-fifths were women. Most commercial artists were employed in big cities, such as New York and Chicago, where the largest users of commercial art are to be found. Some, however, are employed in nearly every city.

Most commercial artists are paid a regular salary as staff artists by advertising agencies, commercial art studios, advertising departments of large companies, printing and publishing firms, textile companies, television and motion picture studios, department stores, and a variety of other business organizations. Many work as freelance artists, selling their artwork to any customer —chiefly to the same types of organizations that employ salaried art-

ists. 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.

Training, Other Qualifications, and Advancement

Artistic ability and good taste are the most important qualifications for success in commercial art, but it is essential that these qualities be developed by specialized training in the techniques of commercial and applied art. In addition, education in the fine arts—painting, sculpture, or architecture—and in academic studies provides a good foundation for obtaining employment in commercial art and may be essential for promotion.

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 usually is required. Some schools admit only applicants who submit 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 years or more of study and confer a bachelor's degree—commonly the bachelor of fine arts (B.F.A.). In these schools, commercial art instruction is supplemented by liberal arts courses, such as English and history. Limited training in commercial art also may be obtained through public vocational high schools, private home-study schools, and practical experience on the job, but supplemental training usually is 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. Artistic judgment, imagination, and ability to visualize ideas on paper 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 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, typography, and printing production is useful in art direction or design. Freelance commercial artists must sell both ideas and finished work to clients. A knowledge of type specifications and printing production is very helpful. Also, a business sense and responsibility in meeting deadlines are assets. Art directors need a strong educational background in art and business practices and the liberal arts. Advertising art directors require 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 to qualify for other than strictly routine work. Advancement is based largely on the individual's artistic talent, creative ability, and education. After considerable experience, may commercial artists leave salaried employment for freelance work. Most illustrators are freelancers; many of them have an agent.

Commercial artists usually assemble their best artwork into a "portfolio," to display their work. A good 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 favorable through the 1970's. Young people having only average ability and little specialized training, however, probably will encounter competition for beginning jobs and will have limited opportunity for advancement.

Employment of commercial artists through the 1970's is expected to increase slowly primarily as a result of the upward trend in business expenditures for visual advertising. This demand includes television graphics, packing design, poster and window displays, and greeting cards. In addition, the expanding field of industrial design is expected to require more qualified artists to do three-dimensional work with engineering concepts. (See statement on Industrial Designers.) In addition to openings that result from growth, some employment opportunities will arise each year from the need to replace commercial artists who retire or leave the field for other reasons.

The demand for commercial artists will continue to vary with the specialization: For example, demand for pasteup and mechanical artists is expected to increase

slightly. Jobs for designers, art directors, and layout men are fewer, much sought after, and open only to experienced, highly talented, and creative artists. Fewer staff positions are expected as a result of increased use of highly skilled freelance artists for specialized jobs.

Earnings and Working Conditions

In 1970, beginning commercial artists having no training beyond vocational high school typically earned from $70 to $75 a week; graduates of 2-year professional schools generally received from $80 to $85 a week; and graduates of 4-year post-high school programs typically received $85 to $100 a week, according to the limited data available. Talented artists having 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 $125 to $175 a week or more. Art directors, designers, executives, well-known freelance illustrators, and others in top positions generally have much higher earnings, from $15,000 to $20,000 a year or more.

Earnings of freelance artists have an especially wide range, since they are affected by factors such as skill level, variety, and popularity of work, which ultimately effects the amount and price of artwork sold. In 1970, 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 $300 for a book jacket or record album. Freelance artists may be paid by the hour or by the assignment. Experienced pasteup and mechanical artists may earn at least $4 to $8 an hour.

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.

Sources of Additional Information

Additional information on employment opportunities in commercial art may be obtained from:

National Art Education Association, National Education Association, 1201 16th St. NW., Washington, D.C. 20036.

INDUSTRIAL DESIGNERS

(D.O.T. 142.081)

Nature of the 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 consuming public has wide choice of styles in products such as radios, television sets, automobiles, refrigerators, and furniture, a primary objective of the industrial designer is to design his own employer's product to compete favorably with similar goods on the market.

As a first step, the industrial designer does historical research on the product or related products. He studies competition in the market and the different ways in which the product may be used. Then, he sketches a variety of possible designs, which are examined by various departments. For example, the designer consults his company's engineers, production supervisors, and sales and market research staffs for their opinions on the practicability of producing a newly designed product, or changing the design of an old product, as well as 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.

Industrial designers also may 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.

Places of Employment

Most of the estimated 10,000 industrial designers in 1970 were employed by large manufacturing companies and by 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. For example, the New York and Chicago areas have the largest number of design consulting organizations. Those employed by industrial firms are found in small and middle size cities as well, since most work in the decentralized 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, may qualify as industrial designers if they have appropriate experience and artistic talent.

Formal education in industrial design at the college or university level usually takes 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; about half of these schools also award the master's degree for advanced study in the field. A few 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. In the past few years, however, most art and museum schools have moved toward accreditation or affiliation with a university, usually offering a 4-year program and a bachelor's degree.

Entrance to the course of study in industrial design is limited, with rare exceptions, to qualified high school graduates; in addition, some schools may require students to present sketches and other examples of their artistic ability. Some schools also require students to complete their freshman or sophomore years 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, and others give students a strong cultural background in art. Nevertheless, most 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 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, psychology, economics, and science in their curriculums.

Creative ability, skill in drawing, and the ability to anticipate consumer needs are the most important personal qualifications needed by young people aspiring to work in this field. A mechanical interest also is desirable for some types of work. 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 required frequently to work cooperatively with engineers and other staff members, the ability to work and communicate well with others is important. Those who plan to practice industrial designing on a consulting basis should have a knowledge of business practices and possess sales ability.

New graduates of industrial design courses frequently start as assistants to experienced 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 re-

sponsibility for the design of a product or a group of products. Those who have an established reputation in the field, as well as the necessary funds, may start their own consulting firms.

Employment Outlook

Employment in this relatively small occupation is expected to expand moderately through the 1970's. Employers will be actively seeking applicants having a college degree and outstanding talent. Some employment opportunities also will arise each year from the need to replace designers who retire or leave the field for other reasons.

A number of factors will affect employment of industrial designers. Rapid obsolescence of household and 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 these markets through the creation of new products, improvements in the design of existing ones, and change in package designs and other modernizations in the appearance and use of their products. Small companies probably will make increasing use of services offered by industrial design consulting firms to compete more effectively with larger firms. All these factors, in addition to rising per capita income, will contribute to the 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.

Earnings and Working Conditions

Starting salaries for inexperienced industrial designers employed by manufacturing firms ranged from $125 to $150 a week in 1970, according to the limited information available. Beginning salaries for those employed by consulting firms were usually lower. Salaries of experienced industrial designers vary greatly, depending on such factors as individual ability, and size and type of firm in which employed. Those having several years of experience earned salaries ranging from $8,000 to $14,000 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, vary widely, and may fluctuate markedly from year to year. In recent years, earnings of most consultants were between $12,000 and $25,000 and heads of large well-known firms earned considerably more.

Sources of Additional Information

General information about careers in industrial design and a list of schools offering courses and degrees in industrial design may be obtained from:

Industrial Designers Society of America, 60 West 55th St., New York, N.Y. 10019.

INTERIOR DESIGNERS AND DECORATORS

(D.O.T. 142.051)

Nature of the 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, as well as on ships and aircraft. Some design stage sets used for motion pictures and television. Interior designers are more involved than decorators in space planning and other interior design; they often work for clients on large design projects such as the interiors of entire office buildings, hospitals, and libraries. Generally, their 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 firm with other designers and decorators; they may sell some or all of the merchandise with which they work. Some work independently or as assistants; 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 own 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 about style and color trends in interior furnishings.

Interior designer helps client select fabric.

Interior designers and decorators usually work directly with clients to determine preferences and needs in furnishings. They may do "boardwork," particularly on large assignments, which includes work on floor plans and elevations and the creation of sketches, or other perspective drawings in such media as watercolor, pastels, or tempera, so clients can visualize their plans. They also provide cost estimates. After the client approves both the plans and the 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.

Places of Employment

More than 15,000 people were engaged full time in interior design and decoration in 1970. About half were women. Men, however, predominate in the interior design field. Many in design and decorating work on a part-time basis.

Most 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 designers of space like architects or suppliers of furniture and materials for use in the space, like antique dealers, office furniture stores, furniture and textile manufacturers, or other manufacturers in the interior furnishings field. They may also work for 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 this 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's 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, metals, plastics, and fabrics. A knowledge of furnishings, art pieces, and antiques is important. In addition, courses in salesmanship, business procedures 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. Membership usually requires the completion of 3 or 4 years 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 having 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 re-

ceptionists, as shoppers with the task of matching materials or finding accessories, or as stockroom assistants, assistant decorators, or junior designers. 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 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 store; it also may lead to a career in merchandising.

After considerable experience, decorators and designers with ability may advance to decorating or design department head, 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 people usually 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 major in interior design will find good opportunities for employment through the 1970's. Applicants who can design and plan the functional arrangement of interior space will be in strong demand. Young people without formal training will find it increasingly difficult to enter the field.

A slow but steady increase in employment of interior designers and decorators is anticipated through the 1970's. 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 replace designers and decorators who die, retire, or leave the field for other reasons.

Department and furniture stores are expected to employ an increasing number of trained decorators and designers. These stores also are 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 increased opportunities in salaried employment. Interior design firms also are expected to continue to expand. However, employment of interior decorators and designers is sensitive to changes in general economic conditions because people often defer this kind of expenditure when the economy slows down.

Earnings and Working Conditions

Beginning salaries ranged generally from $75 to $90 a week in 1970 for art school or college graduates having formal training in interior design and decoration; some graduates of 3- or 4-year design schools received salaries of $100 or more a week, according to limited data available.

Some designers and decorators 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.

Many interior decorators having only average skill in this field earn only moderate incomes—from $5,000 to $7,500 a year, even after many years of experience. Talented decorators who are well known in their localities may earn up to $15,000 or more. Designers and decorators whose abilities are nationally recognized may earn well beyond $25,000 yearly.

Self-employed decorators have an especially wide range of earnings; their profits are related to factors such as the volume of business, their prestige as decorators, economic level of their clients, their own business competence, and the percentage of wholesale prices they receive from the sale of furnishings.

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.

Sources of Additional Information

Information about employment and scholarship opportunities may be obtained from:

National Society of Interior Designers, Inc., 315 East 62nd Street, New York, N.Y. 10021.

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 the allocation 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 as a whole.

Besides these basic social sciences, a number of closely related fields are covered in separate statements elsewhere in this *Handbook*. (See statements on Statisticians, Psychologists, and Social Workers.)

About 80,000 persons were employed professionally in the basic social sciences in 1970; about 1 out of 10 was a woman. Overlapping among the basic social science fields and the sometimes hazy distinction between these and related fields such 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.

Most social scientists are employed by colleges and universities. A large number are employed by the Federal Government and private industry. The trend in some industries is to hire increasing numbers of social science majors 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 very rapidly through the 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 rise in employment in government also is expected. Employment in government agencies often is greatly affected by changes in public policy. For example, more social scientists will be needed to handle research and administrative functions resulting from programs established by Congress to relieve unemployment and eliminate poverty. Rising employment of social scientists in private industry and nonprofit organizations also is expected. In addition, several thousand social scientists will be needed each year to replace those who leave the field because of retirement, death, or other reasons.

Social scientists having doctor's degrees will find favorable employment opportunities through the 1970's in both teaching and nonteaching positions. For those having less training, the outlook is different for the various fields and is discussed in the statements that follow.

ANTHROPOLOGISTS

(D.O.T. 055.088)

Nature of the Work

Anthropologists study man, his origins, physical characteristics, culture, traditions, beliefs, customs, languages, material possessions, and his structured social relationships and value systems. Although anthropologists may specialize in any one of these areas, they are expected to have a general knowledge in all of them.

Most anthropologists specialize in cultural anthropology sometimes called ethnology. *Ethnologists* may spend long periods living with tribal groups or in other communities, to learn about their ways of life. The ethnologist takes detailed and comprehensive notes describing the social customs, beliefs, and material possessions of the people. He usually learns their language in the process. He may make comparative studies of the cultures and societies of various groups. In recent years, his investigations have included complex urban societies.

Archeologists excavate the places where people lived in the past to reconstruct their history and customs 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.

Some anthropologists specialize in *linguistics,* the scientific study of

Anthropologist examines item obtained on field trip.

the sounds and structures of languages and of the historical relationships among languages. They study the relationship between the language and the behavior of people, and their work assists in reconstructing the prehistory of mankind.

Physical 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 groups of mankind as influenced by heredity and environment. Because of their knowledge of body structure, physical anthropologists occasionally are employed as consultants on projects such as the design of driver seats, space suits, cockpits for airplanes and spaceships, and the sizing of clothing. They may consult on projects to improve environmental conditions and on criminal cases. They are increasingly employed in medical schools.

Most anthropologists teach in colleges and universities and often combine research with their teaching. Some anthropologists specialize in museum work, which generally combines management and administrative duties with fieldwork and research on anthropological collections. A few are engaged primarily in consulting, nontechnical writing, or other activities.

Places of Employment

About 3,100 people were employed as anthropologists in 1970. About a fifth of them were women. Most anthropologists were employed in colleges and universities. Several hundred worked in private industry and nonprofit organizations. The Federal Government employed a small number, chiefly in museums, national parks, in the Bureau of Indian Affairs, and in technical aid programs. State and local government agencies also employed some anthropologists, usually for museum work or health research.

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 often 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 holding the Ph. D. degree. In many colleges and most universities, only anthropologists holding the Ph. D. degree can obtain permanent teaching appointments.

Some training in both physical and cultural anthropology is necessary for all anthropologists. Mathematics is helpful since statistical methods and computers are becoming more widely used for research in this field. Undergraduate students may begin their field training in archeology by arranging, through their university department, to accompany expeditions as laborers or to attend field schools established for training. They may advance to supervisor in charge of the digging or collection of material and finally may direct a portion of the work of the expedition. Ethnologists and linguists usually do their fieldwork 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.

In 1970, departments of anthropology in the U.S. numbered over 200. Most universities having graduate programs also offer undergraduate training in anthropology. 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 that offers opportunities for summer experience in archeological fieldwork or should plan to attend an archeological field school elsewhere during their summer vacations.

Young people planning careers in anthropology should have an above average interest in natural history or social studies and enjoy reading, research, and writing. A desire to travel and the ability to cope with

the disadvantages of remote work areas are sometimes necessary for success.

Employment Outlook

The number of anthropologists is expected to increase rapidly through the 1970's. The largest increase in employment will be in the college teaching field. Some additional positions 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 are expected to have good employment opportunities through the 1970's. Graduates with only the master's degree 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 and Working Conditions

In 1970, starting salaries for anthropologists having a Ph. D. generally ranged between $8,000 and $10,000 a year. Experienced anthropologists may earn twice that amount. Anthropologists employed by educational institutions received a median salary of $15,500 for the calendar year or $14,000 for the academic year, according to the National Science Foundation's National Register of Scientific and Technical Personnel.

In the Federal Government, the starting salary was $9,881 for anthropologists having an M.A. and $11,905 for those having a Ph. D. Experienced anthropologists earned from $14,000 to more than $20,000 a year.

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

Anthropologists doing archeological fieldwork sometimes are required to work in adverse weather conditions and perform manual labor. They also must adapt themselves to cultural environments which are materially and socially different.

Sources of Additional Information

Additional information concerning employment opportunities and schools offering graduate training in anthropology may be obtained from:

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

Specific inquiries about anthropology as a career may be addressed to:

Smithsonian Institution, Washington, D.C. 20560.

ECONOMISTS

(D.O.T. 050.088)

Nature of the Work

Economists study the problems that arise in the utilization of limited resources of land, raw materials, and manpower to provide goods and services. 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 produced, distributed, and consumed. Some economists are concerned with practical problems such 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 collect and interpret data on a wide variety of economic problems.

Economists employed in colleges and universities teach the principles and methods of economics and conduct or direct research. They frequently engage in writing and consulting and formulate many of the new ideas that directly or indirectly influence government and industry planning.

Economists in government plan and carry out studies for use in assessing economic conditions and the need for changes in government policy. Their work may include the collection of basic data, analysis, and the preparation of reports. Most government economists are in the fields of agriculture, business, finance, labor, or international trade and development.

Economists employed by business firms provide management with in-

formation for decision making on matters such as markets for and prices of company products, the effect of government policies on business or international trade, the advisability of adding new lines of merchandise, opening new branch operations, or otherwise expanding the company's business.

Places of Employment

Economics is the largest of the basic social science fields. About 33,000 economists were employed in 1970. Industry and business employed more than one-half; colleges and universities, more than one-fourth; and government agencies—chiefly Federal—roughly one-sixth. A few were self-employed, or worked for private research organizations.

Economists are found in all large cities and in university towns. The largest numbers are in the New York and Washington, D.C. metropolitan areas. Some are employed overseas, mainly by the U.S. Department of State and the Agency for International Development.

Training, Other Qualifications, and Advancement

Economists must have a thorough grounding in economic theory and methods of economic analysis. An increasing number of universities also emphasize the value of mathematical methods of economic analysis. Since many beginning jobs for economists in government and business involve the collection and compilation of data, a thorough knowledge of basic statistical procedures usually is required.

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

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 agricultural economics will find good opportunities to gain experience in part-time research work at State universities having agricultural experiment stations.

The master's degree generally is required for appointment as a college instructor, although in large schools graduate assistantships sometimes 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 holding the master's degree usually can qualify for more responsible research positions than are open to those having 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.

Persons considering a career as an economist should be accurate, like details, and prepared to spend much time doing research. Fre-

quently, the ability to work as part of a team is required. Economists must be objective in their work and have oral and writing skills.

Employment Outlook

Employment of economists is expected to increase rapidly through the 1970's. Colleges and universities will need hundreds of new instructors annually to handle an anticipated rapid increase in enrollments and to replace economists who retire, die, or transfer to other fields of work. Employment of economists by industry is expected to increase rapidly as businessmen become more accustomed to rely 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 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 having the doctorate are expected to have very good opportunities for employment. Employment opportunities for economists having a master's degree will be favorable, especially for those with good training in statistics and mathematics. Young people having bachelors' degrees in economics may find employment in government and as management trainees in industry and business.

Earnings

According to the National Science Foundation's National Register of Scientific and Technical Personnel, the median salary of economists employed by colleges and universities in 1970 was $18,000. The median salary for those in business, industry, and nonprofit organizations was $20,000. Economists having Ph. D.'s were paid higher salaries than those who have lesser degrees and similar experience. A substantial number of economists supplement their basic salaries by consulting, teaching, and other activities.

In the Federal Government, the entrance salary in 1970 for beginning economists having a bachelor's degree was $6,548; however, those with superior academic records could begin at $8,098. Those having 2 full years of graduate training or experience could qualify for positions at an annual salary of $9,881. Most experienced economists in the Federal Government earned from $14,000 to $23,000 a year; some having greater administrative responsibilities earned considerably more.

Sources of Additional Information

Additional information on a career as an economist is available from:

American Economic Association, 1313 21st Avenue South, Nashville, Tenn. 37212.

Additional information on employment opportunities in economics and related fields is given in the following publications:

The Foreign Service in the Seventies, U.S. Department of State, Publication 8535, Washington, D.C. 20520. Free.

The International Developer (*Economist*), Professional Talent Search, Office of Personnel and Manpower, Agency for International Development, Washington, D.C. 20523. Free.

GEOGRAPHERS

(D.O.T. 029.088 and 059.088)

Nature of the Work

Geographers study the spatial characteristics of the earth's terrain, minerals, soils, water, vegetation, and climate. They relate these characteristics to changing patterns of human settlement—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; some may combine teaching and research. This 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 and structure of political organizations, transportation systems, marketing systems, and urban systems. Many geographers spend considerable time in field study, and in analyzing maps, aerial photographs, and observational data collected in the field. Photographs and other data from remote sensors on satellites are used increasingly. Other geographers construct maps, graphs, and diagrams.

Most geographers specialize in one main branch or more 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 the way political processes affect geographic boundaries on subnational, national, and international scales, and the relationship of geographic conditions to political processes. *Urban geography,* a

growing field for geographers, is concerned with the study of cities and community planning. (See statement on Urban Planners.) Specialists in *physical geography* study the earth's physical characteristics and those of the moon as well. *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 geographers 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 photo-intelligence specialist or climatological analyst. Still others have titles such as community planner, market or business analyst, or intelligence specialist. Most of those who teach in colleges and universities are called geographers.

Places of Employment

An estimated 7,100 geographers were employed in the United States in 1970; about 15 percent were women.

More than 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 employs a large number of geographers. Among the major agencies employing these workers are the United States Army Topographic Command and other defense related agencies; the Department of the Interior; and the Department of Commerce. State and local governments also employ a small number of geographers, mostly on city and State planning and development commissions.

Most of the relatively 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 foundafirms, or chain stores. A few geogrations and research institutes. A small number are employed as map librarians.

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 400 colleges and universities in 1970. Undergraduate study usually provides a general introduction to geographic knowledge and research methods and often includes some field studies. Typical courses offered are physical and cultural geography, weather and climate, economic geography, political geography, urban geography, location analysis, quantitative methods, and regional courses, such as the 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 offered also.

In 1970, 165 institutions offered training leading to the master's degree, and 55 offered the Ph. D. 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 any of the social or physical sciences, some if they have background in geography. Requirements for advanced degrees include field and laboratory work, as well as classroom studies and thesis preparation.

New graduates having only the bachelor's degree in geography usually find positions connected with making, interpreting, or analyzing maps; or in research, either working for the government or industry. Others enter beginning positions in the planning field. Some obtain employment as research or teaching assistants in educational institutions while studying for advanced degrees. Some earn library science degrees and become map librarians. New graduates having the master's degree can qualify for some teaching and research positions in colleges and for many research positions in government and industry. The Ph. D. degree usually is required for high-level posts in college teaching and research and may be necessary for advancement to top-level positions in other activities.

Young persons considering a career as a geographer should be prepared for a life of reading, studying, and research. New research methods used by the geographer require some mathematical abilities and knowledge of computer capabilities. As with all the sciences, geographers must be willing to work with ideas and theories and should be originative. They must be able to express themselves clearly.The ability to work independently is important.

Employment Outlook

The employment outlook for geographers is expected to be favorable through the 1970's. The demand will be especially strong for geographers having the Ph. D. to fill research and teaching positions in colleges and universities and research jobs in industry and government. Those having the master's degree are likely to find some competition. Geographers with advanced training in fields such as economics or business administration also will be in strong demand.

Colleges and universities are expected to offer the greatest number of employment opportunities as college enrollments increase very rapidly through the 1970's. Rising interest in 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 also is anticipated.

Employment of geographers in government is also likely to increase. The Federal Government may need additional personnel in positions related to regional development; urban planning; resource management; planning, construction, and interpretation of maps; and in intelligence work. State and local government employment of geographers also will expand, particularly in areas such as conservation, highway planning, and city, community, and regional planning and development.

The number of geographers employed in private industry also is expected to rise. Market research and location analysis should continue to grow rapidly. Opportunities also should increase in private area planning and development work.

Earnings and Working Conditions

In the Federal Government in 1970, geographers having the bachelor's degree and no experience started at $6,548 or $8,098 a year, depending on their college record. Geographers having 1 or 2 years of graduate teaching could start at $8,098 or $9,881; and those having the Ph. D. degree, at $11,905.

In colleges and universities, salaries of geographers depend on their teaching rank. Assistant professors entering the field with a Ph. D. received at least $11,500 in 1970. Experienced professors frequently earned $20,000. (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.

Sources of Additional Information

Association of American Geographers, 1710 16th St. NW., Washington, D.C. 20009.

HISTORIANS

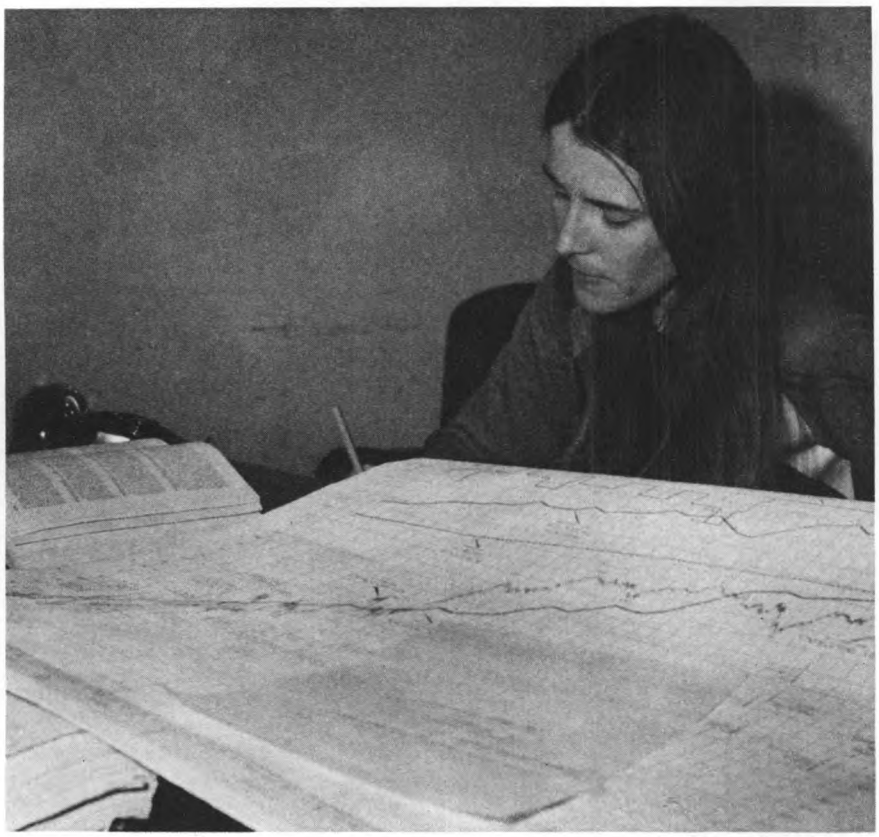
(D.O.T. 052.088)

Nature of the Work

History is the record of the past —past events, institutions, ideas, people. Historians use these records to describe and analyze this past—through writing and teaching, for instance. They also may relate this knowledge of the past to current events, in an effort to explain the present.

Historians may specialize in the history either of a specific country or area, or in a particular period of time—ancient, medieval, or modern. They may specialize also in the history of a field, such as economics, culture, military affairs, the labor movement, art, or architecture. The number of specialties in history is constantly growing. Newer fields include the history of business and of the relationship between technological and other aspects of historical development. In this country, most historians still specialize in the political history of either the United States or modern Europe; however, a growing number are now specializing in African, Latin American, Asian, or Near Eastern history. Some historians also specialize in phases of a larger historical field, such as Civil War history or Ancient Greek civilization.

Most historians are employed as college teachers who may also write, lecture, or take part in research. Some, called *archivists,* work with documentary materials of historical value, and specialize in identifying and preserving them and making them available. Other historians specialize in writing or editing historical materials, preparing exhibits, or speaking for museums, special libraries, and historical societies. A few serve as consultants to editors, publishers, and producers of materials for radio, television, and motion pictures. Historians are employed by governments mainly in connection with research projects, as researchers or administrators; they also may prepare studies, articles, and books on research findings.



Economic historian uses trend data in analysis.

Places of Employment

About 15,500 persons were employed as historians in 1970. Approximately 85 percent of all historians were employed in colleges and universities. About 4 percent were employed in Federal Government agencies, principally the National Archives and the Departments of Defense, Interior, and State. Small but growing numbers were employed by other government organizations (State, local, and international), by nonprofit foundations, research councils, special libraries, State historical societies, museums, and large corporations.

Since history is taught in all U.S. institutions of higher education, historians are found in all college communities. Many of the historians in the Federal Government 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, Other Qualifications, and Advancement

Graduate education usually is necessary for employment as an historian. A master's degree in history is the minimum requirement for the position of college instructor. In many colleges and universities, however, a Ph.D. degree is essential for high-level teaching, research, and administrative positions. Most historians in the Federal Government and in nonprofit organizations have Ph.D. degrees, or their equivalent in training and experience.

Although for some beginning jobs in government—either Federal, State, or local—a bachelor's degree with a major in history is sufficient training; persons in such jobs may not be regarded as professional historians. A knowledge of archival work is helpful, since these beginning jobs are likely to be concerned with collection and preservation of historical data. For jobs in international relations and journalism, an undergraduate major in history is considered helpful.

Employment Outlook

Employment in this relatively small occupation is expected to increase rapidly through the 1970's. At the college level, hundreds of new history teachers probably will be needed annually, because of expanding enrollments, as well as to replace those faculty members who retire, die, or leave for other types of work. In archival work, the number of positions for historians also is expected to rise, although more slowly.

With the doctorate, historians are expected to have relatively favorable employment opportunities through the 1970's, although they may face increasing competition for jobs in college teaching. Historians having only the master's degree probably will encounter considerable competition. Others will find it difficult to obtain professional positions as historians. On the other hand, history majors who meet State school certification requirements may find openings in high school teaching. Some history majors also qualify as administrative and management trainees in government agencies, foundations, civic organizations, and private industry.

Earnings

The average (median) salary of historians employed by colleges and universities was $12,200 in 1970 according to the limited data available. In the Federal Government, the starting salary for persons having a bachelor's degree was $6,548 in 1970. Those having a superior academic record or a year of graduate training were eligible for positions at an annual salary of $8,098. The median annual salary for historians employed by the Federal Government in 1970 was about $14,000.

Some historians, particularly those in college teaching, supplement their income by summer teaching or writing books or articles. A few earn additional income from lectures.

Sources of Additional Information

Additional information on employment opportunities for historians may be obtained from:

American Historical Association, 400 A St. SE., Washington, D.C. 20003.

POLITICAL SCIENTISTS

(D.O.T. 051.088)

Nature of the Work

Political science is the study of government—what it is, what it does, and how and why. Political scientists are interested in government at every level—local, county, State, regional, national, and international. Many of them specialize in one general area of political science, such as political theory, U.S. political institutions and processes, comparative political institutions and processes, or international relations and organizations. Some specialize in a particular type of political institution or in the politics of a specific era.

Political scientists are employed most frequently as college and university teachers. They may combine research, consultation, or administrative duties with teaching. Some teach at universities in other countries, where they prepare students for careers in public administration and assist in the development of training programs for government personnel. Many political scientists are engaged mainly in research. They may survey public opinion on political questions for private research organizations. They may study proposed legislation for State or municipal legislative reference bureaus or for congressional committees. Other political scientists may analyze the operations of government agencies or specialize in foreign affairs research, either for government or nongovernment organizations. Others engage in administrative or managerial duties. Some work as legislative aids to congressmen and as staff members of congressional committees.

Places of Employment

About 11,000 political scientists were employed in 1970, largely in colleges and universities or in government agencies. Most of the remainder worked in research bureaus, civic and taxpayers' associations, and large business firms.

Political scientists are employed in nearly every college in the United States, since courses in political science or government are taught widely. Most other political scientists are located in Washington, D.C., in other large cities, or in State capitals. Some, however, are employed in overseas jobs, mainly by the U.S. Department of State, particularly for positions with the Foreign Service, the U.S. Agency for International Development, and the U.S. Information Agency.

Training and Other Qualifications

Graduate training generally is required for employment as a political scientist. College graduates having a master's degree can qualify for various administrative and research positions in government and in nonprofit research or civic organizations. Nearly 100 colleges and universities offer graduate degrees in political science; over 50, in public administration. Many provide field training and offer internships for experience in government work. Many universities award graduate degrees in international relations, foreign service, and area studies, as well as political science in general. A master's degree in any of these fields is very helpful in obtaining a position in a Federal Government agency concerned with foreign affairs.

Completion of all requirements for the Ph. D. degree, except the doctoral dissertation, is the usual prerequisite for appointment as a college instructor. The Ph. D. degree itself usually is required for advancement to the position of professor.

Some young persons having only a bachelor's degree in political science may qualify as trainees in public relations or research work, or in jobs such as budget analyst, personnel assistant, or investigators in government or industry. Many students having the bachelor's degree in political science go on to study law; others obtain graduate training in public administration, international relations, or some other specialized branch of political science.

Young persons planning careers as political scientists should be prepared for a life of reading, study, and research. An increasing reliance upon mathematical and statistical methods in some specialties within the field make some knowledge of these disciplines useful. As with all social sciences, political scientists must be willing to work with ideas and theories, and able to originate and to express themselves clearly in writing and speaking. The ability to work independently also is important.

Employment Outlook

Employment of political scientists is expected to increase rapidly through the 1970's. The greatest increase in employment will take place in colleges and universities. In government agencies also, the number of political scientists in administrative jobs will probably rise because of a growing recognition of the value of specialized training in developing and planning new programs and analyzing policy alternatives. Government agencies concerned with foreign affairs will continue to employ many political scientists. In private industry, on the other hand, a slow growth is anticipated in employment of political scientists. In addition to those required to staff new positions, many political scientists will be needed to fill positions vacated because of retirements, deaths, or transfers.

Employment opportunities will be more limited for those having less than the Ph. D. degree, but openings will be available to them in Federal, State, and municipal government agencies; research bureaus; political organizations; and civic and welfare agencies. For new graduates having only the bachelor's degree, opportunities for employment in the political science field probably will continue to be very limited. However, those planning to continue their studies in law, foreign affairs, journalism, and other related fields will find their political science background very helpful. Some who meet State certification requirements will be able to enter high school teaching.

Earnings

In educational institutions the average beginning salary of political scientists having the master's degree was $6,000 to $8,500 in 1970, according to a recent survey. The National Science Foundation reports that the median salary for all those in educational institutions was $12,000 for the academic year and $15,300 for the calendar year.

In the Federal Government, the starting salary for political scientists having a bachelor's degree was about $6,500 a year in 1970. Those having a superior academic record or a year of graduate training were eligible for positions at an annual salary of about $8,100. Most of the

experienced political scientists in the Federal Government earned considerably more.

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

Sources of Additional Information

Additional information on employment opportunities in political science and public administration may be obtained from the following organization:

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

SOCIOLOGISTS

(D.O.T. 054.088)

Nature of the Work

Sociologists study the groups which man forms in his association with others—families, tribes, communities, and States, and a great variety of social, religious, political, business, and other organizations. They study the behavior and interaction of these groups, trace their origin and growth, and analyze the influence of group activities on individual members.

Some sociologists are concerned primarily with the characteristics of the social groups and institutions themselves; others are more interested in the ways individuals are affected by groups to which they belong.

Many work in specialties such as social organization, social psychology, or rural sociology; others specialize in intergroup relations, family problems, social effects of urban living, population studies, or analyses of public opinion. Some conduct surveys or concentrate on research methods. Growing numbers apply sociological knowledge and methods in penology and correction, education, public relations in industry, and regional and community planning. A few specialize in medical sociology—the study of social factors that affect mental and public health.

Most sociologists are college teachers, but, as a rule, these teachers also conduct research. Sociological research often involves the collection of data, preparation of case studies, testing, and the conduct of statistical surveys and laboratory experiments.

In their research work, sociologists may study individuals, families, or communities in an attempt to discover the causes of social problems —such as crime, juvenile delinquency, or poverty; the normal pattern of family relations; or the different patterns of living in communities of varying types and sizes. They may collect and analyze data from official government sources to illustrate population trends, including changes in age, sex, race, and other population characteristics; and also the extent of population movement among rural, suburban, and urban areas and among different geographic areas.

Sociologists may conduct surveys which add to basic sociological knowledge or which may be used in public opinion, marketing, and advertising research. Some specialize in the use of mass communication facilities, including radio, television, newspapers, magazines, and circulars.

Sociologists sometimes supervise research projects or the operation of social agencies, including family and marriage clinics. Others are consultants and advise on such diverse problems as the management of hospitals for the mentally ill, the rehabilitation of juvenile delinquents, or the development of effective advertising programs to promote public interest in particular products.

Places of Employment

Approximately 12,000 persons were employed as sociologists in 1970. Numerous others were employed in positions requiring some training in this field, including many in social, recreation, and public health work.

About three-fourths of all sociologists are employed in colleges and universities. The remainder work in Federal, State, local, or international government agencies, in private industry, in welfare or other nonprofit organizations, or are self-employed.

Since sociology is taught in most institutions of higher learning, sociologists may be found in nearly all college communities. They are most heavily concentrated, however, in large colleges and universities which offer graduate training in sociology and opportunities for research.

Training, Other Qualifications, and Advancement

A master's degree with a major in sociology usually is the minimum requirement for employment as a sociologist. The Ph. D. degree is essential for attaining a professorship in most colleges or universities, and is commonly required for directors of major research projects, important administrative positions, or consultants.

Sociologists with master's degrees may qualify for many administrative and research positions, provided they are trained in research methods and statistics. They may be responsible for specific portions of a survey or for the preparation of analyses and reports under general supervision. As they gain experience, they may advance to supervisory positions in both public and private agencies. Sociologists with the master's degree may qualify for some college instructorships. Most colleges, however, appoint as instructors only people with training beyond the master's level—frequently the completion of all requirements for the Ph. D. degree except the doctoral dissertation. Outstanding graduate students often can get teaching or research assistantships which will provide both financial aid and valuable experience.

Young people with only a bachelor's degree in sociology are not usually recognized by the profession as sociologists, although they may secure jobs as interviewers or as research assistants working under close supervision. Many are employed as caseworkers, counselors, recreation workers, or administrative assistants in public and private welfare agencies. Sociology majors with sufficient training in statistics may obtain positions as beginning statisticians. Those who meet State certification requirements may teach high school.

The choice of a graduate school is very important for people planning to become sociologists. Students interested in research should select schools which emphasize training in research methods and statistics, and provide opportunities to gain practical experience in research work. Professors and chairmen of sociology departments frequently aid in the placement of graduates.

Sociologists may spend much time studying and doing research and must possess the necessary oral and writing skills to communicate the results of their research. Sociologists should have mathematical skills and the ability to work independently.

Employment Outlook

Employment opportunities for sociologists having the Ph. D. are expected to be good during the 1970's. Those having only the master's degree will probably continue to face considerable competition.

Sociologists well trained in research methods and advanced statistics will have the widest choice of jobs. Employment opportunities are expected to be very good for research workers in rural sociology, community development, population analysis, public opinion research, and various branches of medical sociology. Employment opportunities also will increase in other applied fields, such as the study of juvenile delinquency and education. Some openings are anticipated in a relatively new area, the sociology of law.

Growth in employment of sociologists is expected to increase rapidly through the 1970's. Because of expanding enrollments, most new positions will be in college teaching. Some of these openings will result from the growing trend to include sociology courses in the curricula of other professions, such as medicine, law, and education. A substantial rise in the number of sociologists in nonteaching fields is anticipated to cope with social and welfare problems and to implement educational and social legislation to develop human resources. In addition, several hundred openings will occur each year to replace sociologists who die, retire, or leave the field for other reasons.

Earnings

In 1970, the median academic year salary of sociologists in educational institutions was $12,200, according to the National Science Foundation. Sociologists working in nonprofit organizations and industry had average annual salaries of $14,700 and $16,200, respectively.

In the Federal Government, the beginning salary in 1970 for sociologists having a master's degree and a superior academic record was $9,881. Salaries of experienced sociologists in the Federal Government generally ranged between $11,905 and $19,643 a year.

In general, sociologists with the Ph. D. degree earn substantially higher salaries than those with the master's degree. Many sociologists supplement their regular salaries with earnings from other sources, such as summer teaching and consulting work. Sociologists employed by colleges and universities are the most likely to have additional earnings.

Sources of Additional Information

Additional information on sociologists may be obtained from:

The American Sociological Association, 1001 Connecticut Ave., NW., Washington, D.C. 20036.

TEACHING

Teaching is the largest of the professions. About 2.6 million men and women were full-time teachers in the Nation's elementary schools, secondary schools, and colleges and universities in the 1970–71 school year. In addition, thousands taught part time; among them were many scientists, physicians, accountants, members of other professions and graduate students. Similarly, large numbers of craftsmen instructed part time in vocational schools. Many other people taught in adult education and recreation programs.

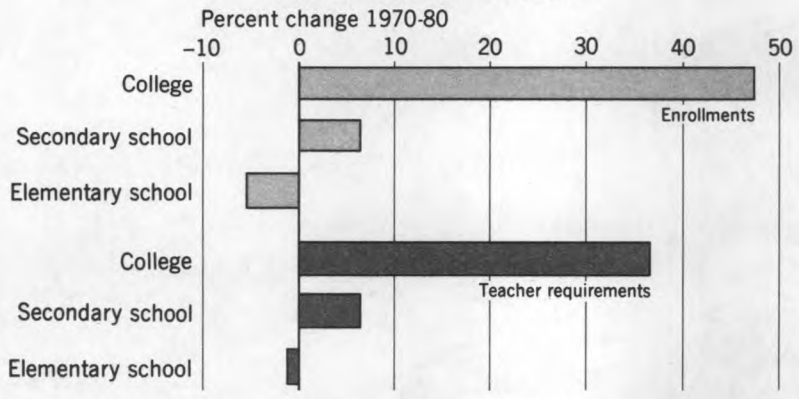
No other profession offers women so many employment opportunities. About 1.7 million or almost 2½ times as many women are teachers as registered nurses, the second largest profession for women. Women teachers far outnumber men in kindergarten and elementary schools and hold more than half the teaching positions in secondary (junior and senior high) schools. However, only about one-fourth of all college and university teachers are women.

The number of teachers needed by the Nation's schools depends chiefly on the number of students enrolled. At the beginning of the 1970–71 school year, 59.2 million people—almost 30 percent of the country's total population—were enrolled in the Nation's schools and colleges. Through the 1970's, continued growth of the school and college population and continued increases in high school and college attendance rates are expected to produce a slight increase in school enrollments and a very rapid rate of increase in college enrollments. Total enrollments in all schools and colleges combined, according to U.S. Office of Education estimates, may exceed 62 million by 1980.

To staff the new classrooms that must be provided for the rising numbers of students, and to continue to improve the student-teacher ratio, the Nation's full-time teaching staff in 1980 will need to be about 7 percent or almost 180,000 more than in 1970. An even larger number of teachers—perhaps as many as 1.8 million—will be required to replace those who leave the profession.

The outlook for teachers at each educational level—in elementary and secondary schools and also in colleges and universities—is discussed in the following statements.

(17) **Growth in teacher requirements is closely related to student enrollment patterns**



SOURCE: U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE, OFFICE OF EDUCATION

KINDERGARTEN AND ELEMENTARY SCHOOL TEACHERS

(D.O.T. 092.228)

Nature of the Work

Elementary school teaching is the largest field of professional employment for women and is a growing field for men. In the 1970–71 school year, over 1.2 million kindergarten and elementary teachers were employed. In addition, an estimated 60,000 principals and supervisors were working in public and private elementary schools.

Kindergarten teachers conduct a program of education for young children. Most frequently, they teach one group in the morning and another group in the afternoon. Some, however, work with one group all day. They provide the children with experiences in play, music, artwork, stories, and poetry; and introduce them to science, numbers, language, and social studies. In a variety of ways, kindergarten teachers help to develop children's curiosity and zeal for learning, as well as to stimulate their ability to think. After school hours, kindergarten teachers may plan the next day's work, prepare the children's school records, confer with parents or professional personnel concerning individual children, par-

ticipate in teachers' in-service activities, and locate and become familiar with teaching resources.

Elementary school teachers usually work with one group of pupils during the entire schoolday. They teach several subjects and supervise various activities such as lunch and play periods. In some school systems, however, teachers in the upper elementary grades may teach one or two subjects to several groups of children. Many school systems also employ special teachers to give instruction and to assist classroom teachers in certain subjects such as art, music, physical education, industrial arts, foreign languages, and homemaking. Teachers in schools which have only a few students, largely in rural areas, may be required to teach all subjects in several grades. Programed instruction, including teaching machines and "talking typewriters," and the increasing use of teacher aids are freeing growing numbers of elementary and kindergarten teachers from routine duties and allowing them to give more individual attention to their students.

Places of Employment

Elementary school teachers are employed in all cities, towns, villages, and in rural areas. As a result of reorganization of school districts, many teachers are employed in consolidated schools in small towns.

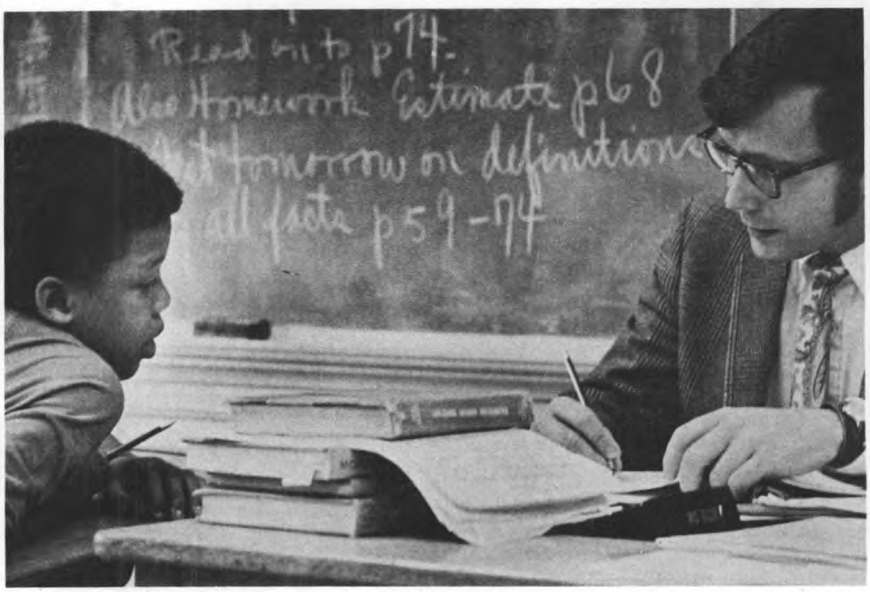
Training, Other Qualifications, and Advancement

All States require that teachers in the public schools have a certificate. Several States require certification for teachers in parochial and other private elementary schools.

In 1970, 47 States and the District of Columbia issued regular teaching certificates only to persons having at least 4 years of approved college preparation. Teacher certification in most States also requires professional education courses. Twelve States require that teachers work toward a fifth year or master's degree within a certain number of years. Some school systems have higher educational requirements than those for State certification.

In nearly all States, certificates are issued by State departments of education on the basis of transcripts of credits and recommendations from approved colleges and universities. Certificates may be issued to teachers from other States if the prescribed programs have been completed at accredited colleges or if the teachers meet the academic and other requirements of the State to which they are applying. Under certain conditions, usually related to a shortage of qualified teachers, most States will issue emergency or temporary certificates to partially prepared teachers. However, these certificates must be renewed annually.

All States have certain additional requirements for public school



teaching. For example, they may require a health certificate, evidence of citizenship, or an oath of allegiance. The prospective teacher should inquire about the specific requirements of the area in which he plans to work by writing to the State department of education or to the superintendent of the local school system.

Most institutions of higher education offer teacher preparation. In a 4-year teacher-preparation curriculum, prospective elementary school teachers spend about one-fourth of the time in professional courses—learning about children, the place of the school in the community, and materials and methods of instruction—including student teaching in an actual school; the remainder of their time is devoted to liberal arts subjects. Some study of human behavior and learning usually is included.

After gaining experience, teachers will find opportunities for advancement through annual salary increases in the same school system; by transferring to a system with a higher salary schedule which recognizes experience gained in another school system; by appointment to a supervisory, administrative, or specialized position in the school system; or by transferring to higher levels of teaching for which their training and experience may qualify them.

Among the most important personal qualifications for elementary school teaching are an enjoyment and understanding of children. Teachers must be patient and self-disciplined, and have high standards of personal conduct. A broad knowledge and appreciation of the arts, sciences, history, and literature also are valuable. Customs and attitudes of the community may influence and sometimes restrict the civic, Social, and recreational activities of teachers.

Employment Outlook

Enrollments in kindergartens and elementary schools in 1980 are expected to be below the 1970 levels. As a result, the number of teaching positions is expected to decline slightly despite an anticipated reduction in the pupil-teacher ratio. Nevertheless, large numbers of teachers will be needed to replace those who retire, die, or leave the profession for other reasons. Also, more than 50,000 teachers will be needed to replace persons not meeting certification requirements. Increasing emphasis on the education of very young children, children in low-income areas, the mentally retarded, and other groups needing special attention may result in larger enrollments and smaller student-teacher ratios than trends would indicate, with an accompanying increase in the number of teachers required.

The number of persons qualified to teach in elementary schools will exceed the number of openings if patterns of entry and reentry to the profession continue in line with past trends. New graduates, therefore, may face keen competition for jobs during the 1970's. Young people seeking their first teaching assignment will find schools placing great emphasis on their academic work and the quality of their training. Nevertheless, employment opportunities may be very favorable in urban ghettos, rural districts, and in all geographic areas where teaching salaries are low and better paying opportunities are available in other fields in the community. The outlook for teachers who are trained to work with children having various handicaps also will be favorable. Many students, however, who are considering elementary teaching as a career will have to change their occupational choice and pursue other careers.

Earnings and Working Conditions

The average salary for classroom teachers in public elementary schools, according to National Education Association (NEA) estimates, was $9,025 in 1970–71. In the five highest paying States (Alaska, New York, California, Michigan, and Hawaii), teachers' salaries averaged $10,000 or more; in the six States having the lowest salaries (Mississippi, South Dakota, Arkansas, North Dakota, South Carolina, and Idaho), they were less than $7,000. An increasing number of States (31 in the 1970–71 academic year) have established minimum salary levels.

Although the average time spent in the classroom (less than 6 hours) usually is less than the average workday in most other occupations, the elementary school teacher must spend additional time each day giving individual help, planning work, preparing instructional materials, developing tests, checking papers, making out reports, and keeping records. Conferences with parents, meetings with school supervisors, and other professional activities also frequently occur after classroom hours.

Since most schools are in session fewer than 12 months a year, teachers often take courses for professional growth or work at other jobs during the summer. Some school systems, however, are extending the teachers' working year to 12 months, including a 1-month vacation in the summer.

Employment in teaching is steady

and usually is not affected by changes in business conditions. Tenure provisions protect teachers from arbitrary dismissal. Pension and sick leave plans are common, and a growing number of school systems grant other types of leave with pay. An increasing number of teachers are being represented by professional teacher associations or by unions that bargain collectively for them on wages, hours, and other conditions of employment.

Sources of Additional Information

Information on schools and certification requirements is available from the State department of education at each State capital.

Information on the Teacher Corps, internships, graduate fellowships, and other information on teaching may be obtained from:

U.S. Department of Health, Education, and Welfare, Office of Education, Washington, D.C. 20202.

Other sources of general information are:

American Federation of Teachers, 1012 14th St. NW., Washington, D.C. 20005.

National Commission on Teacher Education and Professional Standards, National Education Association, 1201 16th St. NW., Washington, D.C. 20036.

SECONDARY SCHOOL TEACHERS

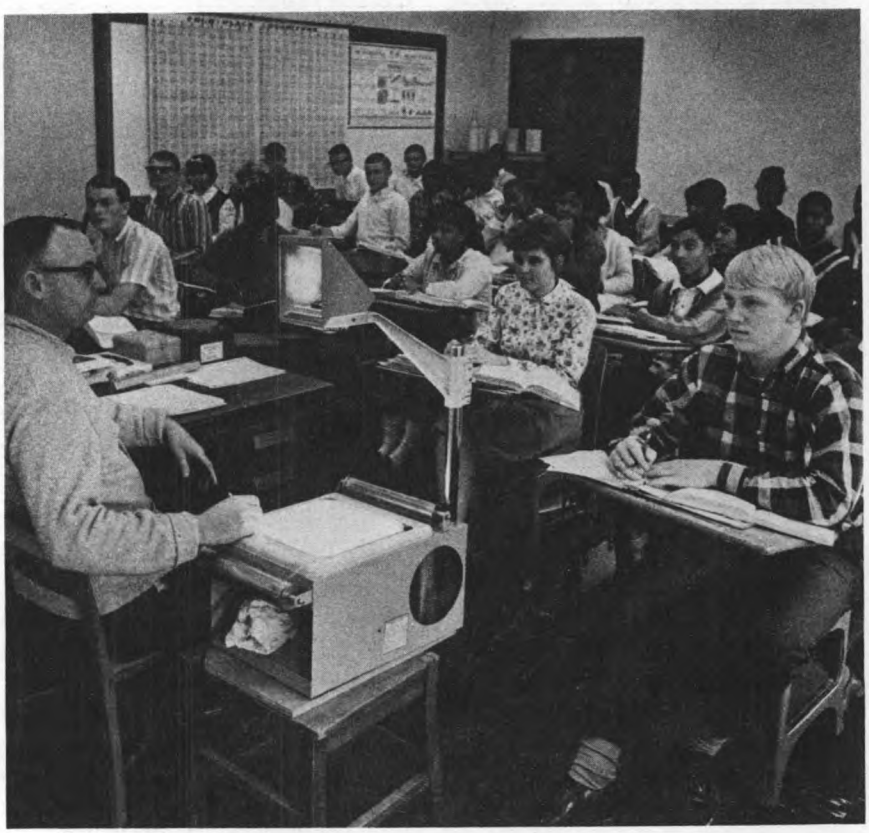
(D.O.T. 091.118 through .228)

Nature of the Work

Secondary school teachers—those employed in junior and senior high schools—usually specialize in a particular subject. They teach several classes every day, either in their main subject, in related subjects, or both. The most frequent combinations are English and history or other social sciences; mathematics and general science; and chemistry and biology or general science. Teachers in some fields, such as home economics, agriculture, commercial subjects, driver education, music, art, and industrial arts, less frequently conduct classes in other subjects. The teaching method may vary from formal lectures to free discussions, depending on the subject and the students' needs and aptitudes. The choice of method usually is left to the teacher.

Besides giving classroom instruction, secondary school teachers plan and develop teaching materials, develop and correct tests, keep records and make out reports, consult with parents, supervise study halls, and perform other duties. The growing use of teaching machines, programmed instruction, and teacher aids relieves the teacher of many routine tasks. Many teachers supervise student activities, such as clubs and social affairs—sometimes after regular school hours. Maintaining good relations with parents and the community is an important aspect of their jobs.

More than 1 million teachers were employed in the Nation's public and private secondary schools in 1970–71. Almost half the classroom teachers in public secondary schools were men. Men far outnumber women as supervisors and administrators in both public and private schools.



Places of Employment

The number of grades in secondary schools depends on the way the local school system is organized. Many secondary school teachers are employed in 6-year combined junior-senior high schools (grades 7–12); others are in separate junior high schools of either two or three grades (7–8 or 7–9); and the remainder teach in 4-year high schools (grades 9–12) and in senior high schools (grades 10–12).

Training, Other Qualifications, and Advancement

In every State, a certificate is required for public secondary school teaching. To qualify for this certificate, the prospective teacher must have at least the equivalent of one-half year of education courses, including practice teaching, plus professional courses in one or more subjects commonly taught in secondary schools.

Twelve States require a fifth year of study or qualification for a master's degree within a specified period following the teacher's beginning employment. Many school systems, especially in large cities, have requirements beyond those needed for State certification. Some systems require additional educational preparation, successful teaching experience, or special personal qualifications.

College students preparing for secondary school teaching usually devote about one-third of the 4-year course to their major, which may be in a single subject or a group of related subjects. About one-sixth of the time is spent in education courses —learning about children, the place of the school in the community, and materials and methods of instruction—including student teaching in an actual school situation. The remaining time is devoted to general or liberal arts courses. Accepted teacher-preparation curriculums are offered by universities with schools of education, by colleges with strong education departments and adequate practice-teaching facilities, and by teachers' colleges.

Although certification requirements vary among the States, the person who is well prepared for secondary school teaching in one State usually has little trouble meeting requirements in another State. A well-qualified teacher ordinarily can obtain temporary certification in a State while preparing to meet its additional requirements.

Qualified secondary school teachers may advance to department heads, supervisors, assistant principals, principals, superintendents, or other administrative officers as openings occur. At least 1 year of professional education beyond the bachelor's degree and several years of successful classroom teaching are required for most supervisory and administrative positions. Often, a doctorate is required for appointment as superintendent. Some experienced teachers are assigned as part- or full-time guidance counselors or as teachers of handicapped or other special groups of children. Usually, additional preparation and sometimes special certificates are required for these assignments.

Probably the most important personal qualifications for secondary school teaching are an appreciation and understanding of adolescent children. Patience and self-discipline are desirable traits, as are high standards of personal conduct. In addition to an enthusiasm for the subjects they teach, a broad knowledge and appreciation of the arts, sciences, history, and literature also are desirable. Civic, social, and recreational activities of teachers may be influenced, and sometimes restricted, by the customs and attitudes of their community.

Employment Outlook

A slowing of enrollment growth in secondary schools is expected during the 1970's. Most teaching positions will result, therefore, from the need to replace the large number of women teachers who leave the profession for family responsibilities. If the total number of degrees awarded increases as projected by the U.S. Office of Education, and if trends in the proportion of graduates prepared to teach in secondary schools continues through the 1970's, the total number of new graduates available for secondary school teaching positions will increase significantly. In addition, many women will continue to wish to reenter teaching after a period of full-time homemaking. New graduates, therefore, may face keen competition for jobs. Also, young people planning to teach, therefore, are likely to find school boards placing much greater emphasis on the type and quality of an applicant's professional training and academic performance.

Despite the anticipated improved supply situation, opportunities will be very favorable in some geographic areas and in subject fields such as the physical sciences, for which the demand in private industry and government is also great. In addition, increased demand for teachers trained in the education of children who are mentally retarded or physically handicapped are expected. Considerable additional demand for teachers also may be generated by Federal legislation that

provides for supplementary educational centers and services and the Teacher Corps. These extensive additions to present teaching services will be available to both public and private school children. Nevertheless, if patterns of entry and reentry to the profession continue in line with past trends, the number of persons seeking to enter secondary teaching will significantly exceed requirements. Many students, therefore, who are considering secondary teaching as a career, will have to change their occupational choice and pursue other careers.

Earnings and Working Conditions

The average annual salary for all classroom teachers in public secondary schools was about $9,540 in 1970–71, according to estimates by the National Education Association. In Alaska, California, and New York, average salaries were $11,400 or more. The average was $7,500 or less in Mississippi, Arkansas, Idaho, South Carolina, Kentucky, Alabama, and Oklahoma. At the beginning of the 1970–71 academic year, 31 States had minimum teacher salary laws.

Teachers of vocational education, physical education, and other special subjects often receive higher salaries than other teachers. Under salary schedules in effect in most school systems, teachers in all subject fields get regular salary increases as they gain experience and additional education.

Teachers' salaries usually are lower in towns and small cities than in larger cities or suburbs, but higher educational and experience requirements are likely to prevail in large city school systems. On the average, salaries of principals in the largest cities, where administrative responsibilities are great, are much higher than in towns and small cities. Salaries of superintendents in 1970–71 averaged nearly $40,000 in the largest school systems.

Teachers often add to their incomes by teaching in summer school, working as camp and recreational counselors, or doing other work. Some teachers supplement their incomes during the regular school year. They may teach in adult or evening classes, work part-time in business or industry, or write for publication.

Some form of retirement is provided for most teachers. Nearly all school systems have some provision for sick leave, and an increasing number grant other types of leave with pay.

According to a recent survey, the average workweek of secondary school teachers is about 46 hours a week, of which 23½ hours are spent in classroom instruction and the remainder in out-of-class instruction and other duties. An increasing number of teachers are represented by professional teacher associations or by unions that bargain collectively for them on wages, hours, and other conditions of employment.

Sources of Additional Information

Information on schools and certification requirements is available from the State department of education at the State capital.

Information on the Teacher Corps, internships, graduate fellowships, and other information on teaching may be obtained from:

U.S. Department of Health, Education, and Welfare, Office of Education, Washington, D.C. 20202.

Other sources of information are:

American Federation of Teachers, 1012 14th St. NW., Washington, D.C. 20005.

National Commission on Teacher Education and Professional Standards, National Education Association, 1201 16th St. NW., Washington, D.C. 20036.

COLLEGE AND UNIVERSITY TEACHERS

(D.O.T. 090.168 and .228)

Nature of the Work

About 720,000 teachers were employed in the Nation's 2,600 colleges and universities in the fall of 1970. Approximately 336,000 were full-time teachers of degree credit courses; in addition, 167,000 taught such courses part time. The remainder included junior instructional staff (primarily graduate students), and staff who taught non-degree courses and gave instruction by television, radio, or mail.

Most full-time college and university teachers instruct in the social sciences, teacher education, English and journalism, fine arts, mathematics, physical or biological sciences, engineering, or the health professions. Teaching duties may include preparing and delivering lectures, leading class discussions, directing graduate students in teaching freshman courses, preparing tests and instruction materials, counseling and assisting individual students, and checking and grading assignments and tests. Grading sometimes is done by teaching assistants or, for objective tests, by computers. In many 4-year institutions, the usual teaching load is 12 to 15 hours a week. Associate professors and full

professors—who advise graduate students and often engage actively in research—may spend only 6 to 8 hours a week in actual classroom work.

In addition to teaching, many college teachers conduct or direct research, write for publication, or aid in college administration. Some act as consultants to business, industrial, scientific, or government organizations.

Places of Employment

About nine-tenths of all full- and part-time teachers were employed by universities and 4-year colleges in 1970; most of the remainder were in 2-year institutions.

Men predominate in college teaching and hold more than nine-tenths of the positions in engineering, the physical sciences, agriculture, and law. However, most teachers in nursing, home economics, and library science are women.

College teachers are concentrated in the States having the largest college enrollments. In the fall of 1970, resident and extension enrollments exceeded 1.1 million in California and were over 700,000 in New York. Three other States had enrollments of more than 400,000: Illinois, Texas, and Pennsylvania.

Training, Other Qualifications, and Advancement

To qualify for most beginning positions, applicants must have at least the master's degree, and for many, they must have completed all requirements for the doctorate except the dissertation. A number of States require State certification to teach in public 2-year colleges. To obtain such a certificate, the master's degree and certain courses in education are required.

To enter college teaching, specialization in some subject field is necessary. In addition, undergraduate courses in the humanities, social sciences, natural sciences, and the mastery of at least one foreign language are important. Intensive instruction in the selected field of specialization is given in graduate school. Outstanding graduate students receive valuable experience through part-time teaching assistantships. Some students develop teaching competence by participating in informal seminars or meetings on teaching methods. Some prospective college teachers, especially those in education departments and junior colleges, gain experience in high school teaching.

Most 4-year colleges and universities recognize four academic ranks: Instructor, assistant professor, associate professor, and full professor. A National Education Association survey indicates that one-quarter of the teaching faculty are professors, nearly one-quarter associate professors, one-third are assistant professors, and almost one-fifth are instructors or lecturers.

Few institutions grant tenure (permanent appointment) to instructors having less than 3 years of service. Advancement to associate professorship generally requires considerable teaching experience and often a doctor's degree. In some institutions, research and publication also may be required. A doctor's degree and 7 or more years of teaching experience usually are necessary to become a full professor. Outstanding achievements, generally through research or publications, hastens advancement.

Beginning teachers in fields that are in strong demand, such as engineering, mathematics, and medicine, sometimes are appointed at higher ranks than other teachers having comparable experience and education. A doctor's degree is required particularly for advancement in the biological sciences, physical sciences, psychology, social sciences, philosophy, and religion; it is least likely to be a requirement in business and commerce, engineering, fine arts, health and physical education, and home economics.

Fellowships are available under the National Defense Education Act to candidates for doctoral degrees who plan careers in college or university teaching. The Education Professions Development Act of 1967 authorizes Federally supported

fellowships for master's degree study for those planning to enter or already engaged in teaching at two-year colleges, four-year colleges, and universities.

Employment Outlook

College teaching opportunities are expected to be good for those having doctoral degrees or having completed all requirements for the doctorate except the dissertation. Opportunities also will be favorable for new entrants having the master's degree, particularly in 2-year colleges.

A great increase in college enrollment is in prospect. The number of young people in the 18- to 21-year age group is expected to rise by nearly 2.7 million between 1970 and 1980. At the same time, larger proportions of young people of college age will attend college—owing to rising family income, recent Federal legislation to help needy college students, and greater demand for college-trained personnel. The anticipated increase in the number of community colleges and schools offering evening classes also will permit more young people and adults to attend. If the proportion continues to increase and facilities are available, college enrollments for degree credit will increase from 7.6 million in 1970 to more than 11.2 million in 1980, according to the U.S. Office of Education.

Taking all these factors into account, the Office of Education estimates that the full-time college teaching staff for resident degree credit courses will increase from 336,000 in 1970 to 460,000 in 1980, or by 37 percent.

The supply of new college teachers, which consists largely of students receiving graduate degrees, also is expected to grow. The U.S. Office of Education estimates that the number of doctorates conferred through 1980 will average about 50,000 a year, and the number of master's degrees about 360,000 annually. It is difficult, however, to say how many of these will enter teaching. Industry, government, and nonprofit organizations also offer employment opportunities to persons having graduate degrees, often at higher salaries than colleges. However, a smaller proportion of each year's doctor's degree recipients will be needed to meet the demand for college teachers. As a result, persons may face some competition in obtaining positions of their choice.

Earnings and Working Conditions

The median salary of full-time faculty who were engaged primarily in teaching in 4-year institutions was estimated at $11,745 in 1969–70 (9 mo.), based on National Education Association data. Salaries generally were higher in universities than in colleges, and highest in large universities. Highest median salaries were paid in the Far West and New England. Estimated median salaries by rank were:

Professor	$16,799
Associate Professor	12,985
Assistant Professor	10,698
Instructor or Lecturer	8,416

The median salary paid full-time faculty in public 2-year colleges in 1969–70 was estimated at $10,850. Teachers in nonpublic 2-year colleges received an estimated median salary of $8,190.

Faculty members who teach year round usually receive higher salaries than those employed for the academic year only. Teachers in professional schools (medicine, dentistry, etc.) and graduate schools generally receive higher salaries than teachers in other colleges.

Some faculty members supplement their regular salaries with earnings from a variety of sources. The chief source is additional teaching (often in summer sessions). Consulting work may be a major source of extra income, particularly in engineering and physical sciences. Research grants are now common, especially in many large, well-known universities; fees for lecturing and royalties on publications are other possible sources of income. Opportunities for additional income usually increase as the faculty member gains recognition. For most college teachers, additional income is small.

Retirement plans differ considerably among institutions, but an increasing number are participating in the Government social security program, often as an accompaniment to plans of their own. The greatest number of institutions have set 65 years as the normal retirement age, although most of these extend the age limit if desired.

Many colleges and universities provide benefits such as: Sabbatical leaves of absence—typically, 1 year's leave with half salary or a half-year's leave at full salary after 6 or 7 years of employment; other types of leave for advanced study; life, sickness, and accident insurance; reduced tuition charges or cash-tuition grants for children of faculty members; housing allowances; travel funds for attending professional meetings; and other benefits.

Sources of Additional Information

Information on college teaching as a career is available from:

U.S. Department of Health, Education, and Welfare, Office of Education, Washington, D.C. 20202.

American Association of University Professors, 1 Dupont Circle NW., Washington, D.C. 20036.

American Council on Education, 1 Dupont Circle NW., Washington, D.C. 20036.

American Federation of Teachers, 1012 14th St. NW., Washington, D.C. 20005

National Education Association, 1201 16th St. NW., Washington, D.C. 20036.

Professional societies in the various subject fields will generally provide information on teaching requirements and employment opportunities in their particular fields. Names and addresses of societies are given in the statements on specific professions elsewhere in the *Handbook*.

TECHNICIAN OCCUPATIONS

Technician occupations are growing rapidly because of the needs of an expanding and increasingly technical economy matched to the growing recognition of the importance of technicians. This chapter is concerned with the technicians who work with engineers and scientists, and with draftsmen, also usually considered technicians. Information on surveyors, often classified as technicians, and on technical occupations in the health field—including dental laboratory technicians, radiological technologists, and dental hygienists—is presented elsewhere in the *Handbook*.

ENGINEERING AND SCIENCE TECHNICIANS

(D.O.T. .002 through .029)

Nature of the Work

The term "technician," as used here, refers to workers whose jobs require both knowledge and use of scientific and mathematical theory; specialized education or training in some aspect of technology or science; and who, as a rule, work directly with scientists and engineers. There is no generally accepted definition of the term "technician." For example, it is used by employers to refer to workers in a great variety of jobs, requiring a wide range of education and training. The term is applied to employees doing relatively routine work, to persons performing work requiring skills within a limited sphere, and to persons doing highly technical work, among them assistants to engineers and scientists.

The workers' job titles may be descriptive of their technical level (for example, biological aid, or engineering technician) or their work activity (for example, quality-control technician, production analyst, tool designer, materials tester, or time-study analyst). Some employees use the word "technician," preceded by adjectives, such as mechanical, electrical, electronics, or chemical, which describes areas of technology in which their personnel are employed.

The jobs of engineering and science technicians are more limited than those of the professional engineer or scientist, and have a greater practical orientation. Many technician jobs require the ability to analyze and solve engineering and science problems and to prepare formal reports on experiments, tests, or other projects. Most of these jobs require some aptitude in mathematics; others, the ability to visualize objects and to make sketches and drawings. Design jobs often require creative ability. Many technician jobs require some familiarity with one or more of the skilled trades, although not the ability to perform as a craftsman. Others demand extensive knowledge of industrial machinery, tools, equipment, and processes. Some jobs held by these technicians are supervisory and require both technical knowledge and the ability to supervise people.

In carrying out their assignments, engineering and science technicians frequently use complex electronic and mechanical instruments, experimental laboratory apparatus, and drafting instruments. Almost all of the technicians whose jobs are described in this statement must be able to use engineering handbooks and computing devices, such as the slide rule or calculating machine.

Technicians engage in virtually every aspect of engineering and scientific work. In research, development, and design, one of the largest areas of employment, they conduct experiments or tests; set up, calibrate, and operate instruments; and make calculations. They also assist scientists and engineers in developing experimental equipment and models by making drawings and sketches and, under the engineer's direction, frequently do some design work.

Technicians also work in jobs related to production, usually following a program course laid out by the engineer or scientist, but often without close supervision. They may aid in the various phases of production operation, such as working out specifications for materials and methods of manufacture, devising tests to insure quality control of products, or making time-and-motion studies (timing and analyzing

the worker's movements) designed to improve the efficiency of a particular operation. They also may perform liaison work between engineering and production or other departments.

Technicians often do work that might otherwise have to be done by engineers. They may serve as technical sales or field representatives of manufacturers; advise on installation and maintenance problems of complex machinery; or write specifications and technical manuals. (See statement on Technical Writers.)

The following sections describe a number of technological fields in which engineering and science technicians are trained and employed.

Aeronautical Technology. Technicians specializing in this area of technology work with engineers and scientists in many phases of the design and production of aircraft, helicopters, rockets, guided missiles, and spacecraft. Many aid engineers in preparing layouts of structures, control systems, or equipment installations by collecting information, making calculations, and performing many other tasks. They work on projects involving stress analysis, aerodynamics, structural design, flight test evaluation, or weight control. For example, under the direction of an engineer, a technician might estimate weight factors, centers of gravity, and other items affecting load capacity of an airplane or missile. Other technicians working on engineering projects prepare or check drawings for technical accuracy, practicability, and economy.

Technicians sometimes help to estimate the cost of the materials and labor needed to manufacture aircraft and missiles. They also may be responsible for liaison between the engineers who do the planning and development work, and the craftsmen who convert the engineers' ideas into finished products. For example, as an aircraft or missile is built, the liaison technician checks it for conformance to specifications, keeps the engineer informed as to progress, and investigates any production engineering problems that arise. He sometimes recommends minor changes in the design, the materials, or the method of fabrication.

Other aeronautical technicians are employed as manufacturer's field service representatives, serving as the link between their company and the military, commercial airlines, and other customers. Technicians often prepare instruction manuals, bulletins, catalogs, and other technical materials. (See statements on Aerospace Engineers and Airplane Mechanics, and chapter on Occupations in Aircraft, Missile, and Spacecraft Manufacturing.)

Air-Conditioning, Heating, and Refrigeration Technology. Air-conditioning technology involves the control of air including its heating, cooling, humidity, cleanliness, and movement. Technicians in this field often become specialists in one area of work, such as refrigeration, and sometimes in a particular type of activity, such as research and development or design of layouts for heating, cooling, or refrigeration systems.

In the manufacture of air-conditioning, heating, and refrigeration equipment, technicians work in research and engineering departments, usually as aids to engineers and scientists. They may be assigned to such jobs as devising methods for testing equipment or analyzing production methods. Technically trained personnel also assist in designing the air-conditioning, heating, or refrigeration systems for a particular office, store, or other location and prepare instructions for their installation. In designing the layout for an air-conditioning or heating system, they must determine the cooling or heating requirements, decide what kind of equipment is most suitable, and estimate costs. Technicians employed as salesmen by equipment manufacturers must be able to supply contractors who design and install systems with information on such technical subjects as installation, maintenance, operating costs, and expected performance of equipment. (See also statement on Refrigeration and Air-Conditioning Mechanics.)

Chemical Technology. Technicians specializing in this area work mainly with chemists and chemical engineers in the development, production, sale, and utilization of chemical and related products and equipment. The field of chemistry is so broad that chemical technicians often become specialists in the problems of a particular industry, such as food processing, or in a particular activity, such as quality control.

Most chemical technicians work in research and development, testing, or other laboratory work. They conduct experiments and tabulate and analyze the results. In testing work, technicians make chemical tests of materials to determine whether the materials meet specifications or whether particular substances are present and, if so, in what quantities. They may, for example, analyze steel for carbon, phosphorous, and sulfur content, or water for the amount of silica, iron, and calcium present. They also perform experiments to determine the characteristics of substances such as the specific gravity and ash content of oil. Technicians employed in re-

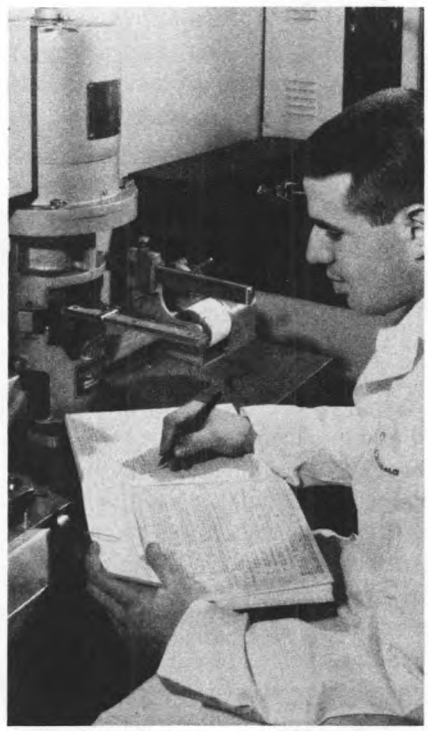
search or testing laboratories often assemble and use such apparatus and instruments as dilatometers (which measure the dilation or expansion of a substance), analytical balances, and centrifuges.

Outside the laboratory, chemical technicians are sometimes employed to supervise various operations in the production of chemical products and as technical salesman of chemicals and chemical equipment. (See also statements on Chemists and Chemical Engineers, and chapter on Occupations in the Industrial Chemical Industry.)

Civil Engineering Technology. Technicians trained in this area assist civil engineers in performing many of the tasks necessary in the planning, design, and construction of highways, railroads, bridges, viaducts, dams, and other types of structures. During the planning stage, technicians may help to estimate costs, to prepare specifications for materials, or participate in surveying, drafting, detailing, or designing work. Once the actual construction work has begun, they may assist the contractor or superintendent in scheduling construction activities or inspecting the work to assure conformance to blueprints and specifications. (See also statements on Civil Engineers, Draftsmen, and Surveyors.)

Electronics Technology. This field includes radio, radar, sonar, telemetering, television, telephony, and other forms of communication; industrial and medical measuring, recording, indicating, and controlling devices; navigational equipment; missile and spacecraft guidance and control instruments; electronic computers; and many other types of equipment using vacuum tubes, transistors, semiconductors, and printed circuits. Because the field is so broad, technicians generally become specialists in one area —for example, induction or dielectric heating, servomechanisms, automation controls, or ultrasonics.

Technicians working with engineers and scientists in the field of electronics do complex technical work that is more difficult than routine operating and repair work. (For additional information on broadcast technicians see chapter on Occupations in Radio and Television Broadcasting.)



Industrial Production Technology. Technicians trained in this area are sometimes called *industrial technicians or production technicians.* They assist industrial engineers on problems involving the efficient use of personnel, materials, and machines in the production of goods or services. Their work includes preparing layouts of machinery and equipment, planning the flow of work, and making statistical studies and analyses of production costs. The industrial technician also may conduct time-and-motion studies.

In the course of their duties, many industrial technicians acquire experience which enables them to qualify for other jobs. For example, those expert in machinery and production methods may move into the field of industrial safety. Others who specialize in job analysis may become involved in the setting of job standards and in the interviewing, testing, hiring, and training of personnel. Still others may move into production supervision. (See statements on Personnel Workers and Industrial Engineers.)

Mechanical Technology. Mechanical technology is a broad term usually used to cover a large number of specialized fields, including automotive technology, diesel technology, tool design, machine design, and production technology.

Technicians in the above areas of mechanical technology often assist engineers in design and development work by making freehand sketches and rough layouts of proposed machinery and other equipment and parts. They help to determine whether a proposed design change in a product is practical and how much the product will cost to produce. They also may be required to solve design problems such as those involving tolerance, stress, strain, friction, and vibration.

The planning and testing of experimental machines and equipment for performance, durability, and efficiency provide a large area of work for technicians. In the testing procedure, they record data, make computations, plot graphs, analyze results, and write reports. They sometimes make recommendations for design changes to improve performance. Their jobs often require skill in the use of instruments, test

equipment and gages, such as dynamometers, as well as the ability to prepare and interpret drawings.

One of the better known specialties which may be grouped under mechanical engineering technology is that of *tool designer*. The tool designer designs tools and devices for the mass production of manufactured articles. He originates and prepares sketches of the designs for cutting tools, jigs, dies, special fixtures, and other attachments used in machine operations. He also may make detailed drawings of these tools and fixtures or supervise others in making them. Besides developing new tools, designers frequently redesign tools to improve their efficiency.

Machine drafting, with some designing, is another major area of work often grouped under mechanical technology. The work is described elsewhere in this chapter.

Some mechanical technicians are employed in manufacturing departments to help develop plans for testing and inspecting machines and equipment, or to work with engineers in eliminating production problems. Some obtain jobs as technical salesmen. (See statements on Mechanical Engineers, Automobile Mechanics, Manufacturers' Salesmen, and Diesel Mechanics.)

As industry becomes increasingly mechanized, new technical occupations continue to emerge. For example, *instrumentation technology* has evolved from the introduction of automatic controls and precision-measuring devices in manufacturing operations. In industrial plants and laboratories, instruments are used to record data, to control and regulate the operation of machinery, and to measure time, weight, temperature, speed of moving parts, mixtures, volume, flow, strain, and pressure. Technicians in this field work with engineers and scientists who develop and design these highly complex devices, as well as with those who use them for research and development work. (See also statement on Instrument Makers.)

Another new area of work for technicians, which has resulted from recognition of the need for a more scientific approach toward the reduction of industrial hazards, is safety technology. In the rapidly growing atomic energy field, in particular, technicians work with scientists and engineers on problems of radiation safety, inspection, and decontamination. (See chapter on Occupations in the Atomic Energy Field.) Other new areas include the environmental control field, where technicians are concerned with the problems of air and water pollution.

Places of Employment

An estimated 650,000 engineering and science technicians, not including draftsmen and surveyors, were employed in 1970—about 11 percent were women. Nearly 460,000 of these technicians (more than 7 out of 10) were employed by private industry. The manufacturing industries employing the largest numbers of engineering and science technicians were electrical equipment, chemicals, machinery, and aerospace. In the nonmanufacturing sector, large numbers of technicians were employed in the communications industry and by engineering and architectural firms.

In 1970, the Federal Government employed over 85,000 engineering and science technicians; chiefly as engineering aids and technicians, electronic technicians, equipment specialists, cartographic aids, meteorological technicians, and physical science technicians. Of these engineering and science technicians, the largest number worked for the Department of Defense. Most of the others were employed by the Departments of Transportation, Agriculture, Interior, and Commerce.

State Government agencies employed nearly 50,000 engineering and science technicians in 1970 and local governments about 12,000. The remainder were employed by colleges and universities, mostly in university-operated research institutes, and by nonprofit organizations.

Training, Other Qualifications, and Advancement

Young men and women who wish to prepare for careers as engineering or science technicians can obtain the necessary training from a great variety of educational institutions or can qualify for their work right on the job. Most employers, however, seek workers who have had some form of specialized training for more responsible technician jobs. Specialized formal training programs are offered in post-secondary schools—technical institutes, junior and community colleges, area vocational technical schools, and extension divisions of colleges and universities—as well as in technical and technical-vocational high schools. Other ways in which persons can become qualified for technician jobs are by completing an on-the-job training program, through work experience and formal courses taken on a part-time basis in post-secondary or correspondence schools, or through training and experience obtained while serving in the Armed Forces. In addition, many engineering and science students who have not completed all the requirements

for a bachelor's degree, as well as some other persons having a college education in mathematics and science, are able to qualify for technician jobs after they obtain some additional technical training and experience. In general, post-secondary school technical training is required for a growing number of engineering and science technician jobs.

Engineering and science technicians usually begin work as trainees or in the more routine positions under the direct supervision of an experienced technician, scientist, or engineer. As they gain experience, they are given more responsibility, often carrying out a particular assignment under only general supervision. Technicians may move into supervisory positions. Those having exceptional ability sometimes obtain additional formal education and are promoted to professional engineering positions.

For admittance to most schools offering post-secondary technician training, a high school diploma is usually required. Some schools, however, admit students without a high school diploma if they are able to pass special examinations and otherwise demonstrate their ability to perform work above the high school level. All engineering and science occupations require basic training in mathematics and science, thus students should obtain a sound background in these subjects when in high school. Many post-secondary schools have arrangements for helping students make up deficiencies in these subjects.

Programs offered by schools specializing in post-secondary technical training require 1, 2, 3, or 4 years of full-time study. The majority are 2-year programs leading to an associate of arts or science degree. Evening as well as day sessions are generally available. The courses offered in science, mathematics, and engineering are usually at the college level. They include instruction in laboratory techniques and the use of instruments, and emphasize the practical problems met on the job. Students also are instructed in the use of machinery and tools to give them a familiarity with this equipment rather than to develop skills.

Some 4-year programs for the bachelor's degree in technology place more emphasis on courses in the humanities and business administration than the 2-year programs, while other 4-year programs emphasize additional technical training.

Because of the variety of educational institutions and the differences in the kind and level of education and training, persons seeking a technical education should use more than ordinary care in selecting a school. Information should be secured about the fields of technology in which training is offered, accreditation, the length of time the school has been in operation, instructional facilities, faculty qualifications, transferability of credits toward the bachelor's degree, and the type of work obtained by the school's graduates.

Briefly discussed here are some of the types of post-secondary educational institutions and other sources where young people can obtain training as technicians.

Technical Institutes. Technical institutes offer training designed to qualify the graduate for a specific job or cluster of jobs immediately upon graduation with only a minimum of on-the-job training. In general, the student receives intensive technical training but less theoretical and general education than is provided in curriculums leading to a bachelor's degree in engineering and liberal arts colleges. A few technical institutes and community colleges offer cooperative programs in which a student spends part of his time in school and part in paid employment related to the occupation for which he is preparing himself.

Some technical institutes are operated as regular or extension divisions of colleges and universities. Others are separate institutions operated by States or municipalities, privately endowed institutions, and proprietary schools.

Junior Colleges and Community Colleges. Many junior and community colleges offer the necessary training to prepare students for technician occupations. Some of these schools offer curriculums that are similar to those given in the freshman and sophomore years of 4-year colleges. Graduates can transfer after the junior college into a 4-year college or qualify for some technician jobs. Most large community colleges offer 2-year technical programs, and many employers express a preference for graduates having this more specialized training. Junior college courses in technical fields are often planned around the employment needs of the industries in their locality.

Area Vocational-Technical Schools. Area vocational-technical schools are post-secondary public institutions that are established in central locations to serve students from several surrounding areas. In general, the admission requirements of vocational-technical schools are as rigid as those of other schools offering post-secondary technician training. Area school curriculums are usually designed to train the types of technicians most needed in the area.

Other Training. Some large corporations conduct training programs to meet their need for technically

trained personnel. This type of training is primarily technical and rarely includes any general studies.

Training for some occupations in the technician category—tool designer and electronic technican, for example—may be obtained through a formal apprenticeship.

Some training also is available in special purpose institutions that specialize in a single field, such as electronics.

Correspondence schools also provide technician training for those who wish to learn more about their jobs.

Technician training is offered by all branches of the Armed Forces. Many of the technicians trained by the military utilize their training in civilian employment, especially in the field of electronics, after they leave the Armed Forces.

Employment Outlook

Employment opportunities for engineering and science technicians are expected to be very good through the 1970's. The demand will be strongest for graduates of post-secondary school technician training programs.

Among the factors underlying the increase in demand for technicians are the anticipated expansion of industry and the increasing complexity of modern technology. As products and the methods by which they are manufactured become more complex, more technicians will probably be required to assist engineers. They may be needed in such activities as production planning, and maintaining liaison between production and engineering departments, and in technical sales work. Furthermore, as the employment of scientists and engineers continues to grow, increasing numbers of technicians will be needed to assist them. The trend toward automation of industrial processes will probably also add to the demand for technical personnel; so will the growth of new areas of work, such as those related to space and oceanographic exploration, atomic engery, environmental control, or urban development. In addition to the technicians needed to fill new positions, thousands will be needed each year through the 1970's to replace those who retire, die, or transfer to other occupations.

Another factor supporting the expected increase in demand for engineering and science technicians is the growth anticipated in research and development (R&D) expenditures. During the 1970 decade, R&D expenditures of Government and industry are expected to increase, although at a slower rate than during the 1960's. The anticipated slowdown in Federal R&D spending basically reflects anticipated reductions in the relative importance of the space and defense components of R&D expenditures. These trends were evidenced in the late 1960's and in 1970.

Expenditures for defense and space programs also affect the demand for technical personnel, because a large number are engaged in activities related to the defense and space programs. The above outlook for technicians is based on the assumption that defense activity as measured by expenditures will be somewhat higher than the level before the Vietnam buildup, approximating the level of the early 1960's. If defense activity should differ substantially from that level, the demand for technicians would be affected accordingly.

Well-qualified women technicians should continue to find favorable employment opportunities, chiefly in designing jobs, in chemical and other laboratory work, and in computation and other work requiring the application of mathematics. Over the long run, it is likely that more women will be trained and will find employment in these and other technician occupations.

Earnings

In general, a technician's earnings depend upon his education and technical specialty, as well as his ability and work experience. Other important factors which influence his earnings are the type of firm for which he works, his specific duties, and the geographic location of his job.

In Federal Government agencies in 1970, beginning engineering and science technicians were offered $5,212, $5,853 or $6,548, depending upon the type of job vacancy and the applicant's education and other qualifications. Some Federal Government agencies hire high school graduates and train them for technician jobs. Beginning salaries for these jobs were $4,621 a year.

Starting salaries in private industry in 1970, for technicians holding associate degrees, ranged from about $6,500 to $8,300 a year; the average was about $7,400.

Most technicians can look forward to an increase in earnings as they move to higher positions. In 1970 annual salaries of workers in responsible technician positions in private industry averaged almost $11,000 and approximately one-fourth of the workers had annual salaries above $11,900, according to a Bureau of Labor Statistics survey.

Sources of Additional Information

General information on careers for engineering and science technicians may be obtained from:

American Society for Engineering Education, Suite 400, 1 Dupont Circle, Washington, D.C. 20036.

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

National Council of Technical Schools, 1835 K. Street, NW., Room 907, Washington, D.C. 20006.

Information on training opportunities may also be obtained from the Engineers' Council for Professional Development, a nationally recognized accrediting agency for engineering technology programs; the National Council of Technical Schools; and the U.S. Department of Health, Education, and Welfare, Office of Education, Division of Higher Education and/or Division of Vocational and Technical Education, Washington, D.C. 20202.

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

American Association of Junior Colleges, Suite 410, 1 Dupont Circle, Washington, D.C. 20036.

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

DRAFTSMEN

(D.O.T. 001. through 019.)

Nature of the Work

In making a space capsule or an electric iron, a nuclear submarine or a television set, a bridge or a typewriter, detailed drawings are needed that give the exact physical dimensions and specifications of the entire object and each of its parts. The workers who draw these plans are draftsmen.

Draftsmen translate the ideas, rough sketches, specifications, and calculations of engineers, architects, and designers into working plans which are used in making a product. Draftsmen may calculate the strength, reliability, and cost of materials. In their drawings and specifications, they describe exactly what materials and workers are to use on a particular job. To prepare their drawings, draftsmen use instruments such as compasses, dividers, protractors, templates and triangles, as well as machines that combine the functions of several devices. They also may use engineering handbooks, tables, and slide rules to assist in solving technical problems.

Draftsmen are often classified according to the type of work they do or their level of responsibility. *Senior draftsmen* use the preliminary information provided by engineers and architects to prepare design "layouts" (drawings made to scale of the object to be built). *Detailers* make drawings of each part shown on the layout, giving dimensions, material, and any other information necessary to make the detailed drawing clear and complete. *Checkers* carefully examine drawings for errors in computing or in recording dimensions and specifications. Under the supervision of draftsmen, *tracers* make minor corrections and prepare drawings for reproduction by tracing them on transparent cloth, paper, or plastic film.

Draftsmen also may specialize in a particular field of work, such as mechanical, electrical, electronic, aeronautical, structural, or architectural drafting.

Places of Employment

An estimated 310,000 draftsmen were employed in 1970; almost 4 percent were women. About 9 out of 10 draftsmen are employed in

private industry. Manufacturing industries that employ large numbers are those making machinery, electrical equipment, transportation equipment and fabricated metal products. Nonmanufacturing industries employing large numbers are engineering and architectural consulting firms, construction companies, and public utilities.

Over 20,000 draftsmen worked for Federal, State, and local governments in 1970. Of those employed by the Federal Government, the large majority worked for the Departments of the Army, Navy, and Air Force. Draftsmen employed by State and local governments worked chiefly for highway and public works departments. Several thousand draftsmen were employed by colleges and universities and by nonprofit organizations.

Training, Other Qualifications, and Advancement

Young persons interested in becoming draftsmen can acquire the necessary training from a number of sources, including technical institutes, junior and community colleges, extension divisions of universities, vocational and technical high schools, and correspondence schools. Others may qualify for draftsmen jobs through on-the-job training programs combined with part-time schooling or through 3- or 4-year apprenticeship programs.

The prospective draftsman's training, whether obtained in high school or post-high school drafting programs, should include courses in mathematics and physical sciences, as well as in mechanical drawing and drafting. The study of shop practices and the learning of some shop skills also are helpful, since many higher level drafting jobs require knowledge of manufacturing or construction methods. Many technical schools offer courses in structural design, strength of materials, and physical metallurgy.

Young people having only high school drafting training usually start out as tracers. Those having some formal post-high school technical training can often qualify as junior draftsmen. As draftsmen gain skill and experience, they may advance to higher level positions as checkers, detailers, senior draftsmen, or supervisors of other draftsmen. Some may become independent designers. Draftsmen who take courses in engineering and mathematics are sometimes able to transfer to engineering positions.

Qualifications for success as a draftsman may include the ability to visualize objects in three dimensions as well as the ability to do freehand drawing. Although such artistic ability is not generally required, it may be very helpful in some specialized fields.

Drafting work also requires good eyesight (corrected or uncorrected), eye-hand coordination, and manual dexterity.

Employment Outlook

Employment opportunities for draftsmen are expected to be favorable through the 1970's. Prospects will be best for those having post-high school drafting training. Well-qualified high school graduates who have had only high school drafting, however, also will be in demand for some types of jobs.

Employment of draftsmen is expected to rise rapidly as a result of the increasing complex design problems of modern products and processes. In addition, as engineering and scientific occupations continue to grow, more draftsmen will be needed as supporting personnel. On the other hand, photoreproduction of drawings and expanding use of electronic drafting equipment and computers are eliminating some routine tasks done by draftsmen. This development will probably bring about a reduction in the need for some less skilled draftsmen.

In addition to draftsmen needed to fill new positions, many will be required each year to replace those who retire, die, or move into other fields of work.

Earnings

In private industry, persons in beginning drafting positions earned an average of about $470 a month in 1970, according to a Bureau of Labor Statistics survey. As they gain experience, draftsmen may move up to higher level positions with a substantial increase in earnings. For example, the earnings of senior draftsmen averaged about $850 a month. Most earned about $700 per month.

In the Federal Civil Service in 1970, the entrance salary for high school graduates without work experience who were employed in trainee-draftsman positions was about $380 a month. For those having post-high school education or some experience in drafting, entrance salaries were higher. The majority of experienced draftsmen working for the Federal Government earned between $600 and $740 a month.

Sources of Additional Information

General information on careers for draftsmen may be obtained from:

American Institute for Design and Drafting, Post Office Box 2955, Tulsa, Oklahoma 74101.

American Federation of Technical Engineers, 1126 16th Street, NW., Washington, D.C. 20036.

See also section on Sources of Additional Information in the statement on Engineering and Science Technicians.

FOOD PROCESSING TECHNICIANS

(D.O.T. 022.281, 029.381)

Nature of the Work

In contrast with the past, when most foods were processed in the home, almost all foods we now eat are processed by industrial firms. A small but important group of workers employed by these firms are food processing technicians.

Food processing technicians assist food scientists in research and development, and in the quality assurance laboratories of processing plants. They also serve as assistant supervisory personnel in production related operations such as processing, packaging and sanitary maintenance, and waste disposal.

Titles of operating and laboratory technicians in the food processing industry vary from plant to plant and industry to industry, as do their responsibilities, which often overlap from one area to the other. Food processing technicians may be known as Laboratory or Quality Assurance Technicians, Physical-Science Aide, Plant Facilities Technician, Biological Aide, Laboratory Analyst, and Research and Development Technician.

In research and development, food processing technicians assist food scientists in improving existing food products, creating new food items, and developing and improving processes related to production. Duties may include weighing out ingredients, performing microbiological tests, and conducting chemical analysis. Technicians also set up panels for organoleptic testing (taste, smell, sight). Other duties include gathering and storing samples for testing; operating and maintaining laboratory equipment; and experimenting with new methods for testing products. Technicians often are required to prepare formal reports on experiments, tests, and other projects. They frequently use instruments such as balances, spectrophotometers (to measure color intensity), autoclaves (for sterilizing), microscopes, and cryoscopes (to determine the freezing point of liquids).

In quality assurance laboratories, they conduct bacteriological, chemical, and physical tests on raw ingredients and finished products to ensure conformance with established industry and government standards. They use equipment such as incubators, refractometers (to measure heat), centrifuges (to separate particles of substances), torsion balances, color comparison charts, and pH meters (to determine the degree of acidity). Other duties may include making brand comparison checks, filling sample orders, and checking samples received against product reports or shipping manifests.

In production operations, food processing technicians assist in the supervision of the overall processing of food products. For example, they work closely with fieldmen to insure a steady flow of products from farm to plant; they inspect incoming raw materials to make certain they are suitable for processing and that they are stored under proper temperatures. Technicians recommend measures to improve production methods, equipment performance, and quality of product, and suggest changes in working conditions and use of equipment to increase processing efficiency. Some technicians supervise packaging operations; others are concerned primarily with sanitation in all areas of a food processing plant. They help identify bacterial problems on the line or in the plant, recommend cleaning and sanitizing solutions, and direct cleaning crews.

Places of Employment

An estimated 3,400 food processing technicians were employed in the food processing industry in 1970. Food processing technicians can be found in all major food industries and are employed in most States. The largest number of food technicians are in those States having the heaviest concentration of food processing workers: California, Illinois, Pennsylvania, Texas, Ohio, New Jersey, Wisconsin, Michigan, Iowa, and New York.

Food technicians, in addition to being employed by food processors, may be employed by State and Federal Government food inspection agencies, food brokers, and supermarket chains. Others are in related fields where their specialized training can be utilized, including food packaging companies, food warehousing and transporting companies, and manufacturer of food processing equipment.

Training, Other Qualifications, and Advancement

Young men and women wishing to prepare for a career as a food

processing technician can obtain the necessary training from a variety of educational institutions, or can qualify for their work on the job. Most employers, however, prefer workers who have had some form of specialized training for more responsible technician jobs. Specialized formal training programs are offered in post-secondary schools —technical institutes, junior and community colleges, and technical divisions of four-year universities. For admittance to most schools offering post-secondary technician training, a high school diploma is required.

Students wishing to prepare for a career as a food processing technician should take a year each of biology and chemistry, and two years of mathematics (algebra and geometry) while in high school. English and social science courses also are recommended. Some post-secondary schools, however, admit students on the basis of successful work experience in the food industry and on the recommendation of their employer.

Programs offered by schools specializing in post-high school technical training generally require one, two, and in very few cases, three or four years of full-time study. The majority are 2-year programs leading to an associate of applied science degree. The courses offered usually include chemistry, microbiology, mathematics, and specialized courses in food processing, quality control, packaging, plant and environmental sanitation, and technical report writing. Elective courses such as accounting, economics, and English generally are offered by the post-secondary schools.

Curriculums may vary considerably among the schools offering programs in food science technology. Some schools, for example, have programs in food processing technology geared towards an individual food processing industry, such as the dairy industry. Many 2-year schools require work experience in some phase of the industry between the first and second years, and others recommend that their students obtain this kind of practical experience. The school's placement bureau often assists the prospective technician in finding this type of employment. Besides providing practical experience, this aids the student in paying his tuition expenses and frequently leads to full-time positions after graduation.

Persons can qualify for technician jobs by completing on-the-job training programs, or through work experience and formal courses taken on a part-time basis in post-secondary schools. In addition, many students from various science disciplines who have not completed all the requirements for a bachelor's degree are able to qualify for technician jobs after they obtain some additional technical training and experience. In general, post-secondary school technical training is required for a growing number of food processing technician jobs. Laboratory technicians in the dairy industry must meet licensing requirements in most States. These requirements vary, but generally include a written test. Some states require an applicant to demonstrate his capabilities.

Food processing technicians usually begin work as trainees under the direct supervision of an experienced food scientist, and are systematically assigned to jobs throughout the plant. Technicians may begin their careers at a lower level supervisory capacity and—depending on training, ability, and experience—can work up to the mid-management level. Food technicians working in laboratories are assigned more demanding functions as they gain experience and may advance to other positions such as salesman, purchasing agent, or fieldman.

Food processing technicians generally work as part of a team. Because the quality of processed food may affect many people, the food technician must work to exacting standards and be dependable. He is frequently required to make oral or written reports on the results of his work.

Employment Outlook

Employment opportunities for food processing technicians are expected to be favorable through the 1970's. The demand will be strongest for graduates of post-secondary technical training programs.

Among the factors underlying the increase in demand for food processing technicians are the desire for more convenience foods in the home, and the need for these products by food service institutions. Also, the complexity of new food products and their related processes will create a need for more technicians to assist food scientists and management personnel in such areas as production planning, technical sales work, purchasing, packaging, personnel work, and warehouse management. The need for technicians will be especially critical in quality assurance areas as higher quality and safety standards are set and as more technical supervision in processing becomes necessary. Many smaller processing firms, which currently operate without the aid of technicians, are expected to require them in the future. Furthermore, as the employment of food scientists continues to grow,

increasing numbers of technicians will be needed to assist them. In addition to the technicians needed to fill new positions, others will be needed each year through the 1970's to replace those who retire, die, or transfer to other occupations.

Earnings

In general, a technician's earnings depend upon his education, ability, and work experience. Other important factors are the type of firm for which he works, his specific duties, and the geographic location of his job. Beginning food processing technicians were offered starting salaries of $7,000 per year in 1970, based on limited data.

Most technicians can look forward to an increase in earnings as they gain experience and advance to higher level positions.

Sources of Additional Information

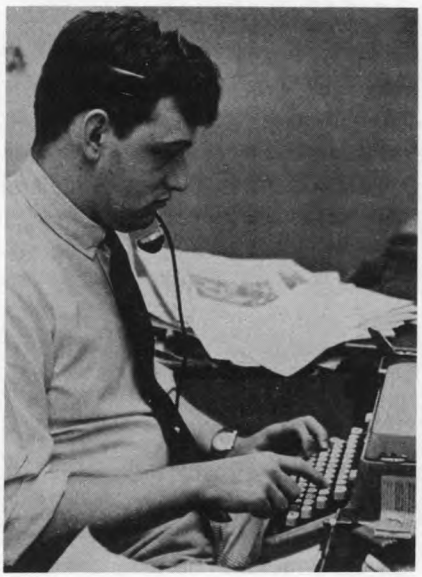
For further information regarding careers as food processing technicians, students should contact their school counselors for help in locating technical institutes, junior and community colleges, and universities offering programs in food processing technology. (See also section on Sources of Additional Information in the statement on Engineering and Science Technicians.)

NEWSPAPER REPORTERS

(D.O.T. 132.268)

Nature of the Work

Newspaper reporters gather information on current events and use it to write stories for publication in daily or weekly newspapers. In covering events, they may interview people, review public records, attend news happenings, and do research. As a rule, reporters take notes or use electronic recording devices while collecting the facts, and write their stories upon return to the office. Sometimes, to meet deadlines, they telephone their stories to other staff members known as "rewrite men," who write the stories for them.



Large dailies frequently assign some reporters to "beats," such as police stations or the courts, to cover news originating in these places. Other local news, such as a story about a lost child or an obituary of a community leader, is handled by general assignment reporters. Specialized reporters, who are well-versed in a subject-matter field as well as in writing, increasingly are interpreting and analyzing the news in fields such as medicine, politics, science, education, business, labor, and religion. Reporters on small newspapers get broad experience; they not only cover all aspects of local news, but also may take photographs, write headlines, lay out inside pages, and even write editorials. On the smallest weeklies, they also may solicit advertisements, sell subscriptions, and perform general office work.

Places of Employment

An estimated 39,000 newspaper reporters were employed in the United States in 1970; more than 35 percent were women. The majority of reporters work for daily newspapers; others work for weekly papers, press services, and newspaper syndicates.

Reporters work in cities and towns of all sizes throughout the country. Of the 1,760 daily and 9,000 weekly newspapers, the great majority are in medium-size towns. Large numbers of reporters, however, are in cities, since big city dailies employ many reporters, whereas a small-town paper generally employs only a few.

Training, Other Qualifications, and Advancement

Most newspapers will consider only applicants having a college education. Graduate work is increasingly important. Some editors prefer graduates who have a degree in journalism, which usually involves a liberal arts education as well as professional training. Other editors consider a degree in liberal arts equally desirable. Although talented writers having little or no academic training beyond high school sometimes become reporters on city newspapers, most reporters without college training begin—and usually remain—on rural, small-town or suburban papers.

Professional studies leading to a bachelor's degree in journalism can be obtained in nearly 200 colleges; about two-thirds of these have separate departments or schools of journalism. The typical undergraduate journalism curriculum is offered during the junior and senior years of college, and is divided about equally between cultural and professional subjects. Among the professional courses are reporting, copyreading, editing, feature writing, and the history of journalism.

Over 250 junior colleges offer journalism programs. Credit secured in most is transferable to the 4-year college programs in journalism. In addition, some junior colleges offer programs especially designed to prepare the student directly for employment as a general assignment reporter on weekly and small daily newspapers.

The master's degree in journalism is awarded by 52 schools; 20 of them offer the doctor's degree in mass communications.

Young people who wish to prepare for newspaper work through a liberal arts curriculum should take English courses that include writing, as well as subjects such as sociology, political science, economics, history, psychology, and speech. Ability to read and speak in a foreign language and some familiarity with mathematics also are desirable. Those who look forward to becom-

ing technical writers, or reporters in a special field such as science, should concentrate on course work in their subject matter areas as much as possible. (See statement on Technical Writers.)

The Armed Forces also provide some training in journalism. The Department of Defense maintains a Defense Information School at Fort Benjamin Harrison, Indianapolis, Ind.

Summer internships on newspapers, providing college students an opportunity to learn the rudiments of reporting or editing, are available from the Newspaper Fund and individual newspapers. Moreover, in addition to many loan programs, more than 2,800 journalism scholarships, fellowships, and assistantships were offered in 1970 by universities, newspapers, and professional organizations.

Important personal characteristics include a "nose for news," curiosity, persistence, initiative, resourcefulness, an accurate memory, and the physical stamina necessary for an active and often fast-paced life. Skill in typing generally is required since reporters usually must type their own news stories. On small papers, a knowledge of news photography also is valuable.

Some who compete for regular positions, find it is helpful to have had experience as a "stringer"—one who covers the news in a particular area of the community for a newspaper and is paid on the basis of the stories printed. Experience on a high school or college newspaper also may be helpful in obtaining employment.

Many beginners work on weekly or on small daily newspapers. Some college graduates are hired as general assignment reporters; others start on large city papers as copy editors. Beginning reporters usually are assigned to news events such as reporting on civic and club meetings, summarizing speeches, writing obituaries, interviewing important visitors to the community, and covering police court proceedings. As they gain experience, they may report more important developments, cover an assigned "beat," or specialize in a particular field of knowledge.

Newspapermen also may advance to reporting for larger papers or for press services and newspaper syndicates. Some experienced reporters become columnists, correspondents, editors, top executives, or publishers; these positions represent the top of the field and competition for them is keen. Other reporters transfer to related fields such as writing for magazines, or preparing copy for radio and television news reports.

Employment Outlook

Well-qualified beginners with exceptional writing talent will find favorable employment opportunities through the 1970's. In 1970, editors of large newspapers were seeking young reporters with exceptional talent. Other beginners, however, were facing competition for jobs, especially on large city dailies, and probably will continue to do so. In addition to seeking young reporters with exceptional talent, editors also were looking for reporters who were qualified to handle news about highly specialized or technical subjects.

Weekly or daily newspapers located in small towns and suburban areas will continue to offer the most opportunities for beginners entering newspaper reporting. Openings arise on these papers as young people gain experience and transfer to reporting jobs on larger newspapers or to other types of work. Preference in employment on small papers is likely to be given to beginning reporters who are able to help with photography and other specialized aspects of newspaper work and are acquainted with the community.

Large city dailies will provide some openings for the inexperienced with good educational backgrounds and a flair for writing to enter as reporter trainees. Some opportunities may continue to be available for young people who enter as copy boys and advance to reporting jobs.

In addition to jobs in newspaper reporting, new college graduates who have journalism training may enter related fields such as advertising, public relations, trade and technical publishing, radio, and television. Some job opportunities also will be found in teaching journalism.

The broad field of mass communication, which has grown rapidly in recent years, will continue to expand in the future. Factors contributing to this continuing expansion include rising levels of education and income; increasing expenditures for newspaper, radio, and television advertising; and a growing number of trade and technical journals and various types of company publications. As newspapers share in this growth, employment of reporters is expected to increase slowly. The greatest number of job openings, more than a thousand each year, will continue to arise from the need to replace reporters who are promoted to editorial or other positions, transfer to other fields of work, retire, or leave the profession for other reasons.