Employment, Education, and Earnings of American Men of Science

Bulletin No. 1027

UNITED STATES DEPARTMENT OF LABOR

Maurice J. Tobin, *Secretary*

BUREAU OF LABOR STATISTICS

Ewan Clague, *Commissioner*

In cooperation with

UNITED STATES DEPARTMENT OF DEFENSE

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Letter of Transmittal

UNITED STATES DEPARTMENT OF LABOR,
BUREAU OF LABOR STATISTICS,
Washington, D. C., May 21, 1951

The SECRETARY OF LABOR:

I have the honor to transmit herewith a report on the employment, education, and earnings of the Nation's leading scientists. The report was prepared in the Bureau's Branch of Occupational Outlook in cooperation with the United States Department of Defense. The coordinating agency of the Department of Defense was the Manpower Branch, Human Resources Division, Office of Naval Research. The National Research Council gave invaluable assistance in connection with the study.

The study was carried out under the supervision of Helen Wood. The report was written by Theresa R. Shapiro and Helen Wood. John S. McCauley directed the editing of the questionnaires. He and Pearl C. Ravner had major responsibility for planning the statistical tabulations and prepared preliminary analyses of the data.

EWAN CLAGUE, *Commissioner.*

Hon. MAURICE J. TOBIN,
Secretary of Labor

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Employment, Education, and Earnings of American Men of Science

Introduction

Our national security and welfare depend to a great extent upon the research carried on by a small number of scientists. The part scientists play in developing weapons for the national defense needs no emphasis in this atomic age. Less spectacular but of equal importance are the countless contributions of science in opening new frontiers of knowledge, raising the standard of living, and improving the health of the Nation.

Despite the importance of scientific research, very little statistical information has been compiled concerning the individuals who do this work. No comprehensive data are available on such questions as: How many scientists are there in different specialties? How old are they? What education did they receive? How much experience have they had? Where are they employed? How much do they earn?

The present report contains information on these and related questions for 42,000 of the Nation's top scientists. The report is a byproduct of a questionnaire survey which had two major purposes: to gather information for a roster of key scientists for use by the National Research Council, the Department of Defense, and other agencies concerned with our supply of scientific personnel; and to provide data for the 1949 edition of *The Biographical Directory of American Men of Science.*

The survey was conducted jointly by the National Research Council, the publisher of *American Men of Science*, and the Department of Defense.[1] Advice and assistance were obtained from several scientific societies, government agencies, and other organizations. The Bureau of Labor Statistics, under contract with the Department of Defense, edited the replies and coded data desired for the roster of scientists. It also undertook a statistical analysis of the information, the major findings of which are presented in this report.

[1] Representatives of the Army, Navy, and Air Force made up a "sponsors" group which guided the project. These three departments and the Atomic Energy Commission provided financial support. The contract was administered by the Manpower Branch, Human Resources Division, Office of Naval Research.

Summary of Findings

Fields of Specialization.—Every branch of the natural sciences was represented among the names in *American Men of Science.* Of the 42,000 scientists in the survey the chemists were by far the largest group, comprising about a fourth. The biologists were second in number and the engineers third, although the total number of engineers in the country exceeds the total number of professional workers in all other scientific fields combined.

The scientists surveyed were above all research scientists. Close to two-thirds of them were or had been engaged in research in the scientific fields in which they had their highest competence. Next to research, teaching was the activity most often reported. Some had had experience in design and development work, others had acted as administrators, and some had served in other capacities. Three out of every four had performed more than one function in their fields of highest competency, either concurrently or in different periods of employment.

As a rule, these scientists had spent the greater part of their adult lives in the work of their first specialty. A median of 15 years' experience in these specialties went along with a median age of

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43 years. Differences in length of experience among scientists in different fields were directly related to differences in age.

Despite long experience in their first specialty, most of the scientists were able to report also a field of second competence. For about half of the scientists, this second specialty was in the same scientific field as their first specialty. For example, 41 percent of those whose highest field of competence was in some branch of mechanical engineering reported a second specialty within this field, and 49 percent of the electronic scientists cited a second field of competence in electronics. The other half reported second specialties in different fields from their first—often in entirely different branches of science.

Level of Education.—The primary purpose of both the 1948 and earlier editions of the Directory, *American Men of Science*, was to list scientists engaged in research, particularly in basic research. A strong effort was always made to reach all the Ph. D.'s in the natural sciences. Roughly two-thirds of all these Ph. D.'s were included in the present study. The scientists in the Directory who did not hold a doctorate constituted a small, select group; presumably they were equal to the Ph. D.'s in scientific achievement.

As a result of the emphasis on the Ph. D. degree as a criterion for inclusion in the Directory, the doctors of philosophy constituted by far the largest segment of the scientists in the survey—63 percent of the entire group. This proportion was even higher (78 percent) for the small number of women (6 percent of the entire group) included in the survey.

The proportion of Ph. D.'s in certain fields was distinctly higher than the over-all average. More than three-fourths of the chemists, psychologists, biologists, and mathematicians and statisticians had doctorates. It was only in medicine and related fields and in engineering that fewer than half of the scientists held Ph. D. degrees. Even in engineering, which had relatively fewer Ph. D.'s than any other field of specialization, the proportion of Ph. D.'s in the survey was much higher than among all the members of the profession.

Among the scientists without a doctorate, the largest group were those who had received but had not gone beyond the master's degree; 15 percent of the surveyed scientists were in this category. The remainder were about equally divided between the doctors of medicine and the group who either held no degree or had only a bachelor's degree. One percent of the scientists held no degree.

Region of education.—The principal region of education of these scientists was the Middle West. About a third of all the baccalaureates and 40 percent of the doctorates were granted in the North Central region. Relative to population, however, New England had contributed a higher proportion of both doctorates and baccalaureates than any other region.

In the absolute numbers of baccalaureates granted these scientists, the Pacific Coast was lower than any other region. The Mountain-Plains States accounted for the fewest doctorates. But when regional population was taken into account, the South ranked lowest with respect to both bachelor's and doctor's degrees.

Type of Employer.—Education was the leading field of employment for scientists, with private industry second, and government third. More than a third (37 percent) were employed solely by universities and colleges at the time of the survey, and an additional 13 percent combined education with some other type of employment. The proportion of scientists working exclusively for private industry was 27 percent, for government agencies, 14 percent. About 2 percent were employed exclusively by nonprofit foundations, and even fewer were wholly self-employed as independent consultants. The remainder were working for more than one type of employer (excluding educational institutions).

Engineering and chemistry offered notable exceptions to the predominance of college and university employment among these scientists. Half of the chemists and over 40 percent of the engineers worked for business firms at the time of the survey. Electronic scientists also were employed mainly by business firms. In geophysics and geology, on the other hand, government employees constituted the largest group, whereas the majority of medical scientists were physicians engaged in private practice.

College and university employment was more common among scientists possessing a Ph. D. than among those who did not have this degree. Three-fourths of the scientists employed exclusively in colleges and universities had Ph. D.

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degrees. However, private industry was the largest field of employment for scientists with no graduate degree, and a relatively high proportion of the master's degree holders worked for the government.

Region of Employment.—More than half of the scientists were employed in the Middle Atlantic region and the eastern North Central States at the time they filled out their questionnaires. Relatively few scientists worked in northern New England, the South, the Mountain-Plains States, and the North Pacific States. Fewer than 1 percent were employed outside continental United States.

Earnings.—Information on the earnings of the scientists included in this survey is most useful for the light it throws on professional earnings of Ph. D.'s and the major factors influencing these salary levels. The median annual salary for all Ph. D.'s was $5,720. Engineers, with a median annual salary of $6,960, were by far the best-paid group of specialists. The chemists had the next highest median salary, $6,030, and the biologists tended to be the lowest paid Ph. D.'s, with a median salary of $4,940.

Salaries in private industry tended to be higher than those paid by other types of employers within each field of specialization, for every age group, and in all regions of employment. For Ph. D.'s in all specialties taken together, the median salary in private industry was $7,070 and in government it was $6,280. The small group of scientists working for nonprofit foundations tended to earn about the same amount as government employees. However, college and university staff members with no other type of employment had a median salary of only $4,860. So important was the difference in salary levels among types of employers that even the lowest-paid scientists in private industry, the biologists, fared better than the highest-paid of all educators—the engineers.

Scope of the Study

Scientists Surveyed.—The scientists to whom questionnaires were sent in connection with this survey included all those in the 1944 edition of *American Men of Science* and those on a list of "new names" developed mainly by the National Research Council.

There were approximately 34,000 scientists listed in the 1944 edition of the Directory. The editors' policy had been to limit the Directory to people engaged in research in the natural sciences. However, some additional persons had been included because they had contributed to science through teaching, administrative work, or the preparation of textbooks and compilations. "There are also some whose work has been chiefly in engineering, medicine, or other applied sciences, and a few whose work is in education, economics, or other subjects not commonly included under the exact and natural science." [2]

In addition to names appearing in the 1944 Directory, a list of "new names" was built up from several sources. The following criteria were used as a guide for inclusion in the Directory:

1. A doctorate in one of the sciences and continuing professional work in science; or
2. For those not having the doctorate, evidence of mature, scientific ability such as would be indicated by publications in recognized scientific journals of original meritorious work involving high grade research, or responsibilities in the direction of scientific activities requiring command of a science and ability to direct the scientific work of others of high degree of training and experience; or
3. Fellowship or membership in a scientific society where such fellowship or membership involved a high degree of discrimination.

Scientists who had been listed in the 1944 Directory were included in the mailing list without reference to the above criteria.

A major source of "new names" was the list of persons granted doctorates in the natural sciences. This list is maintained by the Office of Scientific Personnel of the National Research Council. Questionnaires were mailed to all those who had received a doctorate between 1936 and the time of the survey.

All the organizations listed in the National Research Council's "Directory of Industrial Research Laboratories in the United States" were asked to submit the names of scientists meeting

[2] The Biographical Directory of American Men of Science. New York, The Science Press, 1906. Preface.

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the above criteria who had not been included in the 1944 edition of *American Men of Science*. Nomination slips were also sent to all governmental research agencies. Additional names were obtained by checking the mailing list against membership lists of scientific societies.

Questionnaires were mailed to about 30,000 persons, in addition to those listed in the 1944 Directory, and 24,000 questionnaires were returned. From this latter number about 4,000 were eliminated by the staff of *American Men of Science*, because the respondents failed to meet the criteria listed above. Of the 34,000 scientists listed in the 1944 edition, about 30,000 supplied data for the new edition. The remainder had died, retired, or indicated they no longer wished to be included in the Directory. Thus, the total number of biographical sketches in the 1949 Directory was about 50,000.

TABLE 1.—*Proportion of Ph. D's awarded 1936–45, included in the Directory,* American Men of Science, *in selected fields*

Subject	Total number of degrees 1936–45	Sample used in checking Directory	Percent of sample listed in Directory
Biochemistry	870	100	76
Chemistry	4,905	200	76
Geology	398	100	73
Metallurgy	118	59	64
Paleontology	68	34	82
Physics	1,220	124	85
Psychology	920	100	58

Source: M. H. Trytten, "Coverage of Scientific Personnel in American Men of Science, Eighth Edition." Science, Sept. 8, 1950, vol. 112, No. 2906, (pp. 265–266).

In order to determine what proportion of the specialists in the various scientific fields were included in *American Men of Science*, the National Research Council-National Academy of Science made a check of persons receiving doctorates in the natural sciences (including psychology and geography) from American universities from 1936 through 1945.[3] Every twentieth name was checked, and 76 percent were found to be listed in the Directory. A similar check for the academic year 1946–47 indicated that 81 percent of the scientists who received degrees in that year were included.

For certain subject fields, separate lists of the individuals receiving their doctorates had been maintained, and a sample of each of these lists was checked for the period 1936–45. The results are shown in table 1. The relatively low proportion of psychologists is due to the deliberate exclusion of social psychologists (such as industrial, educational, and guidance psychologists) from the list of "new names."

The present report covers only about 84 percent[4] of the scientists at all educational levels listed in the Directory. Hence, the study's coverage of Ph. D.'s is necessarily lower than the Directory's. However, it is not possible to determine how much lower this coverage is by a direct comparison because no information is available regarding the education of the scientists listed in the Directory but not included in the study.

The Bureau of Labor Statistics estimated the study's coverage of the three fields with the largest number of doctorates—chemistry, biology, and physics. This estimate, covering the degree period 1912–48, indicated that 68 percent of the professionally active Ph. D.'s in chemistry, 78 percent in physics, and 64 percent in biology were included in the study.[5]

It is more difficult to evaluate the coverage of scientists who had not earned Ph. D. degrees. According to the criteria for "new names" listed above, scientists without Ph. D. degrees were added to the Directory only if they had achieved unusual success. Scientists whose names were carried over from previous editions were a more heterogeneous group, since criteria for inclusion in the Directory were not so clearly formulated in earlier years.

It is thus apparent that the scientists included in the survey do not represent a random sample of the Nation's scientists. Rather, they constitute a high proportion of those who held doctorates in the natural sciences plus a small, select, and nonrepresentative group of scientists who did not have Ph. D. degrees.

The information obtained.—The questionnaire used in this survey was designed to serve two main purposes: to obtain the biographical data

[3] M. H. Trytten, "Coverage of Scientific Personnel in American Men of Science, Eighth Edition." Science, September 8, 1950, vol. 112, No. 2906, (pp. 265–266).

[4] In making statistical tabulations it was necessary to establish a cut-off point after data from 43,935 scientists had been punched on machine record cards. Of the latter, 1,951 were excluded from the statistical analysis because they had died, retired, or had failed to furnish data concerning their employment status.

[5] The total number of scientists who had earned a degree and who were still professionally active was estimated by applying the death and retirement rates for professional males against the number of persons granted a doctorate from an American university in each of these fields in each 5-year period of degree from 1912 to 1948. The resulting figures were compared with the number of scientists in the survey who had received their doctorates in these periods. Because no data as to the field of degrees were available, the comparison was based on the fields of specialization of these scientists.

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needed for *American Men of Science* and to provide detailed data on the scientists' fields of specialization and other questions of interest in the recruitment and placement of scientific personnel. Each scientist was asked to give a detailed record of his academic training and professional experience, and to indicate his five main fields of specialization on a check list of about 600 specialties. In addition, information was obtained concerning his publications, inventions, membership in professional societies, knowledge of foreign countries and foreign languages, and other attainments. A question regarding annual professional income was also included.[6]

Most of the data on scientists' incomes and employment relate to the spring of 1948, when the great majority filled out and returned their questionnaires. However, some scientists did not return the completed forms until late 1948 or early 1949.

Within the limits of the present report it was possible to analyze only certain major items of information in the questionnaires. The material chosen for analysis depended in part on those items coded and entered on the punch card, which had been designed for roster purposes. For this reason, certain important information, notably on the functions and industries in which the scientists were employed at the time of the survey, was not available for analysis.

The first topic considered in the report is the specialties of the scientists. Later sections discuss the scientists' educational backgrounds; their employment with respect to type of employer, functions performed, length of experience in a particular specialty, and regions where employed; and, finally, their professional incomes and the factors affecting them.

[6] The questionnaire is reproduced in the Appendix (p. 49).

Fields of Specialization

The most difficult problem facing anyone who wishes to classify scientists, either for roster or for analytical purposes, is to determine their occupational specialties accurately and at the same time group these specialties so that statistical techniques may be utilized. There are no generally accepted definitions of scientific fields or professions, and the fields are so complex and interrelated that it is not easy to secure agreement on definitions and classifications, even among the scientists themselves. There is apt to be difference of opinion, for example, between the academicians who tend to cling to textbook and curriculum classifications and the scientists in industry who frequently consider the end product the more significant basis for classification. Not the least of the many difficulties arises from the fact that the body of scientific knowledge is constantly changing. New discoveries and new concepts create new occupations and alter the character of existing ones.

Under these circumstances, with the boundaries of scientific fields shifting and overlapping, it is often perplexing to ascertain where a particular scientist belongs in any system of classification that is used. Is a specialist who studies plant assimilation of fertilizers containing radioactive elements, to be considered a biologist, a chemist, or a physicist? Is the person working on the problem of surface tensions in plants a biologist or a physicist?

The present study attempted to solve both the problem of the classification of scientific fields and the allocation of individual scientists in two ways. Eminent scientists were asked to cooperate in developing classified lists of their own specialties. The actual slotting of each man into his proper place was done by the scientists in the survey themselves. That is, the respondents were asked to indicate on a previously coded list of several hundred fields each specialty in which they had some competence. The specialty of greatest competence was designated by a "1," that of second greatest competence by a "2," and so forth.

As can be seen from the reproduction of the questionnaire on page 49 of this report, the fields of specialization were narrowly defined. For example, a botanist could indicate whether he was a general botanist, a plant cytologist, a plant physiologist, a plant taxonomist, a paleobotanist, or a general mycologist. A civil engineer, to cite another example, had 11 fields of civil engineering

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from which to choose his particular specialty. In addition, spaces were provided so that the respondent might write in his specialty if he found these listings inadequate.

The present report is limited to scientists employed in their fields of greatest competence at the time of the survey. The 41,737 such scientists constituted 99 percent of all the scientists in the survey who were in the labor force and who were included in the statistical tabulations. The remaining 1 percent was made up of 110 unemployed scientists and 136 who were employed in a specialty other than their field of greatest competence.

Field of Greatest Competence

As table 2 shows, these scientists came from all the natural sciences. A large proportion were from the so-called pure sciences; about half of the entire group were chemists, biologists, physicists, or mathematicians. The chemists, who constituted about one out of four scientists in the survey, were much the largest group. The biologists were next in number. The engineers ranked third.

TABLE 2.—*Number of scientists in each field of specialization, 1948*

Field of specialization	Number	Field of specialization	Number
All fields	41,737	Medicine	2,858
Chemistry	10,625	Clinical medicine	1,164
Chemistry—general	682	Neuropsychiatry	325
Analytic	1,020	Obstetrics	118
Biochemistry	1,594	Ophthalmology	93
Inorganic	763	Pediatrics	171
Organic	4,135	Public health	319
Physical	2,431	Radiology	115
Engineering	4,906	Surgery	553
Aeronautical	220	Fields related to medicine	2,664
Chemical	1,976	Anatomy	527
Civil	696	Dental medicine	116
Electrical	788	Pathology	478
Mechanical	652	Physiology	814
Metallurgical	138	Pharmacy-pharmacology	539
Mining	149	Veterinary medicine	190
Ordnance	157	Mathematics and statistics	1,930
Power plant	130	Mathematics	1,674
Physics and electronics	3,439	Statistics	256
Physics	2,807	Psychology	1,589
Electronics	632		
Earth sciences	2,089	Other	3,391
Geophysics	293	Architecture	24
Geography	262	Astronomy	212
Geology	1,394	Metallurgy	569
Meteorology	140	Military applications of science	136
Agriculture	2,427	Nutrition and foods	524
Biology	5,819	Manpower resources	920
Bacteriology	1,420	All other	1,006
General biology	1,005		
Botany	1,603		
Entomology	822		
Zoology	969		

The smallest numbers of scientists are found in the miscellaneous groups of fields listed as "Other" in table 2. A few of these fields, such as astronomy and metallurgy, are well-recognized branches of the sciences which could not conveniently be classified elsewhere. Others, such as manpower resources and planning, tend to serve as a catch-all for the wide variety of occupations which generally utilize the services of trained scientists but which are not clearly scientific in character. Individuals who were concerned with the administration of scientific activities, with policy making concerning scientific research and scientific personnel, and with the broader aspects of scientific education tended to list themselves as specialists in manpower resources and planning.

The number of scientists in the survey in each field tells little about the relative size of that field in over-all manpower terms. What the figures do reveal is the emphasis on research, college teaching, and the Ph. D. degree as the basis for inclusion in the survey. There were, for example, more than twice as many chemists as engineers among the surveyed scientists, but more than four times as many engineers as chemists in the population as a whole, according to Bureau of Labor Statistics estimates.[7] Medicine is another field which had comparatively few representatives in this survey. Since both engineering and medicine are primarily applied sciences, only a small proportion of the persons employed in each—chiefly those actively engaged in research—met the survey's criteria of selection. However, a science like botany, which is not often used directly in industry and which has few immediate practical applications, was well represented in the survey. More than a fourth of the biologists in this survey listed botany as their specialty. In contrast, only 10 percent of National Roster biologists were botanists.[8]

Specialties of Women Scientists

Only 6 percent of all the scientists in the survey were women (table 3). In two fields, however, psychology and biology, the women scientists represented a sizable segment of the entire group—20 percent of the psychologists and 12 percent of the biologists. In some branches of biology the proportion of women was higher than in this field as a whole—14 percent in bacteriology and 13

[7] The BLS estimates that there were about 80,000 chemists and 350,000 engineers in 1948.

[8] The National Roster of Scientific and Specialized Personnel, Distribution of Roster Registrants, December 31, 1945. The Roster attempted to obtain a comprehensive listing of scientific and specialized personnel, but even this listing was not complete.

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percent in botany, but they constituted a negligible fraction, less than 1 percent, of the engineers and agriculturists, and only 3 percent of the physicists and electronic scientists. Table A on page 36 gives the number of women scientists employed in each specific field.

TABLE 3.—*Number and percent of women scientists in each general field of specialization, 1948*

Field of specialization	All scientists (both sexes)	Women scientists	
		Number	Percent of total
All fields	41,737	2,520	6.0
Chemistry	10,625	486	4.6
Engineering	4,906	7	.1
Physics and electronics	3,439	91	2.6
Earth sciences	2,089	91	4.4
Agriculture	2,427	13	.5
Biology	5,819	679	11.7
Medicine	2,858	125	4.4
Fields related to medicine	2,664	226	8.5
Mathematics and statistics	1,930	186	9.6
Psychology	1,589	323	20.3
Other	3,391	293	8.6

Second Specialties

A very high proportion, 93 percent of the respondents, checked a second field of competence in the detailed listing of specialties on the questionnaire. Because it was not practicable to consider these several hundred fields separately in comparing the first and second fields of specialization, they were grouped in this report into somewhat broader fields—the "specific specialties." [9] Thus, a person listing the field of greatest competence as highway engineering and the second as structural engineering, is shown as having both the first and second specialties in the same specific field, civil engineering. A bacteriologist reporting parasitology as a second specialty was listed as having the second specialty in the same specific field as the first, bacteriology. When, however, the second specialty was reported in a general field different from the first, this general field was tabulated. For example, when an agronomist reported plant pathology as the field of second competence, the general field—biology—is shown. (All second specialties reported, classified according to the scientists' first fields of specialization, are given in table B of the appendix.)

In spite of this grouping of detailed specialties into broader fields, the data show a great variety of combinations of first and second fields of competence. Almost half of the scientists reported a second specialty in a different *specific* field from that of their highest competence; slightly over a third reported a second specialty in a different *general* field. Table 4 shows the proportion, in each general field, of scientists whose second specialty was in another general field,[10] and the two fields listed most frequently in each case.

The second specialties most frequently reported were very much what one would expect to find. Agriculture often involves the application of biological science to specific production problems, and 35 percent of the agriculturists listed some branch of biology as a second specialty. Physics, chemistry, and engineering shade into each other at their limits, and some scientists in each of these fields reported one of the others as the field of second highest competence. Biology and the fields related to medicine overlap to some degree. Certain fields of physics and mathematics are almost indistinguishable. This is reflected in table 4.

Close study of all the combinations of first and second specialties reported by the scientists discloses a much greater number of permutations. As table 5 shows, a few biologists considered engineering their second specialty, some engineers regarded agriculture or biology as their second specialty, and some physicists claimed a biological science as their second field. In short, only about half of the second specialties outside of the general field of highest competence were in closely related sciences. The other half were widely dispersed among a great variety of fields. For example, although 68 percent of the chemists indicated some field of chemistry as their second specialty, table 5 shows that every general scientific field was listed by some chemist. And the two broad fields most frequently cited, physics and engineering, accounted for only 12 percent of the chemists out of the 32 percent whose second fields were not in chemistry.

[9] For clarity, the most refined definition of field of specialization used in this report, such as plant cytology or highway engineering, is termed a "detailed specialty." The next broader group, such as civil engineering or botany, is called a "specific field of specialization" and the broadest, such as engineering or biology, is known as a "general field of specialization." The terms "specialty" and "field of specialization" are used interchangeably. No tabulations of the detailed specialties are included in this report.

[10] Agriculture and psychology were not subdivided further, as were the other general fields. Those agriculturists and psychologists who listed some field of agriculture or psychology as their second specialty were tabulated as having a second specialty in the same specific field as that of their highest competence.

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TABLE 4.—*Second specialties most frequently reported by scientists, by general field of first specialty, 1948*

Field of specialization	Percent of scientists with second general field different from their first	Most frequent second field		Next most frequent second field	
		General field	Percent of scientists [1]	General field	Percent of scientists [1]
Chemistry	32.2	Other sciences [2]	8.5	Physics and electronics	6.6
Engineering	36.9	do [2]	10.4	do	9.6
Physics and electronics	31.3	Engineering	11.6	Mathematics and statistics	5.7
Earth sciences	18.4	do	6.3	Physics and electronics	3.5
Agriculture	66.5	Biology	34.5	Chemistry	10.5
Biology	24.0	Agriculture	7.3	Fields related to medicine	5.5
Medicine	33.2	Fields related to medicine	16.1	Biology	6.6
Fields related to medicine	32.8	Biology	12.9	Chemistry	7.2
Mathematics and statistics	22.1	Physics and electronics	7.7	Engineering	5.3
Psychology	19.7	Other sciences [2]	6.1	Medicine	6.0

[1] The percentages are based on the number of scientists in each field who reported a second specialty.
[2] Other sciences include architecture, astronomy, metallurgy, military application of science, nutrition and foods, manpower resources, and any other science not elsewhere classified.

The grouping of these scientists into general fields conceals many differences among the various specialties. Some of these general fields, particularly the earth sciences and the fields related to medicine, are made up of loosely related specialties. The fact that geophysics is as closely related to physics as to the other earth sciences is reflected in the large proportion of geophysicists who reported a second specialty in physics and electronics, almost as large a percentage as listed a second specialty in the other earth sciences. Of the fields related to medicine, pharmacology, for example, is only slightly related to some of the other specific fields included in this category, such as veterinary medicine and dental medicine, but it is closely related to chemistry. Hence, more pharmacologists reported a second specialty in chemistry than in one of the other fields related to medicine. But even in such well-defined general fields as biology and engineering, some of the specialties are as closely or more closely related to other sciences than to each other. Chemical engineering, for example, is in many ways nearer to chemistry than to other branches of engineering, and fewer chemical engineers cited a second specialty in another engineering field than listed one in chemistry. Similarly, more botanists indicated some area of agriculture as a second specialty than mentioned bacteriology.

TABLE 5.—*Second specialties of scientists in selected fields, 1948*

Second field of specialization	Percent of scientists whose first field of specialization was—			
	Chemistry	Engineering	Physics and electronics	Biology
Second specialty in same general field as first specialty:				
In same specific field	42.0	45.9	60.4	53.9
In other specific field	25.8	17.2	8.3	22.1
Second specialty in another general field:				
Chemistry	----	9.1	4.6	4.0
Engineering	5.5	----	11.6	.2
Physics and electronics	6.6	9.6	----	.6
Earth sciences	1.0	2.5	1.7	.8
Agriculture	1.3	.7	(1)	7.3
Biology	3.2	.5	1.3	----
Medicine	.9	.6	.5	2.7
Fields related to medicine	3.3	.2	.2	5.5
Mathematics and statistics	1.8	3.3	5.7	.5
Psychology	.1	(1)	.2	.2
Other sciences	8.5	10.4	5.5	2.2
Total	100.0	100.0	100.0	100.0

[1] Less than 0.05 percent.

Since all the scientists were asked to indicate a second specialty, some may have listed such a specialty despite a lack of professional competence in the area, and the degree of competence in the second field therefore varied. Without a statistical analysis of the employment histories of these scientists, therefore, it is difficult to know precisely what significance these second specialties may have. A perusal of the questionnaires suggests, however, that in the great majority of cases the scientists had had actual experience in the specialty which they designated as their field of second greatest competence. In some cases, this amounted to no more than work on a doctoral thesis, but such cases were apparently the exception.

Some scientists had been, while they were employed, engaged on research projects in a field other than that of their principal employment. This was particularly true of the college teachers. For example, one scientist who had majored in analytic chemistry as a graduate student and had written his Ph. D. thesis in this field, had taught courses in inorganic chemistry for several years.

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He had continued to carry on research in analytic chemistry and had published several papers in this field. He listed inorganic chemistry as his field of greatest competence and analytic chemistry as his second field.

A large number of scientists found that their current employment covered more than one specialty as defined in the questionnaire. For example, a mechanical engineer employed by a firm manufacturing air-conditioning, heating, and refrigeration equipment was engaged in drawing up the plans for the installation of such equipment and for its adaption to the specific needs of clients. He listed air-conditioning, heating, and refrigeration engineering as his first specialty and mechanical equipment, another branch of mechanical engineering, as his second field. To cite another example, a radio engineer was primarily concerned with electronics in his current job. He listed radio engineering as his first specialty, electronics as his second, and included the years of employment with the current firm as experience in both radio engineering and electronics.

These illustrations do not exhaust all the situations underlying the designations of second specialties. Undoubtedly, there are instances in which the designations have little practical meaning. On the whole, the second specialties appeared to be fields in which the scientists had considerable competence.

Education

Highest Degree Earned

Perhaps the outstanding single characteristic of the surveyed scientists is their high level of education. This is a reflection of the criteria used in selecting scientists for inclusion in the survey. About two-thirds had received a Doctor of Philosophy degree and an additional 11 percent had earned a degree in medicine. (See chart 1.) Over 1,000 of the 41,674 reporting their educational backgrounds had been awarded both a degree in medicine and a Ph. D.

Table 6 shows the highest degrees received by the scientists. It should be noted that seven out of eight people in the first classification, "Bachelor or none," had received a baccalaureate; only 1 percent of all scientists in the study held no degree. Most of the Ph. D.'s had master's degrees as well.

TABLE 6.—*Number and percent of scientists by highest degree earned, 1948*

Highest degree earned	Number	Percent
Total reporting	[1] 41,674	100.0
Bachelor or none	4,807	11.6
Master [2]	6,383	15.3
Ph. D.[3]	26,008	62.4
M. D.[4]	4,461	10.7
Other [5]	15	([6])

[1] Excludes 63 scientists not reporting level of education.
[2] Those with a master's degree but no other graduate degree.
[3] Includes a very small number of doctors of education and doctors of science. Scientists holding Ph. D.'s in addition to M. D.'s are classified in the M. D. category.
[4] Includes a few doctors of veterinary medicine, doctors of dental surgery, and doctors of osteopathy.
[5] This very small group includes doctors of literature and jurisprudence and holders of other degrees equally infrequent among scientists. No honorary degree is included in this or any of the other categories in the table.
[6] Less than 0.05 percent.

Both the Ph. D. and the M. D. categories included a few persons having other degrees—doctors of science and education in the case of the Ph. D. group; doctors of dentistry, osteopathy, and veterinary medicine in the M. D. group. For convenience, however, the abbreviated designations, Ph. D. and M. D., are used throughout in referring to these groups. Those scientists who held both M. D.'s and Ph. D.'s were classified with the M. D.'s.

In all general fields except engineering, medicine, and the fields related to medicine, at least half the scientists held Ph. D. degrees (as shown in table 7). Doctors of philosophy were in the majority also in half the specific fields related to medicine; it was only in dental medicine, pathology, and veterinary medicine that the medical degrees predominated, as they did in medicine. Except for medicine, engineering was the general field with the lowest proportion of Ph. D.'s among the surveyed scientists. Nevertheless, the proportion of Ph. D.'s among the engineers in this survey (33 percent) was much higher than in the profession as a whole. A Bureau survey in 1946 showed that only 6 percent of the Nation's chemical engineers had doctorates and that doctorates were even more exceptional in other branches of the profession.[11]

The proportion of scientists holding Ph. D. degrees was over 80 percent in two general fields

[11] U. S. Department of Labor, Bureau of Labor Statistics, Employment Outlook for Engineers, Bull. No. 968 (pp. 99-100, table D-6).

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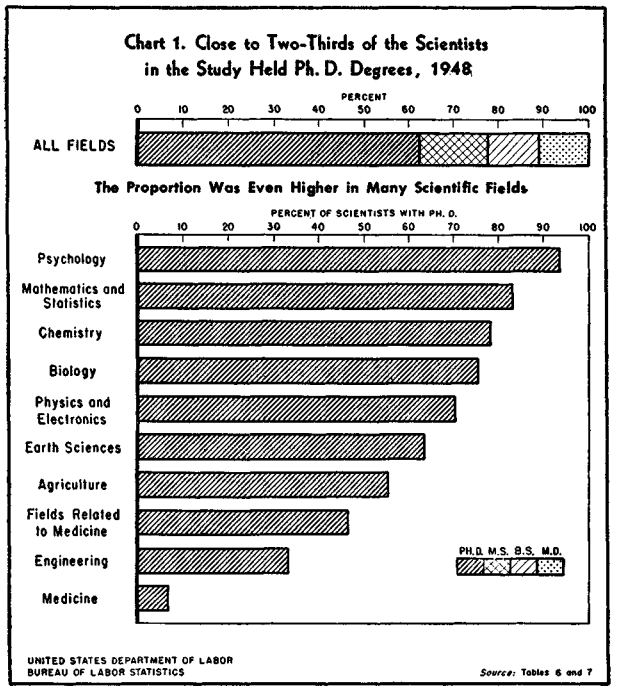

(psychology and mathematics and statistics) and in several specific fields (biochemistry, organic chemistry, physical chemistry, geography, general biology, botany, and mathematics). The astronomers, physicists, and zoologists also were predominantly Ph. D.'s, with over 75 percent in each field having this degree.

Within every general field, the proportion of Ph. D.'s varied among specialties. (See table E, p. 40.) Only 19 percent of the civil engineers but 43 percent of the chemical engineers were doctors of philosophy. There were more Ph. D.'s in physics than in electronics, which draws its personnel from engineering as well as physics.

TABLE 7.—*Percent of scientists in each general field of specialization by highest degree earned, 1948*

Field of specialization	Total reporting	Bachelor or none	Master	Ph.D.	M.D.	Other degree
All fields	100.0	11.6	15.3	62.4	10.7	(1)
Chemistry	100.0	9.9	10.4	78.4	1.3	(1)
Engineering	100.0	33.4	33.1	33.3	.1	.1
Physics and electronics	100.0	10.8	18.1	70.7	.3	.1
Earth sciences	100.0	14.2	22.0	63.7	.1	----
Agriculture	100.0	11.0	32.9	55.9	.2	----
Biology	100.0	5.9	12.4	75.9	5.8	(1)
Medicine	100.0	1.0	1.1	6.8	91.1	(1)
Fields related to medicine	100.0	2.9	3.8	46.7	46.6	----
Mathematics and statistics	100.0	3.5	13.0	83.2	.3	----
Psychology	100.0	.8	4.2	93.8	1.1	.1
Other sciences	100.0	19.6	18.0	59.3	3.0	.1

[1] Less than 0.05 percent.

In biology, the proportion of Ph. D.'s ranged from 63 percent in entomology to 87 percent in botany.

In the absence of statistics on over-all employment in the various scientific fields, it was not possible to determine the extent to which these differences in the relative numbers of Ph. D.'s in the various specialties reflected the differences among all scientists in the country as a whole.

Highest Degree and Age

In contrast with the popular picture of the distinguished scientist as a venerable graybeard, the scientists in the survey constituted a young group. Their median age at the time of the survey was 43 years. They were older by an average of 5 years, however, than both all employed men and all professional and semiprofessional men as reported by the 1940 Census.

Scientists having the doctor of philosophy degree tended to be the youngest group, with a median age of 42 years (table 8). The relative youthfulness of this group was probably due to the growing number of Ph. D.'s in the sciences in this country.[12] However, the relatively high median age of the M. D. group, 48 years, results from the history of the *American Men of Science*. Professors in medical schools were customarily included in early editions of the Directory, but in recent years only a limited number were added, namely, those actively engaged in research.

As table C, page 38, shows, the Ph. D.'s were markedly concentrated in a 15-year-age range, with 57 percent between 30 and 45 years. Only 39 percent of the M. D.'s fell within these age limits. Scientists without graduate degrees and those with master's degrees were fairly well represented at all age levels.

The median age for 6 of the 10 general fields was the same—44 years. In two fields, chemistry and physics, the scientists tended to be younger than the entire group, whereas in agriculture and medicine, the median age was over 44 (table 8).

In most specialties [13] the doctors of medicine tended to be the oldest group. The doctors of philosophy were the youngest group, except in

[12] Between 1912 and 1929, 7,692 Ph. D. degrees in the sciences were granted by American universities. This number almost tripled in the ensuing period, with 21,270 degrees awarded between 1930 and 1945. Figures on the number of doctorates awarded in the natural sciences each year are compiled by the National Research Council—National Academy of Sciences.

[13] It should be noted that these are the specialties of highest competence, and not necessarily the fields in which the respondents received their degrees.

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TABLE 8.—*Median age of all scientists, by highest degree earned, and by general field of specialization, 1948*

Field of specialization	Median age				
	Total reporting	Bachelor or none	Master	Ph. D.	M. D.
All fields	43	44	45	42	48
Chemistry	39	40	40	39	39
Engineering	44	45	47	41	(1)
Physics and electronics	40	35	40	41	(1)
Earth sciences	44	43	41	44	(1)
Agriculture	48	54	51	45	(1)
Biology	44	49	46	43	44
Medicine	50	50	49	47	50
Fields related to medicine	44	44	45	42	46
Mathematics and statistics	44	46	50	44	(1)
Psychology	44	44	42	44	58

[1] Insufficient returns.

physics and electronics, psychology, and the earth sciences. The scientists without any graduate degrees were the youngest group in physics and electronics, as were the master's degree holders in psychology and the earth sciences.

The relative homogeneity of the Ph. D. scientists, as compared with the others in the survey, was reflected in the median ages for the various fields of specialization. The range from the lowest to the highest median age was 11 years for all scientists, but only 8 years for Ph. D.'s. This range reached a high of 19 years for the group having no graduate degrees.

It might have been expected that scientists included in *American Men of Science* despite their lack of a graduate degree would be men who had received their education before a Ph. D. was considered a prerequisite for a responsible position, and to whom the years and their native capacities had given opportunities to make significant contributions in their fields. This seems to have been the case in many fields, notably agriculture, biology, and mathematics. But in physics and chemistry, the scientists without a graduate degree were a young group. Thus, 29 percent of the physicists and electronic scientists, and 16 percent of the chemists, as opposed to 12 percent of all the surveyed bachelors, were under 30 years of age. (See table C, p. 38.) The youthfulness of these physicists and chemists is probably a result of the war. During the war the need for physicists and chemists increased so sharply that young men had unprecedented opportunities to make outstanding contributions in their fields. Some of the leading physicists in atomic research today were recruited from the colleges and graduate schools in the early 1940's.

Women Scientists

Holders of Ph. D. degrees predominated among the women scientists to an even greater extent than among the men. Over three-fourths of the women reporting held this degree, as compared with slightly less than two-thirds of all the scientists in the survey (table 9). The proportion of Ph. D.'s among the women in this survey was much higher than among women scientists in the Nation as a whole (as was true also for the men). Among the women National Roster Registrants as of December 31, 1946, only 10 percent of the physical scientists and 24 percent of the biological and agricultural scientists held doctoral degrees.

The proportion of women scientists at each level of education tended to coincide, in each specialty, with that for all women scientists. The overwhelming majority were those who had earned Ph. D. degrees, followed by holders of the master's degree, the M. D. degree, and those without a graduate degree. Only in the field of medicine was there a marked—and understandable—deviation from this pattern, M. D.'s constituting the largest group. (See table D, p. 39.)

TABLE 9.—*Number and percent of women scientists at each educational level, compared with all scientists, 1948*

Highest degree earned	All scientists		Women scientists	
	Number	Percent	Number	Percent
Total reporting	[1] 41,674	100.0	[1] 2,516	100.0
Bachelor or none	4,807	11.6	113	4.5
Master	6,383	15.3	296	11.8
Ph. D	26,008	62.4	1,961	77.9
M. D	4,461	10.7	146	5.8
Other	15	(2)		

[1] Excludes 63 scientists, 59 men and 4 women, who did not report level of education.
[2] Less than 0.05 percent.

The women scientists in this survey were somewhat older than the men. Their median age was 45 years compared with 43 years for both men and women. Among the women, the youngest tended to be those without a graduate degree, rather than the Ph. D.'s. The former were also the only category of women scientists with a lower median age than the corresponding group of scientists of both sexes (table 10).

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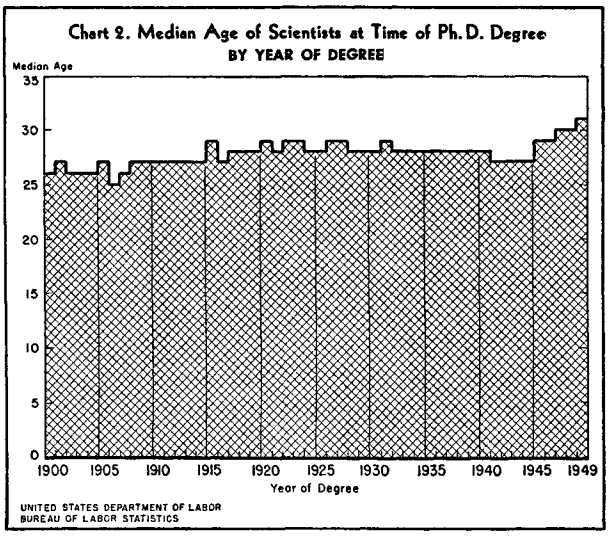
TABLE 10.—*Median age of women scientists at each level of education, compared with all scientists, 1948*

Highest degree earned	Median age	
	All scientists	Women scientists
Total reporting	43	45
Bachelor or none	44	41
Master	45	48
Ph. D	42	45
M. D	48	48

Age at Time of Doctorate

There is no normal age for receiving a doctorate, as table 11 shows. Some scientists were as young as 18, others as old as 77. The average age, however, did not vary greatly, either across fields or over time. The median age of all the scientists in the survey was 29 at the time of award of the doctorate. The physicists and electronic scientists were 29, the chemists were 28, and the biologists were 30. As chart 2 shows [14] the median age at time of degree varied only slightly from year to year from 1901 through 1949. It dropped a little during the depression years when compared with the period of World War I, and rose again to the highest level of any time, in the period following World War II.

[14] The relatively low median age for earning a doctorate in the earliest period, shown in chart 2, seems to be due to the accident of survival rather than to a real difference in the average ages of the degree recipients. Probably among the degree recipients of 1900–1915, a relatively low proportion of those who were older when they obtained their doctorate were professionally active at the time of the survey.



Most of the scientists (76 percent) were between 25 and 35 years of age when the doctorate was awarded. There were, however, significant differences among specialties in the age at the time of award. Seventy-five percent of the chemists received the doctorate under the age of 30, as compared with 66 percent of the physicists and electronic scientists, 62 percent of all scientists, and 50 percent of the biologists. On the other hand, 20 percent of the biologists were 35 years of age or older when they obtained their degrees, as opposed to 7 percent of the chemists, 11 percent of the physicists and electronic scientists, and 14 percent of all scientists. In no field for which information is available, however, did more than 2 percent of the recipients receive their doctorates after they had passed their forty-fifth birthday.

TABLE 11.—*Age at time Ph. D. degree was received, of all scientists, chemists, physicists and electronic scientists, and biologists, 1948*

Age at time of Ph. D. degree	All scientists	Chemists	Physicists and electronic scientists	Biologists
	Percentage distribution			
18–19 years	[1]	[1]	[1]	
20–24 years	9.3	12.9	12.3	4.2
25–29 years	52.8	62.7	53.7	45.4
30–34 years	23.6	17.1	23.2	30.3
35–39 years	9.0	4.9	6.6	13.0
40–44 years	3.5	1.7	3.1	4.7
45–49 years	1.3	.6	.9	1.6
50–54 years	.3	.1	.2	.6
55–59 years	.1		[1]	.1
60–64 years	.1	[1]		.1
65–69 years	[1]			[1]
70–74 years				
75–79 years	[1]			
Total	100.0	100.0	100.0	100.0
Median age	29	28	29	30
Total number reporting	[2] 25,799	[2] 8,261	[2] 2,417	[2] 4,360

[1] Less than 0.05 percent.
[2] Excludes 209 scientists—63 chemists, 13 physicists, and 45 biologists—not reporting date of birth or date of degree.

Region of Education

Every part of the United States contributed to the education of the surveyed scientists but the leading region of education for these scientists was the Middle West. Close to a third of all the baccalaureates and 40 percent of the doctorates were granted in this region. In population terms, however, New England emerged as the leader (table 12). Although that region had only 6 percent of the Nation's population, her institutions conferred about 13 percent of both the bachelor's

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and doctor's degrees held by these scientists.[15] At the other end of the scale, the Pacific region accounted for the fewest bachelor's degrees and the Mountain-Plains States for the fewest Ph. D.'s, measured in absolute numbers. But when regional population was taken into consideration, it was the South which ranked lowest with respect to both baccalaureates and doctorates.

The concentration of graduate training in a limited number of educational institutions is reflected in the figures on the geographic distribution of the scientists' degrees. A much higher proportion of the doctorates than of the baccalaureates awarded were granted in the two leading regions of education. Fifty-four percent of all the bachelor's degrees but 69 percent of the doctorates were awarded in the Middle Atlantic and the North Central States. At the same time the South and the Mountain-Plains States contributed a much lower proportion of the doctorates (8 percent) than of the baccalaureates (25 percent).

The regional distribution of the schools granting baccalaureates and doctorates to the scientists in the survey was compared with the national distribution of these degrees. In each region, the proportion of doctorates granted the scientists between 1930 and 1940 conformed closely to the proportion of all doctor's degrees awarded in this period.[16] But the bachelor's degrees received by the scientists in the 1930's were more narrowly concentrated, on a regional basis, than those granted to all American college graduates. Only 13 percent of the scientists were awarded baccalaureates in the South (between 1931 and 1940) as opposed to 20 percent of all male college graduates (between 1931–32 and 1941–42).[17] All the other regions accounted for a higher proportion of scientists in the survey than of all male college graduates.

There were of course distinct differences among the areas within each region in the number of degrees awarded. These are best seen in the accompanying maps (chart 3), which show the number of baccalaureates and doctorates awarded these scientists in each area per 100,000 inhabitants (as of 1940).

As chart 3 shows, both northern and southern New England exceeded all the other areas in the ratio of bachelor's degrees granted these scientists to population, but the Massachusetts-Rhode Island-Connecticut area far surpassed Maine-Vermont-New Hampshire in this regard. The Arizona-New Mexico area was much below the rest of the Mountain-Plains region in the ratio of baccalaureates to population. The New York-New Jersey-Pennsylvania area had considerably fewer degrees per 100,000 people than the Maryland-Delaware-District of Columbia area. Within the North Central region, the western States surpassed those to the east.

Three areas with extensive facilities for graduate training stood out as markedly high in the number of doctorate degrees granted these scientists per 100,000 inhabitants. These were southern New England, the Maryland-Delaware-District of Columbia area, and the Minnesota-Iowa-Wisconsin area. California was fourth, with a considerably higher ratio than the northern Middle Atlantic States (table 12).

The regional distribution of doctoral degrees for the various specialties[18] follows the over-all regional pattern of doctorates to a surprising degree. The most striking exception is in agriculture, with two regions, the North Central and Middle Atlantic, accounting between them for 82 percent of the Ph. D.'s in this field, in comparison with 64 percent of all the doctorates. In no other field of specialization is there such marked departure from the over-all regional distribution of doctoral degrees, but some variation is found in most fields (as shown in table 13). By comparison with the proportion of doctorates in all specialties granted in the given region, New England was relatively high in the earth sciences, the South in mathematics, and the Pacific region in physics and electronics. On the same basis of comparison, the North Central States produced relatively few physicists and electronic scientists and specialists in medicine, and the Middle Atlantic region relatively few earth scientists.

[15] The population data used in the text and maps are from the 1940 Census. The figures on baccalaureates given in this section of the report cover all the scientists, including those with higher degrees.

[16] Hollis, E. V., "Toward Improving Ph. D. Programs," pp. 39, 43, 44, 45, American Council on Education, Washington, D. C., 1945. Mr. Hollis' figures are based on the academic year; the present study uses the calendar year.

[17] These data are taken from the U. S. Office of Education's biennial surveys of education.

[18] As noted above, these specialties are employment specialties and not necessarily graduate majors. These fields of specialization, however, appear to be sufficiently closely related to the studies of the Ph. D.'s to permit broad comparisons.

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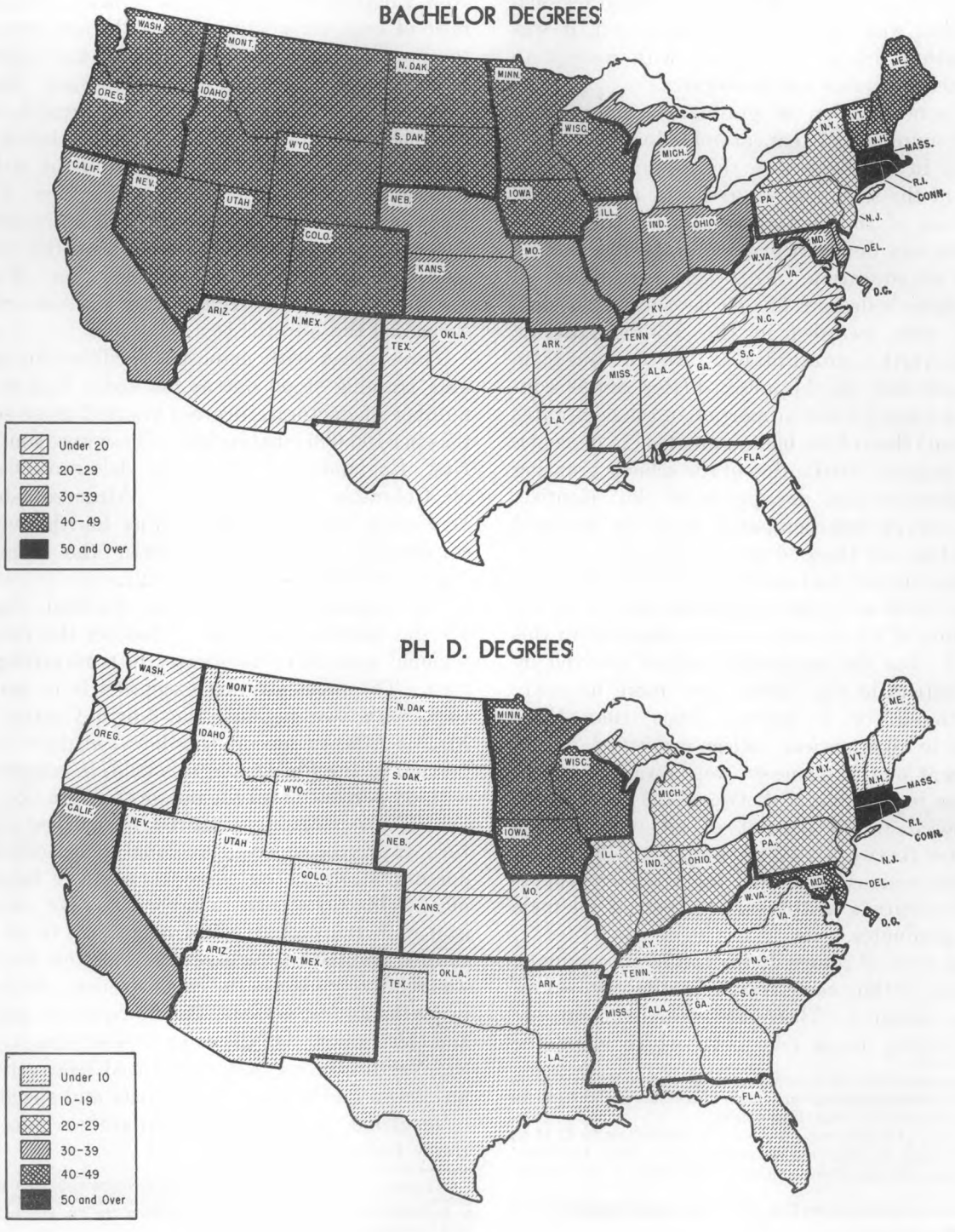
Chart 3. Southern New England Led in Number of Degrees Granted Scientists per 100,000 Population, 1940



UNITED STATES DEPARTMENT OF LABOR
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TABLE 12.—*Percent of scientists who received bachelor's and doctor's degrees in each area, and the number of degrees awarded per 100,000 population, 1948*

Area where degree was awarded	Bachelor		Ph. D.	
	Percent	Number per 100,000 population [1]	Percent	Number per 100,000 population
All areas	100.0		100.0	
New England	12.5	56	13.8	41
Maine, New Hampshire, Vermont	2.1	48	(2)	1
Massachusetts, Rhode Island, Connecticut	10.4	58	13.8	51
Middle Atlantic	21.8	27	28.7	23
New York, New Jersey, Pennsylvania	19.1	26	23.4	21
Maryland, Delaware, District of Columbia	2.7	37	5.3	48
South	12.2	12	4.5	3
Virginia, West Virginia, Kentucky, North Carolina, Tennessee	5.3	14	2.9	5
South Carolina, Georgia, Alabama, Mississippi	2.6	10	(2)	(3)
Florida	.5	9	.2	2
Arkansas, Louisiana, Oklahoma, Texas	3.8	11	1.4	3
North Central	32.3	38	40.3	31
Ohio, Indiana, Illinois, Michigan	22.5	36	25.0	26
Minnesota, Iowa, Wisconsin	9.8	44	15.3	45
Mountain and Plains	12.1	37	3.3	7
Nebraska, Kansas, Missouri	6.5	36	2.7	10
North Dakota, South Dakota, Montana, Idaho, Wyoming, Colorado, Utah, Nevada	5.1	43	.5	3
Arizona, New Mexico	.5	18	.1	2
Pacific	9.1	35	9.4	24
Washington, Oregon	3.1	42	1.1	10
California	6.0	33	8.3	30

[1] 1940 population data were used in computing these ratios.
[2] Less than 0.05 percent.
[3] Less than 1 academic degree per 100,000 inhabitants.

Within each region, there were distinct differences among areas in the proportion of degrees awarded the various specialists. Thus, all the earth scientists who studied in New England received their doctorates in either Massachusetts, Rhode Island, or Connecticut. Virginia, West Virginia, Kentucky, North Carolina, and Tennessee produced most of the South's mathematicians. Thirty-two percent of all the agriculturists with Ph. D.'s came from schools in Iowa, Wisconsin, or Minnesota, and 27 percent from New York, New Jersey, or Pennsylvania. California educated most of the specialists in physics and electronics who received their doctorates on the West Coast. (See table 13.)

Regional Trends in Education

The baccalaureates and doctorates awarded these scientists were for the most part recent degrees. Because death and retirement had thinned the ranks of the older men, the figures on the proportion of degrees granted in the various periods suggest a greater increase in the number of degrees granted to scientists in recent years than actually occurred. It can be assumed, however, that the higher death and retirement rates among the older men applied equally to all regions, and did not therefore affect the trends in the regional distribution of degrees.

Although the absolute number of bachelor's degrees awarded increased in each region throughout the entire period, not all the regions shared

TABLE 13.—*Percent of scientists by general field of specialization and by area in which Ph. D. degree was received, 1948*

Area of Ph. D. degree	Chemistry	Engineering	Physics and electronics	Earth sciences	Agriculture	Biology	Medicine	Fields related to medicine	Mathematics and statistics	Psychology	Other
New England	11.7	18.5	17.0	21.0	4.6	10.4	17.2	13.9	16.7	16.1	20.1
Maine, New Hampshire, Vermont	(1)	.2			.1	(1)	1.6			.1	(1)
Massachusetts, Rhode Island, Connecticut	11.7	18.3	17.0	21.0	4.5	10.4	15.6	13.9	16.7	16.0	20.1
Middle Atlantic	28.8	26.9	28.6	25.3	31.0	28.1	36.6	29.1	27.0	32.3	29.9
New York, New Jersey, Pennsylvania	23.0	22.1	23.2	18.8	26.7	22.4	26.4	24.1	21.9	29.7	25.3
Maryland, Delaware, District of Columbia	5.8	4.8	5.4	6.5	4.3	5.7	10.2	5.0	5.1	2.6	4.6
South	4.8	3.7	4.5	2.8	2.1	5.0	3.8	4.3	7.5	4.9	2.9
Virginia, West Virginia, Kentucky, North Carolina, Tennessee	3.3	1.1	3.1	1.3	1.5	3.0	2.8	2.2	4.6	4.1	1.8
South Carolina, Georgia, Alabama, Mississippi	(1)				.2	.1	.5				
Florida	.2	.1			.2	.2		.7			(1)
Arkansas, Louisiana, Oklahoma, Texas	1.3	2.5	1.4	1.5	.2	1.7	.5	1.4	2.9	.8	1.1
North Central	43.4	38.6	33.7	34.5	50.8	41.9	31.7	39.4	39.0	37.5	33.7
Ohio, Indiana, Illinois, Michigan	28.6	24.1	24.2	23.2	18.9	23.2	22.0	23.6	29.6	22.2	21.0
Minnesota, Iowa, Wisconsin	14.8	14.5	9.5	11.3	31.9	18.7	9.7	15.8	9.4	15.3	12.7
Mountain and Plains	3.4	1.4	2.1	4.0	5.6	4.4	3.2	5.1	2.3	2.2	2.3
Nebraska, Kansas, Missouri	2.6	.5	1.7	2.4	5.4	4.0	2.1	4.3	2.0	1.9	1.7
North Dakota, South Dakota, Montana, Idaho, Wyoming, Colorado, Utah, Nevada	.8	.9	.4	.9		.3	1.1	.8	.3	.2	.4
Arizona, New Mexico	(1)			.7	.2	.1				.1	.2
Pacific	7.9	10.9	14.1	12.4	5.9	10.2	7.5	8.2	7.5	7.0	11.1
Washington, Oregon	1.2	1.2	1.0	.9	1.5	1.5	1.6	1.2	.7	.2	.4
California	6.7	9.7	13.1	11.5	4.4	8.7	5.9	7.0	6.8	6.8	10.7
Percent total United States	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number total United States [2]	7,872	1,533	2,253	1,274	1,330	4,296	186	1,205	1,500	1,451	1,890

[1] Less than 0.05 percent.
[2] Excludes 1,218 scientists not reporting the university from which they had received their Ph. D. degree.

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equally in the upward movement.[19] As chart 4 shows, the proportion of baccalaureates granted in New England declined steadily from the early 1900's until 1936–40,[20] and the percent granted in the North Central and Mountain-Plains regions remained almost stable throughout. In all other regions, the proportion of baccalaureates granted was higher in the 1936–40 period than had been the case before 1905. The gain was most marked in the Pacific region, where the proportion of baccalaureates granted doubled between 1901–05 and 1926–30.

The most striking fact about the regional trends in Ph. D. degrees is the sharp break which occurred during the 1920's in the proportion of degrees granted in the three leading regions. From 1900 to 1919, about 60 percent of the doctorates awarded these scientists were granted in New England and the Middle Atlantic States.[21] At no time in the subsequent three decades did the figure exceed 45 percent. The proportion of doctorates awarded in the North Central States doubled between the periods 1900–1909 and 1920–29, but remained almost constant thereafter. As chart 4 shows, however, there was no such sharp break during the 1920's in the trend of degrees in the other regions. The South declined in importance as a source of doctorates in science from the period 1900–1909 to the period 1910–19 and rose again thereafter—to a pronounced extent during the 1930's. The curve for the Pacific region rises quickly until 1920–29 and levels out thereafter, in the same way as the bachelor's degree curve for that region. The proportion of Ph. D. degrees granted in the Mountain and Plains region changed but slightly during the entire half-century.

[19] The date of bachelor's degree was calculated from the date of birth, on the assumption that the average college graduate earns his baccalaureate in his twenty-second year. The average age of degree award is lower for some colleges, even for some States, than others, but these differences tend to cancel in broad regions such as those discussed here.

[20] These data are not shown for the period after 1940 because so few of these scientists earned their degrees after this year that regional comparisons do not appear warranted.

[21] The percentage of doctorates granted in each area by decades between 1900 and 1950 is shown in table G, p. 41. As can be seen in the table, these regional trends are not always followed in all the areas within each region.

Employment

As well-established members of their professions, mostly in their forties or older, most of the scientists in the survey have a long record of employment. This chapter begins with a brief consideration of two aspects of their employment history—the number of years of experience in their fields of greatest competence and the functions performed in these fields. The relative numbers of scientists working for educational institutions, private industry, government, and other types of employers at the time of the survey are then discussed in greater detail, in relation to field of specialization, highest degree held, and age. The concluding section of the chapter deals with the regions of the country in which the scientists were employed.

Experience in Field of Greatest Competence

Most scientists in this survey had spent the greater parts of their working lives in employment which they regarded as their field of highest competence. They were 43 years of age, on an average, and had a median of 15 years' experience in their first specialty. (See table 14.)

TABLE 14.—*Median years of experience and median age of all scientists by highest degree earned, and by general field of specialization, 1948*

Field of specialization	All scientists [1]		Ph. D.		Master		Bachelor or none	
	Median years of experience	Median age	Median years of experience	Median age	Median years of experience	Median age	Median years of experience	Median age
All fields [2]	15	43	14	42	17	45	16	44
Chemistry	12	39	12	39	13	40	13	40
Engineering	16	44	13	41	19	47	18	45
Physics and electronics	12	40	13	41	12	40	9	35
Earth sciences	16	44	17	44	13	41	15	43
Agriculture	22	48	20	45	24	51	26	54
Biology	17	44	16	43	19	46	23	49
Medicine	21	50	15	47	19	49	23	50
Fields related to medicine	16	44	14	42	19	45	18	44
Mathematics and statistics	18	44	17	44	23	50	15	46
Psychology	15	44	15	44	12	42	[3]	[3]

[1] Including the relatively small number with degrees other than those specified and those not reporting level of education.
[2] Including fields other than those specified.
[3] Insufficient reports to compute median.

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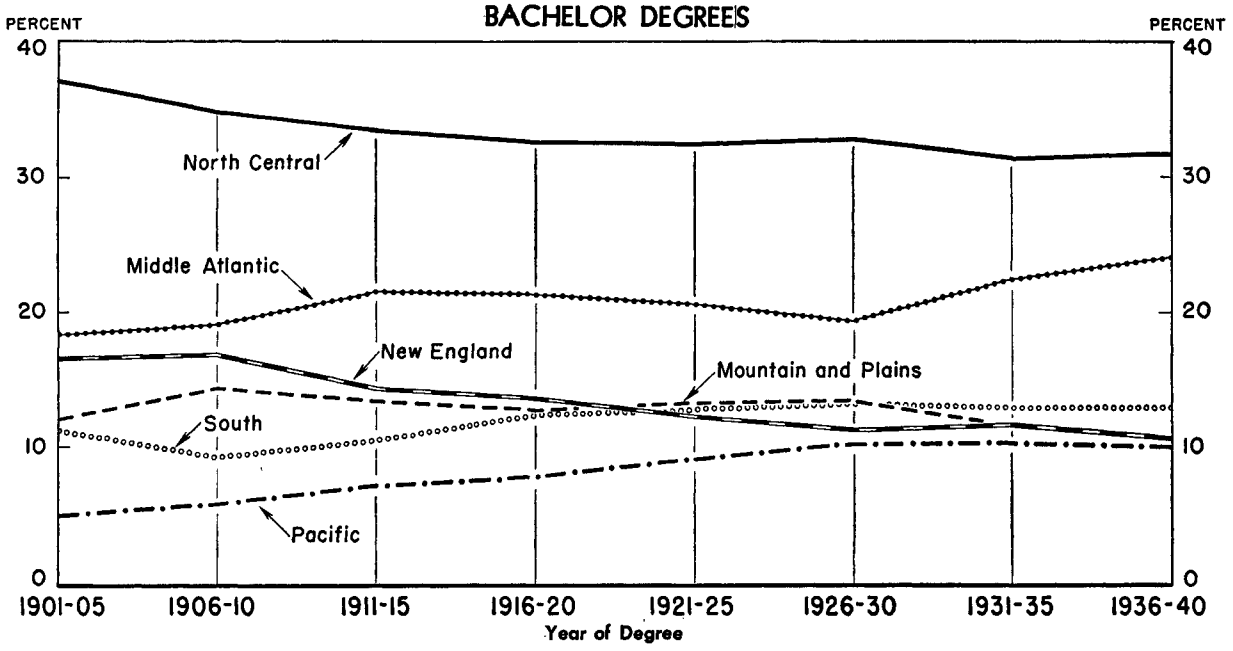
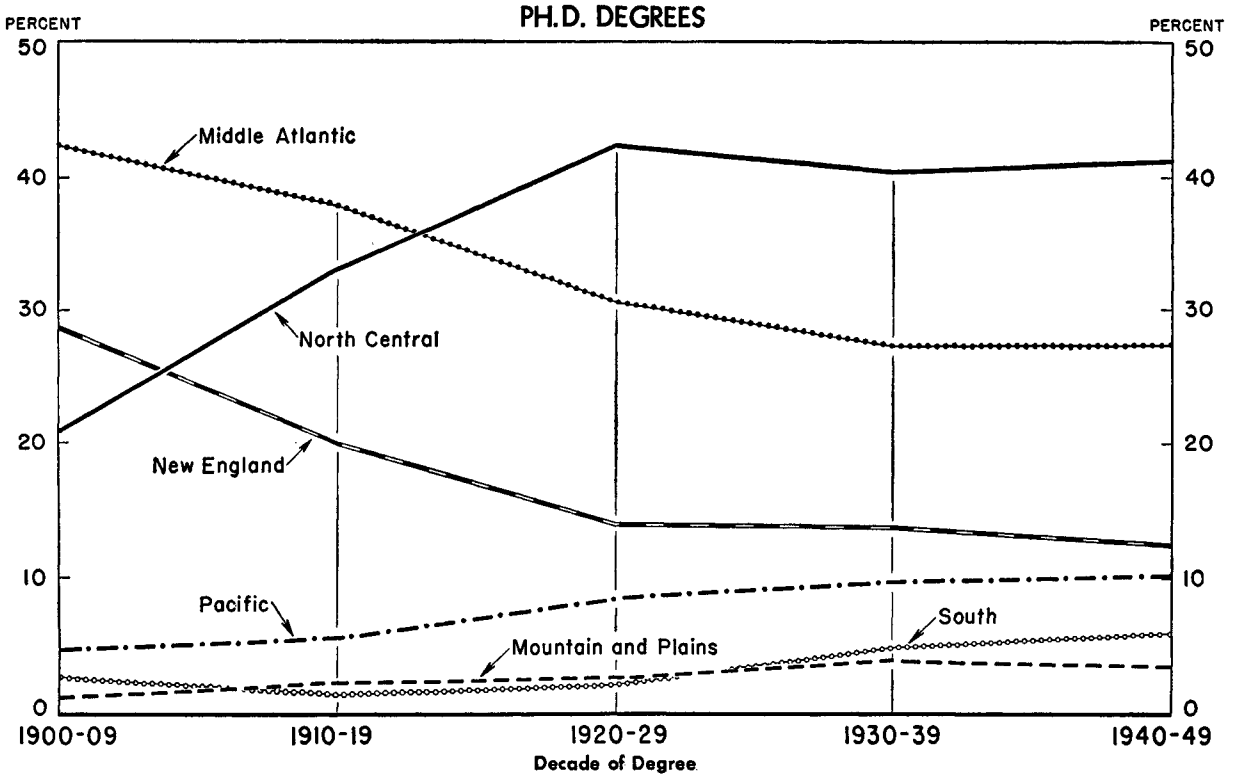
Chart 4. North Central Region Led in Granting of Degrees to Scientists

PERCENT OF DEGREES GRANTED IN EACH REGION





UNITED STATES DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS

Sources: Appendix Tables F and G

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The number of years the scientists had been employed in their first specialties depended mainly on their age. The Ph. D.'s were, on the average, 2 years younger than the scientists with no graduate degree, and also had 2 years less experience. The scientists without graduate degrees were, on the average, 1 year younger in both age and experience than the master's degree group.

An analysis of the different specialties indicates the same age-employment relationship. The chemists and the physicists and electronic scientists—the groups with the lowest median ages—were also those having the shortest experience in their first specialties. At the other end of the scale, the agricultural and medical scientists as a whole could claim to be both the oldest and the most experienced groups.

It should be noted that the data on the scientists' experience are approximations. For technical reasons, the figures for some individuals may understate their experience in their first specialties to a moderate extent.[22] On the other hand, it is probable that many scientists reported all employment bearing even remotely on their fields of highest competence as time spent in that field. Despite these inaccuracies, which tend to offset each other, the data afford ample evidence of the long experience which most scientists in the survey had in their chosen fields. Further, the length of their experience was a function primarily of their age.

Function Performed in Field of Greatest Competence

The great variety of functions which scientists perform have been grouped in the present survey into six broad categories: teaching; research; production; administration; design, development, and testing (the last three treated as a single category and hereafter referred to as "development"); and "other."[23] Each scientist filling out a questionnaire was asked to indicate which of these functions he had performed in his field of greatest competence,[24] during the course of his professional career. If an individual had been engaged in two or more activities, he was classified according to the particular combination of functions reported.

About one out of four scientists reported only one function in his field of highest competence. Most often this single function was research (table 15). Thirteen percent of all the surveyed scientists had been engaged exclusively in research, compared with 6 percent who reported only teaching. Still fewer scientists had experience in one of the other single functions.

About half the scientists reported experience both in research and in some other activity in their first specialties. The most frequent combination was research and teaching, which was reported by about a fifth of the scientists. The next largest group, comprising 1 out of every 10 scientists, reported these 2 functions plus administration. A small number of scientists reported experience in all five types of activities for which separate information was obtained and also in one or more functions in the "other" category.

In some instances, the scientists were performing two or more functions concurrently. In others, their experience in different activities related wholly or partly to different periods of employment. Statistical information is not available concerning the extent to which these functions were performed at different times or the amount of time the scientists spent in each activity reported. It appears, however, that as a group the scientists in the survey were characterized by considerable flexibility of function and by considerable movement from one type of activity to another.

Whatever the highest degree earned, the surveyed scientists were primarily research scientists. But the relative numbers listing research and other activities varied somewhat according to the academic degree held (as shown in table 15). For example, the proportion of scientists reporting a

[22] In filling out the questionnaires, a considerable number of respondents failed to report total experience in their fields of highest competence and merely indicated the number of years they had been engaged in performing each of two or more different functions. In such cases, the highest number of years reported for any function was coded as also representing total years of experience in the field because it was important for roster purposes to have estimates of total experience for as many scientists as possible. This procedure yielded fairly accurate results in a majority of cases. However, it is likely that in some instances, where the scientist's experience in different functions was not all concurrent, this method of estimating led to an understatement of the respondent's total experience in the given specialty.

[23] Writing, editing, field work, and exploration are some of the functions included in the "other" category.

[24] In addition to functions performed in his field of highest competence a scientist may have engaged in other activities in connection with some other field of specialization. This experience may, or may not, have been concurrent with experience in his field of highest competence. The questionnaire asked the scientists to report also functions performed in their second, third, fourth, and fifth fields of specialization, but these data are not included in this report.

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TABLE 15.—*Number and percent of scientists reporting specified functions, by highest degree earned* [1]

Function	Total [2]		Ph. D.		Master		Bachelor or none	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total reporting	[3] 41,668	100.0	25,978	100.0	6,370	100.0	4,792	100.0
Only one function reported	9,613	23.1	5,978	23.0	1,677	26.3	1,150	24.0
Research	5,257	12.6	3,647	14.1	753	11.8	569	11.9
Teaching	2,658	6.4	1,712	6.6	578	9.1	96	2.0
Administration	711	1.7	318	1.2	138	2.1	174	3.6
Development	349	.9	101	.4	95	1.5	147	3.1
Production	95	.2	34	.1	19	.3	32	.7
Other	543	1.3	166	.6	94	1.5	132	2.7
Combination of functions reported	32,055	76.9	20,000	77.0	4,693	73.7	3,642	76.0
Research and teaching	8,079	19.4	6,344	24.4	556	8.7	134	2.8
Research, teaching, and administration	3,925	9.4	2,608	10.1	363	5.7	100	2.1
Research and administration	1,935	4.6	1,186	4.6	306	4.8	431	7.1
Research and development	1,631	3.9	790	3.0	347	5.4	471	9.8
Teaching and administration	1,180	2.8	647	2.5	289	4.5	63	1.3
Research, development, and administration	1,123	2.7	540	2.1	252	4.0	311	6.5
Research, teaching, administration, and development	1,043	2.5	728	2.8	183	2.9	84	1.8
Research, development, and teaching	982	2.4	709	2.7	190	3.0	53	1.1
Research, development, production, and administration	884	2.1	398	1.5	177	2.8	302	6.3
Research, teaching, administration, development, and production	827	2.0	543	2.1	159	2.5	97	2.0
Other combinations [4]	10,446	25.1	5,507	21.2	1,871	29.4	1,686	35.2

[1] Information reported in 1948, but applies also to other years.
[2] Includes scientists holding degrees other than those specified and a few not reporting level of education.
[3] Excludes 69 scientists not reporting functions.
[4] Includes a great number of different combinations any of which was reported by less than 2 percent of the respondents.

combination of research and teaching experience or these two activities plus administration was much higher among the Ph. D.'s than among persons with only a master's or bachelor's degree. Noticeable also is the small proportion of scientists without graduate degrees who had engaged in teaching, and the relatively large proportion who reported experience in development or production.

The relative numbers of scientists not reporting a given function differed widely by field of specialization. For example, in some fields, notably chemistry, an especially high proportion of the scientists had been engaged in research. (See table H, p. 42.) Development and production bulked much larger in the employment history of the engineers than in that of any other group of specialists. In the general field of mathematics and statistics, most of the scientists had been engaged exclusively in teaching or had combined teaching with research.[25] In several specialties, particularly the earth sciences, a high proportion of the scientists were classified in the "other combinations" category. About half of the specialists in the earth sciences reported functions other than those listed in the questionnaire, generally in combination with research and other activities. No doubt many of these scientists were engaged in field work or exploration.

[25] This was particularly true in the specific field of mathematics. Employment by educational institutions was reported by a higher proportion of mathematicians than statisticians.

Type of Employer

Education was by far the most important field of employment for the scientists included in the survey. (See chart 5.) Private industry was second and government third, both for the entire group of scientists and for the members of most specialties. The major exceptions were the chemists and engineers, who were employed mainly in private industry, and the medical scientists, many of whom were physicians engaged in private practice.

Table 16 shows the relative numbers of scientists in each general field of specialization who were working for the various types of employers at the time of completing the questionnaires (usually in mid-1948).[26] Thirty-seven percent of the scientists were employed solely by colleges or universities,[27] and an additional 13 percent combined work for educational institutions with self-employment, as independent consultants, or with work for other types of employers. No statistical information is available as to how those scientists divided their time between activities. General information in the questionnaires indicates that most of them devoted the major portions of their time to their educational work, although some held full-time jobs with the government or private industry and did part-time teaching.

[26] See p. 20.
[27] The term "college or university" is used in this report to cover all types of educational institutions.

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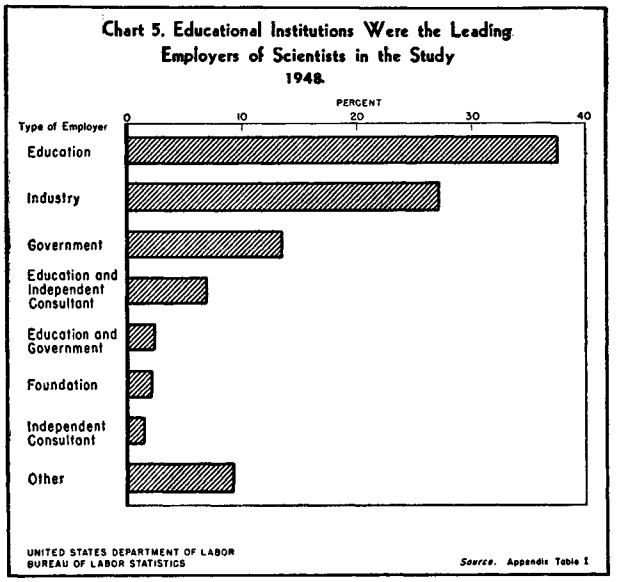

The proportion of scientists working exclusively for private industry was 27 percent, markedly smaller than the group employed solely by educational institutions. Smaller still were the groups reporting other types of employers. Only 14 percent of the scientists were employed solely by government agencies (most of them by the Federal Government). About 2 percent were employed exclusively by nonprofit foundations, and still fewer were wholly self-employed as independent consultants. The group reporting two or more types of employers other than colleges or universities was only slightly larger, about 4 percent.

TABLE 16.—*Percent of scientists employed by each type of employer, for each general field of specialization, 1948*

Field of specialization	Number of scientists reporting	Percent of scientists employed by—				
		All types of employers	Educational institutions [2]	Private industry [2]	Government [2]	Other types of employers, combinations of types or self-employed
All fields	[1] 41,733	100	37.4	27.1	13.5	22.0
Chemistry	10,625	100	27.7	50.1	8.9	13.3
Engineering	4,906	100	18.3	43.8	12.0	25.9
Physics and electronics	3,439	100	43.3	26.7	12.7	17.3
Earth sciences	2,089	100	30.0	16.3	26.6	27.1
Agriculture	2,427	100	45.1	7.9	29.4	17.6
Biology	5,818	100	53.7	9.3	20.8	16.2
Medicine	2,857	100	22.6	7.3	7.5	62.6
Fields related to medicine	2,663	100	57.2	11.9	7.9	23.0
Mathematics and statistics	1,929	100	73.4	6.0	8.1	12.5
Psychology	1,589	100	54.4	4.6	6.4	34.6

[1] Total includes 3,391 scientists in fields other than those listed; excludes 4 not reporting type of employer.
[2] This category includes only scientists employed exclusively by the specified type of employer. All those reporting more than one type of employer or self-employment in addition to a salaried position are included in the "other" category.

More than half the scientists were working solely for colleges and universities in four general fields (mathematics and statistics, fields related to medicine, psychology, and biology). There were, however, wide variations among the specific specialties within these general fields (shown in table I, p. 42). Thus, 80 percent of the mathematicians but only 30 percent of the statisticians reported educational employment only. In biology, the proportion employed exclusively by colleges or universities ranged from 70 percent among zoologists down to 36 percent among entomologists. In the fields related to medicine, the range was from 84 percent for anatomists down to 28 percent for pathologists, many of whom were working in hospitals. [28]

The general fields with the lowest proportions employed by educational institutions were engineering, medicine, chemistry, and the earth sciences (except geography). Only 18 percent of the engineers reported themselves as working exclusively for educational institutions, but even this relatively low percentage was much higher than the proportion of all engineers in the country engaged in education, as determined by the Bureau in a 1946 survey.[29] In chemistry, likewise, the proportion of surveyed scientists employed by educational institutions (28 percent) was much greater than the corresponding figure for all members of the profession—only 7 percent in 1943.[30]

The fact that engineers and chemists are widely employed in private industry explains the small proportion of these scientists working for educational institutions. Fifty percent of the chemists and 44 percent of the engineers among those surveyed were employed exclusively by business organizations. In chemistry, there was one specific field (biochemistry) in which a larger proportion of the scientists were working for educational institutions than for private industry, but the reverse was true in every other specific field of chemistry. In engineering, six of the nine

[28] A comparison of these proportions of scientists employed in colleges and universities with the proportions of Ph. D.'s in each of these specialties shows a close relationship. For example, the relative number of Ph. D's was considerably higher in zoology than in entomology.
[29] U. S. Department of Labor, Bureau of Labor Statistics, Employment Outlook for Engineers, Bull. No. 968 (p. 105, table D-9), 1949.
[30] U. S. Department of Labor, Bureau of Labor Statistics, Factors Affecting Earnings in Chemistry and Chemical Engineering, Bull. No. 881 (p. 8, table 3), 1946.

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specific fields had a larger proportion of scientists working for private industry than for any other type of employer. However, in aeronautical and ordnance engineering, the largest numbers were employed by government agencies; in civil engineering, the largest group was with educational institutions and the second largest with government agencies.

There are two other fields—electronics and metallurgy, both primarily applied sciences—in which private industry was the major employer of the surveyed scientists. Still other deviations from the general rule that educational institutions constitute the major field of employment for the scientists in this study were found in the earth sciences. In meteorology, by far the largest group was on the staff of a government agency, the United States Weather Bureau. In geophysics, government employees slightly outnumbered the scientists with private industry. Among geologists also, government employees were the largest group, but in this specialty the scientists with colleges and universities were nearly as numerous. In the field of medicine, the majority of scientists fell in the residual category "other type of employer," primarily because the large number of M. D.'s in private practice were included in this group.

Level of Education and Type of Employer

The emphasis on a doctoral degree as a prerequisite for a college teaching position is reflected in this study. The Ph. D. degree was held by about three-fourths of the scientists employed exclusively by educational institutions and by the same proportions of those who did both educational and independent consulting work.[31] In private industry, on the other hand, only about three-fifths of the scientists had Ph. D.'s. The relative number was still lower (about half) among the government employees and the smaller groups working for nonprofit foundations or wholly self-employed as independent consultants. Among scientists who held positions with both educational institutions and government agencies, the proportion of Ph. D.'s was about two-thirds, between the figures for the scientists working only for one or the other of these two types of employers. (See table 17.)

Scientists working for still other types of employers or other combinations of types were the group with the lowest proportion of Ph. D.'s (only about a third), because the M. D.'s in private practice were classified in this category. More than half of the scientists in the group held M. D. degrees, though the proportion of M. D.'s was small among the scientists working for each of the other specified types of employers.

Scientists with only a master's degree comprised a small minority of those surveyed who were employed with every type of employer. The proportion they represented was largest (23 percent) among the government employees and smallest (14 percent) among the scientists on educational staffs. In terms of the absolute numbers of persons employed, however, educational institutions represented the largest field of activity for the scientists with master's degrees, as well as for the Ph. D.'s.

The largest field of employment for the scientists with no graduate degree was private industry. Almost half of the surveyed scientists at this educational level were employed exclusively by business organizations, whereas only about one out of four was working for government agencies alone and only one out of eight for educational institutions. The rarity with which scientists without

[31] The distribution of Ph. D. scientists by type of employer and general field of specialization is shown in table L, p. 44.

TABLE 17.—*Number and percent of scientists by type of employer and highest degree earned, 1948*

Type of employer	Total reporting		Ph. D.		M. D.		Master		Bachelor or none	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All fields	[1] 41,655	100.0	26,005	62.4	4,460	10.7	6,383	15.3	4,807	11.6
Educational institution	15,586	100.0	11,493	73.7	1,358	8.7	2,116	13.6	619	4.0
Private industry	11,282	100.0	6,904	61.2	390	3.4	1,745	15.5	2,243	19.9
Government	5,631	100.0	2,829	50.3	385	6.8	1,289	22.9	1,128	20.0
Foundation	912	100.0	462	50.7	97	10.6	134	14.7	219	24.0
Independent consultant (self-employed)	579	100.0	282	48.7	18	3.1	126	21.8	153	26.4
Educational institution and independent consultant	2,821	100.0	2,034	72.1	92	3.3	554	19.6	141	5.0
Educational institution and government	996	100.0	650	65.2	148	14.9	146	14.7	52	5.2
Other and other combinations	3,848	100.0	1,351	35.1	1,972	51.2	273	7.1	252	6.6

[1] Excludes 15 scientists reporting other degrees and 67 scientists not reporting type of employer or level of education.

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graduate degrees were employed in colleges and universities is further emphasized by another comparison: such persons represented only 4 percent of the members of educational staffs in the survey, compared with about 20 percent of the employees of private industry and of government.

The predominance of Ph. D.'s on college and university staffs is matched by the data for the different specialties. In all but two of the general fields of specialization, the proportion of persons in the survey holding the Ph. D. degree was higher in colleges than in government or industry. In agriculture, however, the possession of a Ph. D. was reported by a slightly higher proportion of the small group of scientists in industry than of the larger numbers in colleges and universities. In the field of medicine, the Ph. D. degree was more common in government than in educational institutions; however, if the Ph. D.'s had been combined with the M. D.'s, the proportion of doctors would have been higher in colleges than in government agencies. Detailed figures on level of education, by specialty and type of employer, may be found in table J, page 43.

Age of Scientists and Type of Employer

A comparison of the age distributions of scientists working for different types of employers shows wide differences. Those scientists employed exclusively by private industry and the much smaller number working only for nonprofit foundations tended to be the youngest groups, both having a median age of 39 years (as indicated in table 18). In comparison, the median age of scientists who worked for educational institutions, exclusively or in combination with self-employment as a consultant, and for those whose only employment was with the government was 44 years.

TABLE 18.—*Median age by type of employer and highest degree earned, 1948*

Type of employer	All scientists	Ph. D.	Master	Bachelor or none
Total	43	42	45	44
Educational institution	44	43	48	45
Private industry	39	38	40	42
Government	44	43	44	45
Foundation	39	40	38	34
Independent consultant (self-employed)	57	53	60	62
Educational institution and independent consultant	44	42	49	50
Educational institution and government	46	44	52	53
Other and other combinations	47	42	46	48

Persons who had positions with two or more types of employers were somewhat older than those working for only one type. Thus, the group holding both government and educational posts had a median age of 46 years, 2 years higher than the median figure for scientists with one or the other of these kinds of positions.

Oldest of all were the small group of scientists engaged exclusively in independent consulting work. Their median age was 57 years. These self-employed scientists apparently fell into two main categories: well-known men who had been able to establish full-time consulting services, and scientists past normal retirement age who were no longer working full time but continued to do some consulting work. Nearly a third of the scientists who reported this type of work only were 65 years of age or over.

The finding that the scientists in private industry tended to be younger than those with the two other major types of employers—government agencies and educational institutions—held true for the Ph. D.'s, those with master's degrees, and those without a graduate degree. It also held true in most of the general fields of specialization, both for scientists at all levels of education taken together and for the Ph. D.'s alone (as shown in table K, p. 44). The relative youth of most scientists in private industry as compared with those employed in government and education is treated again in the concluding chapter.[32]

The data in table K illustrate two points made earlier—the heterogeneity of the scientists in the survey who do not have a graduate degree and the comparative homogeneity of the Ph. D. group. Among Ph. D. scientists employed in educational institutions, for example, the range in median ages was only 8 years. The corresponding range for college and university employees with no graduate degree was 27 years. Oldest were the agriculturists, whose median age was 57 years, and the mathematicians and statisticians, half of whom were 54 or older. In contrast, half of the college and university chemists and physicists with only a baccalaureate were under 30. Comments on the questionnaires indicated that many of the young scientists without graduate degrees were continuing their graduate education, expecting ultimately to obtain Ph. D.'s.

[32] See p. 31.

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Region of Employment

That section of the country in which the greatest number of surveyed scientists was employed stretches from Illinois on the west to New York on the east, extending southward along the eastern seaboard to include Delaware and the District of Columbia. (See chart 6.) More than half the scientists were employed in the nine States of this area and the District of Columbia, at the time of the survey. The next largest groups were employed in California and southern New England, as table 19 shows.

These leading areas of employment were also the areas awarding the greatest number of Ph. D. degrees to these scientists. The proportion of scientists who had received their doctorates in the northern Middle Atlantic States and the eastern North Central States taken together was about the same as the proportion employed there at the time of the survey (roughly 45 percent). For the most part, also, the areas which employed the smallest numbers of these scientists—that is, the South, northern New England, the Mountain-Plains States, and the northern Pacific area—likewise accounted for the smallest proportions of Ph. D. degrees. Fewer than 1 percent of the scientists were employed outside continental United States.

Chart 7 shows the number of scientists in each area of continental United States per 1 million individuals in the labor force as of April 1, 1947. As the chart indicates, Maryland-Delaware-District of Columbia, southern New England, and Arizona-New Mexico were outstanding in this respect.

Region and Type of Employer

How the scientists in each region were distributed among the different types of employers is shown in table 20. Marked divergences from the Nation-wide pattern of employment already indicated existed in only two of the six regions. The Middle Atlantic States were distinctly above the over-all average in the proportion of scientists in private industry and distinctly below it in the relative number employed in educational institu-

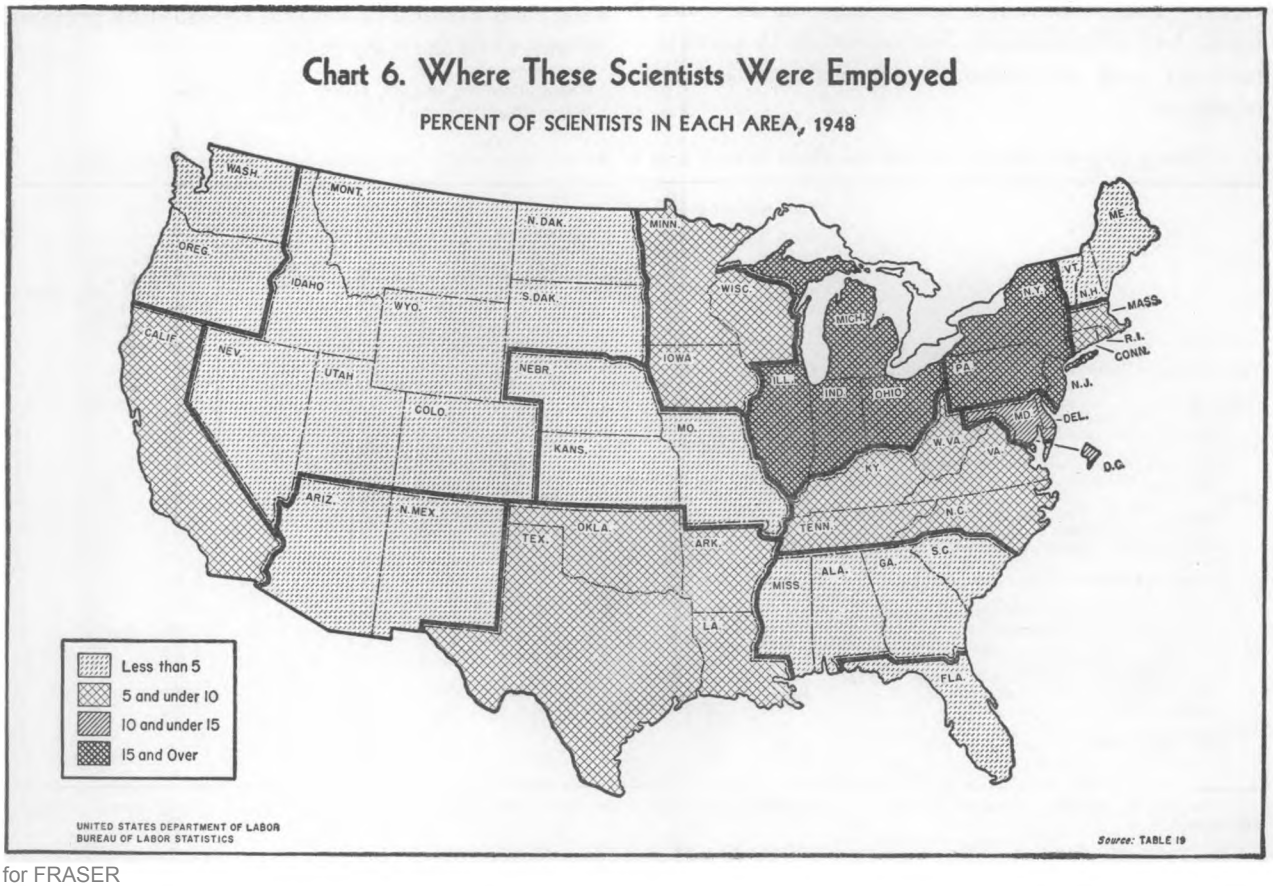

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TABLE 19.—*Number and percent of scientists employed in each area and ratio of scientists to the labor force in the area in 1947*

Area of employment	Number	Percent	Scientists employed per 100,000 in labor force [1]
Total United States	[2] 41,434	100.0	70
New England	3,367	8.1	87
Maine, New Hampshire, Vermont	410	1.0	58
Massachusetts, Rhode Island, Connecticut	2,957	7.1	93
Middle Atlantic	15,410	37.2	108
New York, New Jersey, Pennsylvania	10,980	26.5	86
Maryland, Delaware, District of Columbia	4,430	10.7	312
South	5,828	14.1	37
Virginia, West Virginia, Kentucky, North Carolina, Tennessee	2,290	5.5	42
South Carolina, Georgia, Alabama, Mississippi	1,018	2.5	26
Florida	414	1.0	44
Arkansas, Louisiana, Oklahoma, Texas	2,106	5.1	40
North Central	9,706	23.4	65
Ohio, Indiana, Illinois, Michigan	7,431	17.9	67
Minnesota, Iowa, Wisconsin	2,275	5.5	61
Mountain and Plains	2,937	7.1	58
Nebraska, Kansas, Missouri	1,331	3.2	45
North Dakota, South Dakota, Montana, Idaho, Wyoming, Colorado, Utah, Nevada	1,191	2.9	70
Arizona, New Mexico	415	1.0	99
Pacific	4,186	10.1	76
Washington, Oregon	949	2.3	65
California	3,237	7.8	80

[1] Estimated number in the labor force in each area.
[2] Excludes 5 scientists not reporting region of employment, 79 scientists working in United States territories, and 219 scientists employed in foreign countries.

tions. The Mountain-Plains States, on the other hand, had exceptionally few scientists in private industry and an unusually large proportion in education.

The geographic differences in the relative importance of the various types of employment are seen more clearly when a similar comparison is made for narrower groups of States. New York-New Jersey-Pennsylvania had a preponderance of scientists employed in private industry, 44 percent compared with 27 percent for the entire country. Employment in private industry was also relatively high in the second great industrial area of the country, the east North Central States. On the other hand, in Maryland-Delaware-District of Columbia, there were—quite understandably—twice as many scientists in the Government as in any other area, but a much lower proportion were employed exclusively in education than elsewhere. In several predominantly agrarian areas—northern New England, the deep South,[33] the western States of the North Central region, the Mountain-Plains region, and the northern Pacific States—at least half the scientists were employed in educational institutions. Government employment also was relatively important in Arizona and New Mexico, with installations for work on atomic energy, and in other Rocky Mountain States,[34] with their Federal power and reclamation projects, as well as in the deep South.

[33] South Carolina, Georgia, Alabama, and Mississippi.
[34] Wyoming, Colorado, Utah, and Nevada.

TABLE 20.—*Percent of scientists employed in each area of the continental United States by type of employer, 1948*

Area of employment	Total reporting		Percent of scientists employed by—							
	Number	Percent	Education	Government	Education and Government	Industry	Foundation	Independent consultant	Education and independent consultant	Other
Total all areas: United States	[1] 41,430	100.0	37.4	13.5	2.4	27.1	2.2	1.4	6.8	9.2
New England	3,366	100.0	44.2	4.6	2.9	23.4	1.1	1.6	10.5	11.7
Maine, New Hampshire, Vermont	409	100.0	63.6	5.1	7.1	7.8	2.0	1.2	7.1	6.1
Massachusetts, Rhode Island, Connecticut	2,957	100.0	41.5	4.5	2.3	25.6	.9	1.7	11.0	12.5
Middle Atlantic	15,409	100.0	23.0	19.5	1.5	36.6	2.7	1.5	5.0	10.2
New York, New Jersey, Pennsylvania	10,979	100.0	26.9	5.0	1.2	43.9	3.2	1.8	6.2	11.8
Maryland, Delaware, District of Columbia	4,430	100.0	13.2	55.4	2.2	18.6	1.6	.8	2.0	6.2
South	5,828	100.0	47.1	14.7	3.4	19.1	.8	1.5	6.7	6.7
Virginia, West Virginia, Kentucky, North Carolina, Tennessee	2,290	100.0	48.7	13.4	3.3	20.3	.3	.7	6.2	7.1
South Carolina, Georgia, Alabama, Mississippi	1,018	100.0	51.3	20.4	3.7	9.3	1.3	1.1	6.9	6.0
Florida	414	100.0	47.3	24.6	6.3	9.2	.7	2.2	5.1	4.6
Arkansas, Louisiana, Oklahoma, Texas	2,106	100.0	43.2	11.5	2.8	24.4	1.2	2.5	7.4	7.0
North Central	9,705	100.0	44.3	5.6	2.1	27.0	3.5	.8	7.9	8.8
Ohio, Indiana, Illinois, Michigan	7,430	100.0	40.7	5.3	1.9	30.2	4.2	.9	7.6	9.2
Minnesota, Iowa, Wisconsin	2,275	100.0	55.9	6.5	3.0	16.4	1.0	.7	8.9	7.6
Mountain and Plains	2,936	100.0	54.5	14.5	4.2	9.6	.8	1.3	7.7	7.4
Nebraska, Kansas, Missouri	1,330	100.0	57.7	6.8	3.1	12.8	.9	1.0	7.3	10.4
North Dakota, South Dakota, Montana, Idaho, Wyoming, Colorado, Utah, Nevada	1,191	100.0	51.8	20.2	5.6	6.6	.3	1.4	8.8	5.3
Arizona, New Mexico	415	100.0	52.3	22.4	3.6	8.2	2.4	1.5	6.0	3.6
Pacific	4,186	100.0	43.9	13.5	3.2	18.8	1.0	2.3	7.5	9.8
Washington, Oregon	949	100.0	52.8	13.2	4.2	14.5	.6	1.1	7.2	6.4
California	3,237	100.0	41.3	13.6	2.8	20.1	1.1	2.7	7.6	10.8

[1] Excludes 79 scientists employed in United States territories, 219 working in foreign countries, and 9 not reporting region of employment or type of employer.

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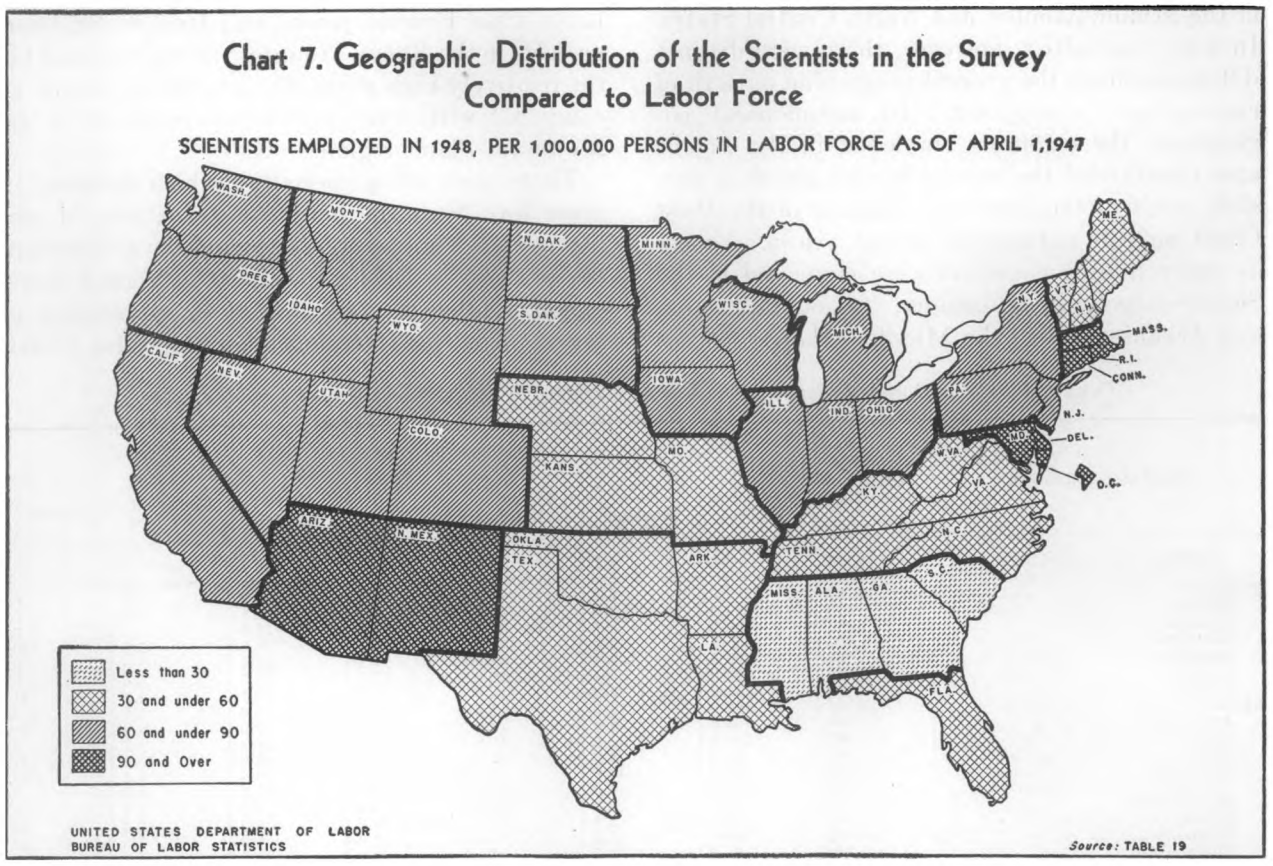

Specialty and Region

In most specialties, the proportion of scientists working in each region followed the general regional pattern of employment. That is, the Middle Atlantic and North Central States were the two leading regions of employment; the South ranked third; and the Pacific, New England, and Mountain States followed in that order. As table 21 shows, the most important exceptions to this general pattern were in biology, agriculture, the earth sciences, and engineering.

The greatest divergence from the over-all regional pattern of employment appears in agriculture. The South employed relatively as many agricultural scientists as the Middle Atlantic States, and twice as large a proportion of these specialists as of the entire group of scientists were working in the Mountain-Plains region. This divergence is largely explained by the fact that private industry employed very few agriculturists, whereas government agencies and colleges and universities employed at least three-quarters of these scientists.

Employment in two fields of biology—general biology and botany, each with an unusually high proportion of scientists in educational institutions—was not concentrated in the two leading regions. Owing to the distribution of employment in these specific specialties, there were almost as many biologists in the South as in the North Central States, and slightly more in the Mountain-Plains region than in New England.

In the earth sciences, the South, rather than the North Central States, ranked second among the regions because it was the leading area of employment for geophysicists and had a larger proportion of the geologists than the North Central States. In meteorology, however, where Federal employment predominated, almost half the scientists were working in the Middle Atlantic region, primarily in the District of Columbia.

As expected, the engineers were generally employed in the industrial sections of the country. A much larger proportion (84 percent) of the metallurgical engineers than that of any other group of specialists covered by the survey were employed

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in the Middle Atlantic and North Central States. In a few specialties, however, there were distinct differences from the general geographic pattern of engineering employment. In aeronautical engineering, the engineers employed in the Pacific area constituted the second largest group, a possible result of the great development of the West Coast aircraft industry in recent years. Almost as many mining engineers were employed in the South—largely in Oklahoma, Texas, Louisiana, and Arkansas—as in the Middle Atlantic States. Large-scale Federal power and land reclamation projects in the Rocky Mountain area accounted for the relatively high proportion of civil engineers, as compared with other scientists, employed in the Mountain-Plains region.

There were other specialties which deviated in some way from the Nation-wide pattern of employment. For example, electronics was more important in New England than in the North Central region. Likewise, about the same number of astronomers were employed on the West Coast,

TABLE 21.—*Percent of scientists employed in each region, by specific field of specialization, 1948*

Field of specialization	Number of scientists reporting	Percent of scientists employed in—						
		Total United States	New England	Middle Atlantic	South	North Central	Mountain and Plains	Pacific
All fields	[1] 41,434	100.0	8.1	37.2	14.1	23.4	7.1	10.1
Chemistry	10,582	100.0	7.2	43.5	11.9	24.2	4.8	8.4
General	678	100.0	7.8	48.1	9.4	24.1	4.0	6.6
Analytic	1,017	100.0	8.7	37.8	14.2	24.5	7.1	7.7
Biochemistry	1,581	100.0	6.3	35.8	12.1	28.0	7.2	10.6
Inorganic	761	100.0	7.4	38.8	14.8	25.4	5.6	8.0
Organic	4,123	100.0	7.1	48.1	11.1	23.7	3.5	6.5
Physical	2,422	100.0	7.0	43.5	11.8	22.1	4.4	11.2
Engineering	4,881	100.0	8.2	40.5	13.0	23.0	5.4	9.9
Aeronautical	218	100.0	8.3	39.9	9.2	17.0	5.0	20.6
Chemical	1,967	100.0	7.4	41.8	14.7	24.3	3.7	8.1
Civil	692	100.0	8.2	31.4	13.9	24.0	11.1	11.4
Electrical	786	100.0	10.6	47.5	8.9	18.4	4.6	10.0
Mechanical	651	100.0	10.6	35.2	13.0	27.8	4.0	9.4
Metallurgical	136	100.0	5.2	46.3	5.9	38.2	1.5	2.9
Mining	145	100.0	2.1	31.7	29.7	6.9	16.5	13.1
Ordnance	157	100.0	5.7	61.8	7.0	8.9	4.5	12.1
Power plant	129	100.0	8.5	34.1	9.3	31.0	4.7	12.4
Physics and electronics	3,423	100.0	10.2	44.2	10.6	20.0	5.6	9.4
Physics	2,791	100.0	9.8	40.5	11.6	22.0	6.3	9.8
Electronics	632	100.0	12.2	60.4	6.0	11.1	2.5	7.8
Earth sciences	2,048	100.0	7.0	30.1	21.2	16.0	13.5	12.2
Geophysics	287	100.0	7.3	32.1	33.1	6.6	7.7	13.2
Geography	261	100.0	6.5	31.8	14.6	31.0	6.1	10.0
Geology	1,360	100.0	6.8	27.7	21.4	15.2	16.8	12.1
Meteorology	140	100.0	9.3	46.4	6.4	15.7	7.2	15.0
Agriculture	2,395	100.0	5.7	22.9	23.5	22.0	14.2	11.7
Biology	5,744	100.0	7.7	29.5	18.7	22.0	9.0	13.1
Bacteriology	1,407	100.0	6.4	40.0	14.3	22.6	6.6	10.1
Biology	996	100.0	10.0	24.2	21.6	23.5	9.5	11.2
Botany	1,578	100.0	7.7	24.6	20.7	22.8	9.2	15.0
Entomology	807	100.0	6.3	29.6	21.5	15.1	12.4	15.1
Zoology	956	100.0	8.3	27.6	16.6	23.6	8.8	15.1
Medicine	2,848	100.0	10.0	36.6	10.7	27.1	5.9	9.7
Clinical	1,160	100.0	10.2	35.8	10.2	28.1	5.7	10.0
Neuropsychiatry	324	100.0	12.0	41.4	9.6	25.0	4.6	7.4
Obstetrics	118	100.0	11.9	32.2	8.5	32.2	5.9	9.3
Ophthalmology	93	100.0	16.1	29.0	6.5	29.0	8.6	10.8
Pediatrics	171	100.0	11.1	39.2	12.3	22.8	6.4	8.2
Public health	316	100.0	9.8	44.6	13.6	17.7	5.1	9.2
Radiology	114	100.0	4.4	29.8	10.5	29.8	8.8	16.7
Surgery	552	100.0	7.8	33.5	11.8	30.6	6.5	9.8
Fields related to medicine	2,647	100.0	7.7	33.4	14.8	27.0	8.1	9.0
Anatomy	524	100.0	8.2	29.2	20.4	26.0	8.0	8.2
Dental medicine	116	100.0	10.3	26.7	7.8	42.3	6.9	6.0
Pathology	478	100.0	6.5	33.3	15.9	25.5	9.6	9.2
Physiology	804	100.0	10.2	34.8	13.2	25.6	6.7	9.5
Pharmacy	537	100.0	6.0	39.9	13.4	25.7	7.4	7.6
Veterinary medicine	188	100.0	2.6	24.5	11.2	34.6	12.8	14.3
Mathematics and statistics	1,925	100.0	8.9	31.6	16.8	25.5	7.2	10.0
Mathematics	1,671	100.0	9.2	29.1	17.5	26.4	7.8	10.0
Statistics	254	100.0	7.5	48.0	12.6	19.3	3.2	9.4
Psychology	1,582	100.0	10.7	32.6	12.3	26.7	6.7	11.0
Other	3,359	100.0	9.0	41.7	8.6	24.5	6.4	9.8
Architecture	24	100.0	12.5	45.9	8.3	25.0	----	8.3
Astronomy	208	100.0	13.4	25.5	7.7	23.6	6.2	23.6
Metallurgy	563	100.0	9.4	40.9	3.7	34.8	6.8	4.4
Military application of science	136	100.0	9.6	55.9	8.8	13.2	3.7	8.8
Nutrition and foods	519	100.0	8.7	33.1	11.4	26.8	6.7	13.3
Manpower resources	915	100.0	6.9	48.0	10.6	22.3	4.7	7.5
All other and no report	994	100.0	10.0	42.1	8.4	21.2	8.0	10.3

[1] Excludes 79 scientists employed in United States territories, 219 employed in foreign countries, and 5 not reporting region of employment.

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with its famous observatories, as in either the Middle Atlantic or North Central States, the two regions which led in the employment of the surveyed scientists.

Earnings

One of the most important contributions of this study is the data it provides on the earnings of scientists—a subject on which little quantitative information was previously available. The respondents were asked to report both their regular annual salary at the time of the survey (mid-1948) and any additional professional income. Since many professional people are reluctant to make their incomes public, the respondents were not asked to specify the exact amounts of their professional earnings. Instead, the questionnaire provided a check list of salary brackets ranging from under $2,000 to $10,000 and over in $1,000 intervals. A check list of income classes was also provided for use in reporting added professional earnings. The optional character of the question on earnings was emphasized, but a very high proportion—82 percent of all the respondents and 85 percent of the Ph. D.'s—supplied salary data. About a third of the scientists who supplied salary information also reported some added professional income.

The data thus collected should not be considered as indicating the average salaries of all scientists in the country in 1948. As was pointed out earlier in this report, the survey includes only a very small unrepresentative group of scientists not having a doctorate, but covers a large proportion of all the Ph. D.'s in the sciences.

Although other studies of earnings in the professions have shown that doctors of philosophy tend to earn more than persons with less academic training, the scientists in the survey having no graduate degree tended to receive higher salaries than the Ph. D.'s in the survey. The median annual salary for all the scientists who supplied this information was $5,850 a year. Those who held bachelor's degrees had a median salary of $6,450 a year, as compared with $5,720 a year for Ph. D.'s and $5,610 a year for scientists with master's degrees. The salaries of the medical doctors, governed in part by the levels set by private practice, tended to be the highest of all—the median being $7,430 a year (table 22).

Not only did the scientists without graduate degrees and those with an M. D. have higher average earnings than the Ph. D.'s but they also had a wider variation in earnings and a larger proportion in the top salary brackets. About 30 percent of the M. D.'s and 18 percent of the scientists with bachelor's degrees earned a salary of $10,000 or more a year, as compared to 8 per-

TABLE 22.—*Median and quartile salaries and interquartile range of salaries by highest degree earned and age, 1948*

Level of education	All age groups	Under 30 years	30–34 years	35–39 years	40–44 years	45–49 years	50–54 years	55–59 years	60–64 years	65–69 years	70 years and over
All scientists:											
Upper quartile	$7,600	$5,350	$6,420	$7,400	$8,020	$8,500	$8,800	$8,900	$8,700	$8,480	$8,440
Median	5,850	4,440	5,260	5,850	6,250	6,360	6,480	6,670	6,550	6,350	5,650
Lower quartile	4,610	3,600	4,290	4,660	4,920	4,960	5,060	5,160	5,090	5,010	3,620
Interquartile range	2,990	1,750	2,130	2,740	3,100	3,540	3,740	3,740	3,610	3,470	4,820
Ph. D. degree:											
Upper quartile	7,200	5,500	6,440	7,210	7,670	7,850	7,980	8,050	8,050	7,720	7,500
Median	5,720	4,580	5,280	5,730	6,000	6,070	6,170	6,300	6,290	6,070	5,520
Lower quartile	4,580	3,720	4,310	4,600	4,820	4,860	4,980	4,990	5,050	4,980	3,610
Interquartile range	2,620	1,780	2,130	2,610	2,850	2,990	3,000	3,060	3,000	2,740	3,890
Master's degree:											
Upper quartile	7,230	4,930	6,180	6,910	7,730	7,960	7,900	8,370	8,100	7,850	6,670
Median	5,610	4,120	5,120	5,630	5,930	5,940	5,920	6,350	6,020	6,160	4,460
Lower quartile	4,420	3,270	4,180	4,550	4,630	4,720	4,710	4,930	4,650	4,690	3,270
Interquartile range	2,810	1,660	2,000	2,360	3,100	3,240	3,190	3,440	3,450	3,160	3,400
Bachelor's degree or no degree:											
Upper quartile	8,680	5,100	6,490	7,960	9,260	[1] 10,000+	[1] 10,000+	[1] 10,000+	9,970	[1] 10,000+	9,670
Median	6,450	4,390	5,320	6,490	7,280	7,780	7,910	8,090	7,430	7,160	6,500
Lower quartile	4,910	3,540	4,430	5,240	5,890	5,960	5,870	6,290	5,780	5,460	4,000
Interquartile range	3,770	1,560	2,060	2,720	3,370	----------	----------	----------	4,190	----------	5,670
M. D. degree:											
Upper quartile	[1] 10,000+	5,250	6,620	9,060	[1] 10,000+	[1] 10,000+	[1] 10,000+	[1] 10,000+	[1] 10,000+	[1] 10,000+	[1] 10,000+
Median	7,430	4,110	5,170	6,900	7,830	8,390	8,920	8,150	8,310	8,140	7,330
Lower quartile	5,210	3,330	3,800	5,250	5,860	5,990	6,190	6,100	6,030	5,360	4,330
Interquartile range	----------	1,920	2,820	3,810	----------	----------	----------	----------	----------	----------	----------

[1] $10,000 and over.

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cent of the Ph. D.'s and 10 percent of those with a master's degree. Similarly, the range in earnings between the highest salary of the lowest-paid fourth and the lowest salary of the highest-paid fourth (the interquartile range) was smaller for the Ph. D.'s than for any other group (table 22).

Although the Ph.D.'s in this survey were younger than their colleagues and therefore presumably less experienced, these differences in median salaries cannot be ascribed to differences in the age composition of the various groups.[35] The tendency of the surveyed scientists with no graduate degrees to earn higher salaries than those with higher degrees (except M. D.'s) was true for every age group except that of persons under 30 years.

Whatever the level of education attained, the older and more experienced men tended to receive higher salaries than the younger scientists, the peak salaries having been received in most cases by those 55–59 years of age. The difference in median salary between the lowest-paid age group —the scientists under 30—and the highest-paid group was even greater for the bachelors than for the Ph. D.'s. The lower and upper quartile salaries also tended to increase more sharply with age for the scientists with the bachelor's degree than for those holding doctorates. (See table 22.)

This paradoxical finding that the Ph. D.'s earned less, on the average, than the scientists without graduate degrees was undoubtedly due in large part to the type of employment and to the characteristics of the latter group. For one thing, almost half of this latter group were employed in private industry, where salaries are relatively high, whereas the largest number of Ph. D.'s were on college faculties. A sizable proportion (34 percent) of the bachelors were in engineering, the best paying general field of specialization. Most important, the criteria for inclusion set by the compilers of the Directory were such that the scientists in this survey without graduate degrees were outstanding and conspicuously successful. Many of them must have earned salaries considerably above the levels prevailing for all scientists without graduate training, even within private industry and within engineering. Similarly, the M. D.'s in the survey did not in any sense represent their colleagues throughout the Nation.

In the case of Ph. D.'s, however, the proportion included in the survey was large enough to validate broad conclusions as to salary levels in 1948 and as to the factors which influenced the earnings of all Ph. D. scientists. The findings on the relation of salary levels to field of specialization, age, type of employer, and region of employment are treated in the following pages. Many other factors influence earnings, but some of these are not amenable to statistical analysis, and for some the necessary information was not available.

It must be borne in mind that the salaries were earned in a particular year, a year characterized by a high level of industrial production and a large measure of business prosperity. Inevitably, the scientists employed in industry also prospered. A survey of annual earnings in some other phase of the business cycle might have shown a somewhat different salary pattern, since salaries in government agencies and educational institutions tend to be more stable than those in private industry.

Salaries of Ph. D.'s

Field of Specialization

Engineers, with a median salary of $6,960 a year, were much the best-paid group of specialists among the scientists in the survey who had Ph. D. degrees. As table 23 shows, there was a sharp difference in average earnings between the engineers and the next highest-paid group, the chemists, whose median salary was $6,030. The difference between the middle salary figures for chemists and engineers was about as great as the spread between the median salary in the lowest-paid general field, biology, and that in chemistry. Earnings of the highest-paid fourth of the engineers compared still more favorably with the corresponding figures for other specialties. The lowest salary of the top-paid 25 percent (the upper-quartile salary) was $8,900 in engineering as against $7,560 in physics and electronics and also medicine, the two fields having the next highest upper-quartile salaries. Engineers near the bottom of the salary scale for their profession also fared better than the lower-paid members of other specialties. (See table 23.) In fact, the lower-quartile salary for engineers exceeded the median salaries of the scientists in 4 of the 10 general fields.

[35] In the absence of information on length of experience, this analysis was based on age, which is a close approximation of the former. The alternative datum, years since award of highest degree, seemed inadequate because so many of the Ph. D.'s were doing professional work before they received their doctorates. The relation of salary to age indicated by the data is of course based on the findings of a single year, and cannot be taken to mean that an individual's earnings necessarily increase as he grows older.

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TABLE 23.—*Median and quartile salaries of Ph. D.'s by general field of specialization, 1948*

Field of specialization	Median	Upper quartile	Lower quartile	Interquartile range
All fields	$5,720	$7,200	$4,580	$2,620
Engineering	6,960	8,900	5,620	3,280
Chemistry	6,030	7,490	4,860	2,630
Physics and electronics	5,960	7,560	4,740	2,820
Medicine	5,830	7,560	4,680	2,880
Earth sciences	5,710	7,130	4,650	2,480
Agriculture	5,660	6,790	4,840	1,950
Fields related to medicine	5,420	6,810	4,390	2,420
Psychology	5,320	6,550	4,340	2,210
Mathematics and statistics	5,060	6,510	4,220	2,290
Biology	4,940	6,090	4,150	1,940

In every general specialty, salaries tended to increase with age (table 24). Some young men earned more than some older members of their professions, but average salaries were higher for the older men. The rate of increase and the age at which peak median salaries were received varied from one specialty to another. In two such widely disparate fields as engineering and biology, it was the group between 60 and 65 who had the highest salaries. This was also true in the fields related to medicine, agriculture, and psychology. In physics and electronics, however, the scientists between 40 and 45 years of age had the highest salaries. This does not mean that physicists begin to decline in earning power at a relatively young age. Rather, these salary figures reflect, in great measure, the unprecedented demand for nuclear physicists and electronic scientists in recent years. This demand threatened to outrun the available supply and pushed salaries in these fields above previously existing levels. At the same time, it was mostly the younger men who were trained in nuclear physics and electronics and who thus obtained a monetary advantage over their elder colleagues.

Type of Employer

The type of employer for whom scientists work exerts an even greater influence on earnings than either specialty or age. For Ph. D.'s in all specialties taken together, the median salary in private industry was $7,070 a year, in government, $6,280. The small group of scientists working for nonprofit foundations and institutes tended to earn about the same amount as government employees. But college and university staff members with no other type of employment were found to have a median salary of only $4,860 a year.

If all the educators, including those who had other work, had been combined into one category, the median salary in education would have been somewhat higher. The median salary of Ph. D.'s employed by both government and educational institutions was $5,710 a year (table M, p. 45) whereas those who combined educational employment and work as a consultant had a median salary of $5,570. Since many of the group who combined education with other employment were full-time educators, it appears that the highest paid members of college and university staffs were in the best position to secure additional work. In considering these salary figures, however, allowance must be made for the fact that a small proportion of these educators may have reported the combined receipts from both sources of employment as regular annual salaries.

Within the various general specialties also, scientists employed exclusively in educational institutions earned less than their colleagues working in government agencies, who in turn averaged somewhat less than the group employed by business firms. In the one field, physics and electronics, where an exception to this rule is

TABLE 24.—*Median salaries of Ph. D.'s by general field of specialization and age, 1948*

Field of specialization	All age groups	Under 30 years	30–34 years	35–39 years	40–44 years	45–49 years	50–54 years	55–59 years	60–64 years	65–69 years	70 years and over
All fields	$5,720	$4,580	$5,280	$5,730	$6,000	$6,070	$6,170	$6,300	$6,290	$6,070	$5,520
Chemistry	6,030	4,830	5,790	6,370	6,720	6,460	6,580	6,860	6,500	6,110	5,500
Engineering	6,960	5,130	6,360	7,120	7,460	7,570	8,210	7,810	9,170	7,500	5,000
Physics and electronics	5,960	4,450	5,520	6,440	6,690	6,510	5,940	5,880	5,880	5,820	(1)
Earth sciences	5,710	(1)	4,730	5,290	5,720	6,110	6,220	6,750	6,500	6,600	(1)
Agriculture	5,660	4,560	5,120	5,230	5,700	5,970	6,200	6,520	6,790	5,810	(1)
Biology	4,940	4,070	4,430	4,720	5,080	5,290	5,550	5,700	5,910	5,630	5,400
Medicine	5,830	(1)	(1)	5,210	5,950	7,000	6,130	(1)	(1)	(1)	(1)
Fields related to medicine	5,420	3,900	4,720	5,250	5,490	5,840	6,280	6,470	6,640	6,290	(1)
Mathematics and statistics	5,060	3,770	4,460	4,950	5,210	5,460	5,720	5,720	5,500	5,890	(1)
Psychology	5,320	4,020	4,670	5,420	5,640	5,670	5,450	5,410	5,820	5,750	(1)
Other	6,520	5,070	5,460	6,320	6,950	6,960	7,350	7,080	7,360	7,750	(1)

[1] Insufficient reports to compute median.

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shown (table 25), the tendency toward top salaries in private industry held for scientists of comparable age. (See table 28.)

Differences in salary from one type of employer to another tended to be greater than salary differences from one specialty to another in any given type of employment. Even the biologists employed in private industry, who earned less on the average than any other group so employed, fared better than the highest paid of all the college teachers, the engineers. (See table 25.)

TABLE 25.—*Median age and median salary of Ph. D.'s in each general specialty by type of employer, 1948*

Field of specialization	Scientists employed solely in—					
	Education		Government		Industry	
	Median age [1]	Median salary	Median age [1]	Median salary	Median age [1]	Median salary
All fields	42	$4,860	42	$6,280	38	$7,070
Chemistry	39	4,670	41	6,290	37	6,880
Engineering	42	5,700	42	7,400	39	8,000
Physics and electronics	42	5,040	41	7,400	38	7,350
Earth sciences	45	5,200	42	6,120	42	7,780
Agriculture	43	5,390	45	5,980	42	6,670
Biology	42	4,610	43	5,480	40	6,250
Fields related to medicine	42	5,060	42	5,930	39	6,850
Mathematics and statistics	44	4,760	41	6,830	40	7,350
Psychology	44	4,920	42	6,180	40	7,940

[1] These median age figures refer only to the scientists who reported salary.

It was not practicable to analyze separately the salary levels of scientists in each specific specialty working for each type of employer. However, the differences in median earnings among the specific fields, shown in table 26, appear to be associated with the varying proportions of scientists in private industry, government, and educational employment. For example, civil engineers had a lower median salary than was found in any other branch of engineering, and they also constituted much the smallest proportion of engineers employed in private industry. Electronic scientists, who were more frequently employed in private industry than physicists, tended to earn higher salaries than the latter. There were relatively more geophysicists than other earth scientists working for private business firms, and geophysicists had the highest median salary in this general field. In biology, salary levels were lowest in zoology, general biology, and botany—the branches which had the highest proportions of scientists in educational institutions. The mathematicians, with a middle salary of $4,920 a year, were working mostly for colleges and universities; the statisticians had a much higher median salary ($6,350) and a relatively small proportion were employed exclusively in educational institutions.

TABLE 26.—*Median and quartile salaries of Ph. D.'s in each specific field of specialization, 1948*

Field of specialization	Number reporting salary	Median	Upper quartile	Lower quartile	Interquartile range
All fields reporting	22,116	$5,720	$7,200	$4,580	$2,620
Chemistry	6,915	6,030	7,490	4,860	2,630
General	321	6,800	8,520	5,560	2,960
Analytic	498	5,450	6,610	4,460	2,150
Biochemistry	1,110	5,640	6,960	4,580	2,380
Inorganic	438	5,680	6,990	4,490	2,500
Organic	2,832	6,240	7,730	5,100	2,630
Physical	1,716	6,110	7,520	4,890	2,630
Engineering	1,313	6,960	8,900	5,620	3,280
Aeronautical	73	7,820	8,930	6,440	2,490
Chemical	680	7,020	9,460	5,670	3,790
Civil	103	6,240	7,830	4,900	2,930
Electrical	184	6,680	8,650	5,330	3,320
Mechanical	114	6,520	8,380	5,440	2,940
Metallurgical	25	7,880	[1]10,000+	6,310	--------
Mining	28	7,750	[1]10,000+	6,200	--------
Ordnance	68	7,540	8,430	6,600	1,830
Power plant	38	7,000	6,950	5,720	1,230
Physics and electronics	2,059	5,960	7,560	4,740	2,820
Physics	1,818	5,840	7,380	4,650	2,730
Electronics	241	6,910	8,670	5,610	3,060
Earth sciences	1,102	5,710	7,130	4,650	2,480
Geophysics	99	6,780	8,930	5,060	3,870
Geography	188	5,670	6,750	4,790	1,960
Geology	763	5,630	7,020	4,580	2,440
Meteorology	52	5,670	7,330	4,770	2,560
Agriculture	1,213	5,660	6,790	4,840	1,950
Biology	3,826	4,940	6,090	4,150	1,940
Bacteriology	822	5,420	6,590	4,470	2,120
Biology	720	4,880	6,220	4,050	2,170
Botany	1,183	4,870	6,010	4,160	1,850
Entomology	450	5,130	6,120	4,350	1,770
Zoology	651	4,520	5,510	3,720	1,790
Medicine	155	5,830	7,560	4,680	2,880
Fields related to medicine [2]	1,125	5,420	6,810	4,390	2,420
Anatomy	307	5,180	6,580	4,250	2,330
Pathology	34	5,400	6,920	4,350	2,570
Physiology	500	5,210	6,580	4,270	2,310
Pharmacy-pharmacology	263	5,950	7,520	4,970	2,550
Mathematics and statistics	1,404	5,060	6,510	4,220	2,290
Mathematics	1,234	4,920	6,250	4,150	2,100
Statistics	170	6,350	7,870	5,190	2,680
Psychology	1,304	5,320	6,550	4,340	2,210
Other fields	1,700	6,520	8,610	5,040	3,570
Astronomy	134	5,450	6,620	4,200	2,420
Metallurgy	207	6,830	8,380	5,530	2,850
Military application of science	54	7,300	9,580	5,390	4,190
Nutrition and foods	337	5,710	7,180	4,650	2,530
Manpower resources [3]	436	8,730	[1]10,000+	7,090	--------
All others	532	5,800	7,380	4,580	2,800

[1] $10,000 and over.
[2] Total also includes dental medicine and veterinary medicine.
[3] As was indicated on p. 6 this was a miscellaneous group containing many individuals in policy-making and executive positions.

Scientists in private industry enjoyed a salary advantage in all sections of the country, as well as in the Nation as a whole. This is shown by the figures on median salaries of Ph. D.'s in different regions, which are given in table 27. In every region, the Ph. D.'s employed exclusively in private industry tended to earn considerably higher salaries than those in government agencies, and the government scientists, in turn, fared much better than those in educational institutions.

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TABLE 27.—*Median salaries of Ph. D. scientists by type of employer and region of employment, 1948*

Region of employment	All scientists[1]	Scientists employed solely in—		
		Educational institutions	Private industry	Government
All regions	$5,720	$4,860	$7,070	$6,280
New England	5,380	4,730	6,590	5,410
Middle Atlantic	6,310	4,930	7,320	6,730
South	5,200	4,700	7,240	5,660
North Central	5,730	5,070	6,940	5,750
Mountain and Plains	4,940	4,620	6,500	5,810
Pacific	5,550	4,940	6,630	6,050

[1] Includes scientists working for all types of employers and all combinations of types.

Moreover, the highest median salary received by educators in any one region was below the lowest regional median salary of government scientists.

The monetary advantages of private employment appear even greater when age is taken into account. Despite their higher median earnings, the Ph. D.'s in business firms were younger than their fellow specialists elsewhere employed. As table 25 shows, scientists in all fields had a lower median age in private industry than in any of the other principal types of employment, with one exception. Earth scientists in government employment had the same median age as those in private industry.

It would be expected, then, that private industry would be the most remunerative type of employment and education the least for the members of each specialty in every age group. This was true wherever the number of the scientists reporting was large enough to permit such comparisons. (See table 28.) In chemistry, biology, and physics and electronics, educators had the lowest median salaries and employees of business firms the highest in every case. Very few agriculturists with Ph. D.'s were employed in industry. Those in government service tended to earn higher salaries than educators in every group between 30 and 60 years with one exception, the 35–39 age group. A comparison of median salaries of engineers associated with business firms and those working solely for universities shows great differentials at every age level.

The data shown in table 28 suggest that salaries tend to increase more rapidly with age in private industry than in any other type of employment. A detailed analysis of the relation of type of employer to changes in salary levels with age, which is possible only for all specialties taken together, points to this conclusion (chart 8). For the young men at the beginning of their careers, there was not much difference in median salaries among types of employment. Among the scientists reporting only one source of employment, the annual median salary of the group under 30 was not much higher in private industry than in government employment, $5,560 compared with $5,050 (table N, p. 45). In the 50–54-year age group, the annual median salary in private industry was $9,980 and in government only $6,800.

The advantage enjoyed by scientists in private industry was most marked at the higher salary levels. An examination of upper-quartile salaries shows an even sharper rate of increase with age than that in median salaries, and an even greater disparity between the rate of increase in private industry and in other employment (chart 8).

TABLE 28.—*Median salaries in selected specialties by age and type of employer, for Ph. D.'s employed exclusively with one of the three principal types of employers, 1948*

Field of specialization and type of employer	Under 30 years	30–34 years	35–39 years	40–44 years	45–49 years	50–54 years	55–59 years	60–64 years	65–69 years
Chemistry:									
Educational institutions	$3,800	$4,430	$4,680	$4,930	$5,030	$5,240	$5,550	$5,520	$5,580
Government	5,100	5,690	6,060	6,380	6,820	6,910	7,450	(1)	(1)
Private industry	5,550	6,360	7,280	8,170	8,700	9,110	[2] 10,000+	[2] 10,000+	(1)
Biology:									
Educational institutions	3,840	4,150	4,460	4,670	4,820	5,120	5,240	5,440	5,280
Government	(1)	4,660	4,820	5,580	5,870	5,970	6,390	6,860	(1)
Private industry	(1)	5,850	6,250	6,530	6,690	(1)	(1)	(1)	(1)
Physics and electronics:									
Educational institutions	4,070	4,600	5,150	5,500	5,570	5,410	5,230	5,440	5,330
Government	(1)	6,440	7,330	7,910	7,750	7,000	(1)	(1)	(1)
Private industry	5,590	6,520	7,790	8,030	8,800	[2] 10,000+	(1)	(1)	(1)
Agriculture:[3]									
Educational institutions	4,550	4,880	5,010	5,460	5,620	5,960	5,970	6,500	(1)
Government	(1)	5,320	4,970	5,860	6,350	6,670	7,400	(1)	(1)
Engineering:[3]									
Educational institutions	4,460	5,190	5,440	6,180	5,960	6,400	(1)	(1)	(1)
Private industry	5,720	6,860	7,980	8,890	9,700	[2] 10,000+	[2] 10,000+	(1)	----

[1] Insufficient reports to compute median.
[2] $10,000 and over.
[3] There were fewer than 20 scientists in most age groups among agriculturists employed in private industry, and among engineers employed in government.

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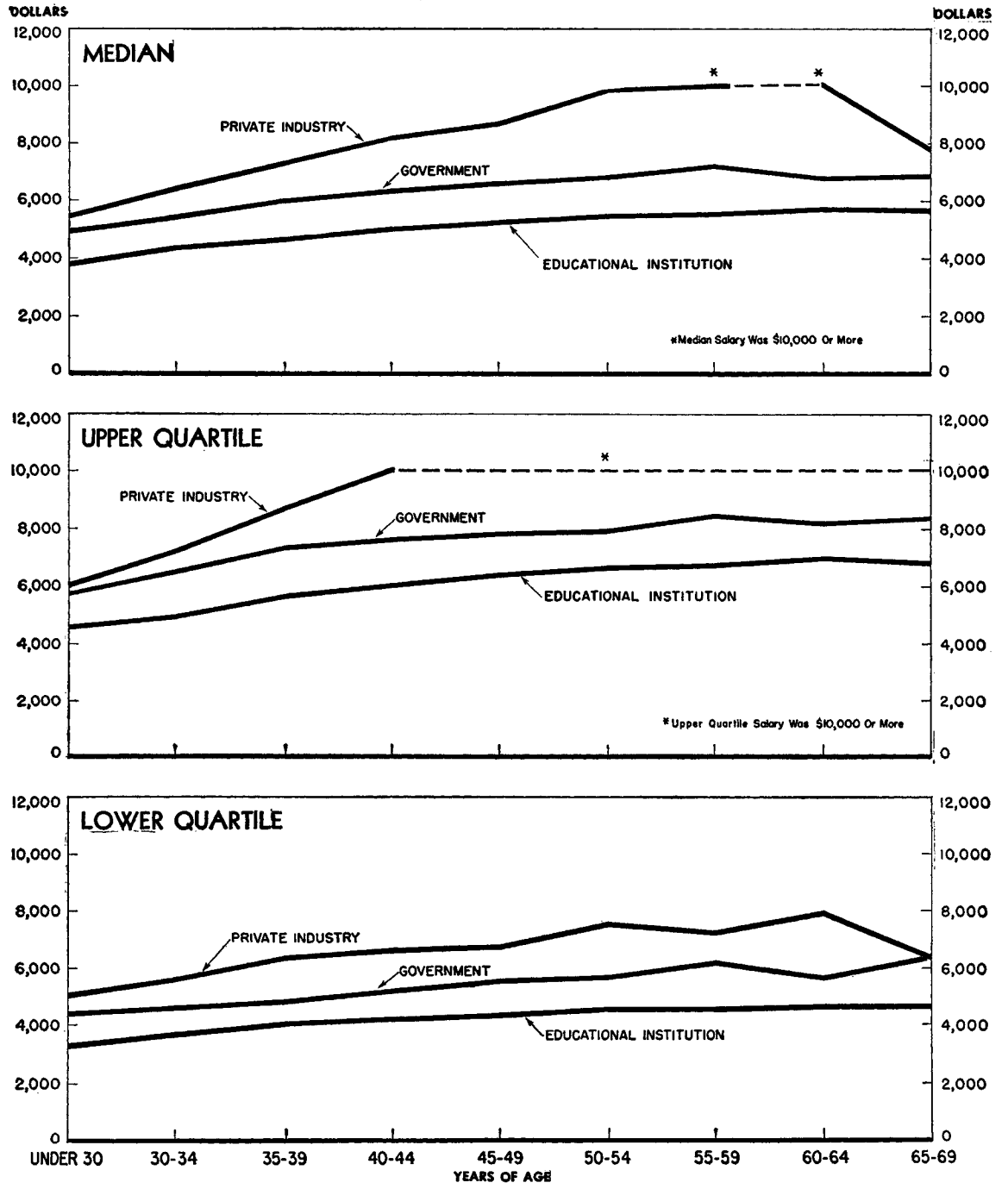
Chart 8. Salary Levels of Ph. D. Scientists Were Highest in Private Industry

MEDIAN AND QUARTILE SALARIES OF PH.D.'S EMPLOYED EXCLUSIVELY IN PRIVATE INDUSTRY, GOVERNMENT, OR EDUCATIONAL INSTITUTIONS, 1948



UNITED STATES DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS

Source: Appendix Table M

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Among Ph. D.'s under 30 years of age, the lowest salary of the top 25 percent was almost the same in government and in private industry, $5,820 and $6,050, respectively. However, among those 40 to 44 years of age, the upper-quartile salary in private industry was over $10,000 but only $7,670 in government and $6,050 in educational institutions.

Data as to annual salaries above $10,000 are not available, but a good indication of the continuing advance of salaries in private industry is given by the high proportions in the older groups who earned $10,000 or more. Thirty-nine percent of the scientists between 40 and 45 years employed by business firms earned $10,000 or more a year. This proportion increased to 59 percent of the group between 55 and 60 years, and to 62 percent of those between 60 and 64 years. In contrast, the proportion of government scientists who earned $10,000 a year or more did not exceed 10 percent at any age level, and the highest proportion in any age group of educators was 5 percent.

The highest-paid scientists were found in private industry. However, the range of salaries was much greater in this type of employment than in either education or government. Some scientists in industry were no better off than their colleagues in either government or education. By and large, however, the lower-paid scientists in private industry earned higher salaries than the lower-paid group in any other kind of employment. Salaries under $5,000 were reported by only 5 percent of the Ph. D. scientists between 50 and 65 in industry, but by 11 percent of those in government. It was only among educators that the group earning under $5,000 constituted a sizable proportion—36 percent—of the doctors of philosophy between 50 and 65 years of age.

Salaries also tended to increase with age among the scientists employed in nonprofit institutions and among educators who combined employment in colleges and universities with either consultation or government work. Median and quartile salaries at each age level for each type of employer or combination thereof are shown in table N, page 45.

Additional Professional Income of Ph. D.'s

Information on the professional income that Ph. D. scientists earned in addition to their regular salaries is interesting for the light it throws on their activities and their total earnings. It also provides a desirable check on the analysis of salary differentials.

As mentioned above, the scientists were asked to indicate on check lists the average amount of additional professional income they had received annually during recent years and the source of this income. Additional income was reported by 39 percent of the Ph. D.'s reporting regular salary. Another 26 percent specified that they had no additional professional income, and the remainder (about 35 percent) failed to respond.[36] It is believed that many scientists in the last group did not have any added professional income.[37]

Consulting and teaching (in evening, extension or summer programs) were the most frequent sources of added income. About half of the scientists reporting such income derived it exclusively from one or both of these activities; another sizable group received added income from consulting or teaching in combination with other sources. Royalties from publications were also frequently mentioned as a source of extra income.

For those Ph. D.'s who supplemented their regular salaries from one or more sources, the added earnings often made a real difference in total income. Half of them earned at least $890 extra a year. One out of four received over $1,550. However, for another fourth the added pay amounted to less than $500.

The proportion of scientists with extra earnings tended to be highest among those who were slightly above the bottom of the salary scale. About half (52 percent) of the group with regular salaries of $3,000 to $3,999 reported added income, compared with 45 percent of those in the $4,000 to $4,999 salary bracket and considerably lower proportions of the groups making under $3,000 or $5,000 and above. In terms of the amount of added income received, however, it was the top-salaried scientists who made the most. Median added income ranged from $1,890 for the group with regular salaries of $10,000 or over, down to $650 for those whose salaries were under $3,000. The proportion of Ph. D.'s in each salary bracket

[36] Data concerning scientists who did not report any additional income are based on a hand count of several hundred questionnaires.

[37] On the questionnaire the check list for additional income was printed next to that for regular salary. It was assumed that if a scientist had both types of income, he would have reported his regular salary and then failed to indicate his added income.

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who reported added income and the amount of such income are shown for each general specialty in table Q, page 48.

Type of Employer

Throughout the discussion of salaries, it has been repeatedly demonstrated that educators receive considerably lower salaries than scientists in either government or private industry employment. The scientist on the campus typically has a shorter working week and working year than his colleagues in the business world. Many people assume, therefore, that educators can and do augment their regular salaries by other employment to a much greater extent than is possible for scientists in government or industry.

This observation seems valid to some extent among the scientists in the survey with Ph. D. degrees. A much larger proportion of the educators than of other scientists did supplement their salaries by earnings from other sources, though the extra income by no means made up the difference in salary levels between education and other employment. Secondary professional earnings were of minor importance to government employees and to people employed in private industry, both in the proportion who earned such income and in the median amount received. (See table 29.) In contrast, nearly half the faculty members (44 percent) had extra income, and their median added income was $810.

For obvious reasons, it was the scientists who were working regularly for more than one type of employer for whom added professional income was most important. For example, 90 percent of those who combined education with consulting had supplementary earnings, and the median sum earned was $1,260 a year. The proportion reporting added earnings was generally very large also

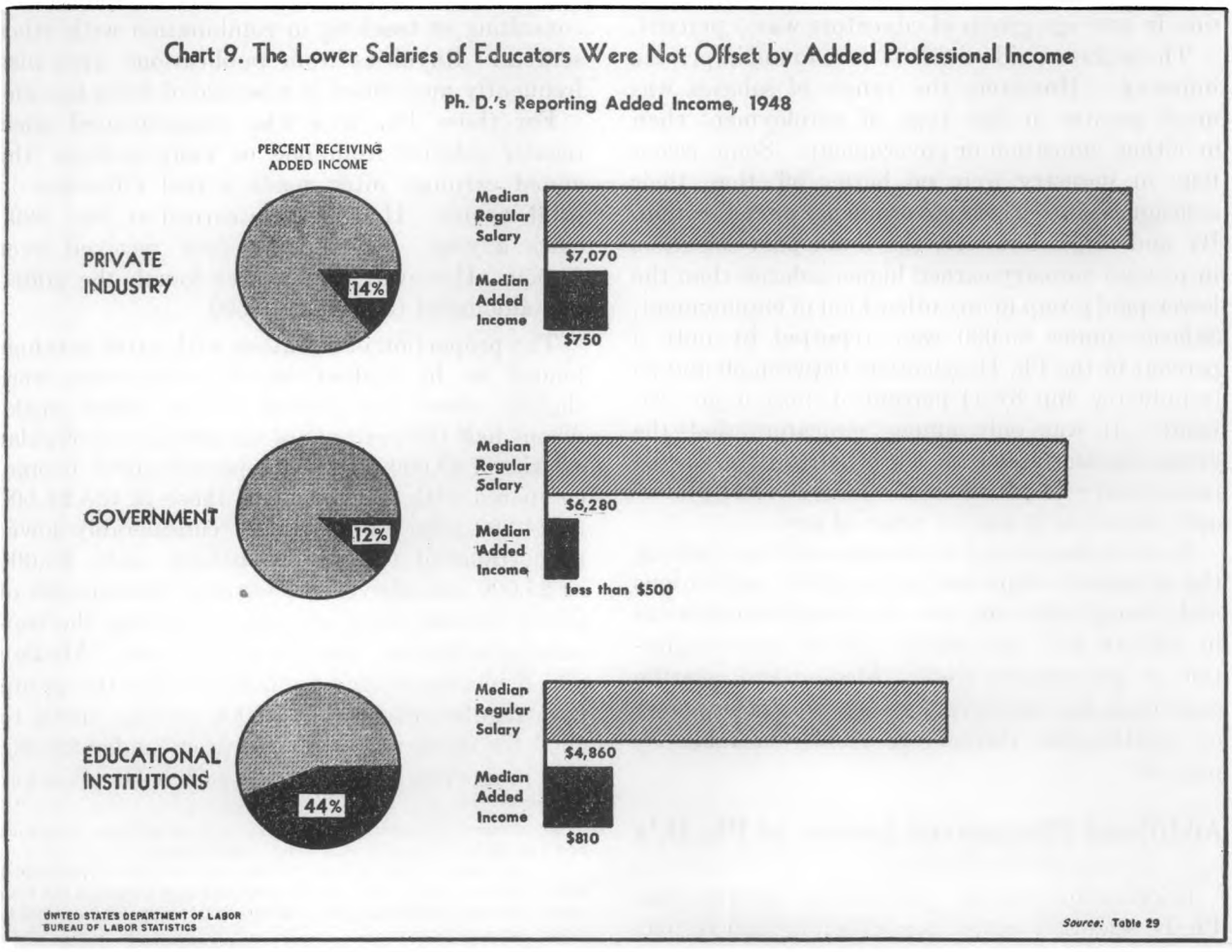

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TABLE 29.—*Added professional income and median regular salary of Ph. D.'s working for specified types of employers, 1948*

Type of employer	Median regular salary	Added income	
		Percent reporting [1]	Median
Educational institution	$4,860	43.9	$810
Private industry	7,070	13.9	750
Government	6,280	12.2	[2]
Foundation	6,070	17.8	520
Educational institution and independent consultant	5,570	92.2	1,260
Educational institution and government	5,710	44.9	970
Educational institution and private industry	6,170	78.2	1,140
Independent consultant and government	6,720	89.6	710
Independent consultant, government, and educational institution	5,530	94.1	1,480
Independent consultant and private industry	7,710	84.1	1,060

[1] Percents are based only on scientists reporting regular salary.
[2] Less than $500.

among the scientists with other combinations of employment. There was one major exception: only 45 percent of the scientists who were employed in both educational institutions and government agencies reported any additional professional income. Some of these scientists may have failed to report because their secondary incomes were very small, and others considered money received from secondary employment a part of their regular salaries.

Supplementary income compensated little for the low salary levels in education as is seen in chart 9. For some people, earnings from consultation, teaching, or writing made a real contribution to the family budget. For the group of educators as a whole, however, total professional income apparently was well below the average total income of scientists working in industry or government.

Field of Specialization

The proportion of scientists with added professional income varied widely by field of specialization as well as by type of employer, as indicated in table 29. More than two-thirds of the Ph. D. psychologists and slightly over half of the Ph. D.'s in the earth sciences and in the general field of mathematics and statistics reported additional income. On the other hand, only about a fourth of the agricultural scientists and a third of the biologists had added professional incomes.

These differences persisted when the type of employer was taken into account. Among the various specialists employed by educational institutions, for example, the pattern was much the same as it was for scientists in all types of employment taken together (table 30). However, in each general specialty, as in all fields taken together, the proportion of scientists reporting added income was much higher in colleges and universities than it was in government or private industry. And in every field except agriculture it was the specialists working for more than one type of employer who most often reported added income.[38]

The differences in added income among the various fields of specialization did not make up for the differences in salary levels discussed above. In fact, four of the five fields having the highest median salaries also fared relatively well in regard to added income (table 31). A considerable proportion of the engineers, the highest salaried

[38] Because land grant colleges and State experimental stations are usually one unit for administrative purposes, agriculturists frequently act both as teachers and research scientists for one salary. This is probably why only a sixth of the agriculturists who reported both government and education employment also reported secondary professional income.

TABLE 30.—*Percent of Ph. D. scientists reporting added income by general field of specialization and type of employer, 1948* [1]

Field of specialization	Percent reporting added income	Educational institution	Private industry	Government	Other single types of employers	Education and independent consultant	Education and Government	Other combinations of employers
All fields	38.9	43.9	13.9	12.2	22.6	92.1	44.9	84.7
Chemistry	30.1	40.7	12.7	9.2	19.0	93.7	40.3	82.1
Engineering	44.2	53.5	15.0	15.2	38.5	93.5	[2]	86.6
Physics and electronics	45.1	48.0	15.2	14.0	30.3	92.9	58.8	92.9
Earth sciences	52.9	62.7	10.6	12.2	34.6	91.6	75.0	84.4
Agriculture	24.2	24.3	11.1	9.5	[2]	91.3	16.2	83.9
Biology	34.5	38.9	13.2	8.8	14.9	88.2	33.0	72.2
Fields related to medicine	35.6	35.7	13.2	12.3	22.2	83.8	[2]	70.0
Mathematics and statistics	54.6	53.5	29.5	29.1	[2]	88.2	95.5	83.3
Psychology	68.7	62.6	37.3	21.8	26.1	94.7	83.7	94.6

[1] Based upon number of scientists reporting regular salary.
[2] Insufficient reports to compute median.

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TABLE 31.—*Median regular salary and added income of Ph. D.'s by general field of specialization, 1948*

Field of specialization	Median regular salary	Percent reporting added income	Median amount of added income
All fields	$5,720	38.9	$890
Chemistry	6,030	30.1	900
Engineering	6,960	44.2	1,260
Physics and electronics	5,960	45.1	940
Earth sciences	5,710	52.9	1,100
Agriculture	5,660	24.2	(1)
Biology	4,940	34.5	740
Medicine	5,830	51.6	1,040
Fields related to medicine	5,420	35.6	720
Mathematics and statistics	5,060	54.6	890
Psychology	5,320	68.7	1,010

[1] Less than $500.

specialists, reported additional income, and the median amount that they received was well above that for any other field of specialization. Scientists in medical fields, the earth sciences, and the general field of physics and electronics also fared relatively well in regard to both added income and regular salary. However, in chemistry, the field with the second highest median salary, only 30 percent of the scientists reported any extra earnings. The group with the lowest median salary, the biologists, also ranked very low in regard to additional professional income.[39]

[39] There was not much variation in regard to added income among the different specific fields within the same general specialty. This was true even in specialties, such as the general field of mathematics and statistics, where considerable differences in regular salary have been observed. However, in civil engineering the proportion reporting added income was considerably higher than in other branches of engineering.

Appendix Tables

TABLE A.—Number of Women Scientists in Each Specific Field of Specialization, 1948

Field of specialization	Number	Field of specialization	Number	Field of specialization	Number
Total	2,520	Earth sciences	91	Fields related to medicine	226
		Geophysics	5	Anatomy	62
		Geography	30	Dental medicine	3
Chemistry	486	Geology	54	Pathology	28
General	30	Meteorology	2	Physiology	112
Analytic	54			Pharmacy	19
Biochemistry	185	Agriculture	13	Veterinary medicine	2
Inorganic	31				
Organic	129	Biology	679	Mathematics and statistics	186
Physical	57	Bacteriology	200	Mathematics	165
		General biology	102	Statistics	21
Engineering	7	Botany	206		
Aeronautical		Entomology	23	Psychology	323
Chemical	4	Zoology	148		
Civil				Other sciences	293
Electrical	1	Medicine	125	Architecture	1
Mechanical		Clinical	29	Astronomy	21
Metallurgical		Neuropsychiatry	27	Metallurgy	4
Mining		Obstetrics	5	Military application of science	4
Ordnance	1	Ophthalmology	10	Nutrition and foods	158
Power plant	1	Pediatrics	17	Manpower resources	17
		Public health	30	All other	88
Physics and electronics	91	Radiology	2		
Physics	87	Surgery	5		
Electronics	4				

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TABLE B.—Second Specialties Reported by Scientists by Specific and General Field of First Specialty, 1948

Field of specialization	Total reporting second field of specialization		Percent reporting a second specialty in—													
			Same general field		Other general fields											
	Number	Percent	Same specific field	Other specific field	All other general fields	Chemistry	Engineering	Physics and electronics	Earth sciences	Agriculture	Biology	Medicine	Fields related to medicine	Mathematics and statistics	Psychology	Other
All fields	[1] 38,820	100.0	50.7	15.2	34.1	4.6	4.4	4.3	1.2	1.7	4.7	1.6	3.1	2.2	0.6	5.7
Chemistry	9,733	100.0	42.0	25.8	32.2	------	5.5	6.6	1.0	1.3	3.2	.9	3.3	1.8	.1	8.5
General	------	100.0	28.1	37.9	34.0	------	7.9	4.7	1.2	2.5	3.7	1.4	2.7	2.0	.2	7.7
Analytic	940	100.0	23.0	43.1	33.9	------	4.0	7.4	2.2	2.1	2.9	1.1	1.9	2.0	.3	10.0
Biochemistry	1,529	100.0	38.7	14.5	46.8	------	.8	.6	.1	2.1	11.0	3.4	12.1	.3	------	16.4
Inorganic	702	100.0	26.2	41.9	31.9	------	8.0	6.4	3.7	1.3	.4	.3	.4	2.4	.4	8.6
Organic	3,793	100.0	56.4	22.8	20.8	------	5.6	2.3	.4	.9	2.0	.2	2.4	1.4	[2]	5.6
Physical	2,260	100.0	36.2	23.4	40.4	------	8.0	18.1	1.3	.6	.9	.3	.4	3.2	.1	7.5
Engineering	4,496	100.0	45.9	17.2	36.9	9.1	------	9.6	2.5	.7	.5	.6	.2	3.3	[2]	10.4
Aeronautical	214	100.0	53.8	25.2	21.0	1.9	------	8.4	.5	------	------	------	------	6.0	------	4.2
Chemical	1,777	100.0	42.3	15.5	42.2	19.2	------	4.3	.9	.6	.7	.3	.4	3.2	------	12.6
Civil	627	100.0	61.9	8.3	29.8	1.1	------	3.3	7.3	2.6	.5	2.7	------	3.7	------	8.6
Electrical	736	100.0	55.4	8.2	36.4	.7	------	29.1	.5	------	.3	.1	.3	2.7	------	2.7
Mechanical	593	100.0	41.2	31.5	27.3	3.0	------	8.3	.3	.8	.5	.3	.2	3.5	.2	10.2
Metallurgical	131	100.0	26.0	16.8	57.2	3.8	------	1.5	------	------	------	------	------	------	------	51.9
Mining	135	100.0	26.7	20.0	53.3	7.4	------	3.7	32.6	------	.7	------	------	2.2	------	6.7
Ordnance	154	100.0	26.0	26.6	47.4	9.1	------	21.4	.7	------	.7	------	------	5.8	------	9.7
Power plant	129	100.0	37.2	42.6	20.2	4.6	------	10.2	------	.8	------	------	------	------	------	4.6
Physics and electronics	3,299	100.0	60.4	8.3	31.3	4.6	11.6	------	1.7	[2]	1.3	.5	.2	5.7	.2	5.5
Physics	2,669	100.0	63.0	5.9	31.1	5.2	9.3	------	1.7	[2]	1.5	.5	.2	6.6	.2	5.9
Electronics	630	100.0	49.4	18.4	32.2	1.7	21.6	------	1.9	------	.5	.3	.3	2.1	------	3.8
Earth sciences	2,017	100.0	70.9	10.7	18.4	1.4	6.3	3.5	------	.5	2.3	------	.1	1.2	[2]	3.1
Geophysics	291	100.0	21.6	24.1	54.3	4.5	17.2	17.9	------	1.7	.7	------	.3	3.4	.3	8.3
Geography	255	100.0	77.7	13.3	9.0	------	------	------	------	.8	3.1	------	------	.4	------	4.7
Geology	1,338	100.0	81.7	6.9	11.4	1.2	5.1	.3	------	.1	2.5	------	------	.4	------	1.8
Meteorology	133	100.0	57.1	14.3	28.6	------	6.0	11.3	------	1.5	2.3	------	.7	5.3	------	1.5
Agriculture	2,175	100.0	33.5	------	66.5	10.5	3.4	.2	2.2	------	34.5	.5	1.4	4.1	.3	9.4
Biology	5,592	100.0	53.9	22.1	24.0	4.0	.2	.6	.8	7.3	------	2.7	5.5	.5	.2	2.2
Bacteriology	1,391	100.0	56.6	12.2	31.2	7.9	.1	------	.2	4.2	------	8.4	6.1	.3	------	4.0
Biology, general	977	100.0	27.7	37.2	35.1	3.2	.4	3.4	.8	11.0	------	1.7	11.2	1.6	.2	1.6
Botany	1,518	100.0	58.8	20.0	21.2	4.4	.1	.1	1.2	12.5	------	.3	.7	.1	.2	1.6
Entomology	773	100.0	71.4	18.6	10.0	1.4	.3	------	.1	5.0	------	.5	1.4	.1	------	1.2
Zoology	933	100.0	54.8	27.3	17.9	.6	.1	------	1.8	1.8	------	.8	9.9	.3	.4	2.2
Medicine	2,426	100.0	54.2	12.6	33.2	3.0	.4	.4	.2	.1	6.6	------	16.1	.6	2.8	3.0
Clinical	1,016	100.0	55.4	8.5	36.1	4.2	------	.3	.3	------	7.3	------	20.5	------	.4	3.1
Neuropsychiatry	302	100.0	69.2	8.3	22.5	.3	------	.3	------	------	.7	------	6.6	.3	13.3	1.0
Obstetrics	115	100.0	81.8	7.8	10.4	------	------	------	------	------	------	------	9.5	------	------	.9
Ophthalmology	83	100.0	63.9	9.6	26.5	1.2	------	3.6	------	------	4.8	------	4.8	------	7.3	4.8
Pediatrics	150	100.0	58.7	15.3	26.0	7.3	------	------	------	------	5.3	------	6.7	------	2.0	4.7
Public health	294	100.0	34.7	17.7	47.6	3.4	3.7	------	1.0	.7	18.4	------	7.2	4.4	3.7	5.1
Radiology	91	100.0	49.4	22.0	28.6	2.2	------	4.4	------	------	9.9	------	6.6	------	------	5.5
Surgery	375	100.0	42.7	22.1	35.2	1.3	------	------	------	.3	2.1	------	29.1	.3	.5	1.6
Fields related to medicine	2,564	100.0	54.7	12.5	32.8	7.2	.4	.5	------	1.0	12.9	6.6	------	[2]	.7	3.5
Anatomy	514	100.0	59.9	15.0	25.1	.6	------	.2	------	.4	16.7	5.2	------	------	.4	1.6
Dental medicine	104	100.0	63.5	8.6	27.9	2.9	1.0	2.9	------	1.0	2.9	8.6	------	------	------	8.6
Pathology	445	100.0	62.2	9.9	27.9	2.0	------	.2	------	.5	13.3	8.5	------	------	1.6	1.8
Physiology	795	100.0	40.1	14.1	45.8	9.8	.6	.5	------	.9	16.5	9.1	------	.1	1.1	7.2
Pharmacy-pharmacology	522	100.0	58.0	12.1	29.9	17.0	.8	.6	------	------	5.9	4.2	------	------	.2	1.2
Veterinary medicine	184	100.0	71.2	8.2	20.6	.5	------	------	------	7.1	10.8	1.1	------	------	------	1.1
Mathematics and statistics	1,771	100.0	72.2	5.7	22.1	.5	5.3	7.7	1.0	.3	1.1	.4	.2	------	1.1	4.5
Mathematics	1,518	100.0	75.1	4.2	20.7	.3	5.7	8.9	.6	.1	.4	------	.1	------	.5	4.1
Statistics	253	100.0	54.6	14.6	30.8	1.6	3.2	.4	3.6	1.6	5.1	2.7	1.2	------	4.7	6.7
Psychology	1,516	100.0	80.3	------	19.7	.1	.3	.3	------	------	.6	6.0	1.6	4.7	------	6.1
Other	3,231	100.0	36.0	5.2	58.8	14.9	13.7	10.3	2.0	1.9	4.4	1.9	3.9	3.0	2.8	------
Architecture	23	100.0	8.7	4.3	87.0	13.0	30.4	13.0	17.4	4.4	4.4	------	------	4.4	------	------
Astronomy	199	100.0	56.8	3.0	40.2	1.5	3.5	22.1	1.5	------	------	------	------	11.1	.5	------
Metallurgy	551	100.0	60.1	2.3	37.6	9.8	23.2	3.1	.4	.2	------	.2	.2	.5	------	------
Military application of science	134	100.0	15.7	13.4	70.9	11.9	13.4	7.5	6.0	1.5	4.5	9.0	10.4	4.5	2.2	------
Nutrition and foods	513	100.0	35.3	1.7	63.0	36.3	1.8	.4	------	4.9	7.0	2.3	9.7	.2	.4	------
Manpower resources	917	100.0	34.0	5.7	60.3	14.0	19.3	8.1	1.8	2.2	3.4	1.5	2.9	1.6	5.5	------
All other	894	100.0	22.9	7.6	69.5	10.2	10.8	20.5	3.6	1.4	7.7	2.5	3.6	5.4	3.8	------

[1] Excludes 2,916 scientists who failed to report a second specialty and 1 scientist failing to report either a first or second specialty.

[2] Less than 0.05 percent.

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TABLE C.—Percent of Scientists in Each Age Group by General Field of Specialization and Highest Degree Earned, 1948

Highest degree earned by general specialty	Total reporting age		Under 30 years	30–34 years	35–39 years	40–44 years	45–49 years	50–54 years	55–59 years	60–64 years	65–69 years	70 years and over
	Number	Percent										
All fields	[1] 41,384	100.0	6.3	16.9	17.3	16.7	13.1	10.5	8.4	5.8	3.2	1.8
Bachelor or none	4,752	100.0	11.6	15.5	13.7	12.9	11.5	10.2	10.2	7.1	4.4	2.9
Master	6,315	100.0	7.0	15.0	14.5	13.5	13.4	11.6	11.0	7.9	4.1	2.0
M. D.	4,427	100.0	1.9	8.9	14.0	15.9	14.9	14.6	12.0	9.1	5.0	3.7
Ph. D.	25,815	100.0	5.9	19.0	19.3	18.3	13.1	9.6	6.8	4.5	2.3	1.2
Other degree and no report	75											
Chemistry	10,547	100.0	10.5	24.0	19.5	15.5	10.5	8.5	5.4	3.4	1.8	.9
Bachelor or none	1,044	100.0	16.3	19.0	15.7	12.5	10.5	10.2	7.2	4.3	2.0	2.3
Master	1,098	100.0	9.7	22.3	17.8	12.9	8.6	9.0	8.6	6.1	3.6	1.4
M. D.	133	100.0	6.8	20.3	27.1	12.8	10.5	8.3	6.0	3.0	3.0	2.2
Ph. D.	8,265	100.0	9.9	24.9	20.1	16.3	10.8	8.2	4.8	2.9	1.5	.6
Other degree and no report	7											
Engineering	4,861	100.0	6.5	15.2	15.6	15.5	13.1	11.1	9.2	6.7	4.4	2.7
Bachelor or none	1,618	100.0	9.0	14.6	12.9	12.9	12.6	10.6	10.7	7.8	5.3	3.6
Master	1,599	100.0	5.5	11.4	13.3	14.6	14.3	14.1	10.7	8.3	5.4	2.4
M. D.	6	100.0	16.7				16.7	16.7			49.9	
Ph. D.	1,622	100.0	5.1	19.6	20.6	19.4	12.4	8.6	6.4	3.9	2.1	1.9
Other degree and no report	16											
Physics and electronics	3,413	100.0	10.6	21.0	18.5	16.2	12.0	8.0	5.6	4.0	2.6	1.5
Bachelor or none	361	100.0	28.8	20.8	15.2	11.6	8.0	5.3	4.2	3.0	1.7	1.4
Master	617	100.0	13.6	21.7	15.9	13.8	10.5	8.8	7.6	4.4	2.4	1.3
M. D.	9	100.0		44.5		11.1	22.2	11.1			11.1	
Ph. D.	2,420	100.0	7.1	20.8	19.8	17.5	12.9	8.2	5.4	4.1	2.7	1.5
Other degree and no report	6											
Earth sciences	2,070	100.0	3.9	15.0	16.9	19.7	13.4	10.8	8.5	5.6	4.2	2.0
Bachelor or none	293	100.0	8.9	17.1	13.0	19.1	8.5	9.6	6.8	8.9	6.1	2.0
Master	453	100.0	8.4	22.1	16.8	13.7	11.0	9.7	7.5	5.3	3.1	2.4
M. D.	2	100.0							50.0			50.0
Ph. D.	1,317	100.0	1.3	12.1	17.8	22.1	15.3	11.5	9.1	4.9	4.1	1.8
Other degree and no report	5											
Agriculture	2,409	100.0	2.7	10.8	13.9	14.5	14.6	14.8	13.9	9.0	4.4	1.4
Bachelor or none	263	100.0	2.7	6.1	9.1	9.1	10.3	14.4	23.2	14.0	8.4	2.7
Master	787	100.0	2.7	7.9	9.6	11.4	15.5	15.1	16.9	12.7	6.0	2.2
M. D.	6	100.0		16.7		16.7	16.7	16.7			33.2	
Ph. D.	1,347	100.0	2.8	13.4	17.3	17.4	14.9	14.6	10.4	5.9	2.5	.8
Other degree and no report	6											
Biology	5,767	100.0	3.6	15.3	17.8	18.4	13.8	10.3	9.5	6.7	2.8	1.8
Bachelor or none	337	100.0	5.0	10.4	11.3	11.6	14.5	12.8	15.7	9.8	5.3	3.6
Master	715	100.0	7.5	11.8	14.1	14.8	15.8	10.9	11.8	7.3	3.6	2.4
M. D.	332	100.0	3.3	14.8	17.5	17.5	13.0	8.4	10.8	8.4	2.1	4.2
Ph. D.	4,368	100.0	2.9	16.3	19.0	19.6	13.5	10.2	8.5	6.2	2.4	1.4
Other degree and no report	15											
Medicine	2,831	100.0	1.2	6.1	12.7	15.3	15.9	16.8	13.3	9.5	5.6	3.6
Bachelor or none	27	100.0		11.1	11.1	14.8	11.1	22.3	14.8	7.4	3.7	3.7
Master	30	100.0	3.3	10.0	6.7	10.0	23.3	10.0	33.4	3.3		
M. D.	2,579	100.0	1.2	6.0	12.5	15.2	15.3	16.8	13.4	10.0	5.8	3.8
Ph. D.	192	100.0	1.0	6.2	16.2	18.8	23.4	16.7	8.9	4.7	3.6	.5
Other degree and no report	3											
Fields related to medicine	2,644	100.0	3.1	14.1	18.1	19.3	14.2	10.5	9.2	6.3	3.2	2.0
Bachelor or none	73	100.0	9.6	21.9	12.3	8.2	12.3	9.6	2.8	11.0	8.2	4.1
Master	102	100.0	4.9	15.7	13.7	14.7	14.7	7.8	19.6	5.9	2.0	1.0
M. D.	1,236	100.0	2.4	11.7	15.1	17.4	14.3	12.7	10.4	8.5	4.3	3.2
Ph. D.	1,232	100.0	3.2	15.9	21.9	22.1	14.3	8.5	7.4	3.9	2.0	.8
Other degree and no report	1											
Mathematics and statistics	1,913	100.0	5.8	14.6	15.9	16.3	14.7	10.1	8.6	7.3	4.8	1.9
Bachelor or none	66	100.0	21.2	9.1	13.6	4.6	7.6	10.6	16.6	4.6	9.1	3.0
Master	246	100.0	5.3	9.8	13.8	8.1	13.0	13.4	11.8	14.6	6.9	3.3
M. D.	6	100.0				33.3	16.7	16.7	33.3			
Ph. D.	1,594	100.0	5.3	15.6	16.4	18.0	15.3	9.5	7.7	6.3	4.3	1.6
Other degree and no report	1											
Psychology	1,570	100.0	5.7	15.0	16.4	17.3	14.0	10.7	9.8	6.4	2.7	2.0
Bachelor or none	13	100.0	7.7	23.0	7.7	15.4	15.4	7.7	7.7		7.7	7.7
Master	64	100.0	17.2	15.6	14.1	6.2	7.8	4.7	18.8	10.9	1.6	3.1
M. D.	18	100.0			5.6		27.7	5.6	22.2	22.2	5.6	11.1
Ph. D.	1,473	100.0	5.3	15.1	16.8	18.1	14.0	11.1	9.2	6.0	2.6	1.8
Other degree and no report	2											
Other	3,359	100.0	4.4	14.9	18.3	18.1	15.7	10.6	8.3	5.6	2.6	1.5
Bachelor or none	656	100.0	9.3	15.1	15.4	14.8	12.6	8.8	11.0	7.1	3.5	2.4
Master	604	100.0	3.2	14.2	16.7	14.9	18.7	11.6	9.6	7.8	1.8	1.5
M. D.	100	100.0	3.0	13.0	15.0	19.0	23.0	11.0	5.0	5.0	3.0	3.0
Ph. D.	1,986	100.0	3.2	15.2	20.0	20.1	15.4	10.7	7.2	4.5	2.5	1.2
Other degree and no report	13											

[1] Excludes 353 scientists not reporting age.

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TABLE D.—Number of Women Scientists by Age Group, Level of Education, and General Field of Specialization, 1948

Field of specialization and highest degree earned	Total reporting age	Under 30 years	30–34 years	35–39 years	40–44 years	45–49 years	50–54 years	55–59 years	60–64 years	65–69 years	70 years and over
All fields	[1] 2,415	194	262	308	405	407	358	256	138	60	27
Bachelor or none	109	30	13	9	14	15	13	5	3	4	3
Master	277	32	21	25	32	48	44	42	21	9	3
M. D.	139	4	10	20	19	26	19	23	12	2	4
Ph. D	1,886	128	218	253	340	317	282	186	102	43	17
Other degree and no report	4			1		1				2	
Chemistry	465	64	67	61	77	71	65	32	18	7	3
Bachelor or none	29	14	5	1	3	3	2			1	
Master	48	8	4	4	6	9	8	8	1		
M. D.	7			2	1		1	2			1
Ph. D	381	42	58	54	67	59	54	22	17	6	2
Other degree and no report											
Engineering	7	1	1	2	2	1					
Bachelor or none	1				1						
Master											
M. D.											
Ph. D	6	1	1	2	1	1					
Other degree and no report											
Physics and electronics	86	9	11	16	10	8	12	11	8	1	
Bachelor or none	4	3						1			
Master	10	1		2	1	1		3	1	1	
M. D.											
Ph. D	72	5	11	14	9	7	12	7	7		
Other degree and no report											
Earth sciences	84	4	7	16	11	14	10	12	5	4	1
Bachelor or none	5	1	1			1	2				
Master	22	2	3	4	1	4	1	4	3		
M. D.											
Ph. D	57	1	3	12	10	9	7	8	2	4	1
Other degree and no report											
Agriculture	12			3	1	3	4	1			
Bachelor or none											
Master	4					1	3				
M. D.											
Ph. D	8			3	1	2	1	1			
Other degree and no report											
Biology	655	51	78	90	125	105	99	57	32	14	4
Bachelor or none	40	4	3	5	6	7	7	3	3	1	1
Master	96	13	5	11	15	18	17	10	2	5	
M. D.	13	1	1	3	3		1	1	1	1	1
Ph. D	504	33	69	70	101	80	74	43	26	6	2
Other degree and no report	2			1						1	
Medicine	117	2	6	15	17	24	22	20	7	1	3
Bachelor or none	1				1						
Master	3						1	2			
M. D.	75	2	6	12	10	12	11	14	6		2
Ph. D	38			3	6	12	10	4	1	1	1
Other degree and no report											
Fields related to medicine	215	12	21	31	43	39	26	22	12	3	6
Bachelor or none	7		2		3					1	1
Master	14	1	3	1	1	3	2	2			1
M. D.	37	1	3	3	5	11	6	4	3	1	
Ph. D	157	10	13	27	34	25	18	16	9	1	4
Other degree and no report											
Mathematics and statistics	181	15	15	13	29	35	27	19	18	8	2
Bachelor or none	3	2		1							
Master	25	2	2		3	2	4	4	5	2	1
M. D.											
Ph. D	153	11	13	12	26	33	23	15	13	6	1
Other degree and no report											
Psychology	313	25	34	31	46	47	50	47	18	10	5
Bachelor or none	3	1				2					
Master	14	3	2		1	1	2	3	1		1
M. D.	5					2		1	2		
Ph. D	290	21	32	31	45	42	48	43	15	9	4
Other degree and no report	1									1	
Other	280	11	22	30	44	60	43	35	20	12	3
Bachelor or none	16	5	2	2		2	2	1		1	1
Master	41	2	2	3	4	9	6	6	8	1	
M. D.	2					1		1			
Ph. D	220	4	18	25	40	47	35	27	12	10	2
Other degree and no report	1					1					

[1] Excludes 105 women scientists not reporting date of birth.

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TABLE E.—Percent of Scientists in Each Specific Field of Specialization by Highest Degree Earned, 1948

Field of specialization	Total reporting		Bachelor's degree or no degree	Master's degree	Ph. D.	M. D.	Other
	Number	Percent					
All fields	[1] 41,674	100.0	11.6	15.3	62.4	10.7	[2]
Chemistry	10,621	100.0	9.9	10.4	78.4	1.3	[2]
General	679	100.0	17.1	14.0	67.6	1.3	
Analytic	1,020	100.0	23.4	19.5	56.8	.2	0.1
Biochemistry	1,594	100.0	4.4	6.8	81.8	7.0	
Inorganic	762	100.0	17.1	15.3	67.6		
Organic	4,135	100.0	7.7	9.3	82.8	.2	[2]
Physical	2,431	100.0	7.5	8.3	84.1	.1	
Engineering	4,892	100.0	33.4	33.1	33.3	.1	.1
Aeronautical	220	100.0	29.5	32.3	37.3	.9	
Chemical	1,975	100.0	34.1	22.6	43.2	.1	
Civil	693	100.0	35.4	45.7	18.5	.1	.3
Electrical	783	100.0	29.9	41.2	28.5	.3	.1
Mechanical	649	100.0	33.4	44.7	21.9		
Metallurgical	137	100.0	40.1	28.5	31.4		
Mining	148	100.0	35.1	37.9	27.0		
Ordnance	157	100.0	30.6	21.6	47.8		
Power plant	130	100.0	33.1	33.1	33.8		
Physics and electronics	3,435	100.0	10.8	18.1	70.7	.3	.1
Physics	2,804	100.0	7.4	15.8	76.6	.2	[2]
Electronics	631	100.0	26.0	28.8	44.5	.5	.2
Earth sciences	2,083	100.0	14.2	22.0	63.7	.1	
Geophysics	292	100.0	31.2	25.0	43.8		
Geography	262	100.0	4.2	15.3	80.5		
Geology	1,392	100.0	11.4	21.5	67.0	.1	
Meteorology	137	100.0	24.8	34.3	40.2	.7	
Agriculture	2,421	100.0	11.0	32.9	55.9	.2	
Biology	5,805	100.0	5.9	12.4	75.9	5.8	[2]
Bacteriology	1,418	100.0	4.8	8.2	67.0	19.9	.1
General biology	1,003	100.0	4.3	10.6	82.2	2.9	
Botany	1,603	100.0	2.6	10.8	86.5	.1	
Entomology	819	100.0	13.4	23.1	62.9	.6	
Zoology	962	100.0	8.0	14.4	75.7	1.8	.1
Medicine	2,856	100.0	1.0	1.1	6.8	91.1	[2]
Clinical medicine	1,164	100.0	.4	.4	2.2	97.0	
Neuropsychiatry	325	100.0		.3	13.5	86.2	
Obstetrics	117	100.0		.8	.8	98.4	
Opthalmology	93	100.0	2.1	1.1	26.9	69.9	
Pediatrics	171	100.0	.6		2.9	96.5	
Public health	319	100.0	4.1	6.9	26.0	63.0	
Radiology	115	100.0	4.3		6.1	89.6	
Surgery	552	100.0	.5		.7	98.6	.2
Fields related to medicine	2,663	100.0	2.9	3.8	46.7	46.6	
Anatomy	527	100.0	2.1	3.8	65.5	28.6	
Dental medicine	116	100.0	4.3	.9	8.6	86.2	
Pathology	478	100.0	.6	1.1	9.0	89.3	
Physiology	814	100.0	.9	2.6	66.2	30.3	
Pharmacy-pharmacology	538	100.0	8.9	10.1	54.8	26.2	
Veterinary medicine	190	100.0	1.1	.5	6.3	92.1	
Mathematics and statistics	1,929	100.0	3.5	13.0	83.2	.3	
Mathematics	1,673	100.0	2.3	12.7	84.9	.1	
Statistics	256	100.0	11.7	14.4	72.3	1.6	
Psychology	1,588	100.0	.8	4.2	93.8	1.1	.1
Other	3,381	100.0	19.6	18.0	59.3	3.0	.1
Architecture	24	100.0	4.2	54.1	41.7		
Astronomy	211	100.0	8.1	12.3	78.2	.9	.5
Metallurgy	568	100.0	31.0	24.6	44.4		
Military application of science	134	100.0	26.9	16.4	44.0	12.7	
Nutrition and foods	524	100.0	11.4	11.3	74.4	2.9	
Manpower resources	918	100.0	21.5	19.8	54.6	4.0	.1
All other and no report	1,002	100.0	17.5	16.6	62.6	3.2	.1

[1] Does not include 63 persons not reporting level of education.
[2] Less than 0.05 percent.

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TABLE F.—Percentage Distribution of Bachelor's Degrees by Period of Degree and Region of Degree, 1948

Region of bachelor's degree	Year of bachelor's degree [1]								
	Before 1900	1901–05	1906–10	1911–15	1916–20	1921–25	1926–30	1931–35	1936–40
	Percentage distribution								
New England	24.0	16.5	16.8	14.3	13.5	12.2	11.2	11.5	10.7
Middle Atlantic	19.1	18.3	19.0	21.4	21.2	20.5	19.4	22.5	24.0
South	8.1	11.0	9.1	10.5	12.3	12.7	13.1	12.9	12.8
North Central	32.3	37.1	34.9	33.4	32.5	32.4	32.7	31.4	31.7
Mountain and Plains	9.9	12.1	14.3	13.3	12.7	13.1	13.4	11.5	10.8
Pacific	6.6	5.0	5.9	7.1	7.8	9.1	10.2	10.2	10.0
Total United States	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total number reporting [2]	566	1,073	2,069	3,068	3,803	4,828	6,276	6,608	6,629

[1] Year of bachelor's degree was computed by subtracting age shown on questionnaire from 1948 and adding 22 years, at which age it was assumed the average college graduate earned his degree.

[2] The total number reporting, 34,920, excludes 2,501 earning degrees after 1940, 307 scientists failing to report date of birth, 3,636 who did not report region of bachelor's degree, and 373 scientists who did not receive bachelor's degree.

TABLE G.—Percentage Distribution of Ph. D. Degrees by Decade of Degree and Area of Degree, 1948

Area of Ph. D. degree	Decade of Ph. D. degree				
	1900–09	1910–19	1920–29	1930–39	1940–49
	Percentage distribution				
New England	28.6	20.0	14.0	13.9	12.3
Maine, New Hampshire, Vermont	-------	.1	.1	(1)	(1)
Massachusetts, Rhode Island, Connecticut	28.6	19.9	13.9	13.9	12.3
Middle Atlantic	42.4	38.0	30.7	27.4	27.3
New York, New Jersey, Pennsylvania	28.6	30.7	23.6	22.4	23.2
Maryland, District of Columbia, Delaware	13.8	7.3	7.1	5.0	4.1
South	2.5	1.4	2.0	4.8	5.8
Virginia, West Virginia, Kentucky, North Carolina, Tennessee	2.5	1.0	1.3	3.4	3.3
South Carolina, Georgia, Alabama, Mississippi	-------	.1	.1	(1)	(1)
Florida	-------	-------	-------	.2	.2
Arkansas, Louisiana, Oklahoma, Texas	-------	.3	.6	1.2	2.3
North Central	20.8	33.0	42.4	40.3	41.1
Ohio, Indiana, Illinois, Michigan	16.6	25.2	25.5	24.4	25.7
Minnesota, Iowa, Wisconsin	4.2	7.8	16.9	15.9	15.4
Mountain and Plains	1.1	2.1	2.5	3.9	3.4
Nebraska, Kansas, Missouri	1.1	1.8	2.1	3.2	2.7
North Dakota, South Dakota, Montana, Idaho, Wyoming, Colorado, Nevada, Utah	-------	.3	.4	.6	.6
Arizona, New Mexico	-------	-------	(1)	.1	.1
Pacific	4.6	5.5	8.4	9.7	10.1
Washington, Oregon	-------	.1	.4	1.3	1.3
California	4.6	5.4	8.0	8.4	8.8
Total	100.0	100.0	100.0	100.0	100.0
Total number reporting [2]	283	1,353	4,210	9,618	9,290

[1] Less than 0.05 percent.

[2] The 24,754 scientists reporting excludes 45 scientists receiving Ph. D. degree before 1900, 6 who failed to report year of degree, and 1,203 who did not report region of degree.

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TABLE H.—Percent of Scientists Engaged in Various Functions by General Field of Specialization [1]

Function	Total	Chemistry	Engineering	Physics and electronics	Earth sciences	Agriculture	Biology	Medicine	Fields related to medicine	Mathematics and statistics	Psychology	Other
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Only one function reported	23.1	27.2	15.3	28.1	17.4	15.4	25.8	17.8	17.7	31.2	14.1	28.8
Research	12.6	22.1	4.5	14.8	6.4	9.9	15.5	3.8	9.3	7.7	3.2	10.2
Teaching	6.4	3.7	4.4	11.1	4.5	2.9	8.3	7.1	6.9	22.0	8.7	2.3
Administration	1.7	.3	1.0	.2	.8	1.0	.4	1.9	.4	.5	.7	13.9
Development	.9	.5	3.7	1.8	.1	.1	.1	.1	.1	.5	.5	.7
Production	.2	.2	.6	[2]	.3	.2	.1	.2	.2	----	.1	.3
Other	1.3	.4	1.1	.2	5.3	1.3	1.4	4.7	.8	.5	.9	1.4
More than one function reported	76.9	72.8	84.7	71.9	82.6	84.6	74.2	82.2	82.3	68.8	85.9	71.2
Research and teaching	19.4	20.3	4.2	18.1	15.2	15.9	27.5	19.5	34.3	35.0	21.4	9.3
Research, teaching, and administration	9.4	8.0	3.0	6.6	5.7	16.2	10.1	17.0	20.2	7.2	13.3	7.0
Research and administration	4.6	7.6	3.4	3.2	3.7	5.8	4.2	1.4	3.0	1.7	1.4	6.4
Research and development	3.9	5.7	8.1	9.2	1.0	.7	1.3	.4	.7	.8	1.2	4.0
Teaching and administration	2.8	1.0	2.1	4.9	2.0	2.2	3.0	4.7	2.9	8.6	5.2	2.1
Research, development, and administration	2.7	3.5	6.6	4.3	1.3	.5	.7	.2	.8	.5	1.4	4.0
Research, teaching, administration, and development	2.5	1.9	5.6	4.3	.7	1.4	1.1	1.2	1.8	1.0	7.5	2.5
Research, development, and teaching	2.4	2.3	5.4	5.6	.5	1.0	.8	.7	1.1	.9	5.0	1.7
Research, development, production, and administration	2.1	2.7	6.8	2.0	.5	.7	.6	.1	.3	.3	.4	3.3
Research, teaching, administration, development, and production	2.0	2.1	4.6	1.6	.7	2.6	.8	.7	.9	1.1	3.0	2.8
Other combinations	25.1	17.7	34.9	12.1	51.3	37.6	24.1	36.3	16.3	11.7	26.1	28.1
Total number reporting	[3] 41,668	10,611	4,901	3,432	2,086	2,425	5,813	2,846	2,659	1,928	1,587	3,380

[1] Information reported in 1948, but applies also to other years.
[2] Less than 0.05 percent.
[3] Excludes 69 scientists not reporting functions.

TABLE I.—Percent of Scientists in Each Specific Field of Specialization by Type of Employer, 1948

Field of specialization	Total reporting		Education	Private industry	Government	Foundation	Consultant	Education and consultant	Education and Government	Other
	Number	Percent								
All fields	[1] 41,733	100.0	37.4	27.1	13.5	2.2	1.4	6.8	2.4	9.2
Chemistry	10,625	100.0	27.7	50.1	8.9	2.3	.9	5.2	.9	4.0
General	682	100.0	24.0	51.8	10.6	2.6	3.2	3.1	1.0	3.7
Analytic	1,020	100.0	29.9	38.2	16.2	2.6	1.1	7.6	1.4	3.0
Biochemistry	1,594	100.0	42.0	26.2	13.0	3.3	.5	5.7	2.4	6.9
Inorganic	763	100.0	38.7	42.7	6.4	2.1	.9	5.7	.9	2.6
Organic	4,135	100.0	19.7	63.7	5.8	2.0	.8	4.2	.3	3.5
Physical	2,431	100.0	28.5	49.7	8.7	1.9	.7	6.1	.6	3.8
Engineering	4,906	100.0	18.3	43.8	12.0	2.0	3.9	12.9	.8	6.3
Aeronautical	220	100.0	20.0	20.0	32.3	.9	.9	18.2	2.3	5.4
Chemical	1,976	100.0	8.8	67.5	6.1	2.2	3.0	6.5	.6	5.3
Civil	696	100.0	28.2	9.0	22.8	.4	7.6	22.6	.9	8.5
Electrical	788	100.0	28.4	38.6	8.0	.2	2.8	14.9	1.0	6.1
Mechanical	652	100.0	26.7	31.9	6.7	2.8	4.0	20.5	.3	7.1
Metallurgical	138	100.0	6.5	51.4	7.2	14.5	4.4	8.0	----	8.0
Mining	149	100.0	12.1	32.2	18.8	----	11.4	15.4	2.0	8.1
Ordnance	157	100.0	14.7	23.6	50.3	1.9	.6	.6	1.3	7.0
Power plant	130	100.0	26.9	30.8	11.5	6.2	4.6	16.2	----	3.8
Physics and electronics	3,439	100.0	43.3	26.7	12.8	1.1	.9	9.3	1.4	4.5
Physics	2,807	100.0	48.7	22.4	11.6	1.3	.9	9.8	1.4	3.9
Electronics	632	100.0	19.4	45.6	17.9	.2	.9	7.4	1.6	7.0
Earth sciences	2,089	100.0	29.9	16.3	26.6	1.2	4.6	10.7	3.8	6.9
Geophysics	293	100.0	15.7	30.0	31.4	1.4	3.4	8.9	1.7	7.5
Geography	262	100.0	68.7	1.1	11.1	.4	.8	9.5	3.4	5.0
Geology	1,394	100.0	25.7	17.4	26.3	1.4	6.0	11.8	4.4	7.0
Meteorology	140	100.0	30.0	5.0	48.6	----	.7	5.7	2.1	7.9
Agriculture	2,427	100.0	45.1	7.9	29.4	.7	1.4	4.9	8.1	2.5
Biology	5,818	100.0	53.7	9.3	20.8	3.1	.6	3.6	4.6	4.3
Bacteriology	1,420	100.0	41.0	19.3	18.8	3.3	.5	4.4	3.9	8.8
Biology	1,005	100.0	64.1	3.7	15.8	3.1	.4	5.1	3.2	4.6
Botany	1,603	100.0	57.8	7.9	20.5	2.2	.7	2.9	6.1	1.9
Entomology	822	100.0	35.8	10.1	39.6	1.6	.7	2.1	7.7	2.4
Zoology	968	100.0	70.2	2.2	13.2	5.5	.8	3.1	1.9	3.1
Medicine	2,857	100.0	22.6	7.3	7.5	2.0	.7	2.7	3.0	54.2
Clinical	1,164	100.0	24.8	7.1	4.6	2.2	.5	2.2	2.3	56.3
Neuropsychiatry	325	100.0	15.4	5.6	7.1	.9	.9	4.3	4.9	60.9
Obstetrics	117	100.0	21.4	6.9	----	.8	----	.8	.8	69.3
Ophthalmology	93	100.0	23.6	7.5	5.4	----	1.1	5.4	----	57.0
Pediatrics	171	100.0	21.6	5.9	2.9	.6	2.9	4.1	2.9	59.1
Public health	319	100.0	19.7	8.2	33.5	6.9	.3	4.7	8.2	18.5
Radiology	115	100.0	28.7	13.9	5.2	.9	----	1.7	1.7	47.9
Surgery	553	100.0	23.2	7.6	2.5	.7	.6	1.4	1.4	62.6

See footnote at end of table.

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TABLE I.—Percent of Scientists in Each Specific Field of Specialization by Type of Employer, 1948—Continued

Field of specialization	Total reporting		Education	Private industry	Government	Foundation	Consultant	Education and consultant	Education and Government	Other
	Number	Percent								
Fields related to medicine	2,663	100.0	57.2	11.9	7.9	1.9	.2	3.8	2.3	14.8
Anatomy	526	100.0	83.5	1.7	3.2	1.9		1.9	1.7	6.1
Dental medicine	116	100.0	43.1	3.4	6.9	.9		4.3	4.3	37.1
Pathology	478	100.0	28.0	13.2	10.2	1.9	.6	2.7	3.4	40.0
Physiology	814	100.0	68.5	7.5	6.8	2.8	.1	3.9	2.0	8.4
Pharmacy, pharmacology	539	100.0	41.9	30.6	9.8	1.1	.2	6.9	1.3	8.2
Veterinary medicine	190	100.0	61.7	8.4	14.7	1.0		1.6	4.7	7.9
Mathematics and statistics	1,929	100.0	73.4	6.0	8.1	.3	.6	7.4	1.4	2.8
Mathematics	1,673	100.0	80.0	4.8	5.2	.3	.5	6.4	1.1	1.7
Statistics	256	100.0	30.5	13.7	26.9		1.6	13.7	3.5	10.1
Psychology	1,589	100.0	54.4	4.6	6.4	1.4	.8	11.4	3.0	18.0
Other	3,391	100.0	28.6	33.0	15.3	5.4	1.5	7.7	1.5	7.0
Architecture	24	100.0	25.0	8.3	16.7	8.3	12.5	20.9		8.3
Astronomy	212	100.0	74.5	3.8	10.4	1.9	.5	2.8	1.4	4.7
Metallurgy	569	100.0	13.4	47.7	9.3	11.2	1.2	11.2	.7	5.3
Military application of science	136	100.0	17.6	22.8	38.2	2.2	2.2	5.9	1.5	9.6
Nutrition and foods	524	100.0	35.5	36.6	10.1	1.7	1.5	6.9	2.9	4.8
Manpower resources	920	100.0	14.0	44.6	19.4	4.0	1.5	7.6	1.2	7.7
All others and no report	1,006	100.0	39.1	20.3	15.5	6.4	1.5	7.0	1.7	8.5

[1] Excludes 4 scientists not reporting type of employer.

TABLE J.—Percent of Scientists by Highest Degree Earned, Principal Type of Employer, and Genera Field of Specialization, 1948

Type of employer and field of specialization	Total reporting		Ph. D.[3]	M. D.[3]	Master [4]	Bachelor or none
	Number [1]	Percent				
Educational institution	15,586	100.0	73.7	8.7	13.6	4.0
Chemistry	2,940	100.0	85.5	2.0	9.1	3.4
Engineering	897	100.0	36.6	.1	46.1	17.2
Physics and electronics	1,488	100.0	76.3	.3	17.6	5.8
Earth sciences	626	100.0	78.8		16.6	4.6
Agriculture	1,094	100.0	61.3	.4	31.9	6.4
Biology	3,123	100.0	84.5	3.4	10.4	1.7
Medicine	646	100.0	9.4	88.7	1.6	.3
Fields related to medicine	1,524	100.0	57.1	37.7	3.5	1.7
Mathematics and statistics	1,415	100.0	85.7	.2	12.4	1.7
Psychology	863	100.0	95.1	.8	3.6	.5
Other	970	100.0	76.8	2.7	13.2	7.3
Private industry	11,282	100.0	61.2	3.4	15.5	19.9
Chemistry	5,327	100.0	76.8	.4	10.1	12.7
Engineering	2,142	100.0	33.2	.1	25.5	41.2
Physics and electronics	914	100.0	61.0	.2	21.0	17.8
Earth sciences	340	100.0	55.6		25.6	18.8
Agriculture	192	100.0	63.0	1.1	22.9	13.0
Biology	538	100.0	73.2	6.9	10.8	9.1
Medicine	209	100.0	7.7	86.6		5.7
Fields related to medicine	317	100.0	40.7	40.7	8.5	10.1
Mathematics and statistics	116	100.0	63.8		20.7	15.5
Psychology	73	100.0	80.8	1.4	13.7	4.1
Other	1,114	100.0	50.8	1.2	19.6	28.4
Government	5,631	100.0	50.3	6.8	22.9	20.0
Chemistry	943	100.0	61.7	1.7	18.1	18.5
Engineering	587	100.0	21.5		30.0	48.5
Physics and electronics	437	100.0	61.3	.2	22.2	16.3
Earth sciences	552	100.0	42.2	.2	30.8	26.8
Agriculture	709	100.0	44.9		37.5	17.6
Biology	1,207	100.0	58.8	5.6	21.2	14.4
Medicine	214	100.0	18.2	76.7	4.2	.9
Fields related to medicine	210	100.0	40.5	52.9	1.4	5.2
Mathematics and statistics	156	100.0	74.4	.6	14.1	10.9
Psychology	101	100.0	92.1		6.9	1.0
Other	515	100.0	50.3	4.5	21.7	23.5

[1] The 32,499 scientists employed by the three principal employers do not include 9,156 who reported other employers and combinations of employers, 4 who did not report type of employer, and 78 who reported other degrees or who failed to report level of education.

[2] Includes a very small number of doctors of education and doctors of science.

[3] Includes a few doctors of veterinary medicine, doctors of dental science, and doctors of osteopathy.

[4] Those with a master's degree but no other graduate degree.

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TABLE K.—Median Age of Scientists Working for Various Types of Employers, by Highest Degree Earned and General Field of Specialization, 1948

Highest degree earned and field of specialization	Total reporting age		Education [1]		Private industry [1]		Government [1]		Other [2]	
	Number	Median age	Number	Median age	Number	Median age	Number	Median age	Number	Median age
Total reporting [3]	41,384	43	15,448	44	11,212	39	5,613	44	9,111	46
Chemistry	10,547	39	2,912	40	5,291	38	944	42	1,400	42
Engineering	4,861	44	886	47	2,129	41	584	45	1,262	48
Physics and electronics	3,413	40	1,479	42	909	38	434	40	591	39
Earth sciences	2,070	44	622	45	334	43	551	41	563	45
Agriculture	2,409	48	1,084	47	190	45	711	47	424	52
Biology	5,767	44	3,097	43	533	41	1,199	45	938	45
Medicine	2,831	50	640	48	209	49	212	46	1,770	50
Fields related to medicine	2,644	44	1,512	44	316	41	207	44	609	46
Mathematics and statistics	1,913	44	1,402	45	115	40	155	40	241	43
Psychology	1,570	44	854	45	73	41	100	42	543	43
Other fields	3,359	43	960	45	1,113	42	516	44	770	44
Ph. D	25,815	42	11,390	43	6,861	38	2,816	43	4,748	43
Chemistry	8,264	39	2,490	40	4,062	37	582	41	1,130	42
Engineering	1,622	41	325	42	708	39	125	43	464	43
Physics and electronics	2,420	41	1,129	42	555	39	268	41	468	40
Earth sciences	1,317	44	490	45	186	42	232	43	409	45
Agriculture	1,347	45	666	44	120	43	318	45	243	48
Biology	4,368	43	2,615	43	391	40	703	44	659	44
Medicine	192	47	60	48	16	[4]	39	47	77	46
Fields related to medicine	1,232	42	863	42	128	40	83	42	158	42
Mathematics and statistics	1,594	44	1,204	44	73	40	116	41	201	42
Psychology	1,473	44	812	45	59	41	91	42	511	43
Other fields	1,986	43	736	44	563	41	259	43	428	43
Master	6,315	45	2,090	48	1,726	40	1,278	44	1,221	48
Chemistry	1,098	40	264	45	534	38	171	42	129	43
Engineering	1,599	47	409	51	538	42	172	47	480	49
Physics and electronics	617	40	260	45	190	38	94	39	73	38
Earth sciences	453	41	103	42	85	43	168	39	97	43
Agriculture	787	51	344	51	44	49	265	49	134	56
Biology	715	46	321	45	55	39	255	46	84	48
Medicine	30	49	10	[4]	----	----	9	[4]	11	[4]
Fields related to medicine	102	45	53	49	27	36	3	[4]	19	[4]
Mathematics and statistics	246	50	171	53	24	38	22	37	29	49
Psychology	64	42	30	43	10	[4]	7	[4]	17	[4]
Other fields	604	45	125	46	219	44	112	44	148	47
Bachelor or none	4,752	44	609	45	2,215	42	1,119	45	809	48
Chemistry	1,045	40	99	30	669	40	174	44	103	38
Engineering	1,618	45	151	53	874	43	284	45	309	51
Physics and electronics	361	35	83	31	159	37	70	36	49	35
Earth sciences	293	43	29	34	63	47	147	41	54	51
Agriculture	263	54	69	57	24	51	124	51	46	58
Biology	337	49	53	48	48	42	172	51	64	51
Medicine	27	50	2	[4]	12	[4]	1	[4]	12	[4]
Fields related to medicine	73	44	25	51	31	37	10	[4]	7	[4]
Mathematics and statistics	66	46	23	54	18	[4]	16	[4]	9	[4]
Psychology	13	[4]	4	[4]	3	[4]	1	[4]	5	[4]
Other fields	656	44	71	41	314	43	120	46	151	43

[1] Employed exclusively by this type of employer.
[2] Employed by other single employers and all combinations of employers. Also includes four scientists not reporting type of employer.
[3] Includes scientists holding M. D. degrees, other degrees, and those not reporting level of education; excludes 353 scientists not reporting age.
[4] Insufficient reports to compute median.

TABLE L.—Percent of Ph. D.'s Employed by Each Type of Employer, by General Field of Specialization, 1948

Type of employer	Total reporting		Chemistry	Engineering	Physics and electronics	Earth sciences	Agriculture	Biology	Medicine	Fields related to medicine	Mathematics and statistics	Psychology
	Number	Percent										
Total	[1] 26,005	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Educational institution	11,493	44.2	30.2	20.1	46.7	37.1	49.6	60.0	31.3	70.1	75.6	55.1
Government	2,829	10.9	7.0	7.7	11.0	17.6	23.5	16.1	20.0	6.8	7.3	6.3
Educational institution and government	650	2.5	.8	1.2	1.6	5.3	9.0	4.7	3.1	1.0	1.4	3.1
Private industry	6,904	26.5	49.1	43.6	22.9	14.2	9.0	9.0	8.2	10.4	4.6	4.0
Foundation	462	1.8	2.1	.9	1.0	1.0	.6	2.4	3.1	2.3	.3	1.1
Independent consultant	282	1.1	.8	4.0	.8	3.8	.7	.5	2.5	.2	.6	.7
Educational institution and independent consultant	2,034	7.8	6.0	15.6	11.4	13.8	5.2	4.1	10.8	5.5	7.4	11.7
All other combinations	1,351	5.2	4.0	6.9	4.6	7.2	2.4	3.2	21.0	3.7	2.8	18.0

[1] Total includes 2,005 scientists in fields other than those listed; excludes 3 not reporting type of employer.

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TABLE M.—Median Salary, Median Age, and Number of Ph.D.'s Reporting Salary by General Field of Specialization and Type of Employer, 1948

Item	Total	Education	Government	Industry	Foundation	Education and government	Education and independent consultant	Other
All fields:								
Number reporting salary	[1] 22,116	9,913	2,556	5,434	366	570	1,986	1,291
Median age	42	42	42	38	39	44	42	42
Median salary	$5,720	$4,860	$6,280	$7,070	$6,070	$5,710	$5,570	$6,350
Chemistry:								
Number reporting salary	6,915	2,137	522	3,241	146	62	493	314
Median age	38	39	41	37	38	42	42	41
Median salary	$6,030	$4,670	$6,290	$6,880	$5,980	$5,670	$5,360	$6,340
Engineering:								
Number reporting salary	1,313	271	112	535	13	13	245	124
Median age	41	42	42	39	----------	----------	42	42
Median salary	$6,960	$5,700	$7,400	$8,000	----------	----------	$5,860	$7,750
Physics and electronics:								
Number reporting salary	2,059	962	243	422	23	34	267	108
Median age	40	42	41	38	35	40	40	40
Median salary	$5,960	$5,040	$7,400	$7,350	$6,250	$7,380	$5,650	$6,500
Earth sciences:								
Number reporting salary	1,102	410	205	141	8	64	179	95
Median age	44	45	42	42	----------	44	44	44
Median salary	$5,710	$5,200	$6,120	$7,780	----------	$5,590	$5,340	$6,060
Agriculture:								
Number reporting salary	1,213	613	294	90	6	105	69	36
Median age	44	43	45	42	----------	46	48	47
Median salary	$5,660	$5,390	$5,980	$6,670	----------	$5,660	$5,780	$6,500
Biology:								
Number reporting salary	3,826	2,321	627	310	80	179	178	131
Median age	42	42	43	40	40	44	43	43
Median salary	$4,940	$4,610	$5,480	$6,250	$5,650	$5,370	$5,410	$5,800
Fields related to medicine:								
Number reporting salary	1,125	785	81	114	24	10	68	43
Median age	42	42	42	39	40	----------	42	41
Median salary	$5,420	$5,060	$5,930	$6,850	$6,670	----------	$5,500	$6,500
Mathematics and statistics:								
Number reporting salary	1,404	1,043	110	61	3	22	119	46
Median age	43	44	41	40	----------	40	42	42
Median salary	$5,060	$4,760	$6,830	$7,350	----------	$6,140	$5,680	$6,880
Psychology:								
Number reporting salary	1,304	706	87	51	9	43	170	238
Median age	43	44	42	40	----------	43	43	41
Median salary	$5,320	$4,920	$6,180	$7,940	----------	$5,720	$5,490	$5,750

[1] Includes 1,855 scientists reporting other fields of specialization; excludes 3,889 not reporting salary and 3 who did not report either type of employer or salary.

NOTE: Median ages shown above are for only those scientists who reported salary. Where fewer than 20 scientists reported salary, median age and median salary were not computed.

TABLE N.—Median and Quartile Salaries of Ph. D.'s by Type of Employer and Age of Scientists, 1948

Type of employer	Age of scientists								
	Under 30 years	30–34 years	35–39 years	40–44 years	45–49 years	50–54 years	55–59 years	60–64 years	65–69 years
Educational institution:									
Median salary	$3,900	$4,390	$4,720	$5,040	$5,260	$5,460	$5,540	$5,700	$5,620
Lower quartile salary	3,390	3,700	4,090	4,260	4,380	4,510	4,520	4,700	4,670
Upper quartile salary	4,610	5,020	5,600	6,050	6,440	6,640	6,740	7,050	6,880
Government:									
Median salary	5,050	5,450	6,070	6,330	6,650	6,800	7,130	6,840	6,890
Lower quartile salary	4,410	4,620	4,890	5,250	5,510	5,680	6,120	5,630	6,310
Upper quartile salary	5,820	6,520	7,380	7,670	7,820	7,970	8,400	8,180	8,390
Private industry:									
Median salary	5,560	6,400	7,350	8,150	8,760	9,980	[1] 10,000+	[1] 10,000+	7,830
Lower quartile salary	5,100	5,640	6,310	6,690	6,740	7,540	7,250	7,920	6,390
Upper quartile salary	6,050	7,240	8,760	[1] 10,000+	[1] 10,000+	[1] 10,000+	[1] 10,000+	[1] 10,000+	[1] 10,000+
Foundation:									
Median salary	4,680	5,410	5,910	6,880	7,360	6,790	(2)	(2)	(2)
Lower quartile salary	3,780	4,420	5,010	6,150	5,290	5,810	(2)	(2)	(2)
Upper quartile salary	5,720	6,250	6,950	7,960	9,250	[1] 10,000+	(2)	(2)	(2)
Educational institution and government:									
Median salary	(2)	4,960	5,400	5,660	6,240	6,000	6,280	6,630	(2)
Lower quartile salary	(2)	4,220	4,560	4,740	5,070	5,050	5,320	5,320	(2)
Upper quartile salary	(2)	5,940	6,320	6,620	7,480	7,750	6,970	8,380	(2)
Educational institution and independent consultant:									
Median salary	4,220	4,730	5,350	5,870	5,950	6,020	6,680	6,690	6,360
Lower quartile salary	3,590	4,170	4,530	5,090	5,040	5,090	5,340	5,470	5,250
Upper quartile salary	4,820	5,560	6,320	6,950	7,550	7,480	8,010	8,170	8,250
Other: [3]									
Median salary	4,950	5,840	5,990	6,600	6,960	6,440	7,620	6,730	6,500
Lower quartile salary	4,070	4,740	4,930	8,360	5,510	5,150	5,670	5,540	4,880
Upper quartile salary	6,040	6,950	7,910	5,710	[1] 10,000+	9,720	[1] 10,000+	8,630	9,750

[1] $10,000 and over.
[2] Insufficient reports to compute median.
[3] Includes self-employed scientists, independent consultants, and scientists employed by any combination of types of employers other than those listed elsewhere in the table.

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TABLE O.—Distribution of Salaries for Ph. D.'s in Each General Field of Specialization Employed Exclusively by One of the Three Principal Types of Employers, 1948

Annual salary	Chemists employed by—				Engineers employed by—			
	All types of employers	Educational institutions	Government	Private industry	All types of employers	Educational institutions	Government	Private industry
Total reporting	[1] 6,915	2,137	522	3,241	[1] 1,313	271	112	535
$0–$1,999	25	16		2	2			
$2,000–$2,999	45	34	1	3	6	2		1
$3,000–$3,999	655	541	8	19	30	20		
$4,000–$4,999	1,164	711	83	154	158	67	5	15
$5,000–$5,999	1,531	436	131	709	221	66	11	56
$6,000–$6,999	1,378	232	133	835	252	64	23	101
$7,000–$7,999	790	89	90	517	196	13	43	95
$8,000–$8,999	469	34	54	314	134	12	22	69
$9,000–$9,999	223	13	6	174	68	10	2	35
$10,000 and over	635	31	16	514	246	17	6	163
	Physicists and electronic scientists employed by—				Earth scientists employed by—			
	All types of employers	Educational institutions	Government	Private industry	All types of employers	Educational institutions	Government	Private industry
Total reporting	[1] 2,059	962	243	422	[1] 1,102	410	205	141
$0–$1,999	4	2			4			1
$2,000–$2,999	12	9			4	3	1	
$3,000–$3,999	197	168		1	101	59	2	
$4,000–$4,999	409	294	12	15	257	121	37	10
$5,000–$5,999	425	224	32	69	261	113	57	15
$6,000–$6,999	361	138	55	102	183	53	46	25
$7,000–$7,999	245	64	56	68	116	34	28	25
$8,000–$8,999	166	22	54	61	70	11	23	15
$9,000–$9,999	73	20	13	26	30	5	4	11
$10,000 and over	167	21	21	80	76	11	7	39
	Agriculturists employed by—				Biologists employed by—			
	All types of employers	Educational institutions	Government	Private industry	All types of employers	Educational institutions	Government	Private industry
Total reporting	[1] 1,213	613	294	90	[1] 3,826	2,321	627	310
$0–$1,999					31	23	2	1
$2,000–$2,999	3	2			86	71	2	3
$3,000–$3,999	51	30	12	4	660	553	37	11
$4,000–$4,999	298	194	57	8	1,212	845	195	40
$5,000–$5,999	383	206	80	15	832	437	160	80
$6,000–$6,999	222	91	62	27	526	222	115	79
$7,000–$7,999	108	50	36	8	230	86	61	37
$8,000–$8,999	68	25	24	7	109	44	31	15
$9,000–$9,999	29	8	9	4	47	9	18	10
$10,000 and over	51	7	14	17	93	31	6	34
	Specialists in medicine employed by—				Specialists in fields related to medicine employed by—			
	All types of employers	Educational institutions	Government	Private industry	All types of employers	Educational institutions	Government	Private industry
Total reporting	[1] 155	48	36	10	[1] 1,125	785	81	114
$0–$1,999	2			1	7	7		
$2,000–$2,999	1			1	17	17		
$3,000–$3,999	12	5	3		143	126	4	3
$4,000–$4,999	35	16	6		290	232	17	10
$5,000–$5,999	33	8	8	3	249	175	21	21
$6,000–$6,999	22	6	10		171	108	13	27
$7,000–$7,999	20	7	6		104	55	16	13
$8,000–$8,999	9	2	2	1	66	34	7	16
$9,000–$9,999	6	4		1	25	10	2	6
$10,000 and over	15		1	3	53	21	1	18

See footnotes at end of table.

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TABLE O.—Distribution of Salaries for Ph. D.'s in Each General Field of Specialization Employed Exclusively by One of the Three Principal Types of Employers, 1948—Continued

Annual salary	Mathematicians and statisticians employed by—				Psychologists employed by—			
	All types of employers	Educational institutions	Government	Private industry	All types of employers	Educational institutions	Government	Private industry
Total reporting	[1] 1,404	1,043	110	61	[1] 1,304	706	87	51
$0–$1,999	5	3		1	17	12	1	
$2,000–$2,999	19	17	2		21	13		
$3,000–$3,999	234	214	3	1	170	133	3	1
$4,000–$4,999	428	379	10	2	343	212	16	5
$5,000–$5,999	277	201	21	10	317	170	20	6
$6,000–$6,999	177	112	23	12	199	91	19	5
$7,000–$7,999	122	57	25	13	103	34	17	9
$8,000–$8,999	57	22	12	8	57	19	8	7
$9,000–$9,999	25	14	2	3	25	11	1	3
$10,000 and over	60	24	12	11	52	11	2	15

[1] Excludes 1,410 chemists, 318 engineers, 371 physicists and scientists in electronics, 225 earth scientists, 139 agriculturists, 578 biologists, 40 scientists in medicine, 118 in fields related to medicine, 200 mathematicians and statisticians, and 185 psychologists not reporting salary and 3 scientists not reporting either type of employer or salary.

TABLE P.—Median Salaries of Ph. D.'s Working Exclusively for One of the Three Principal Types of Employers, by General Field of Specialization and Region of Employment, 1948

Region of employment	Total [1]	Chemistry	Engineering	Physics and electronics	Earth sciences	Agriculture	Biology	Fields related to medicine	Mathematics and statistics	Psychology
	Scientists employed by all types of employers [2]									
Total [3]	$5,720	$6,030	$6,960	$5,960	$5,710	$5,660	$4,940	$5,420	$5,060	$5,320
New England	5,380	5,510	6,470	5,540	5,330	5,080	4,680	5,180	5,250	5,180
Middle Atlantic	6,310	6,530	7,580	6,420	6,060	6,340	5,430	5,540	5,640	5,620
South	5,200	5,570	6,650	5,530	5,630	5,460	4,640	5,270	4,730	5,000
North Central	5,730	5,950	6,780	5,810	5,710	5,790	4,790	5,700	4,960	5,330
Mountain and Plains	4,940	4,950	6,030	5,100	5,170	5,110	4,620	4,970	4,700	4,710
Pacific	5,550	5,650	6,870	5,990	5,690	5,740	5,050	5,100	5,080	5,260
	Scientists employed by educational institutions									
Total [3]	$4,860	$4,670	$5,710	$5,040	$5,200	$5,390	$4,610	$5,060	$4,760	$4,920
New England	4,730	4,510	[4]	4,980	4,890	5,080	4,370	4,710	5,000	4,810
Middle Atlantic	4,930	4,780	6,080	4,990	5,480	5,600	4,690	4,890	4,890	4,940
South	4,700	4,570	5,440	4,990	4,800	5,310	4,450	5,140	4,650	4,740
North Central	5,070	4,750	6,000	5,290	5,450	5,610	4,790	5,430	4,760	5,270
Mountain and Plains	4,620	4,550	5,500	4,800	4,530	4,820	4,360	4,840	4,610	4,430
Pacific	4,940	4,670	5,150	5,030	5,430	5,670	4,850	4,940	4,780	5,030
	Scientists employed by private industry									
Total [3]	$7,070	$6,880	$8,000	$7,350	$7,780	$6,670	$6,250	$6,850	$7,350	$7,940
New England	6,590	6,340	6,880	8,670	[4]	[4]	[4]	[4]	[4]	[4]
Middle Atlantic	7,320	7,080	8,440	7,370	9,750	7,630	6,360	7,600	7,170	8,200
South	7,240	7,000	7,960	7,580	7,830	[4]	6,430	[4]	[4]	[4]
North Central	6,940	6,800	7,800	6,980	[4]	7,000	6,080	6,670	[4]	[4]
Mountain and Plains	6,500	6,330	[4]	[4]	7,130	[4]	[4]	[4]	[4]	[4]
Pacific	6,630	6,410	7,640	7,380	[4]	[4]	5,770	[4]	[4]	[4]
	Scientists employed by government									
Total [3]	$6,280	$6,290	$7,400	$7,400	$6,120	$5,980	$5,480	$5,930	$6,830	$6,180
New England	5,410	[4]	[4]	[4]	[4]	[4]	4,830	[4]		
Middle Atlantic	6,730	6,370	7,650	7,420	6,490	7,100	5,960	5,920	6,910	6,620
South	5,660	6,320	[4]	[4]	[4]	5,690	5,030	[4]	[4]	[4]
North Central	5,750	6,310	[4]	[4]	[4]	5,670	4,920	[4]	[4]	[4]
Mountain and Plains	5,810	[4]	[4]	[4]	5,720	5,320	5,750			[4]
Pacific	6,050	5,920	[4]	7,630	[4]	5,440	5,210	[4]	[4]	[4]

[1] Includes scientists in fields of specialization other than those listed.
[2] Includes scientists not employed by one of the three principal types of employers.
[3] Includes scientists employed in United States Territories, foreign countries, and those who did not report region of employment.
[4] Insufficient reports to compute median.

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Table Q.—Added Professional Income of Ph. D. Scientists in Each General Field of Specialization, by Amount of Regular Salary, 1948

Field of specialization	All scientists	$0–$2,999	$3,000–$3,999	$4,000–$4,999	$5,000–$5,999	$6,000–$6,999	$7,000–$7,999	$8,000–$8,999	$9,000–$9,999	$10,000 and over
	Percent reporting additional income [1]									
All fields	38.9	36.2	52.2	45.4	38.8	33.0	33.0	34.3	36.8	28.0
Chemistry	30.1	37.1	49.8	41.6	25.8	23.0	23.7	28.4	33.2	22.5
Engineering	44.2	[2]	80.0	67.7	54.4	40.4	33.7	39.0	41.2	31.2
Physics and electronics	45.1	[2]	59.4	62.1	48.2	32.4	38.8	31.9	32.9	34.1
Earth sciences	52.9	[2]	76.2	64.0	57.2	46.4	39.7	36.2	40.0	27.6
Agriculture	24.2	[2]	25.5	16.1	25.6	24.3	27.8	39.7	37.9	23.5
Biology	34.5	31.6	45.2	34.1	32.8	31.2	29.1	26.6	21.3	30.1
Fields related to medicine	35.6	16.7	37.7	36.6	39.8	33.9	30.1	29.8	44.0	32.1
Mathematics and statistics	54.6	41.7	58.1	60.5	57.8	48.0	45.1	47.4	56.0	35.0
Psychology	68.7	44.7	73.1	68.5	69.7	69.8	67.0	73.7	72.0	57.7
	Median added income									
All fields	$890	$650	$770	$850	$920	$940	$1,060	$960	$1,170	$1,890
Chemistry	900	700	780	850	900	540	1,070	1,200	1,170	2,580
Engineering	1,260	[4]	1,170	1,190	1,100	1,320	1,000	870	1,880	3,250
Physics and electronics	940	[4]	800	900	1,080	970	990	930	1,100	1,250
Earth sciences	1,100	[4]	1,010	920	1,120	1,400	1,300	1,250	[4]	1,880
Agriculture	[3]	[4]	[4]	[3]	[3]	[3]	670	630	[4]	[4]
Biology	740	[3]	680	740	860	790	720	530	[4]	1,330
Fields related to medicine	720	[4]	600	780	680	[3]	660	640	[4]	[4]
Mathematics and statistics	890	[4]	770	870	1,020	880	1,130	1,550	[4]	810
Psychology	1,010	[4]	830	910	1,040	1,380	1,520	1,380	[4]	1,000

[1] Percentages in this table are based only on scientists reporting regular salary.
[2] Fewer than 20 scientists reported regular salary.
[3] Less than $500.
[4] Insufficient reports to compute median.

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AMERICAN MEN OF SCIENCE

in cooperation with

THE NATIONAL RESEARCH COUNCIL

The items preceded by a symbol (†) will be used by AMERICAN MEN OF SCIENCE in the eighth edition. The National Research Council and the Federal Government will make use of certain items in connection with their participation in the National Science Program and for studying American scientific personnel resources. If for any item you do not have enough space, kindly attach supplementary sheets, clearly identifying each such addition by item-number. Disregard code numbers and checking boxes except where specifically directed otherwise. Entries should be typed or very clearly printed.

INFORMATION ON AMERICAN SCIENTISTS

†1. *Full Name with Preferred Title:* (Prof., Dr., Miss, etc.) Print your name in capitals. Enclose within parentheses the part of your name you ordinarily omit in correspondence—e.g., Dr. SMITH, J(OHN) WILSON; Prof. JONES, M(ARY) E(LIZABETH).

....
TITLE — LAST NAME (PRINT IN CAPITALS) — FIRST (PRINT IN CAPITALS) — MIDDLE (PRINT IN CAPITALS)

PLEASE DO NOT WRITE IN THESE BOXES [12-28]

†2. ☐ *Home Address:* ....
NUMBER & STREET — CITY — ZONE — STATE

†3. ☐ *Employment Address:* .... [29–31]
INSTITUTION OR FIRM — NUMBER & STREET — CITY — ZONE — STATE

Check (X) one of the two boxes at the left of Items 2 and 3 to show which address you prefer printed in AMERICAN MEN OF SCIENCE.

4. *Permanent Address:* Addresses frequently change, sometimes are lost. Kindly give below the names and addresses of two institutions, friends or relatives, who will always know your current address.

Name:..... Address:.....

Name:..... Address:.....

†5. *Other Names:* Names are frequently changed, causing confusion in records where there are many listed. Kindly record the name or names applicable as replies to each of the questions below. Where your answer to any one of these is identical with your name as recorded in item 1 above, make a dash (—) as your response.

Professional Name: What name or names have you used professionally?.....

Publication Name: Under what name or names have you published?.....

Maiden Name (Women):
If you are or have been married, what was your maiden name?.....

†6. *Place of Birth:* .... †7. *Date of Birth:* .... [6–7]
CITY — COUNTY — STATE — COUNTRY — MONTH — DAY — YEAR

†8. *Sex and Present Marital Status:* [2–5]

A. Check (X) one box to indicate your sex and present marital status.

1. ☐ Male–Single
2. ☐ Male–Married
3. ☐ Male {Widowed / Separated / Divorced}
4. ☐ Female–Single
5. ☐ Female–Married
6. ☐ Female {Widowed / Separated / Divorced} [32]

Date of Marriage:..... [33-34]
YEAR

B. Children: I have.....children, whose ages are:..... [35]
(GIVE NO. OR RECORD "NONE")

†9. *Citizenship:* Check (X) one box [| | | S] [8–11]

1. ☐ Native-born citizen of the U. S., including those born abroad of U. S. parentage.
2. ☐ Naturalized citizen of the U. S.—COUNTRY of previous citizenship and DATE of naturalization:.....
3. ☐ Alien, IN PROCESS of naturalization.—Country of present citizenship:.....
4. ☐ Alien, NOT IN PROCESS of naturalization.—Country of present citizenship:..... [36]

†10. *Academic Training and Specialization:* For each college attended—undergraduate and graduate—record in chronological order the facts requested below.

[| |] [37–39] [|] [40–41] [ ] [42] [ ] [43–44]

Academic Institution and State in which Located	Inclusive Dates of Attendance	Earned Degree	Date Awarded	Major Field of Specialization	Minor Field or Fields of Specialization

†11. *Honorary Degrees:* Record below your honorary degrees.

College or University Granting Honorary Degree and State in which Located	Honorary Degree	Date Awarded

12. Doctoral Dissertation

Titles of Dissertations for Earned Doctoral Degrees	Major Professor or Professors. Give full name

†13. *Postdoctoral Fellowships:*

(1)..... .... $.....
NAME OF FELLOWSHIP — YEAR — INSTITUTION OR INSTITUTIONS ATTENDED — ANNUAL MONETARY VALUE, INCLUDING SUBSISTENCE IF RECEIVED.

Topic(s) Investigated.....

(2)..... .... $.....
NAME OF FELLOWSHIP — YEAR — INSTITUTION OR INSTITUTIONS ATTENDED — ANNUAL MONETARY VALUE, INCLUDING SUBSISTENCE IF RECEIVED.

Topic(s) Investigated.....

†14. *Professional Employment History:* Start with your first position and bring your employment record to date, recording your important professional positions. Record multiple concurrent employments as separate jobs. Place a capital "P" in front of your present regular job. EXCLUDE any employment of a nontechnical nature.

	Job Title (Use abbreviations sparingly)	Name and Location of Employer	Inclusive Dates of Employment	DUTIES (Be as specific as possible)
	Assistant Professor of Geology	*Univ. of Algano Alpako, Ariz.*	1914–1917	*Taught Three Quiz Sections and Two 2-hr. Laboratories in Paleontology*
	Director of Field Studies	*National Botanical Survey, Wash. D.C.*	1917–1919	*Leader of Field Party of 10 Studying Algae of Lower Mississippi River Valley*
1.	(Earliest Job)			
2.	(Second Job)			
3.				
4.				
5.				
6.				
7.				
8.				
9.				[ ] [45–47]
10.				

If additional space is needed, attach a sheet of paper, identify the item by number (14) and continue the above system of numbering your positions.

15. Present Annual Professional Income: (VOLUNTARY) There are almost no reliable data on the salaries of scientists. It therefore is obvious why such data are important.

TABLE A. Regular Annual Salary: Check (X) once. The salary reported below is based on ____ months of work per year.

0 ☐ $0——$2000
1 ☐ $2000–$2999
2 ☐ $3000–$3999
3 ☐ $4000–$4999
4 ☐ $5000–$5999
5 ☐ $6000–$6999
6 ☐ $7000–$7999
7 ☐ $8000–$8999
8 ☐ $9000–$9999
9 ☐ $10,000 and over
[48]

NOTE: Income from summer school, night school and extension teaching, not a part of your regular employment, should be reported in "Sources of Additional Income," Table B.

TABLE B. Additional Annual Professional Income: (In addition to your regular salary. See Sources Table C.) Check (X) to show average annual amount for recent years.

☐ No additional professional income.
0 ☐ $100——$499
1 ☐ $500——$999
2 ☐ $1000–$1499
3 ☐ $1500–$1999
4 ☐ $2000–$2499
5 ☐ $2500–$2999
6 ☐ $3000–$3499
7 ☐ $3500–$3999
8 ☐ $4000–$4499
9 ☐ $4500 and over
[49]

NOTE: Non-professional income, such as that received from investments, speculations, stocks and bonds, profits, rents, interest, etc., should not be recorded.

TABLE C. Sources of Additional Professional Income: Check (X) one or more times as it applies to you.

1 ☐ Consultant fees
2 ☐ Teaching salary, outside regular duties
4 ☐ Royalties from inventions and patents
8 ☐ Royalties from publications
(X) ☐ Royalties from popularized writing
16 ☐ Honoraria
32 ☐ Other sources (specify):.....

[ ] .....
.....
[50–51]

†16. *Professional Scientific Societies:* Record honorery societies in Item 23 below.

Name of Professional Society (*PLEASE* do not use abbreviations)	Year Elected (Approximate)	Present Grade of Membership (e.g., Associate, Honorary Member, Fellow)	Major Offices Held (especially Pres., V. Pres., Sec'y., Treas.) with Dates
			[ ] [52]

†17. *Chief Fields of Research:* Record below the chief fields or areas in which you have done or are doing research. UNDERLINE those in which you are now engaged. Be as specific as possible, e.g., micropaleontology, mass spectroscopy, genetics of Drosophila, design of radio transmitters, metallurgy of chromium alloys.

.....
.....
.....
.....

†19. *Patents, Inventions and Completed Developments:* List those for which you have been fully or mainly responsible. Do not record patent numbers; rather, give the purpose or needs which the patent or invention fulfills, e.g., a patent on tetraethyl lead to prevent cylinder-knocking in gasoline engines.

.....
.....
.....
..... [ ] [53]

18. Bibliography of Publications: Record below several of your publications (books, monographs, articles, reviews only if especially noteworthy) so chosen to illustrate best (1) the unique angle or trend of your specialization in the field of your greatest professional competence; (2) the diversity of your scientific interests and accomplishments to date. If you have available a prepared list of your publications, attach it, instead of writing here selected titles; then star (*) those titles which are most representative.

☐ Check (X), at the left, if you are attaching a list of your publications.

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20. Employment as a Scientist by Government Research Agencies, on Contracts, and Development Projects: Check (X) as many times as appropriate in EACH row below, to show the history of your employment IN THE PAST and AT PRESENT on government-sponsored research of the types mentioned.

0 ☐ I have NOT been associated at any time with a government-sponsored research or development project. (See list below.) (If you check this answer, proceed immediately to Item 21.)

Government Research and Research-Contracting Agencies	I have PARTICIPATED IN THE PAST as a scientist in the work of the agency mentioned, as: A civilian	I have PARTICIPATED IN THE PAST as a scientist in the work of the agency mentioned, as: A member of the armed forces		I am AT PRESENT ENGAGED IN A SCIENTIFIC CAPACITY AS: A direct employee of the agency mentioned	I am AT PRESENT ENGAGED IN A SCIENTIFIC CAPACITY AS: An employee of a contractor of the agency mentioned	I have NEVER BEEN ENGAGED as a scientist on a research sponsored by or originating from the agency mentioned.
Atomic Energy Commission; or Manhattan District			1			
O.S.R.D.: N.D.R.C.: or J.R.D.B.			2			
Army			3			
Air Force			4			
Navy			5			
N.A.C.A.			6			
Bureau of Standards			7			
Public Health Service			8			
Other Government Agency or Agencies (specify): ..... AGENCY			9			
	[54] Mul.P.			[55] Mul.P.		

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†21. *Military and Civilian Service with the Armed Forces:* Complete the following statement; also the table below:

My U.S. military serial number is.....

SERIAL NUMBER IF NONE, WRITE "NONE"

Military Service		Name of Service (1) (Copy both name and subscript)	DO NOT WRITE IN THIS COLUMN	
Civilian Professional Consultant in World War II	1			
Active Military War Service for a Foreign Government Specify Country..... COUNTRY	2			
Active U.S. Military Service World War I	3			
Active U.S. Military Service World War II	4		☐	■[57]
Active U.S. Military Service AT PRESENT	5		☐	■[58]
In U.S. Reserve Military Organization AT PRESENT (2)	6		☐	■[59]

■ [56]

(1) Services: Army$_1$, Navy$_2$, Air Force$_3$, Marine Corps$_4$, Coast Guard$_5$, Merchant Marine$_6$.
(2) Reserve Organizations: Organized Reserve Corps$_1$, Naval Reserve$_2$, Air Force Reserve$_3$, Marine Reserve$_4$, Air Force National Guard$_5$, Army National Guard$_6$.

22. *Modern Foreign Language Facility:* Record in the first column of the table below, IN ORDER OF YOUR GENERAL COMPETENCE (best language first), the modern foreign languages in which you have some knowledge. Be sure to include the names of any rare, little-spoken, or out-of-the-beaten-path modern language even if your competence is limited. Then check your proficiency in reading and speaking each language.

[60-62]

LANGUAGE (In descending order of your facility)	READ			SPEAK		
	Fair	Good	Exc.	Fair	Good	Exc.
1						
2						
3						
4						
5						
6						
7						
8						
9						

†23. *Other Attainments and Achievements:* Record below any data about yourself not previously mentioned that you feel should properly be included in a complete biography of yourself, e.g., community service; professional achievements, honors, and awards; honorary positions; scholarships and fellowships; honorary and academic societies such as Sigma Xi, Phi Beta Kappa; expeditions; prizes and medals.

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24. *Knowledge of Foreign Countries and Resources:* Regardless of how your information was obtained, list the names of those countries of whose resources you have considerable knowledge in any one or more of the following respects: foreign industry and technology, research scientists, agriculture, educational institutions, native customs and folkways, or similar information.

.....

.....

.....

.....

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25. *Avocations, Hobbies or Special Skills.* List each avocation or hobby, record the number of years you have had the interest, and check your degree of skill as compared with others having this same interest.

Avocation or Hobby	Number of years you have had the interest	Degree of Skill			
		Fair	Good	Very Good	Excellent

FIELDS OF SPECIALIZATION

Please see directions, questions 26 below, for checking in the boxes all your specialties and ranking the five in which you have greatest competence: 1 = greatest competence.

N.E.C.—NOT ELSEWHERE CLASSIFIED

AGRICULTURE

CODE NOS.
410 ☐.....Agriculture, General
411 ☐.....Agricultural Engineering
412 ☐.....Agronomy & Soil Science
413 ☐.....Agricultural Economics
414 ☐.....Animal Husbandry
415 ☐.....Poultry Husbandry
416 ☐.....Dairy Science
417 ☐.....Horticulture
418 ☐.....Forestry
419 ☐.....Fisheries
420 ☐.....Agriculture, not elsewhere classified

Specify:.....

ANATOMY

CODE NOS.
500 ☐.....Anatomy, General
501 ☐.....Gross Human Anatomy
502 ☐.....Embryology
503 ☐.....Cytology & Histology
504 ☐.....Neurological Anatomy
505 ☐.....Comparative Anatomy (Primates)
506 ☐.....Anatomy, N.E.C.

Specify:.....

ARCHITECTURE

CODE NOS.
300 ☐.....Architecture, General
301 ☐.....Housing
302 ☐.....Commercial and Industrial Building
303 ☐.....Institutional and Public Building
304 ☐.....Structures other than Buildings
305 ☐.....City & Regional Planning
306 ☐.....Architecture, N.E.C.

Specify:.....

ASTRONOMY

CODE NOS.
100 ☐.....Astronomy, General
101 ☐.....Astronomical Bodies
102 ☐.....Celestial Navigation
103 ☐.....Celestial Mechanics
104 ☐.....Astrophysics
105 ☐.....Astronomy, N.E.C.

Specify:.....

BACTERIOLOGY AND PARASITOLOGY

CODE NOS.
420 ☐.....Bacteriology, General
421 ☐.....Parasitology, General
422 ☐.....Microbiology
423 ☐.....Taxonomy and Physiology of Bacteria
424 ☐.....Serum & Vaccine Production
425 ☐.....Industrial Bacteriology
426 ☐.....Medical Bacteriology and Parasitology
427 ☐.....Epidemiology
428 ☐.....Virology
429 ☐.....Antibiosis, Bacteriotherapy, Microbiotic Agents and Phagotherapy
42X ☐.....Bacteriology, N.E.C.

Specify:.....

BIOLOGY, GENERAL

CODE NOS.
400 ☐.....Biology, General
401 ☐.....Ecology
402 ☐.....Evolution
403 ☐.....Biometry
404 ☐.....Cytology
405 ☐.....Genetics
406 ☐.....General Physiology
407 ☐.....Biological Physics
408 ☐.....Fresh Water Biology
409 ☐.....Salt Water Biology
40X ☐.....Biology, Mathematical
40Y ☐.....General Biology, N.E.C.

Specify:.....

BOTANY

CODE NOS.
430 ☐.....Botany, General
431 ☐.....Plant Anatomy
432 ☐.....Plant Physiology
433 ☐.....Plant Pathology
434 ☐.....Plant Cytology
435 ☐.....Taxonomy
436 ☐.....Paleobotany
437 ☐.....Pharmacognosy
438 ☐.....Mycology, General
439 ☐.....Botany, N.E.C.

Specify:.....

CHEMISTRY

A

Check (X) opposite the term below which best describes your classification as a chemist:

0 ☐.....Analytic Chemist
28 ☐.....Inorganic Chemist
56 ☐.....Organic Chemist
84 ☐.....Physical Chemist
112 ☐.....Biochemist
140 ☐.....Chemical Engineer

B.

Then, indicate in which of the following sub-fields you apply your specialization: The sub-fields listed below apply to any of the above six divisions of chemistry.

00 ☐.....General
01 ☐.....Atomic and Molecular Structure
02 ☐.....Electrochemistry
03 ☐.....Heavy Chemicals
04 ☐.....Fine Chemicals
05 ☐.....Coal and Coal Products
06 ☐.....Synthetic Resins and Plastics
07 ☐.....Petroleum, Natural Gas and their Products
08 ☐.....Paints, Enamels and Varnishes
09 ☐.....Pigments, Dyes, and Inks
10 ☐.....Ceramics and Glass
11 ☐.....Textile Products
12 ☐.....Wood, Paper, and Pulp
13 ☐.....Rubber
14 ☐.....Explosives
15 ☐.....Oils, Fats, Waxes, and Soaps
16 ☐.....Organic Solvents
17 ☐.....Pharmaceutical Chemistry
18 ☐.....Water, Sewage, and Sanitation
19 ☐.....Agricultural Chemistry
20 ☐.....Food Chemistry, Composition, and Processing
21 ☐.....Carbohydrates
22 ☐.....Proteins
23 ☐.....Physiological Biochemistry
24 ☐.....Nutrition Biochemistry
25 ☐.....Medical Biochemistry
26 ☐.....Medicinal Agents Geochemistry See Geophysics No. 188
27 ☐.....Other Specialization, N.E.C.

Specify.....

CLINICAL MEDICINE

CODE NOS.
610 ☐.....Clinical Medicine, General
611 ☐.....Infectious Diseases
612 ☐.....Degenerative Diseases
613 ☐.....Cardiovascular Diseases
614 ☐.....Metabolic Diseases
615 ☐.....Dermatology
616 ☐.....Tropical Medicine
617 ☐.....Medical Specialities, N.E.C.

Specify:.....

DENTAL MEDICINE

CODE NOS.
680 ☐.....Dental Medicine, General
681 ☐.....Dental Histology & Embryology
682 ☐.....Operative Dentistry
683 ☐.....Oral and Maxillo-Facial Surgery
684 ☐.....Orthodontia
685 ☐.....Exodontia
686 ☐.....Oral Pathology
687 ☐.....Prosthetic Dentistry and Removable Dentures
688 ☐.....Dental Prophylaxis
689 ☐.....Dental Hygiene
68X ☐.....Dental Specialities, N.E.C.

Specify:.....

ELECTRONICS

CODE NOS.
190 ☐.....Electronics, General
191 ☐.....Radiation & Propagation
192 ☐.....Circuitry
193 ☐.....Electronic Ballistics
194 ☐.....Insulation & Shielding
195 ☐.....Microwave
196 ☐.....Instrumentation & Telemetering
197 ☐.....Television
198 ☐.....Radar
199 ☐.....Sonar
19X ☐.....Loran
19Y ☐.....Electronics, N.E.C.

Specify:.....

ENGINEERING, AERONAUTICAL

CODE NOS.
310 ☐.....Aeronautical Engineering, General
311 ☐.....Aerodynamics
312 ☐.....Aeronautical Design and Structures
313 ☐.....Instruments and Equipment
314 ☐.....Propellers
380 ☐.....See Power Plant Engineering
315 ☐.....Transonic Engineering
316 ☐.....Supersonic Engineering
317 ☐.....Hydrodynamics (Also See 167 Physics)
318 ☐.....Aeronautical Engineering, N.E.C.

Specify:.....

ENGINEERING, CIVIL

CODE NOS.
320 ☐.....Civil Engineering, General
411 ☐.....Agricultural Engineering See 411 Agriculture
321 ☐.....Surveying and Mapping
322 ☐.....Highway Engineering
323 ☐.....Railway Engineering
324 ☐.....Hydraulic Engineering
325 ☐.....Hydrographic and Reclamation Engineering
326 ☐.....Structural
327 ☐.....Sanitary and Public Health Engineering
328 ☐.....Airport Engineering
329 ☐.....Civil Engineering, N.E.C.

Specify:.....

ENGINEERING, ELECTRICAL

CODE NOS.
330 ☐.....Electrical Engineering, General
331 ☐.....Radio
332 ☐.....Communications (other than Radio)
333 ☐.....Electricity and Magnetism
334 ☐.....Electrophonics
335 ☐.....Power Generation, Transmission, and Distribution
336 ☐.....Illumination Engineering
337 ☐.....Electrical Apparatus and Machinery
338 ☐.....Electrical Engineering, N.E.C.

Specify:.....

ENGINEERING, MECHANICAL

CODE NOS.
340 ☐.....Mechanical Engineering, General
341 ☐.....Automotive Engineering
342 ☐.....Internal Combustion Engines
343 ☐.....Power Plants also See 380
344 ☐.....Machinery & Equipment
345 ☐.....Heating, Refrigerating, and Air Conditioning
346 ☐.....Industrial and Safety Engineering
347 ☐.....Naval Architecture and Marine Engineering
348 ☐.....Naval Salvage
349 ☐.....Mechanical Engineering, N.E.C.

Specify:.....

ENGINEERING, METALLURGICAL

CODE NOS.
350 ☐.....Metallurgical Engineering, General
351 ☐.....Metallurgical Plants and Equipment
352 ☐.....Selection and Specification of Metals
353 ☐.....Welding Engineering See 147 Metallurgy
354 ☐.....Metallurgical Engineering, N.E.C.

Specify:.....

ENGINEERING, MINING

CODE NOS.
360 ☐.....Mining Engineering, General
361 ☐.....Coal Mining
362 ☐.....Metal Mining
363 ☐.....Nonmetallic Mining & Quarrying
364 ☐.....Petroleum & Natural Gas
365 ☐.....Mining Engineering, N.E.C.

Specify:.....

ENGINEERING, ORDNANCE

CODE NOS.
370 ☐.....Explosives
371 ☐.....Propellents
372 ☐.....Pyrotechnics
373 ☐.....Chemical Warfare
374 ☐.....Armor and Penetration
375 ☐.....Demolition
376 ☐.....Underwater Ordnance
377 ☐.....Ballistics Internal & External See 136 Mathematics
378 ☐.....Guns and Mounts
379 ☐.....Fire Control
37X ☐.....Guided Missiles
37Y ☐.....Ordnance Engineering, N.E.C.

Specify:.....

ENGINEERING, POWER PLANTS

CODE NOS.
380 ☐.....Power Plant Engineering, General
381 ☐.....Steam Engineering
382 ☐.....Jet Engineering
383 ☐.....Rocket Engineering
384 ☐.....Gas Turbine Engineering
385 ☐.....Diesels
386 ☐.....Reciprocating Engines
387 ☐.....Nuclear Power System
388 ☐.....Power Plant Engineering, N.E.C.

Specify:.....

ENTOMOLOGY

CODE NOS.
440 ☐.....Entomology, General
441 ☐.....Taxonomy
442 ☐.....Ecology
443 ☐.....Control Techniques
444 ☐.....Insects affecting Men and Animals
445 ☐.....Forest Insects
446 ☐.....Insects affecting Field and Cultivated Crops
447 ☐.....Apiculture
448 ☐.....Entomology, N.E.C.

Specify:.....

GEOGRAPHY

CODE NOS.
110 ☐.....Geography, General
111 ☐.....Physical Geography
112 ☐.....Regional Geography
113 ☐.....Cartographic and Field Geography
114 ☐.....Economic and Political Geography
115 ☐.....Polar Geography
116 ☐.....Tropical Geography
117 ☐.....Desert Geography
118 ☐.....Medical Geography
119 ☐.....Military Geography
11X ☐.....Geography, N.E.C.

Specify:.....

GEOLOGY

CODE NOS.
120 ☐.....Geology, General
121 ☐.....Mineralogy
122 ☐.....Petrology
123 ☐.....Structural Geology
124 ☐.....Stratigraphy and Sedimentation
125 ☐.....Paleontology
436 ☐.....Paleobotany See Botany
126 ☐.....Surficial Geology
1261 ☐.....Geomorphology
1271 ☐.....Economic Geology, Coal, and Petroleum,
1272 ☐.....Economic Geology Metalic Minerals
1273 ☐.....Ground water Geology
128 ☐.....Military Geology,
129 ☐.....Geology, N.E.C.

Specify:.....

GEOPHYSICS

CODE NOS.
180 ☐.....Geophysics, General
181 ☐.....Geodesy
182 ☐.....Geophysical Prospecting
183 ☐.....Hydrology
150 ☐.....Meteorology
184 ☐.....Oceanography
185 ☐.....Seismology
186 ☐.....Terrestrial Magnetism
187 ☐.....Volcanology
188 ☐.....Geochemistry
189 ☐.....Geophysics, N.E.C.

Specify:.....

MATHEMATICS

CODE NOS.
130 ☐.....Mathematics, General
131 ☐.....Algebra
132 ☐.....Geometry
133 ☐.....Analysis
134 ☐.....Statistics and Probability See 170 Statistics
135 ☐.....Actuarial Science
136 ☐.....Ballistics See 377 Ordnance Eng.
137 ☐.....Cryptoanalysis
138 ☐.....Computing Devices
139 ☐.....Mathematical Instruments
40X ☐.....Mathematical Biology See Biology
13X ☐.....Applied Mathematics, N.E.C.

Specify:.....

METALLURGY

CODE NOS.
140 ☐.....Metallurgy, General
141 ☐.....Beneficiation, Smelting, Refining
142 ☐.....Physical Metallurgy
143 ☐.....Casting, Forming, Fabricating and Finishing
144 ☐.....Powder Metallurgy
145 ☐.....Ferrous
146 ☐.....Non Ferrous
147 ☐.....Welding See 353 Metallurgical Eng.
148 ☐.....Instrumentation
149 ☐.....Metallurgy, N.E.C.

Specify:.....

METEOROLOGY

CODE NOS.
150 ☐.....Meteorology, General
151 ☐.....Climatology
152 ☐.....Physical and Dynamic Meteorology
153 ☐.....Weather Forecasting
154 ☐.....Meteorology, N.E.C.

Specify:.....

NEUROPSYCHIATRY

CODE NOS.
650 ☐.....Neuropsychiatry, General
651 ☐.....Clinical Neurology
652 ☐.....Clinical Psychiatry
463 ☐.....Clinical Psychology (See Psychology)
653 ☐.....Mental Hygiene
654 ☐.....Psychoanalysis
664 ☐.....Neurosurgery See Surgery
655 ☐.....Psychotherapy
656 ☐.....Neuropsychiatry, N.E.C.

Specify:.....

NUTRITION AND FOODS

CODE NOS.
450 ☐.....Nutrition and Foods, General
451 ☐.....Food Chemistry
452 ☐.....Physiology of Nutrition
453 ☐.....Food Technology
454 ☐.....Economics
455 ☐.....Vitamins, Enzymes and Accessory Food Factors
456 ☐.....Public Health Nutrition
457 ☐.....Nutrition and Foods, N.E.C.

Specify:.....

OBSTETRICS AND GYNECOLOGY

CODE NOS.
630 ☐.....Obstetrics, General
631 ☐.....Gynecology, General

OPHTHALMOLOGY

CODE NOS.
620 ☐.....Ophthalmology, General
621 ☐.....Refraction
622 ☐.....Physiological Optics
668 ☐.....Ophthalmological Surgery See Surgery
623 ☐.....Ophthalmology, N.E.C.

Specify:.....

PATHOLOGY

CODE NOS.
520 ☐.....Pathology, General
521 ☐.....Special Pathology
522 ☐.....Clinical Pathology
523 ☐.....Pathology of Neoplasm
524 ☐.....Pathology, N.E.C.

Specify:.....

PEDIATRICS

CODE NOS.
640 ☐.....Pediatrics, General
641 ☐.....Infectious Diseases
642 ☐.....Cardiovascular Diseases
643 ☐.....Metabolic Diseases
644 ☐.....Nutrition
645 ☐.....Pediatric Specialities, N.E.C.

Specify:.....

PHARMACOLOGY

CODE NOS.
530 ☐.....Pharmacology, General
531 ☐.....Pharmacodynamics
532 ☐.....Bio-Assaying
533 ☐.....Toxicology
534 ☐.....Chemotherapy
535 ☐.....Pharmacology, N.E.C.

Specify:.....

PHARMACY

CODE NOS.
540 ☐.....Pharmacy, General
541 ☐.....Drug Manufacture
542 ☐.....Drug Standardization
543 ☐.....Pharmaceutical Chemistry
544 ☐.....Pharmacognosy
545 ☐.....Bio-Assaying
546 ☐.....Pharmacy, N.E.C.

Specify:.....

PHYSICS

CODE NOS.
160 ☐.....Physics, General
407 ☐.....Biophysics
161 ☐.....Mechanics
162 ☐.....Heat
1621 ☐.....Cryogenics
163 ☐.....Sound
1631 ☐.....Underwater Sound
164 ☐.....Light
1641 ☐.....Physical Optics
1642 ☐.....Spectroscopy
1643 ☐.....Infrared
165 ☐.....Electricity and Magnetism See 186 Geophysics
166 ☐.....Electronics
167 ☐.....Fluid Dynamics and Statics
168 ☐.....Molecular and Atomic Physics
169 ☐.....Nuclear Physics See 385 Power Plant Eng.
16X ☐.....Radiological Physics
16Y ☐.....Mathematical Physics

PHYSIOLOGY

CODE NOS.
510 ☐.....Physiology, General
452 ☐.....Physiology of Nutrition (See nutrition & foods)
511 ☐.....Sensory & Neural Physiology
512 ☐.....Endocrinology & Metabolism
513 ☐.....Respiratory Physiology
514 ☐.....Physiology of the Blood and Circulation
515 ☐.....Gastro-Enterology
516 ☐.....Stress & Environmental Physiology
517 ☐.....Psychosomatic Physiology
518 ☐.....Excretory Physiology
519 ☐.....Physiology, N.E.C.

Specify:.....

PSYCHOLOGY

CODE NOS.
460 ☐.....Psychology, General
461 ☐.....Physiological Psychology
462 ☐.....Developmental Psychology
463 ☐.....Clinical Psychology
464 ☐.....Animal or Comparative Psychology
465 ☐.....Laboratory and Experimental Psychology
466 ☐.....Social Psychology
467 ☐.....Educational Psychology
468 ☐.....Guidance
469 ☐.....Business and Industrial Psychology
46X ☐.....Psychometry
46Y ☐.....Psychology, N.E.C.

Specify:.....

PUBLIC HEALTH

CODE NOS.
600 ☐.....Public Health, General
327 ☐.....Public Health Engineering
456 ☐.....Public Health Nutrition
601 ☐.....Preventive Medicine
602 ☐.....Sanitation
603 ☐.....Physiological Hygiene
604 ☐.....Mental Hygiene
605 ☐.....Tuberculosis
606 ☐.....Social Hygiene
607 ☐.....Other Communicable Diseases
608 ☐.....Public Health Administration
609 ☐.....Industrial Medicine and Hygiene
60X ☐.....Sight Conservation
60Y ☐.....Public Health, N.E.C.

Specify:.....

RADIOLOGY

CODE NOS.
670 ☐.....Radiology, General
671 ☐.....Clinical X-ray
672 ☐.....Therapeutic Radiation
673 ☐.....Radiology, N.E.C.

Specify:.....

STATISTICS

CODE NOS.
170 ☐.....Statistics, General
171 ☐.....Mathematical Research
172 ☐.....Sampling Design
173 ☐.....Design of Experiments
174 ☐.....Control of Quality
175 ☐.....Correlation Analysis
176 ☐.....Mathematical Statistics
177 ☐.....Econometrics
178 ☐.....Application of statistical techniques to various fields, (E.G. demography, geodesy)
179 ☐.....Statistics, N.E.C.

Specify:.....

SURGERY

CODE NOS.
660 ☐.....Surgery, General
661 ☐.....Anesthesia
662 ☐.....Otology and Laryngology
663 ☐.....Orthopedic Surgery
664 ☐.....Neurosurgery
665 ☐.....Genitourinary Surgery
666 ☐.....Thoracic Surgery
667 ☐.....Plastic Surgery
668 ☐.....Opthalmological Surgery
669 ☐.....Surgery, N.E.C.

Specify:.....

VETERINARY MEDICINE

CODE NOS.
690 ☐.....Veterinary Medicine, General
691 ☐.....Veterinary Anatomy
692 ☐.....Veterinary Physiology
693 ☐.....Animal & Poultry Pathology
694 ☐.....Animal & Poultry Bacteriology
695 ☐.....Animal & Poultry Immunology
696 ☐.....Veterinary Surgery
697 ☐.....Meat Inspection
698 ☐.....Veterinary Medicine, N.E.C.

Specify:.....

ZOOLOGY

CODE NOS.
470 ☐.....Zoology, General
471 ☐.....Comparative Anatomy
472 ☐.....Comparative Physiology
473 ☐.....Invertebrate Zoology
474 ☐.....Vertebrate Taxonomy and Ecology
475 ☐.....Ornithology
476 ☐.....Mammalogy
477 ☐.....Ichthyology & Herpetology
478 ☐.....Histology
479 ☐.....Embryology
47X ☐.....Neurology
47Y ☐.....Zoology, N.E.C.

Specify:.....

MISCELLANEOUS

CODE NOS.
740 ☐.....Anthropology
741 ☐.....Ethnography

SPECIAL APPLICATIONS OF SCIENCE

SPECIAL OPERATIONS

CODE NOS.
720 ☐.....Aviation Medicine
721 ☐.....Submarine & Diving Medicine
722 ☐.....Prosthetics
723 ☐.....Amphibious Operations
724 ☐.....Subsurface Operations
725 ☐.....Operational Research
726 ☐.....Strategy and Tactics
727 ☐.....Synthetic Training Devices
728 ☐.....Firefighting
729 ☐.....Emergency Operations, N.E.C.

Specify:.....

INTELLIGENCE

CODE NOS.
710 ☐.....Aerial mapping
711 ☐.....Cryptography See 137 Mathematics
712 ☐.....Cartography
713 ☐.....Photography
714 ☐.....Photogrammetry
715 ☐.....Intelligence, N.E.C.

Specify:.....

LOGISTICS

CODE NOS.
700 ☐.....Raw Material Reserves
701 ☐.....Materiel Supplies
702 ☐.....Transportation
703 ☐.....Mobile Equipment
704 ☐.....Storage
705 ☐.....Stowage
706 ☐.....Containers & Packaging
707 ☐.....Food Sources
708 ☐.....Food Requirements
709 ☐.....Clothing
70X ☐.....Shelter
70Y ☐.....Logistics, N.E.C.

Specify:.....

MANPOWER RESOURCES AND PLANNING

CODE NOS.
730 ☐.....Personnel Requirements
731 ☐.....Personnel Selection
732 ☐.....Personnel Classification
733 ☐.....Personnel Training
734 ☐.....Utilization of Scientific & Technical Personnel
735 ☐.....Administration of Personnel
736 ☐.....Administration of Scientific Activities
737 ☐.....Manpower Resources and Planning, N.E.C.

Specify:.....

26. *Occupational Specialties:* Inspect carefully the list of Fields of Specialization, designated by code-numbers below.
A. Mark (X) in the little box opposite each specialty in which you have some competence, regardless of the science under which it appears.
B. Then write "1" opposite the specialty of your greatest competence, even if it should not be in the field of your present occupation; "2" opposite the field of your second greatest competence, and so on up to five (5). Do not erase any of your X's from the Fields of Specialization.
NOTE: If in the Fields of Specialization you do not find categories to express adequately the picture of your competence, kindly record on the dotted line below, as concisely as possible, the names of those fields in which you are competent:

.....

YOUR FIELD OF SPECIALIZATION NOT ELSEWHERE LISTED

C. Complete the following table after you have checked the Fields of Specialization.

Order of Competence in *decreasing* order (1 = greatest competence)	FIELDS OF SPECIALIZATION (in decreasing order of competence)				
	Greatest Competence 1	*Second Greatest* Competence 2	*Third Greatest* Competence 3	*Fourth Greatest* Competence 4	*Fifth Greatest* Competence 5
Record at the right your fields-of-specialization →	.....	.....	.....	.....	.....
and	specialty	specialty	specialty	specialty	specialty
their code numbers →	.....	.....	.....	.....	.....
	code no.	code no.	code no.	code no.	code no.
Total years of your experience in each of the above fields-of-specialization, i.e., regardless of duties or functions					
FUNCTIONS	Record below your total years of experience in the several functions of the specialty in question. Experience in several functions may run concurrently.				
Research 0					
Design, development and testing 1					
Production 2					
Teaching 3					
Administration 4					
Other e.g. editing, field work and exploration 5 Specify.....					
	[63–68]	[69–74]	[75–80]		

Date..... Signature.....

This blank should be returned to the Biographical Directory of American Men of Science, Lancaster, Pa.

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