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Energy-Related Doctoral Scientists and Engineers in the United States, 1977

April 1980

Prepared for:
U.S. Department of Energy
Office of Intergovernmental Affairs

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Prepared by:
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Oak Ridge, Tennessee 37830
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FOREWORD

The pursuit of "a vigorous research and development program to provide renewable and other resources to meet U.S. energy needs in the next century" is an important objective of the National Energy Act, the President's National Energy Plan, and recent energy policy directives. A highly educated and motivated pool of engineers and scientists must be available for energy research and development if this objective is to be achieved.

The present report provides information about the number and characteristics of doctoral level engineers and scientists in primarily energy-related activities. These data for the year 1977 are part of the data base for a program of continuing studies on the employment and utilization of all scientists and engineers involved in energy-related activities. Information from these studies will help indicate the actions necessary to ensure that adequate numbers of qualified doctoral level scientists and engineers are available when needed to develop the nation's energy resources and technologies.

Special recognition goes to Jane E. Rall, Larry M. Blair, and Sharon E. Bell, all of Oak Ridge Associated Universities, who are responsible for the analysis and preparation of this report; and to the National Academy of Sciences—National Research Council for assistance in data tabulations.

Norman Seltzer, Chief
Manpower Assessment Program

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HIGHLIGHTS—ENERGY-RELATED DOCTORAL SCIENTISTS AND ENGINEERS, 1977

Energy-Related and Total Doctoral Employment

Of those doctoral scientists and engineers who indicated that they spent a significant proportion of their professional time on a topic of national interest during the survey week in 1977, 28,600 indicated energy and fuel as the topic on which they spent the most time. (See Figure 1.) This represents about 10 percent of the 284,000 doctoral scientists and engineers employed in the United States in 1977.

Among the doctoral engineers and the earth, environmental, and marine scientists, 26 percent and 27 percent, respectively, were energy-related.

Among the doctoral physical scientists, 16 percent were energy-related, but among doctoral life, social, and other scientists, only 3 percent were energy-related.

Degree Specialties and Employment Fields

Seventy-five percent of the energy-related scientists and engineers had doctorate degree specialties in engineering or physical science compared to 38 percent of all doctoral scientists and engineers.

Sixty-eight percent of the energy-related doctorates worked as either engineers or physical scientists compared with 33 percent of the total doctoral population who worked as engineers or physical scientists.

High proportions of doctoral scientists and engineers employed in the following fields were engaged in energy-related activities: plasma physics (72 percent), thermodynamics and materials properties chemistry (44 percent), stratigraphy and sedimentation geology (54 percent), geophysics (49 percent), applied geology (55 percent), nuclear engineering (77 percent), and fuel technology and petroleum engineering (95 percent).

Minorities, Women, and Non-U.S. Citizens

Compared with all doctoral scientists and engineers, relatively fewer of the energy-related population indicated their race or ethnicity as white, black, American Indian, or Hispanic, and relatively more indicated Oriental or other Asian.

Only 2.1 percent of the energy-related population were women, compared with 9.7 percent of all doctoral scientists and engineers.

Non-U.S. citizens comprised 8.3 percent of the energy-related doctorates versus 5.9 percent of all doctoral scientists and engineers.

Type of Employer

Among the energy-related, 47 percent worked in business or industry, and 38 percent worked at educational institutions; in the total doctoral population, 25 percent worked in business or industry and 57 percent in educational institutions.

Primary Work Activity

Sixty-four percent of the energy-related doctorates were involved directly or indirectly in research and development, as opposed to 46 percent of the total doctoral population.

Geographic Location and Employment

A higher proportion of energy-related doctorates (37 percent) than of all doctorates (28 percent) was employed in the West South Central, Mountain, and Pacific regions.

U.S. Government Support

Half of the energy-related doctorates received U.S. government support versus 43 percent for all doctoral scientists and engineers.

Of the energy-related doctoral scientists and engineers who received federal government support, 63 percent received support from the Energy Research and Development Administration (ERDA, now the Department of Energy). Fifteen percent received some support from the National Science Foundation, 12 percent from the Department of Defense, and 7 percent from the Department of Interior.

Comparison of 1975 and 1977 Surveys

Between 1975 and 1977, the proportion of all doctoral scientists and engineers whose work was energy-related rose from 7.9 to 10.0 percent. The rise was especially pronounced for mechanical engineers (27 percent to 41 percent), plasma physicists (62 percent to 72 percent), and stratigraphy/sedimentation geologists (33 percent to 54 percent).

Over the two-year period, employment of energy-related doctorates increased at educational institutions (from 28 percent to 38 percent) and decreased in business and industry (56 percent to 47 percent).

In 1977, ERDA provided support to a higher proportion of those doctorates receiving U.S. government support than it did in 1975 (63 percent in 1977 versus 52 percent in 1975).

CHAPTER 1. INTRODUCTION AND DATA BASE DESCRIPTION

A growing concern has emerged in recent years over the adequacy of future energy resources. In response to this concern, the nation is expending considerable effort to determine the need for various policies and programs to ensure sufficient supplies of energy in the future. Yet many analysts now question whether there will be enough people with the appropriate skills to carry out energy programs. Scientific, engineering, and technical skills are especially crucial to these ventures.[1]

The United States Department of Energy (DOE) and its predecessor, the Energy Research and Development Administration (ERDA), have developed a data base to provide information on scientific, engineering, and technical personnel. The data are used both for labor research and to develop policy recommendations that will help meet energy program needs, especially in research, development, and demonstration activities. Information is provided here on one segment of the energy-related labor force in the nation: doctoral-level scientists and engineers who indicated that in 1977 they devoted a significant proportion of their professional time to energy-related activities.

Data Source and Scope

This report was developed from data tabulations provided by the National Academy of Sciences—National Research Council (NAS-NRC).[2] The data were collected in 1977 in a survey conducted by the NAS-NRC with the support of the National Science Foundation, the National Endowment for the Humanities, and the National Institutes of Health.

The survey sample was drawn from a universe of doctorate recipients compiled by the NRC. The survey universe included persons who received their doctorates in science, engineering, or the humanities between 1930 and 1976.[3] The data provided in this report are restricted to doctorates

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[1]"Synfuels: An Engineering Manpower Crunch Ahead?" *Chemical Engineering,* (January 28, 1980): 67-69; "Department of Energy-University Relationships," *Science* 206 (October 12, 1979): 149.

[2]Unless otherwise noted, the data tabulations were provided by the Commission on Human Resources, National Research Council, 2101 Constitution Avenue, Washington, D.C. 20418.

[3]For details of the NAS-NRC survey, including survey procedures and statements concerning the statistical significance of the sample data, see National Academy of Sciences, *Science, Engineering, and Humanities Doctorates in the United States, 1977 Profile* (Washington, D.C.: 1978).

who either earned their degree in science or engineering or who were employed as scientists or engineers in February 1977. While the NAS-NRC survey of earned doctorates included employed, unemployed, and those not in the labor force, the data presented here are restricted to doctorates who were employed as scientists or engineers during the reference week of February 6-12, 1977.

Stratified sampling was used to establish the survey sample base. This method permitted collection of relatively larger samples of small subgroups to obtain reliable estimates for all subgroups. The survey sample for all doctoral scientists and engineers was approximately 13 percent of the total universe. The sample responses were inflated, according to the stratified sample sizes, to represent the total population of doctoral scientists and engineers and the entire populations for each subgroup.

The survey indicated that there were approximately 284,000 employed doctoral scientists and engineers in the United States at the beginning of 1977, and it included information about doctoral degree specialties, employment fields, types of employers, primary work activities, sources of government support, and various biographical data. Appendix A shows the survey questionnaire and the detailed list of doctoral degree specialties and employment fields used in the survey.

Description of Energy-Related Doctoral Data

In this report, energy-related is used to denote the population of doctoral scientists and engineers who indicated in the survey that during the week of February 6-12, 1977, they devoted a significant portion of their professional time to the area of energy and fuel. (The actual question from the 1977 survey is reproduced in Figure 1.) The survey did not collect information on the actual proportion of time spent in energy- and fuel-related activities nor on the segment of the energy field in which the respondent was involved (e.g., fossil, nuclear, solar).

15. Listed below are selected topics of national interest. If you devoted a proportion of your professional time which you considered significant to any of these problem areas during the week of February 6-12, 1977, please check the box for the one on which you spent the MOST time.

1 ☐ Health	6 ☐ Crime prevention and control	11 ☐ Housing (planning, design, construction)
2 ☐ Defense	7 ☐ Energy and fuel	12 ☐ Transportation, communications
3 ☐ Environmental protection, pollution control	8 ☐ Food and other agricultural products	13 ☐ Cultural life
4 ☐ Education	9 ☐ Natural resources,other than fuel or food	14 ☐ Other area, specify: _____
5 ☐ Space	10 ☐ Community development and services	15 ☐ Does not apply

(10-11)

Figure 1. NAS-NRC Survey Question for Identifying Energy-Related Doctoral Scientists and Engineers, 1977

The survey indicated that approximately 10 percent (or 28,600) of the 284,000 employed doctoral scientists and engineers devoted a significant portion of their professional time to energy- and fuel-related activities in 1977. However, this survey number is by no means a complete count of doctoral scientists and engineers with energy- and fuel-related experience or training in the United States in 1977. Survey respondents were asked to indicate only one area of national interest—the one on which they spent the most time. Many individuals who indicated another area of national interest, or who did not indicate any area, may have devoted a lesser part of their time to energy-related activities in 1977 or may have engaged in energy-related work in previous years. Moreover, many doctoral scientists and engineers who received funds from energy-related agencies (such as ERDA, now DOE) checked an area other than energy and fuel (e.g., environment, defense). It should also be noted that the data presented here are restricted to persons who were employed in February 1977. It is not known how many persons with training or experience in the energy field were unemployed or out of the labor force at that time.

Finally, the reader should be aware that some of the subgroups in the energy-related populations were represented by fairly small samples. The accuracy of the count and characteristics of subgroups with small estimated populations should be viewed with some caution.

Comparisons of 1977 and 1975 Surveys

A survey similar to that used in 1977 was conducted by NAS-NRC in 1975. The 1977 data are compared (in Chapter 8) with those presented in a report

based on the 1975 survey.[1] However, the reader should note that there were several differences between the two surveys.

In 1975, a 15 percent sample was used to represent an actual population of approximately 263,000 employed doctoral scientists and engineers. In 1977, the sample percent was slightly lower at 13 percent. In both cases, sample responses were inflated according to stratified sample sizes. It should also be noted that some adjustments were made to the sampling frame between 1975 and 1977.[2]

While both the 1975 and 1977 surveys asked for the same basic information, there were some slight modifications in the wording or the choices on many of the questions, and these could, naturally, affect the comparability of the data. The reader should especially be aware of the changes made in the question used to determine energy-relatedness. In 1975, respondents were asked to report on their activities during the entire month of February; in 1977, they were asked to restrict their attention to the week of February 6-12. The choices of areas of national interest also differ slightly between the two surveys. In 1975, there were two choices of education categories (i.e., "teaching" and "other") and a category called "other mineral resources" instead of "natural resources." The choices "cultural life" and "does not apply," which appear in 1977, were not included in 1975. The order in which the choices appear also varies slightly between the two surveys. Overall, however, it seems unlikely that these changes would have a significant effect on the number of persons indicating their work was energy-related.

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[1]U.S. Department of Energy, Division of Manpower Assessment, *Energy-Related Doctoral Scientists and Engineers in the United States, 1975* (Washington, D.C.: November 1977, DOE/IR-0033).

[2]For details, see National Academy of Sciences, *Science, Engineering, and Humanities Doctorates in the United States, 1977 Profile* (Washington, D.C.: 1978), Appendix B.

CHAPTER 2. DEGREE SPECIALTIES AND EMPLOYMENT FIELDS

Approximately 10 percent (28,557 out of 284,237) of the doctoral scientists and engineers indicated an involvement in energy-related activities in 1977. Over three-quarters of these were either engineers or physical scientists (Figures 2 and 3). Several employment fields and degree specialties showed greater involvement in energy-related work (Tables 2-1 through 2-5). Over 25 percent of the doctorates receiving their degrees in engineering or earth, environmental, and marine sciences reported energy-related activities; and nearly 20 percent of doctorates working as physicists were doing energy-related work.

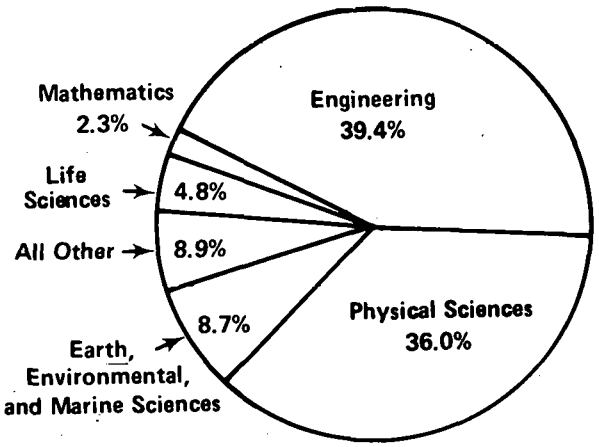

Figure 2. Degree Specialty Distribution of Energy-Related Doctoral Scientists and Engineers

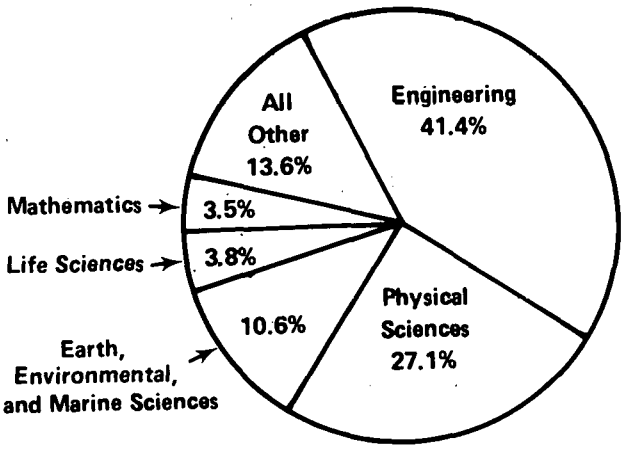

Figure 3. Employment Field Distribution of Energy-Related Doctoral Scientists and Engineers

In many of the more narrowly defined employment subfields, energy-related doctorates constituted from 30 percent to as much as 95 percent of the total doctoral population in that subfield (Tables 2-2 through 2-4, 2-6 through 2-8). In fact, six engineering subfields and four subfields of earth, environmental, and marine sciences showed more than 30 percent involvement in energy-related activities. The employment subfields with the largest proportions of energy-related respondents were plasma physics (72 percent), nuclear engineering (77 percent) and fuel technology/petroleum engineering (95 percent).

Thus, substantial proportions of doctorates in many degree specialties and employment fields were involved in energy-related activities. Programs and policies designed to significantly change energy research and development, or energy production and use might have major impacts on the work activities and labor markets for several types of doctoral scientists and engineers; and shortages of qualified scientists and engineers in several specific employment fields could adversely affect the cost and timing of some energy programs.

The survey indicates that one-fifth of the doctoral scientists and engineers were working in employment fields that differed from their doctoral degree specialties (Figure 4, Tables 2-9 through 2-11). The range for energy-related doctorates reporting employment in the same field as their doctoral degree specialty varied from 66 percent (physics) and 68 percent (life sciences) to 93 percent (earth, environmental, and marine sciences). For example, only 3,100 out of 4,800 of the energy-related doctorates with degrees in physics were working as physicists.

The data tabulations do not show the actual number of doctoral scientists and engineers who switched from their degree subspecialties to different employment subfields within the same general fields. However, some evidence of switching between subfields can be found by comparing the numbers reporting specific degree subspecialties to the number reporting employment in the corresponding subfield (Tables 2-12 and 2-13). In several energy-related employment subfields there were at least two or three times more doctorates employed in the subfield than degree holders in the corresponding subspecialty (e.g., fuel technology/petroleum engineering, geophysics, applied geology). These additional specialists have probably switched from subfields, such as elementary particle physics or structural geology, which showed employment levels substantially below the number of persons holding doctorates in those subspecialties.

Thus, the survey indicates that 20 percent of the doctoral scientists and engineers are working in employment fields different from their doctoral degree specialties or subspecialties. It is not possible to determine what proportion of this field switching was forced (by a shortage of jobs in the degree field) and what proportion was voluntary (due to more interesting work, or better pay). However, it can be noted that many doctoral scientists and engineers in all degree specialties have switched fields, and field

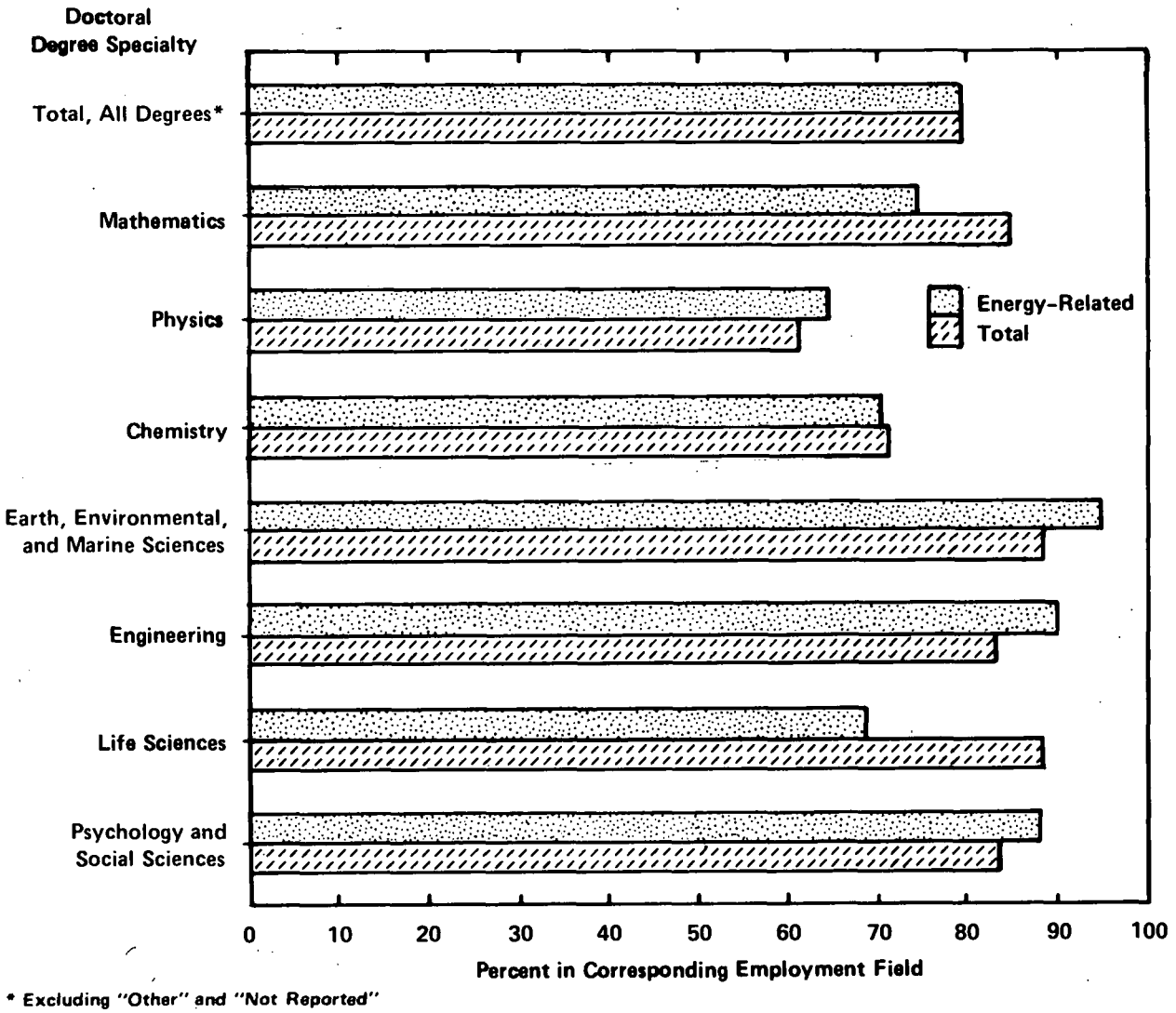

Figure 4. Degree Specialties and Percent Working in Corresponding Employment Fields

switching may have a significant effect on the relative supply of doctorates available for employment in specific fields.

It should also be noted that the employment field and degree specialty data cannot be used to develop relative supply and demand estimates without further knowledge of the interactions in the labor market for doctoral scientists and engineers; that is, no clear-cut appraisals of job opportunities for various degree specialties can be provided. For example, among the energy-related population, a large percentage of doctorates employed in mathematics and in earth, environmental, and marine sciences earned their degrees in other specialties. The switch into these fields might indicate that a relative shortage of doctorates existed in these degree areas, and that doctorates with degree specialties in these two areas could have found employment in their fields. This does indeed appear to be the case for earth, environmental, and marine scientists, since 93 percent of those receiving their doctorates in the specialty were employed in the same field. The relationship is not so clear for doctorates in mathematics; only 75 percent of the energy-related doctorates with degrees in mathematics were employed as mathematicians.

Table 2-1. Distribution by Degree Specialty: Energy-Related and All Doctoral Scientists and Engineers, Employed Population, 1977

Doctoral Degree Specialty	Energy-Related		Total		Percent Energy-Related in Specialty
	Number	Percent[a]	Number	Percent[a]	
Mathematics/computer science	653	2	16,495	6	4.0
Physics/astronomy	4,782	17	25,076	9	19.1
Chemistry	5,498	19	41,185	14	13.3
Earth, environmental, and marine sciences	2,472	9	9,102	3	27.2
Engineering	11,241	39	42,808	15	26.3
Life sciences	1,376	5	69,113	24	2.0
Psychology	161	1	32,216	11	0.5
Social sciences	2,236	8	40,915	14	5.5
All other and not reported	138	[b]	7,327	3	1.9
Total, all specialties	28,557	100	284,237	100	10.0

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Numbers may not add to 100 percent due to independent rounding.

[b]Less than 0.5 percent.

Table 2-2. Engineering Degree Specialties: Energy-Related and All Doctoral Scientists and Engineers, Employed Population, 1977

Engineering Doctoral Degree Specialty[a]	Energy-Related		Total		Percent Energy-Related in Specialty
	Number	Percent[b]	Number	Percent[b]	
Civil	681	6	3,543	8	19
Chemical	2,731	24	6,832	16	40
Electrical	1,170	10	8,653	20	14
Nuclear	711	6	1,027	2	69
Engineering mechanics	650	6	2,903	7	22
Mechanical	1,967	17	4,784	11	41
Metallurgy and physical metallurgy	1,072	10	3,349	8	32
All other engineering specialties	2,259	20	11,717	27	19
Total, engineering	11,241	100	42,808	100	26

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Each specialty listed accounted for 5 percent or more of the energy-related engineering doctoral degrees.

[b]Numbers may not add to 100 percent due to independent rounding.

Table 2-3. Degree Specialties for Physics; Chemistry; and Earth, Environmental, and Marine Sciences: Energy-Related and All Doctoral Scientists and Engineers, Employed Population, 1977

Doctoral Degree Specialty[a]	Energy-Related		Total		Percent Energy-Related in Specialty
	Number	Percent[b]	Number	Percent[b]	
Physics					
Atomic and molecular	604	13	2,468	10	24
Plasma	403	8	802	3	50
Elementary particle	315	7	3,114	12	10
Nuclear structure	818	17	3,461	14	24
Solid state	1,155	24	5,504	22	21
General	310	6	1,902	8	16
All other physics	1,177	25	7,825	31	15
Total, physics	4,782	100	25,076	100	19
Chemistry					
Analytical	406	7	3,119	8	13
Inorganic	784	14	3,811	9	21
Organic	1,076	20	15,388	37	7
Physical	2,081	38	9,941	24	21
All other chemistry	1,151	21	8,926	22	13
Total, chemistry	5,498	100	41,185	100	13
Earth, environmental, and marine sciences					
Mineralogy/petrology	135	5	761	8	18
Stratigraphy/sedimentation	631	26	1,197	13	53
Structural geology	132	5	381	4	35
Applied geology	229	9	459	5	50
Earth sciences, general	373	15	999	11	37
Earth sciences, other	571	23	2,748	30	21
All other earth, environmental, and marine sciences	401	16	2,557	28	16
Total, earth, environmental, and marine sciences	2,472	100	9,102	100	27

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Each specialty listed accounted for 5 percent or more of the energy-related doctoral degrees in the specialty area.

[b]Numbers may not add to 100 percent due to independent rounding.

Table 2-4. Degree Specialties for Psychology, Social Sciences, Humanities, and Education: Energy-Related and All Doctoral Scientists and Engineers, Employed Population, 1977

Doctoral Degree Specialty[a]	Energy-Related		Total		Percent Energy-Related in Specialty
	Number	Percent[b]	Number	Percent[b]	
Psychology	161	6	32,216	40	c
Sociology	169	7	7,435	9	2
Economics/econometrics	1,209	48	11,759	15	10
Social sciences, all other	858	34	21,721	27	4
Humanities and education	106	4	6,754	8	2
Total, psychology, social sciences, humanities, and education	2,503	100	79,885	100	3

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Each specialty listed accounted for 5 percent or more of the energy-related doctoral degrees in the specialty area.

[b]Numbers may not add to 100 percent due to independent rounding.

[c]Less than 0.5 percent.

Table 2-5. Distribution by Employment Field: Energy-Related and All Doctoral Scientists and Engineers, Employed Population, 1977

Employment Field	Energy-Related		Total		Percent Energy-Related in Field
	Number	Percent[a]	Number	Percent[a]	
Mathematics/computer science	989	3	19,271	7	5.1
Physics/astronomy	3,617	13	17,984	6	20.1
Chemistry	4,124	14	33,344	12	12.4
Earth, environmental, and marine sciences	3,033	11	12,573	4	24.1
Engineering	11,823	41	42,442	15	27.9
Life sciences	1,080	4	68,094	24	1.6
Psychology	145	1	31,303	11	0.5
Social sciences	2,169	8	36,025	13	6.0
Education, business, and other	1,191	4	17,165	6	6.9
Not reported	386	1	6,036	2	6.4
Total, all fields	28,557	100	284,237	100	10.0

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Numbers may not add to 100 percent due to independent rounding.

Table 2-6. Engineering Employment Fields: Energy-Related and All Doctoral Scientists and Engineers, Employed Population, 1977

Engineering Employment Field[a]	Energy-Related		Total		Percent Energy-Related in Field
	Number	Percent[b]	Number	Percent[b]	
Chemical	2,054	17	5,108	12	40
Electrical	760	6	3,917	9	19
Nuclear	1,327	11	1,728	4	77
Mechanical	1,903	16	4,289	10	44
Metallurgy and physical metallurgy	719	6	2,353	6	31
Fuel technology/petroleum	725	6	767	2	95
Materials science	695	6	2,175	5	32
All other engineering	3,640	31	22,105	52	16
Total, engineering	11,823	100	42,442	100	28

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Each field listed accounted for 5 percent or more of the energy-related engineering employment.

[b]Numbers may not add to 100 percent due to independent rounding.

Table 2-7. Employment Subfields for Physics; Chemistry; and Earth, Environmental, and Marine Sciences: Energy-Related and All Doctoral Scientists and Engineers, Employed Population, 1977

Employment Field[a]	Energy-Related Number	Energy-Related Percent[b]	Total Number	Total Percent[b]	Percent Energy-Related in Field
Physics					
Atomic and molecular	503	14	1,335	7	38
Plasma	816	23	1,137	6	72
Nuclear structure	191	5	1,045	6	18
Solid state	777	21	3,053	17	25
Physics, general	410	11	3,107	17	13
All other physics	920	25	8,307	46	11
Total, physics	3,617	100	17,984	100	20
Chemistry					
Analytical	512	12	3,959	12	13
Inorganic	369	9	1,734	5	21
Organic	526	13	5,761	17	9
Physical	886	21	3,723	11	24
Thermodynamics and materials properties	196	5	445	1	44
Polymers	371	9	4,392	13	8
All other chemistry	1,264	31	13,330	40	9
Total, chemistry	4,124	100	33,344	100	12
Earth, environmental, and marine sciences					
Mineralogy/petrology	145	5	832	7	17
Geochemistry	231	8	623	5	37
Stratigraphy/sedimentation	392	13	722	6	54
Geophysics	524	17	1,078	9	49
Applied geology	605	20	1,096	9	55
Environmental sciences, general and other	220	7	2,048	16	11
Earth sciences, general and other	367	12	1,664	13	22
All other earth, environmental, and marine sciences	549	18	4,510	36	12
Total, earth, environmental, and marine sciences	3,033	100	12,573	100	24

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Each field listed accounted for 5 percent or more of the energy-related employment in the field area.

[b]Numbers may not add to 100 percent due to independent rounding.

Table 2-8. Employment Fields for Psychology, Social Sciences, Education, Business, and Other Fields: Energy-Related and All Doctoral Scientists and Engineers, Employed Population, 1977

Employment Field[a]	Energy-Related Number	Energy-Related Percent[b]	Total Number	Total Percent[b]	Percent Energy-Related in Field
Psychology, social sciences, education, business, and other fields					
Sociology	165	5	6,152	7	3
Economics/econometrics	1,148	33	8,845	10	13
Political science/public administration	397	11	7,866	9	5
Social sciences, other	459	13	13,162	16	3
Education	318	9	6,161	7	5
Business administration	377	11	3,865	5	10
Other fields	641	18	38,442	45	2
Total, psychology, social sciences, education, business, and other fields	3,505	100	84,493	100	4

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Each field listed accounted for 5 percent or more of the energy-related employment in the field area.

[b]Numbers may not add to 100 percent due to independent rounding.

Table 2-9. Employment Field and Doctoral Degree Specialty: Energy-Related and All Doctoral Scientists and Engineers, Employed Population, 1977[1]

Employment Field	Mathematics/ Computer Science	Physics	Chemistry	Earth, Environmental, and Marine Sciences	Engineering	Life Sciences	Psychology and Social Sciences	Other and Not Reported	Employment Field Total
Mathematics/computer science									
Energy-related	491	101	28	a	315	a	a	a	989
All doctorates	13,800	1,296	396	44	2,380	164	564	627	19,271
Physics									
Energy-related	14	3,135	187	21	239	a	0	a	3,617
All doctorates	46	15,503	785	106	1,253	206	12	73	17,984
Chemistry									
Energy-related	0	62	3,833	0	137	82	0	10	4,124
All doctorates	3	291	29,438	39	496	2,946	23	108	33,344
Earth, environmental, and marine sciences									
Energy-related	8	235	168	2,293	150	161	a	a	3,033
All doctorates	82	1,161	1,006	7,786	816	1,353	307	62	12,573
Engineering									
Energy-related	84	956	775	60	9,868	26	a	a	11,823
All doctorates	782	3,681	2,419	265	34,545	336	281	133	42,442
Life sciences[1]									
Energy-related	0	48	15	a	0	938	a	23	1,080
All doctorates	535	812	2,999	348	526	59,699	2,651	524	68,094
Psychology and social sciences									
Energy-related	0	46	49	a	42	a	2,066	73	2,314
All doctorates	178	180	172	61	188	579	60,170	5,800	67,328
Other and not reported									
Energy-related	56	199	443	63	490	119	207	0	1,577
All doctorates	1,069	2,152	3,970	453	2,604	3,830	9,123	0	23,201
Degree specialty, total									
Energy-related	653	4,782	5,498	2,472	11,241	1,376	2,397	138	28,557
All doctorates	16,495	25,076	41,185	9,102	42,808	69,113	73,131	7,327	284,237

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Sample size was too small to provide a usable estimate of the group's energy-related population.

[1]These data comparing employment fields and degree specialties can indicate field mobility for doctoral scientists and engineers. However, a degree of caution should be used in interpreting the data. Some of the field switching may reflect different definitions of specialty categories; for example, a biochemist may report his doctorate in chemistry and his employment in biology (life sciences). Also, many individuals who reported employment fields that differed from their doctoral degree specialties may have minors or other degrees related to their employment fields.

Table 2-10. Percentage of Doctoral Degree Specialty Reporting Same Employment Field: Energy-Related and All Doctoral Scientists and Engineers, Employed Population, 1977

Doctoral Degree Specialty	Percentage Reporting Same Employment Field	
	Energy-Related	All Doctorates
Mathematics/computer science	75	84
Physics	66	62
Chemistry	70	71
Earth, environmental, and marine sciences	93	86
Engineering	88	81
Life sciences	68	86
Psychology and social sciences	86	82
Total, all degree specialties[a]	80	80

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Not including "Other" and "Not Reported."

Table 2-11. Percentage of Employment Field Reporting Same Degree Specialty: Energy-Related and All Doctoral Scientists and Engineers, Employed Population, 1977

Employment Field	Percentage Reporting Same Degree Specialty	
	Energy-Related	All Doctorates
Mathematics/computer science	50	72
Physics	87	86
Chemistry	93	88
Earth, environmental, and marine sciences	76	62
Engineering	83	81
Life sciences	87	88
Psychology and social sciences	89	89
Total, all employment fields[a]	84	85

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Not including "Other" and "Not Reported."

Table 2-12. Engineering Employment Field and Degree Specialty: Energy-Related Doctoral Scientists and Engineers, Employed Population, 1977

Engineering Field[b]	Number Reporting[a]	
	Doctoral Degree Specialty	Employment Field
Civil	681	465
Chemical	2,731	2,054
Electrical	1,170	760
Nuclear	711	1,327
Engineering mechanics	650	471
Mechanical	1,967	1,903
Metallurgy and physical metallurgy	1,072	719
Fuel technology/petroleum	106	725
Materials science	289	695
Total, engineering	9,377	9,119

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]The overlap between the number reporting a doctoral degree specialty and the number reporting an employment field in the same area is not known. That is, it is not possible to estimate, using the survey data, the number of doctoral degree specialty holders who were working in the same employment field.

[b]Each area listed accounted for 5 percent or more of the doctoral degrees in the specialty or 5 percent or more of the employment in the field.

Table 2-13. Physics; Chemistry; and Earth, Environmental, and Marine Sciences Employment Field and Degree Specialty: Energy-Related Doctoral Scientists and Engineers, Employed Population, 1977

Area	Number Reporting[a]	
	Doctoral Degree Specialty	Employment Field
Physics[b]		
Atomic and molecular	604	503
Plasma	403	816
Elementary particle	315	69
Nuclear structure	818	191
Solid state	1,155	777
General	310	410
Total, physics	3,605	2,766
Chemistry[b]		
Analytical	406	512
Inorganic	784	369
Organic	1,076	526
Physical	2,081	886
Total, chemistry	4,347	2,293
Earth, environmental, and marine sciences[b]		
Mineralogy/petrology	135	145
Geochemistry	115	231
Stratigraphy/sedimentation	631	392
Structural geology	132	96
Geophysics	39	524
Applied geology	229	605
Earth sciences, general	373	81
Total, earth, environmental, and marine sciences	1,654	2,074

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]The overlap between the number reporting a doctoral degree specialty and the number reporting an employment field in the same area is not known. That is, it is not possible to estimate, using the survey data, the number of doctoral degree specialty holders who were working in the same employment field.

[b]Each area listed accounted for 5 percent or more of the doctoral degrees in the specialty or 5 percent or more of the employment in the field.

CHAPTER 3. BIOGRAPHICAL CHARACTERISTICS OF NEW DOCTORATES

The age distribution of the doctoral scientists and engineers who reported energy-related activities was very similar to that for all doctoral scientists and engineers (Figure 5, Table 3-1); on the average, the energy-related were slightly younger. For each age group, the percentage who were energy-related was roughly the same (10 percent).

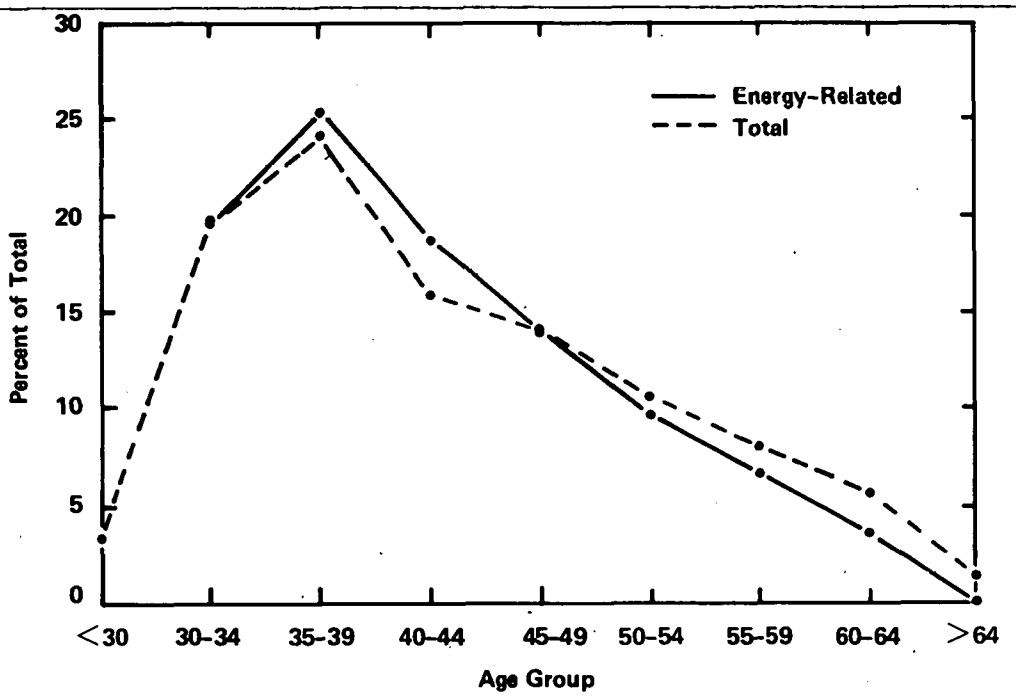

Figure 5. Age Distribution of Doctoral Scientists and Engineers, Employed Populations, 1977

Doctorates receiving their degrees in 1975-1976 showed characteristics very similar to the total population of energy-related scientists and engineers who earned their doctorates between 1930-1976 (compare Tables 2-1, 2-5, and 3-2, 3-3). Nine percent of the new doctorates (compared with 10 percent of all doctorates) indicated involvement with energy-related activities in 1977. The degree specialties and employment fields of the energy-related new graduates followed the same distribution patterns as for all energy-related doctoral scientists and engineers: roughly 41 percent of the energy-related group were engineers, with an additional 36 to 38 percent in the physical sciences or in earth, environmental, and marine sciences. A slightly smaller proportion of 1975-1976 earth, environmental, and marine science graduates than of all graduates in this specialty were

involved in energy-related work (22 percent versus 27 percent), while the reverse was true of engineers. Twenty-nine percent of new engineers and 26 percent of all engineers were energy-related.

The proportion of doctorates reporting their racial identification as white was slightly higher for all doctoral scientists and engineers than for energy-related doctorates (Tables 3-4 and 3-5, Figure 6). However, the proportion indicating their racial background as Asian/Pacific Islander was slightly higher for the energy-related group than for the total population of doctorates.

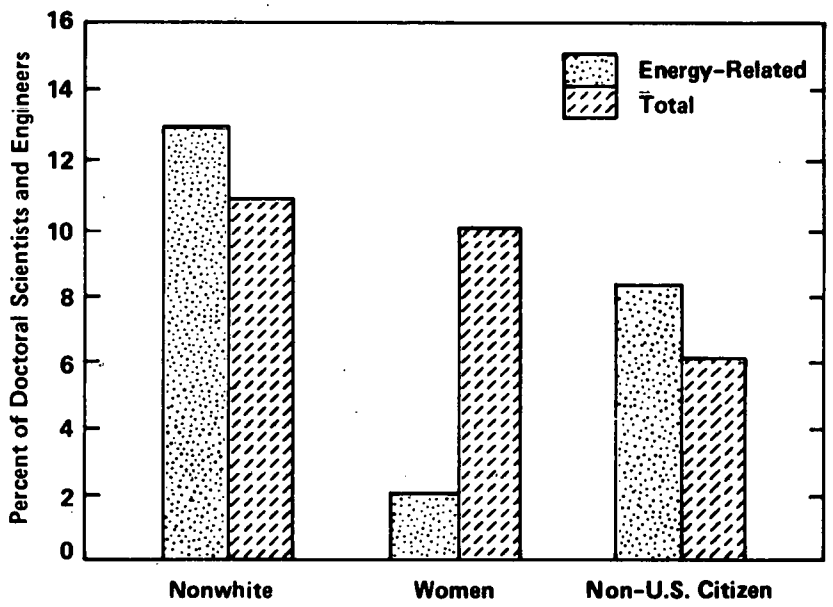

Figure 6. Percentage of Doctorates Held by Nonwhites, Women, and Non-U.S. Citizens, 1977

Table 3-6 shows that the percentage of energy-related doctoral women (2.1 percent) was considerably lower than the percentage of women among all doctoral scientists and engineers (9.7 percent). For each degree specialty or employment field, except engineering, the percentage of women in the energy-related area was about half of what it was for all doctoral scientists and engineers.

The proportion of non-U.S. citizens employed in energy-related activities was somewhat higher than for all doctoral scientists and engineers (Table 3-7). Earth, environmental, and marine science was the only field which showed a significantly lower percentage of non-U.S. citizens in the energy-related group than for all doctoral scientists and engineers.

Much of the difference in the representation of minority groups, women, and non-U.S. citizens between the energy-related and total populations falls in the "other and not reported" category, and provides no information on the reasons for this discrepancy. However, some of the differences in the proportions of women in these two groups can be explained by the relatively high percentage of women in the life and social sciences (30 percent by both degree specialty and employment field). Few graduates in these fields indicated energy-related activities. In addition, women in fields with a high proportion of energy-related members (physics, engineering, and earth, environmental, or marine sciences) comprised less than 10 percent of all women doctorates.

Table 3-1. Distribution by Age Group: Energy-Related and All Doctoral Scientists and Engineers, Employed Population, 1977

Age Group	Energy-Related		Total	
	Number	Percent[a]	Number	Percent[a]
Under 30	871	3	8,474	3
30-34	5,502	19	53,562	19
35-39	6,841	24	66,741	23
40-44	5,167	18	45,147	16
45-49	3,765	13	37,626	13
50-54	2,799	10	30,935	11
55-59	2,060	7	22,507	8
60-64	1,148	4	12,944	5
Over 64 or not reported	404	1	6,301	2
Total, all age groups	28,557	100	284,237	100

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Numbers may not add to 100 percent due to independent rounding.

Table 3-2. Degree Specialties of 1975-1976 Graduates: Energy-Related and All Doctoral Scientists and Engineers, Employed Population, 1977

Doctoral Degree Specialty	1975-1976 Graduates				Percent Energy-Related in Specialty
	Energy-Related		Total		
	Number	Percent[a]	Number	Percent[a]	
Mathematics and physical sciences	871	29	7,208	22	12
Earth, environmental, and marine sciences	265	9	1,228	4	22
Engineering	1,273	43	4,455	14	29
Life sciences	169	6	8,086	25	2
Social sciences	390	13	11,336	35	3
All other specialties	0	0	423	1	6
Total, all specialties	2,968	100	32,736	100	9

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Numbers may not add to 100 due to independent rounding.

Table 3-3. Employment Fields of 1975-1976 Graduates: Energy-Related and All Doctoral Scientists and Engineers, Employed Population, 1977

Employment Field	1975-1976 Graduates				
	Energy-Related		Total		Percent Energy Related in Field
	Number	Percent[a]	Number	Percent[a]	
Mathematics and physical sciences	808	27	6,860	21	12
Earth, environmental, and marine sciences	280	9	1,387	4	20
Engineering	1,205	41	4,090	12	29
Life sciences	177	6	8,165	25	2
Social sciences	354	12	10,185	31	3
All other fields	97	3	1,539	5	6
Not reported	47	2	510	2	9
Total, all fields	2,968	100	32,736	100	9

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Numbers may not add to 100 percent due to independent rounding.

Table 3-4. Race/Ethnic Groups, Women, and Non-U.S. Citizens by Employment Field: Energy-Related Doctoral Scientists and Engineers, Employed Population, 1977

Employment Field	Race/Ethnic Group				Women	Non-U.S. Citizen	Energy-Related Total
	White	Asian	Other Race/ Ethnic Groups	Not Reported			
Mathematics/computer science	894	54	13	28	30	94	989
Physical sciences							
Physics	3,223	175	30	189	52	301	3,617
Chemistry	3,765	203	60	96	117	278	4,124
Total, physical sciences	6,988	378	90	285	169	579	7,741
Earth, environmental, and marine sciences	2,764	112	12	145	56	133	3,033
Engineering							
Civil	305	160	[a]	0	[a]	111	465
Chemical	1,709	253	[a]	71	[a]	244	2,054
Electrical, electronic	875	140	[a]	15	[a]	93	1,038
Nuclear	1,120	151	[a]	53	[a]	133	1,327
Mechanical	1,491	361	[a]	49	[a]	273	1,903
All other engineering	4,283	504	[a]	237	[a]	497	5,036
Total, engineering	9,783	1,569	46	425	72	1,351	11,823
Life sciences	982	42	14	42	78	63	1,000
Psychology and social sciences	2,109	79	35	91	142	49	2,314
All other and not reported	1,338	116	25	98	64	106	1,577
Total, all fields	24,858	2,350	235	1,114	611	2,365	28,557

Source: U.S. Department of Energy, based on Academy of Sciences data.

[a]Sample size was too small to estimate the group's energy-related population in the employment field.

Table 3-5. Percent of Employment Field by Race/Ethnic Group: Energy-Related and All Doctoral Scientists and Engineers, Employed Population, 1977

Employment Field	Distribution of Race/Ethnic Groups				
	White (Percent)	Asian (Percent)	Other (Percent)	Not Reported (Percent)	Total[a] (Percent)
Mathematics/computer science					
Energy-related	90.4	5.5	1.3	2.8	100.0
All doctorates	87.8	6.5	1.0	4.7	100.0
Physical sciences					
Energy-related	90.3	4.9	1.2	3.7	100.0
All doctorates	89.2	5.9	1.3	3.7	100.0
Earth, environmental, and marine sciences					
Energy-related	91.1	3.7	0.4	4.8	100.0
All doctorates	92.5	3.9	0.3	3.3	100.0
Engineering					
Energy-related	82.7	13.3	0.4	3.6	100.0
All doctorates	85.0	10.9	0.6	3.5	100.0
Life sciences					
Energy-related	90.9	3.9	1.3	3.9	100.0
All doctorates	89.5	5.2	1.6	3.7	100.0
Psychology and social sciences					
Energy-related	91.1	3.4	1.5	3.9	100.0
All doctorates	91.0	2.1	2.1	4.8	100.0
Other and not reported					
Energy-related	84.8	7.4	1.6	6.2	100.0
All doctorates	89.1	3.9	2.2	4.8	100.0
Total, all fields					
Energy-related	87.0	8.2	0.8	3.9	100.0
All doctorates	89.1	5.4	1.5	4.1	100.0

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Numbers may not add to 100 percent due to independent rounding.

Table 3-6. Percent of Doctorates Held by Women in Each Degree Specialty and Employment Field: Energy-Related and All Doctoral Scientists and Engineers, Employed Population, 1977

Area	Percent of Doctorates Held by Women			
	Degree Specialty		Employment Field	
	Energy-Related	All Doctorates	Energy-Related	All Doctorates
Mathematics/computer science	4.4	6.8	3.0	6.3
Physics	1.3	2.4	1.4	2.7
Chemistry	3.0	5.9	2.8	6.1
Earth, environmental, and marine sciences	2.5	3.5	1.8	3.4
Engineering	0.4	0.5	0.6	0.7
Life sciences	6.5	12.6	7.2	12.4
Psychology and social sciences	6.4	17.7	6.1	17.9
Other and not reported	5.3	16.4	4.1	11.2
Total, all fields	2.1	9.7	2.1	9.7

Source: U.S. Department of Energy, based on National Academy of Sciences data.

Table 3-7. Percent of Doctorates Held by Non-U.S. Citizens in Each Employment Field: Energy-Related and All Doctoral Scientists and Engineers, Employed Population, 1977

Employment Field	Percent Held by Non-U.S. Citizens	
	Energy-Related	All Doctorates
Mathematics/computer science	9.5	7.9
Physics	8.3	8.3
Chemistry	6.7	6.6
Earth, environmental, and marine sciences	4.4	6.3
Engineering	11.4	9.0
Life sciences	5.8	5.9
Psychology and social sciences	2.1	2.9
All other fields	3.5	2.5
Not reported	16.6	8.6
Total, all fields	8.3	5.9

Source: U.S. Department of Energy, based on Academy of Sciences data.

CHAPTER 4. TYPE OF EMPLOYER

The major employers of doctoral scientists and engineers were private business or industry and educational institutions (Figure 7). Almost half (47 percent) of the energy-related population was employed in private business or industry and another 38 percent in educational institutions (Tables 4-1 and 4-2). In contrast, for the total population of scientists and engineers, only 25 percent were employed by private business/industry while 57 percent worked in educational institutions.

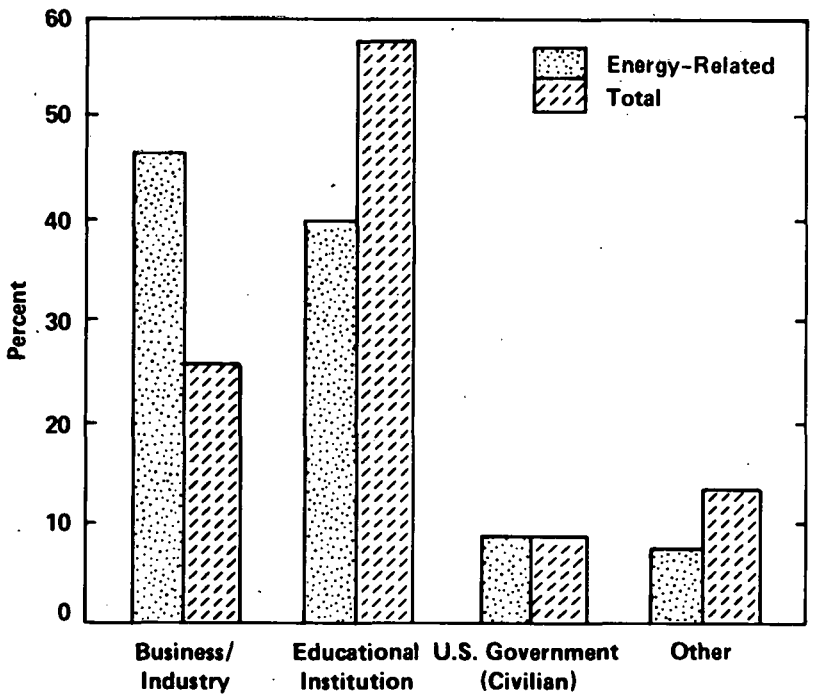

Figure 7. Type of Employer, Doctoral Scientists and Engineers, 1977

The percentage distribution by type of employer varied somewhat among different employment field categories. For energy-related doctorates employed in mathematics, physical sciences, or earth, environmental, and marine sciences, the percentage employed by private business/industry was only slightly higher than the percentage at educational institutions (45 percent versus 40 percent). On the other hand, twice as many energy-related engineers were employed in private business/industry as in educational

institutions (60 percent versus 30 percent). While the percentage employed at educational institutions was higher for the total population than for the energy-related group in both of the above-mentioned employment categories, the contrast is much sharper for those employed in mathematics, physical sciences, or earth, environmental, and marine sciences.

Since doctoral engineers are more likely to be employed in private business/industry than at educational institutions, and since roughly 40 percent of the energy-related population are engineers, it is not surprising to find greater employment of energy-related doctoral scientists and engineers in private business/industry than in educational institutions.

Table 4-1. Distribution by Type of Employer: Energy-Related and All Doctoral Scientists and Engineers, Employed Population, 1977

Type of Employer	Energy-Related		Total		Percent Energy-Related by Type of Employer
	Number	Percent[a]	Number	Percent	
Business/industry	13,458	47	71,464	25	19
Educational institution	10,984	38	163,101	57	7
U.S. government,civilian	2,282	8	21,353	8	11
State and local government	210	1	5,328	2	4
Nonprofit organization	1,511	5	8,366	3	18
All other and not reported	112	[b]	14,625	5	1
Total, all employers	28,557	100	284,237	100	10

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Numbers may not add to 100 percent due to independent rounding.

[b]Less than 0.5 percent.

Table 4-2. Type of Employer by Employment Field: Energy-Related and All Doctoral Scientists and Engineers, Employed Population, 1977

Type of Employer	Energy-Related Employment Field							
	Mathematics/Computer Science; Physical Sciences; Earth, Environmental, and Marine Sciences		Engineering		All Other and Not Reported		Energy-Related Total	
	Number	Percent[a]	Number	Percent[a]	Number	Percent[a]	Number	Percent[a]
Business/industry	5,276	45	7,058	60	1,124	23	13,458	47
Educational institution	4,700	40	3,500	30	2,784	56	10,984	38
U.S. government, civilian	1,117	9	657	6	508	10	2,282	8
State and local government	59	1	48	[b]	103	2	210	1
Nonprofit organization	601	5	560	5	350	7	1,511	5
All other and not reported	10	[b]	0	0	102	2	112	[b]
Total, all employers	11,763	100	11,823	100	4,971	100	28,557	100

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Numbers may not add to 100 percent due to independent rounding.

[b]Less than 0.5 percent.

Table 4-3. Percentage Distribution by Type of Employer and Employment Field: Energy-Related and All Doctoral Scientists and Engineers, Employed Population, 1977

Type of Employer	Distribution by Employment Field							
	Mathematics/Computer Science; Physical Sciences; Earth, Environmental, and Marine Sciences		Engineering		All Other and Not Reported		Total[a]	
	Energy-Related (percent)	All Doctorates (percent)	Energy-Related (percent)	All Doctorates (percent)	Energy-Related (percent)	All Doctorates (percent)	Energy-Related (percent)	All Doctorates (percent)
Business/industry	45	33	60	51	23	14	47	25
Educational institution	40	54	30	35	56	65	38	57
U.S. government, civilian	8	8	9	8	6	8	10	7
State and local government	1	1	[b]	1	2	3	1	2
Nonprofit organization	5	3	5	3	7	3	5	3
All other and not reported	[b]	1	0	1	2	8	[b]	5
Total, all employers	100	100	100	100	100	100	100	100

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Numbers may not add to 100 due to independent rounding.

[b]Less than 0.5 percent.

CHAPTER 5. PRIMARY WORK ACTIVITIES

Energy-related doctorates were often involved in some aspect of research and development. As Table 5-1 shows, nearly two-thirds (64 percent) reported their primary work activity as either research and development (43 percent), management and administration of research and development (18 percent), or management and administration that included research and development (3 percent). In contrast, only 46 percent of all doctorates indicated that their primary work activity involved research and development of any type (Table 5-2). Energy-related doctorates also cited teaching as a primary work activity less often than did all doctorates (Figure 8).

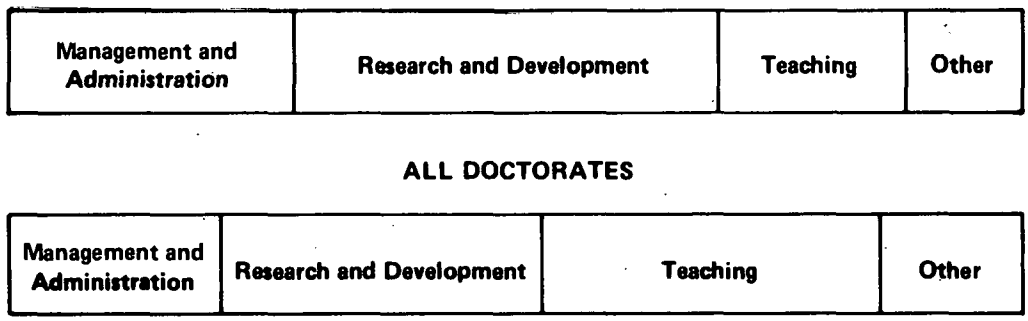

Figure 8. Primary Work Activity for Doctoral Scientists and Engineers, 1977

Among energy-related doctorates, applied research was the most commonly cited activity of chemists, engineers, and earth, environmental, and marine scientists. Of the energy-related doctorates in other fields, physicists were most often working in basic or applied research. Those in mathematics/computer science, psychology and social sciences, and life sciences reported teaching activities more frequently than did those in other fields.

The concentration of energy-related doctorates in research and development is not surprising, given the high proportion of engineers, physical scientists, and earth, environmental, and marine scientists in the energy-related population. A high percentage of all doctorates in these fields was involved in research and development or management of research and development.

Primary work activity also relates to type of employer (see Chapter 4). For example, since proportionally fewer of the energy-related are employed at educational institutions, fewer reported teaching as their primary work activity.

Table 5-1. Primary Work Activity by Employment Field: Energy-Related Doctoral Scientists and Engineers, Employed Population, 1977

Primary Work Activity	Energy-Related Employment Field																	
	Mathematics/ Computer Science		Physics		Chemistry		Earth, Environmental, and Marine Sciences		Engineering		Life Sciences		Psychology and Social Sciences		All Other and Not Reported		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Management and administration of																		
Research and development	75	8	503	14	940	23	425	14	2,715	23	176	16	110	5	261	17	5,205	18
Other	74	7	67	2	132	3	251	8	917	8	50	5	116	5	393	25	2,000	7
Both	29	3	60	2	73	2	80	3	383	3	46	4	62	3	154	10	887	3
Total *management* and administration[a]	178	18	630	17	1,145	28	756	25	4,015	34	272	25	288	12	808	51	8,092	23
Research and development																		
Basic research	41	4	1,081	30	951	23	620	20	548	5	240	22	192	4	45	3	3,638	18
Applied research	196	20	1,055	29	1,141	28	780	26	2,837	24	147	14	547	24	86	5	6,789	24
Development	171	17	58	2	171	4	106	3	1,239	10	11	1	0	0	18	1	1,769	6
Total research and development[a]	408	41	2,194	61	2,263	55	1,506	50	4,624	39	398	37	649	28	144	9	12,186	43
Teaching	242	24	626	17	481	12	413	14	1,594	13	237	22	999	43	283	18	4,875	17
All other and not reported	161	16	167	5	235	6	358	12	1,590	13	173	16	378	26	242	22	3,404	12
Total, all activities[a]	989	100	3,617	100	4,124	100	3,033	100	11,823	100	1,080	100	2,314	100	1,577	100	28,557	100

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Numbers may not add to 100 due to independent rounding.

Table 5-2. Percentage Distribution by Primary Work Activity and Employment Field: Energy-Related and All Doctoral Scientists and Engineers, Employed Population, 1977

Primary Work Activity	Employment Field									
	Mathematics/ Computer Science		Physics		Chemistry		Earth, Environmental, and Marine Sciences		Engineering	
	Energy-Related (percent)	All Doctorates (percent)	Energy-Related (percent)	All Doctorates (percent)	Energy-Related (percent)	All Doctorates (percent)	Energy-Related (percent)	All Doctorates (percent)	Energy-Related (percent)	All Doctorates (percent)
Management and administration of										
Research and development	8	5	14	11	23	17	14	13	23	20
Other	7	5	2	3	3	4	8	8	8	8
Both	3	2	2	2	2	2	3	3	3	3
Total management and administration[b]	18	13	17	15	28	23	25	23	34	31
Research and development										
Basic research	4	11	30	28	23	21	20	20	5	4
Applied research	20	8	29	18	28	20	26	17	24	20
Development	17	10	2	3	4	5	3	2	10	13
Total research and development[b]	41	29	61	50	55	46	50	39	39	37
Teaching	24	52	17	31	12	24	14	27	13	20
All other and not reported	16	7	5	4	6	7	12	11	13	12
Total, all activities[b]	100	100	100	100	100	100	100	100	100	100

Table 5-2 (continued)

Primary Work Activity	Employment Field: Life Sciences — Energy-Related (percent)	Life Sciences — All Doctorates (percent)	Psychology and Social Sciences — Energy-Related (percent)	Psychology and Social Sciences — All Doctorates (percent)	All Other and Not Reported — Energy-Related (percent)	All Other and Not Reported — All Doctorates (percent)	Total — Energy-Related (percent)	Total — All Doctorates (percent)
Management and administration of								
Research and development	16	10	5	5	17	8	18	11
Other	5	5	5	8	25	25	7	8
Both	4	2	3	2	10	5	3	3
Total management and administration[b]	25	18	12	15	51	39	28	21
Research and development								
Basic research	22	29	4	7	3	3	13	15
Applied research	14	13	24	7	5	4	24	13
Development	1	1	0	[a]	1	2	6	4
Total research and development[b]	37	43	28	15	9	9	43	32
Teaching	22	27	43	46	18	24	17	32
All other and not reported	16	12	16	24	22	29	12	15
Total, all activities[b]	100	100	100	100	100	100	100	100

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Less than 0.5 percent.

[b]Numbers may not add to totals due to independent rounding.

CHAPTER 6. REGIONAL LOCATION

Overall, the largest numbers of energy-related doctorates were found in the Middle Atlantic region, followed by the Pacific, East North Central, and South Atlantic states (Figure 9). The energy-related population in states east of the Mississippi River accounted for 58 percent of the energy-related doctorates (Table 6-1). However, compared with all doctoral scientists and engineers, the energy-related population was relatively more concentrated in three western regions (Table 6-2): the West South Central, Mountain, and Pacific states. These areas accounted for roughly 38 percent of the energy-related population but only 28 percent of all doctoral scientists and engineers.

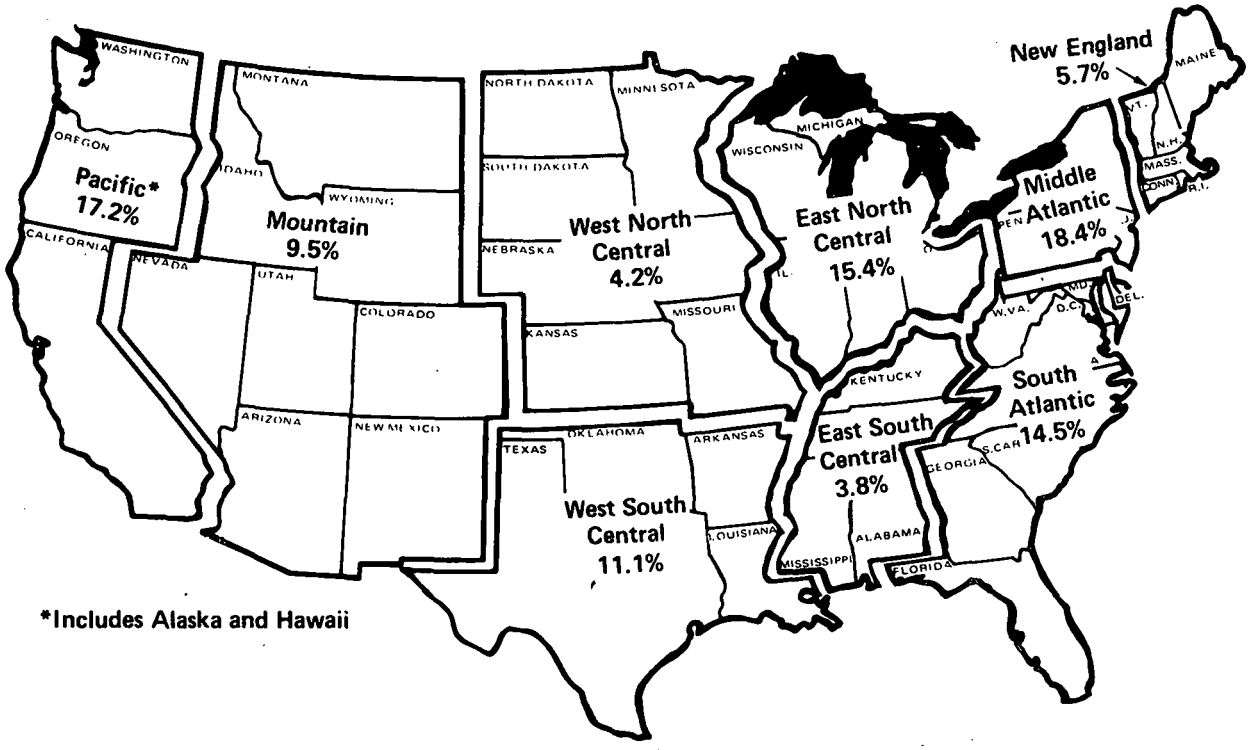

Figure 9. Regional Distribution of Energy-Related Doctoral Scientists and Engineers, 1977

The regional distribution of the energy-related doctorates varied somewhat among the employment fields. While 24 percent of the energy-related chemists were in the Middle Atlantic states, for example, only 7 percent of the energy-related earth, environmental, and marine scientists were in that region. Similarly, 29 percent of the energy-related earth, environmental, and marine scientists were in the West South Central region while only 3 percent of the energy-related physicists were working there.

Though some of the regional distribution variation between employment fields for the energy-related population simply reflects the variation for the total population of doctorates, differences can be noted in the regional distributions of the energy-related doctorates and all doctorates in several employment fields. For example, 29 percent of the energy-related earth, environmental, and marine scientists were in the West South Central region while only 13 percent of all doctorates in the field worked in that region.

The concentration of the oil and natural gas industry in Texas and Oklahoma helps explain the high percentage of energy-related doctoral scientists and engineers in the West South Central region. The Mountain and Pacific regions contain (in addition to significant portions of the petroleum industry) six laboratories run by DOE contractors. It is not surprising, then, that energy-related doctorates were relatively concentrated in the western states.

Table 6-1. Regional Location by Employment Field: Energy-Related Doctoral Scientists and Engineers, Employed Population, 1977

Region	Energy-Related Fields																	
	Mathematics/Computer Science		Physics		Chemistry		Earth, Environmental, and Marine Sciences		Engineering		Life Sciences		Psychology and Social Sciences		All Other and Not Reported		Total	
	Number	Percent[a]	Number	Percent[a]	Number	Percent[a]	Number	Percent[a]	Number	Percent[a]	Number	Percent[a]	Number	Percent[a]	Number	Percent[a]	Number	Percent[a]
New England	97	10	271	7	229	6	122	4	648	5	33	3	155	7	90	6	1,645	5
Middle Atlantic	228	23	562	16	974	24	216	7	2,524	21	110	10	300	13	347	22	5,261	18
East North Central	183	19	477	13	694	17	250	8	1,884	16	169	16	415	18	312	20	4,384	15
West North Central	0	0	114	3	181	4	126	4	548	5	28	3	157	7	51	3	1,205	4
South Atlantic	70	7	663	18	586	14	411	14	1,399	12	227	21	431	19	368	23	4,155	14
East South Central	60	6	119	3	138	3	31	1	474	4	61	6	151	7	57	4	1,091	4
West South Central	128	13	125	3	449	11	871	29	1,263	11	43	4	154	7	127	8	3,160	11
Mountain	97	10	525	15	272	7	403	13	986	8	150	14	204	9	68	4	2,705	9
Pacific	126	13	755	21	595	14	603	20	2,096	18	248	23	345	15	157	10	4,925	17
U.S. possessions	0	0	6	[b]	6	[b]	0	0	1	[b]	11	1	2	[b]	0	0	26	[b]
Total, all regions	989	100	3,617	100	4,124	100	3,033	100	11,823	100	1,080	100	2,314	100	1,577	100	28,557	100

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Numbers may not add to 100 due to independent rounding.

[b]Less than 0.5 percent.

Table 6-2. Percentage Distribution by Regional Location and Employment Field
Energy-Related and All Doctoral Scientists and Engineers,
Employed Population, 1977

Region	Distribution by Employment Field[a]									
	Mathematics/Computer Science		Physics		Chemistry		Earth, Environmental, and Marine Sciences		Engineering	
	Energy-Related (percent)	All Doctorates (percent)	Energy-Related (percent)	All Doctorates (percent)	Energy-Related (percent)	All Doctorates (percent)	Energy-Related (percent)	All Doctorates (percent)	Energy-Related (percent)	All Doctorates (percent)
New England	10	8	7	10	6	7	4	8	5	7
Middle Atlantic	23	20	16	19	24	24	7	10	21	20
East North Central	19	17	13	14	17	19	8	10	16	17
West North Central	0	7	3	4	4	6	4	4	5	4
South Atlantic	7	16	18	18	14	17	14	19	12	15
East South Central	6	4	3	3	3	4	1	3	4	4
West South Central	13	8	3	5	11	7	29	13	11	8
Mountain	10	6	15	9	7	4	13	14	8	7
Pacific	13	14	21	19	14	11	20	20	18	17
U.S. possessions	0	[b]	[b]	[b]	[b]	[b]	0	[b]	[b]	[b]
Total, all regions	100	100	100	100	100	100	100	100	100	100

Table 6-2 (continued)

Region	Distribution by Employment Field[a]							
	Life Sciences		Psychology and Social Sciences		All Other and Not Reported		Total	
	Energy-Related (percent)	All Doctorates (percent)	Energy-Related (percent)	All Doctorates (percent)	Energy-Related (percent)	All Doctorates (percent)	Energy-Related (percent)	All Doctorates (percent)
New England	3	6	7	8	6	9	6	8
Middle Atlantic	10	16	13	20	22	20	18	19
East North Central	16	16	18	17	20	15	15	16
West North Central	3	8	7	7	3	6	4	6
South Atlantic	21	19	19	18	23	19	14	18
East South Central	6	5	7	4	4	4	4	4
West South Central	4	8	7	6	8	7	11	7
Mountain	14	6	9	5	4	5	9	6
Pacific	23	15	15	16	10	15	17	15
U.S. possessions	1	[b]	[b]	[b]	0	[b]	[b]	[b]
Total, all regions	100	100	100	100	100	100	100	100

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Numbers may not add to 100 due to independent rounding.

[b]Less than 0.5 percent.

CHAPTER 7. U.S. GOVERNMENT FUNDING SOURCES

Half of the energy-related doctorates received support from the U.S. government compared with 42 percent of all doctoral scientists and engineers (Figure 10, Tables 7-1 and 7-2).[1] All employment fields except engineering and earth, environmental, and marine sciences had higher percentages receiving U.S. government support among the energy-related than among all doctoral scientists and engineers. The energy-related engineers reported roughly the same percentage receiving government support as did all doctoral engineers, while energy-related earth, environmental and marine scientists showed a clearly lower percentage receiving government funds than all doctorates employed in the field.

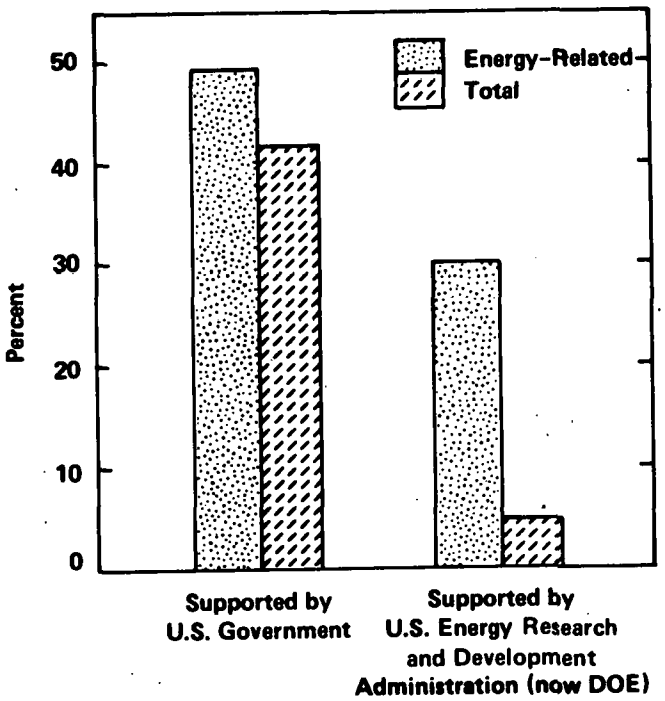

Figure 10. Percentage of Doctoral Scientists and Engineers Receiving U.S. Government Support, 1977

[1]It should be noted that the actual extent of the support received from the U.S. Government could range from a minimal amount to full support; see question 16 in the questionnaire (Appendix A).

The percentage of doctorates receiving U.S. government support was higher for the energy-related than for all doctoral scientists and engineers for each type of employer (Table 7-3). However, for business and industry, the difference was only 28 percent for the energy-related versus 22 percent for all doctoral scientists and engineers, while at educational institutions it was 61 percent versus 41 percent. One-half (7,073) of the 14,234 energy-related doctorates who received government support reported research and development as their primary work activity; another 3,950 (28 percent) were primarily involved in management or administration (Table 7-4).

Of the 14,234 energy-related doctorates who received U.S. government support, 63 percent received support from ERDA (now DOE) (Table 7-2). Fifteen percent received some support from the National Science Foundation, 12 percent from the Department of Defense, and 7 percent from the Department of Interior. ERDA was the largest supporter of energy-related doctorates employed in mathematics/computer science, and the physical sciences and engineering, but not for those employed in earth, environmental, and marine sciences, life sciences, or psychology and social sciences.

Over 16,000 doctoral scientists and engineers received support from ERDA; of these, 8,954 (56 percent) reported "energy and fuel" as the area of national interest on which they spent the most time (Table 7-5). Significant numbers of ERDA-supported doctorates indicated that they were primarily involved in defense, environmental protection, and education. Thirty-one percent of the energy-related doctorates received support from ERDA compared with only 6 percent of all doctoral scientists and engineers.

Table 7-1. Percentage of U.S. Government-Supported Personnel by Employment Field[a]: Energy-Related and All Doctoral Scientists and Engineers, Employed Population, 1977

Employment Field	Percent in Each Field Reporting U.S. Government Support	
	Energy-Related	All Doctorates
Mathematics/computer science and physical sciences	57	37
Earth, environmental, and marine sciences	44	54
Engineering		
Civil	41	48
Chemical	34	25
Electrical, electronic	44	48
Nuclear	62	64
Mechanical	50	46
Other engineering	52	56
Total, engineering	48	50
Life sciences	65	57
Psychology and social	41	31
All other and not reported	36	24
Total, all fields	50	42

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Indicates at least partial support or sponsorship of work activities by the U.S. government.

Table 7-2. Employment Fields and U.S. Government Funding Sources: Energy-Related Doctoral Scientists and Engineers, Employed Population, 1977

Employment Field	Energy-Related Doctorates Receiving U.S. Government Support							
	National Science Foundation	Environmental Protection Agency	ERDA	Nuclear Regulatory Commission	Department of Interior	Department of Defense	All Other Federal Government Agencies	Energy-Related U.S. Government Supported Total[a]
Mathematics/computer science and physical sciences	859	93	3,630	209	20	741	812	4,959
Earth, environmental, and marine sciences	314	90	494	101	536	121	281	1,340
Engineering								
Civil	41	11	88	21	48	0	50	189
Chemical	132	84	572	32	18	16	72	699
Electrical, electronic	102	0	270	22	18	91	112	461
Nuclear	44	10	605	208	0	16	101	817
Mechanical	130	58	636	74	18	139	196	957
Other engineering	211	150	1,839	143	212	520	701	2,606
Total, engineering	660	313	4,010	500	314	782	1,232	5,729
Life sciences	142	52	281	22	48	8	374	697
Psychology and social sciences	118	62	292	80	84	61	586	946
All other and not reported	66	0	247	32	28	41	261	563
Total, all fields	2,159	610	8,954	944	1,030	1,754	3,546	14,234

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a] Indicates at least partial support or sponsorship of work activities by the U.S. government. The total is the number of individuals reporting one or more sources of U.S. government funding support. Because some individuals reported multiple sources of U.S. government funding support, the sum of individuals reported for all agencies is larger than the total number receiving support.

Table 7-3. U.S. Government-Supported Personnel by Type of Employer: Energy-Related and All Doctoral Scientists and Engineers, Employed Population, 1977

Type of Employer	Energy-Related			All Doctorates		
	Total	Government-Supported[a]	Percent Government-Supported	Total	Government-Supported[a]	Percent Government-Supported
Business/industry	13,458	3,723	28	71,464	15,712	22
Educational institution	10,984	6,742	61	163,101	66,308	41
All other and not reported	4,115	3,769	92	49,672	37,607	76
Total, all employers	28,557	14,234	50	284,237	119,627	42

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Indicates at least partial support or sponsorship of work activities by the U.S. government.

Table 7-4. U.S. Government-Supported Personnel by Primary Work Activity: Energy-Related and All Doctoral Scientists and Engineers, Employed Population, 1977

Primary Work Activity	Energy-Related			All Doctorates		
	Total	Government-Supported[a]	Percent Government-Supported[a]	Total	Government-Supported[a]	Percent Government-Supported
Management/administration						
of research & development	5,205	3,014	58	30,733	15,729	51
of other and of both	2,887	936	32	29,731	10,958	37
Total, management/ administration	8,092	3,950	49	60,464	26,687	44
Research and development	12,186	7,073	58	91,259	56,699	62
All other and not reported	8,279	3,211	39	132,514	36,331	27
Total, all activities	28,557	14,234	50	284,237	119,627	42

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Indicates at least partial support or sponsorship of work activities by the U.S. government.

Table 7-5. U.S. ERDA-Funded Personnel by Area of National Interest: All Doctoral Scientists and Engineers, Employed Population, 1977

Area of National Interest	Personnel Supported by ERDA[a]	
	Number	Percent[b]
Energy and fuel	8,954	56
Food and other agricultural products	179	1
Natural resources, other than fuel or food	203	1
Environmental protection, pollution control	1,311	8
Defense	1,638	10
Space	88	1
Health	863	5
Education	1,073	7
Transportation, communications	90	1
All other areas	228	1
Not reported	1,489	9
Total, all areas	16,116	100

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Indicates at least partial support or sponsorship of work activities by the U.S. Energy Research and Development Administration (now DOE).

[b]Numbers may not add to 100 due to independent rounding.

CHAPTER 8. COMPARISON OF ENERGY-RELATED DOCTORAL SCIENTISTS AND ENGINEERS: 1977 VERSUS 1975

The number of doctoral scientists and engineers who reported spending a significant portion of their time on energy-related work rose from 20,852 in 1975 to 28,557 in 1977, an increase of 37 percent.[1] At the same time, the total population of doctorates rose by only eight percent.

The percentage of all doctoral scientists and engineers who reported energy-related activities rose from 7.9 to 10.0 percent over the two-year period (Figure 11). For doctorates in several degree and employment fields the rise was much more dramatic (Tables 8-1 through 8-6). In 1977, 41 percent of all doctorates with degrees in mechanical engineering were energy-related, compared with 27 percent in 1975. For doctorates employed in plasma physics the percentage energy-related rose from 62 percent to 72 percent, while for those working in stratigraphy/sedimentation it rose from 33 percent to 54 percent.

The distribution of the energy-related doctorates by employment field and by degree specialty remained relatively unchanged. There was a very slight decrease in the percentage of engineers and chemists and an increase in social scientists between 1975 and 1977. Overall, four out of five doctoral scientists and engineers reported employment in the same field as their doctoral degree specialty in both 1975 and 1977 (Table 8-7). However, there was less evidence of field switching in 1977 than in 1975 for doctorates with degrees in mathematics/computer science and social sciences.

The biographical characteristics of the energy-related population continued to reflect the characteristics of the total population of doctoral scientists and engineers (Tables 8-8 through 8-10). The racial distribution and the percentage of non-U.S. citizens remained fairly constant over the two-year period from 1975 to 1977. The percentage of women in the energy-related population increased slightly over the two years, but remained far below their percentage in the total population of doctoral scientists and engineers.

There was a significant shift in the distribution by type of employer of energy-related doctoral scientists and engineers between 1975 and 1977:

[1]The reader should be advised that there were slight modifications between 1975 and 1977 in the choices and wording on many of the questions used in the survey. Changes in the question used to determine energy-relatedness and in the survey sample are discussed in Chapter 1.

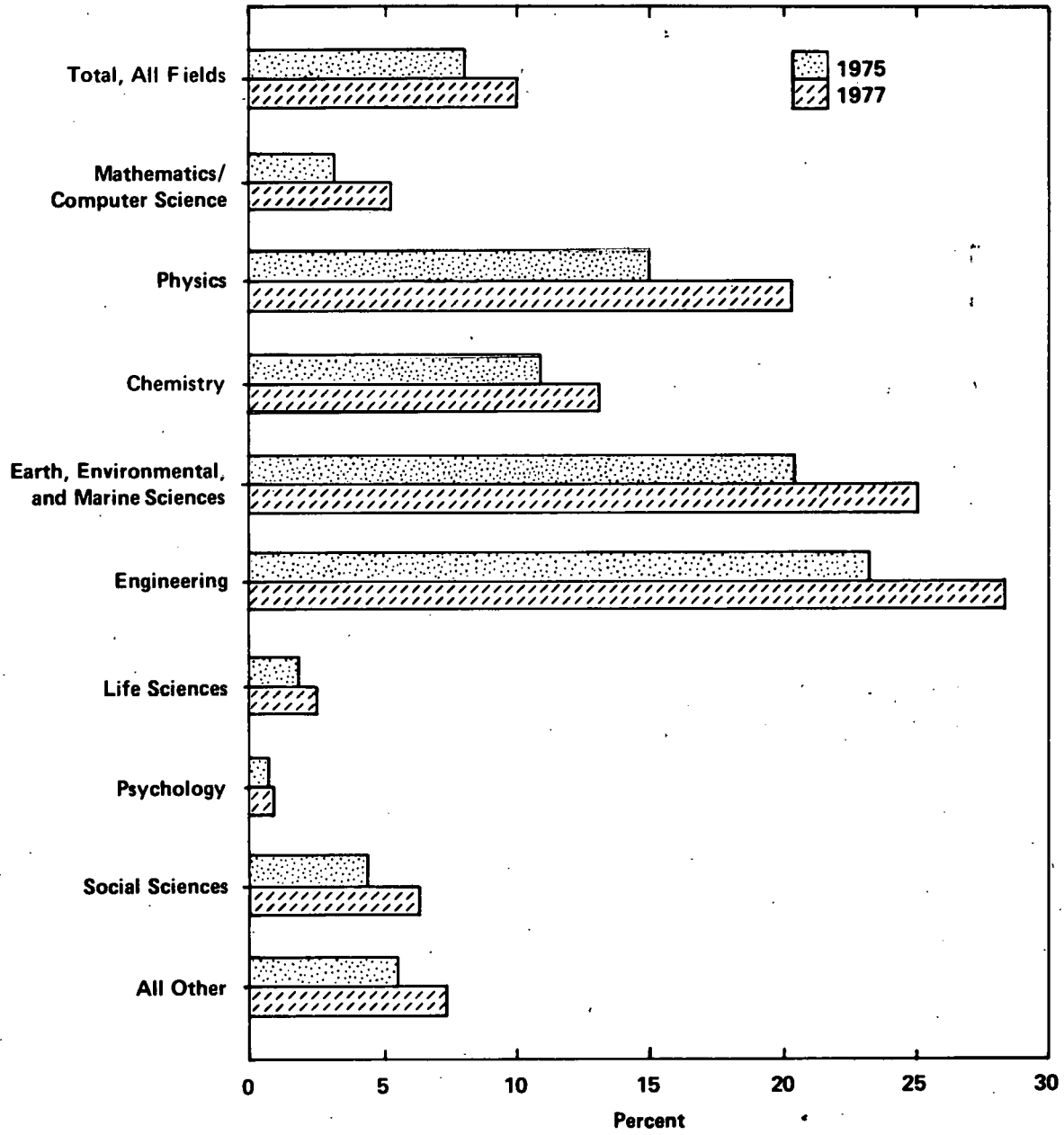

Figure 11. Energy-Related Employment as a Percentage of Total Doctoral Employment by Employment Field, 1975 and 1977

the percentage employed at educational institutions increased, and the percentage in private business/industry decreased (Tables 8-11, 8-12, Figure 12). There was also a slight decrease in the percentage employed by the U.S. government.

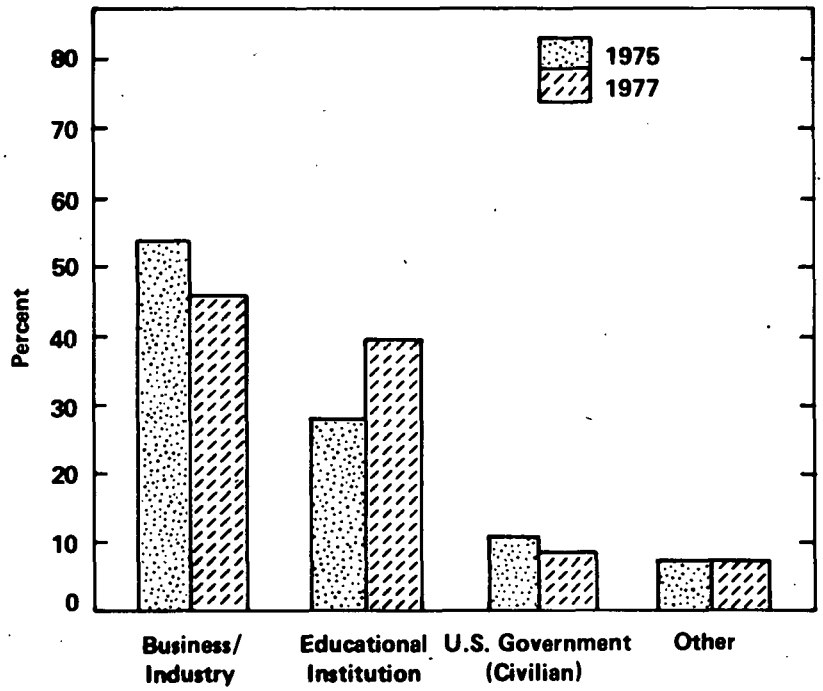

Figure 12. Percentage Distribution by Type of Employer, Energy-Related Doctoral Scientists and Engineers, 1975 and 1977

A corresponding shift can be noted in the primary work activities of the energy-related doctorates (Tables 8-13, 8-14, Figure 13). In 1977, a larger percentage reported teaching as their primary work activity, while the percentage reporting management and administration of research and development and applied research (the two most common work activities of energy-related doctorates) decreased.

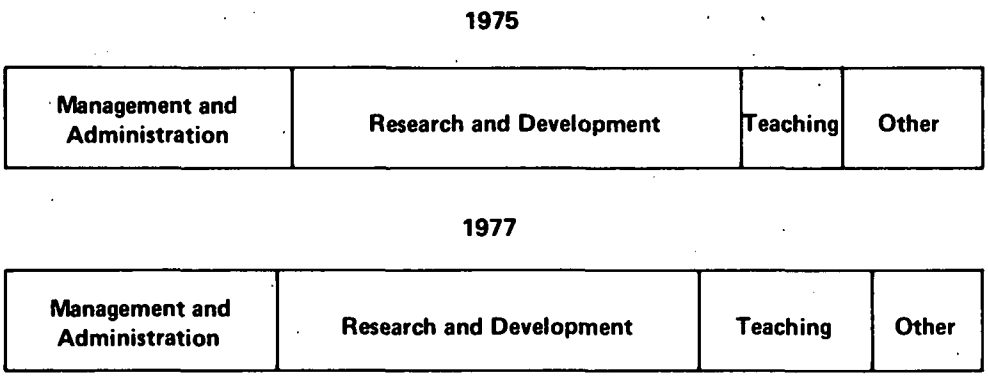

Figure 13. Primary Work Activities of Energy-Related Doctoral Scientists and Engineers, 1975 and 1977

The regional distribution of the energy-related doctoral scientists and engineers shows little change between 1975 and 1977 (Tables 8-15, 8-16). However, a slight increase can be observed in the relative percentage in the West North Central region, along with a slight decrease in the West South Central states.

The percentage of energy-related doctorates receiving U.S. government support rose slightly from 47 percent in 1975 to 50 percent in 1977 (Table 8-17). The percentage receiving government funds rose the most for doctorates employed in earth, environmental, and marine sciences and in engineering (especially chemical and mechanical engineering). Of those receiving U.S. government support, there was an increase in the percentage who received funds from ERDA (from 52 percent in 1975 to 63 percent in 1977), and a decrease in support from all other government departments and agencies (Table 8-18).

The percentage of energy-related doctorates employed at educational institutions who received U.S. government support decreased from 69 percent in 1975 to 61 percent in 1977 (Figure 14, Table 8-19). At the same time, for doctorates in private business/industry (who show a greater percentage involvement in energy-related activities than do doctorates at educational

institutions) the percentage receiving U.S. government funds increased from 23 percent to 28 percent.

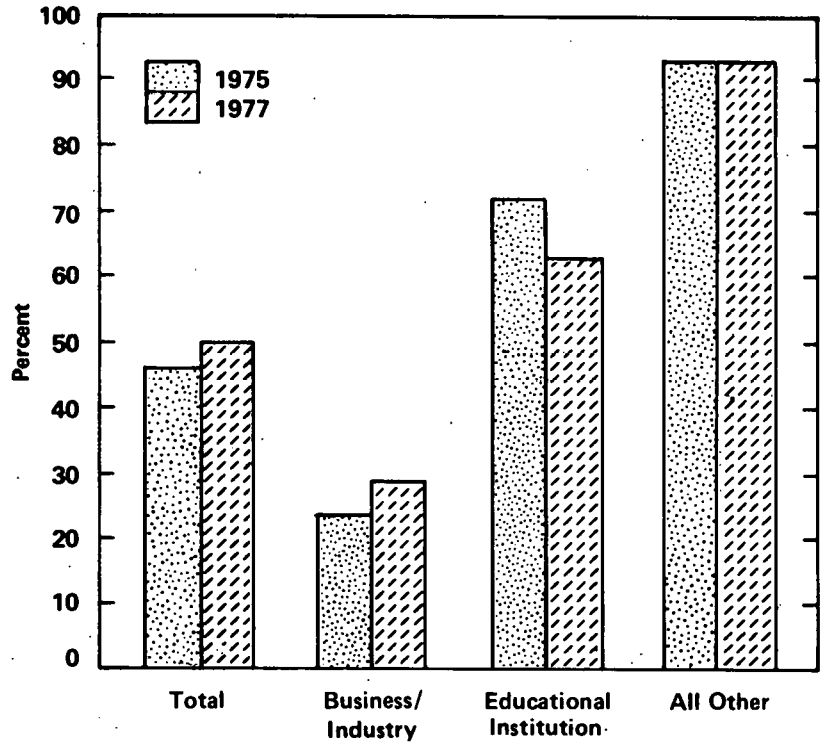

Figure 14. Percentage U.S. Government-Supported by Type of Employer, Energy-Related Doctoral Scientists and Engineers, 1975 and 1977

Though energy-relatedness is more common among doctorates employed in business/industry than among those at educational institutions (19 percent versus 7 percent in 1977), there was an increase between 1975 and 1977 in the percentage of energy-related doctorates who reported educational institutions as their type of employer. However, a lower percentage of the doctorates at educational institutions received U.S. government support in 1977 than in 1975. This might explain part of the increase in energy-related doctorates reporting teaching as their primary work activity.

Table 8-1. Doctoral Degree Specialties: Energy-Related Doctoral Scientists and Engineers, Employed Populations, 1977 versus 1975

Degree Specialty	1977 Number	1977 Percent[a]	1977 Percent Energy-Related of Total in Specialty	1975 Number	1975 Percent[a]	1975 Percent Energy-Related of Total in Specialty
Mathematics/computer science	653	2	4.0	335	2	2.2
Physics/astronomy	4,782	17	19.1	3,422	16	14.5
Chemistry	5,498	19	13.3	4,514	22	11.2
Earth, environmental, and marine sciences	2,472	9	27.2	1,851	9	21.9
Engineering	11,241	39	26.3	8,475	41	21.2
Life sciences	1,376	5	2.0	838	4	1.3
Psychology	161	1	0.5	76	b	0.3
Social sciences	2,236	8	5.5	1,273	6	3.5
All other and not reported	138	b	1.9	68	b	1.3
Total, all specialties	28,557	100	10.0	20,852	100	7.9

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Numbers may not add to 100 percent due to independent rounding.

[b]Less than 0.5 percent.

Table 8-2. Engineering Degree Specialties: Energy-Related Doctoral Scientists and Engineers, Employed Populations, 1977 versus 1975

Engineering Degree Specialty[a]	1977 Number	1977 Percent[b]	1977 Percent Energy-Related of Total in Specialty	1975 Number	1975 Percent[b]	1975 Percent Energy-Related of Total in Specialty
Civil	681	6	19	567	7	17
Chemical	2,731	24	40	2,435	29	37
Electrical	1,170	10	14	793	9	10
Nuclear	711	6	69	544	6	67
Engineering mechanics	650	6	22	429	5	16
Mechanical	1,967	17	41	1,204	14	27
Metallurgy and physical metallurgy	1,072	10	32	818	10	27
Other engineering	2,259	20	19	1,685	20	15
Total, engineering	11,241	100	26	8,475	100	21

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Each specialty listed accounted for 5 percent or more of the energy-related engineering doctoral degrees in both 1975 and 1977.

[b]Numbers may not add to 100 percent due to independent rounding.

Table 8-3. Degree Specialties for Physics; Chemistry; and Earth, Environmental, and Marine Sciences: Energy-Related Doctoral Scientists and Engineers, Employed Populations, 1977 versus 1975

Doctoral Degree Specialty[a]	1977 Number	1977 Percent[b]	1977 Percent Energy-Related of Total in Specialty	1975 Number	1975 Percent[b]	1975 Percent Energy-Related of Total in Specialty
Physics						
Atomic and molecular	604	13	24	357	10	15
Plasma	403	8	50	294	9	41
Elementary particle	315	7	10	312	9	11
Nuclear structure	818	17	24	632	18	19
Solid state	1,155	24	21	740	22	15
General	310	6	16	206	6	12
All other physics	1,177	25	15	881	26	12
Total, physics	4,782	100	19	3,422	100	15
Chemistry						
Analytical	406	7	13	345	8	12
Inorganic	784	14	21	424	9	12
Organic	1,076	20	7	992	22	7
Physical	2,081	28	21	1,758	39	18
All other chemistry	1,151	21	13	995	22	11
Total, chemistry	5,498	100	13	4,514	100	11
Earth, environmental, and marine sciences						
Stratigraphy/sedimentation	631	26	53	426	23	38
Structural geology	132	5	35	96	5	28
Applied geology	229	9	50	127	7	31
Earth sciences, general	373	15	37	344	19	31
Earth sciences, other	571	23	21	406	22	20
All other earth, environmental, and marine sciences	536	21	16	452	24	13
Total, earth, environmental, and marine sciences	2,472	100	27	1,851	100	22

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Each specialty listed accounted for 5 percent or more of the energy-related doctoral degrees in the specialty area in both 1975 and 1977.

[b]Numbers may not add to 100 percent due to independent rounding.

Table 8-4. Employment Field: Energy-Related Doctoral Scientists and Engineers, Employed Populations, 1977 versus 1975

Employment Field	1977 Number	1977 Percent[a]	1977 Percent Energy-Related of Total in Field	1975 Number	1975 Percent[a]	1975 Percent Energy-Related of Total in Field
Mathematics/computer science	989	3	5.1	446	2	2.7
Physics/astronomy	3,617	13	20.1	2,619	13	14.6
Chemistry	4,124	14	12.4	3,434	16	10.4
Earth, environmental, and marine sciences	3,033	11	24.1	2,402	12	19.8
Engineering	11,823	41	27.9	9,181	44	22.1
Life sciences	1,080	4	1.6	748	4	1.2
Psychology	145	1	0.5	78	[b]	0.3
Social sciences	2,169	8	6.0	1,091	5	3.5
Education, business, and other	1,191	4	6.9	645	3	5.0
Not reported	386	1	6.4	208	1	6.1
Total, all fields	28,557	100	10.0	20,852	100	7.9

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Numbers may not add to 100 percent due to independent rounding.

[b]Less than 0.5 percent.

Table 8-5. Engineering Employment Fields: Energy-Related Doctoral Scientists and Engineers, Employed Populations, 1977 versus 1975

Engineering Employment Field[a]	1977 Number	1977 Percent[b]	1977 Percent Energy-Related of Total in Field	1975 Number	1975 Percent[b]	1975 Percent Energy-Related of Total in Field
Chemical	2,054	17	40	1,921	21	37
Electrical	760	6	19	441	5	11
Nuclear	1,327	11	77	1,176	13	68
Mechanical	1,903	16	44	1,143	12	29
Metallurgy and physical metallurgy	719	6	31	533	6	25
Fuel technology, petroleum	725	6	95	635	7	84
Materials science	695	6	32	411	5	22
All other engineering	3,640	31	16	2,921	32	13
Total, engineering	11,823	100	28	9,181	100	22

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Each field listed accounted for 5 percent or more of the energy-related engineering employment in both 1975 and 1977.

[b]Numbers may not add to 100 percent due to independent rounding.

Table 8-6. Employment Fields for Physics; Chemistry; and Earth, Environmental, and Marine Sciences: Energy-Related Doctoral Scientists and Engineers, Employed Populations, 1977 versus 1975

Employment Field[a]	1977 Number	1977 Percent[b]	1977 Percent Energy-Related to Total in Field	1975 Number	1975 Percent[b]	1975 Percent Energy-Related to Total in Field
Physics						
Atomic and molecular	503	14	38	310	12	27
Plasma physics	816	23	72	629	24	62
Nuclear structure	191	5	18	151	6	13
Solid state	777	21	25	512	20	16
Physics, general	410	11	13	274	10	10
All other physics	920	25	11	743	28	9
Total, physics	3,617	100	20	2,619	100	15
Chemistry						
Analytical	512	12	13	350	10	9
Inorganic	369	9	21	220	6	14
Organic	526	13	9	332	10	6
Physical	886	21	24	736	21	20
Thermodynamics and materials properties	196	5	44	201	6	45
Polymers	371	9	8	372	11	9
All other chemistry	1,264	31	9	1,223	36	9
Total, chemistry	4,124	100	12	3,434	100	10
Earth, environmental, and marine sciences						
Geochemistry	231	8	37	197	8	31
Stratigraphy/ sedimentation	392	13	54	229	10	33
Geophysics	524	17	49	469	20	44
Applied geology	605	20	55	496	21	42
Environmental sciences, general and other	220	7	11	236	10	9
Earth sciences, general and other	367	12	22	278	11	24
All other earth, environmental, and marine science	694	23	13	497	21	10
Total, earth, environmental, and marine sciences	3,033	100	24	2,402	100	20

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Each field listed accounted for 5 percent or more of the energy-related employment in the field area in both 1975 and 1977.

[b]Numbers may not add to 100 due to independent rounding.

Table 8-7. Percentage of Doctoral Degree Specialty Reporting Same Employment Field: Energy-Related Doctoral Scientists and Engineers, Employed Population, 1977 versus 1975

Doctoral Degree Specialty	Percent of Energy-Related Reporting Same Employment Field	
	1977	1975
Mathematics/computer science	75	65
Physics	66	64
Chemistry	70	72
Earth, environmental, and marine sciences	93	94
Engineering	88	89
Life sciences	68	73
Psychology and social sciences	86	78
Total, all degree specialties[a]	80	80

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Not including "other" and "not reported."

Table 8-8. Distribution by Race/Ethnic Group: Energy-Related Doctoral Scientists and Engineers, Employed Populations, 1977 versus 1975

Race/Ethnic Group	Energy-Related Distribution			
	1977		1975	
	Number	Percent[a]	Number	Percent[a]
White	24,858	87.0	18,375	88.1
Asian	2,350	8.2	1,608	7.7
Other	235	0.8	117	0.6
Not reported	1,114	3.9	752	3.6
Total, all groups	28,557	100.0	20,852	100.0

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Numbers may not add to 100 due to independent rounding.

Table 8-9. Percent of Doctorates Held by Women in Each Employment Field: Energy-Related Doctoral Scientists and Engineers, Employed Populations, 1977 versus 1975

Employment Field	Energy-Related Women			
	1977		1975	
	Number	Percent of All Energy-Related Doctorates	Number	Percent of All Energy-Related Doctorates
Mathematics/computer science	30	3.0	13	2.9
Physical sciences	169	2.2	111	1.8
Earth, environmental, and marine sciences	56	1.8	25	1.0
Engineering	72	0.6	43	0.5
Life sciences	78	7.2	48	6.4
Psychology and social sciences	152	6.1	58	5.0
Other and not reported	64	4.1	[a]	[a]
Total, all fields	611	2.1	314	1.5

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Sample size was too small to provide a usable estimate of the group's energy-related population in the employment field.

Table 8-10. Percent of Doctorates Held by Non-U.S. Citizens in Each Employment Field: Energy-Related Doctoral Scientists and Engineers, Employed Populations, 1977 versus 1975

Employment Field	Energy-Related Non-U.S. Citizens			
	1977		1975	
	Number	Percent of All Energy-Related Doctorates	Number	Percent of All Energy-Related Doctorates
Mathematics/computer science	94	9.5	37	8.3
Physical sciences	579	7.5	445	7.4
Earth, environmental, and marine sciences	133	4.4	119	5.0
Engineering	1,351	11.4	1,046	11.4
Life sciences	63	5.8	61	8.2
Psychology and social sciences	49	2.1	69	5.9
Other and not reported	106	6.7	60	7.0
Total, all fields	2,375	8.3	1,837	8.8

Source: U.S. Department of Energy, based on National Academy of Sciences data.

Table 8-11. Type of Employer: Energy-Related Doctoral Scientists and Engineers, Employed Populations, 1977 versus 1975

Type of Employer	Energy-Related Doctorates			
	1977		1975	
	Number	Percent[a]	Number	Percent[a]
Business/industry	13,458	47	11,744	56
Educational institution	10,984	38	5,845	28
U.S. government, civilian	2,232	8	1,985	10
State and local government	210	1	165	1
Nonprofit organization	1,511	5	1,031	5
All other and not reported	112	[b]	82	[b]
Total, all employers	28,557	100	20,852	100

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Numbers may not add to 100 due to independent rounding.

[b]Less than 0.5 percent.

Table 8-12. Type of Employer by Employment Field: Energy-Related Doctoral Scientists and Engineers, Employed Populations, 1977 versus 1975

Type of Employer	Energy-Related Employment Field: Mathematics/Computer Science; Physical Sciences; Earth, Environmental, and Marine Sciences		Engineering		All Other and Not Reported		Totals	
	1977 Percent[a]	1975 Percent[a]	1977 Percent[a]	1975 Percent[a]	1977 Percent[a]	1975 Percent[a]	1977 Percent[a]	1975 Percent[a]
Business/industry	45	52	60	69	23	27	47	56
Educational institution	40	31	30	20	56	45	38	28
U.S. government, civilian	9	11	6	7	10	16	8	10
State and local government	1	1	[b]	[b]	2	2	1	1
Nonprofit organization	5	5	5	4	7	8	5	5
All other and not reported	[b]	[b]	[b]	[b]	2	1	[b]	[b]
Total, all employers	100	100	100	100	100	100	100	100

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Numbers may not add to 100 due to independent rounding.

[b]Less than 0.5 percent.

Table 8-13. Primary Work Activity: Energy-Related Doctoral Scientists and Engineers, Employed Populations, 1977 versus 1975

Primary Work Activity	Energy-Related Doctorates			
	1977		1975	
	Number	Percent[a]	Number	Percent[a]
Management and administration of				
Research and development	5,205	18	4,313	21
Other	2,000	7	1,344	6
Both	887	3	553	3
Total, management and administration	8,092	28	6,210	30
Research and development				
Basic research	3,628	13	2,559	12
Applied research	6,789	24	5,568	27
Development	1,769	6	1,332	6
Total, research and development	12,186	43	9,459	45
Teaching	4,875	17	2,069	10
All other and not reported	3,404	12	3,114	15
Total, all activities	28,557	100	20,852	100

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Numbers may not add to 100 due to independent rounding.

Table 8-14. Primary Work Activity by Employment Field: Energy-Related Doctoral Scientists and Engineers, Employed Populations, 1977 versus 1975

Primary Work Activity	Energy-Related Employment Field							
	Mathematics/Computer Science; Physical Sciences; Earth, Environmental, and Marine Sciences		Engineering		All Other and Not Reported		Totals	
	1977 Percent[a]	1975 Percent[a]	1977 Percent[a]	1975 Percent[a]	1977 Percent[a]	1975 Percent[a]	1977 Percent[a]	1975 Percent[a]
Management and administration of								
Research and development	17	20	23	24	11	13	18	21
Other	4	4	8	7	11	12	7	6
Both	2	3	3	3	5	2	3	3
Total, management and administration	23	27	34	34	28	27	28	30
Research and development								
Basic research	23	21	5	3	8	12	13	12
Applied research	27	32	24	24	16	18	24	27
Development	4	3	10	12	[b]	[b]	6	6
Total, research and development	54	56	39	39	24	31	43	45
Teaching	15	9	13	8	31	20	17	10
All other and not reported	8	9	13	19	18	23	12	15
Total, all activities	100	100	100	100	100	100	100	100

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Numbers may not add to 100 percent due to independent rounding.

[b]Less than 0.5 percent.

Table 8-15. Regional Location: Energy-Related Doctoral Scientists and Engineers, Employed Populations, 1977 versus 1975

Region	Energy-Related Doctorates			
	1977		1975	
	Number	Percent[a]	Number	Percent[a]
New England	1,645	6	1,035	5
Middle Atlantic	5,261	18	4,032	19
East North Central	4,384	15	3,240	16
West North Central	1,205	4	481	2
South Atlantic	4,155	14	2,805	13
East South Central	1,091	4	846	4
West South Central	3,160	11	2,735	13
Mountain	2,705	9	1,905	9
Pacific	4,925	17	3,756	18
Total, all regions[b]	28,557	100	20,852	100

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Numbers may not add to 100 due to independent rounding.

[b]Including U.S. possessions.

Table 8-16. Regional Location by Employment Field: Energy-Related Doctoral Scientists and Engineers, Employed Populations, 1977 versus 1975

Region	Energy-Related Employment Field							
	Mathematics/Computer Science; Physical Sciences; Earth, Environmental, and Marine Sciences		Engineering		All Other and Not Reported		Totals	
	1977 Percent[a]	1975 Percent[a]	1977 Percent[a]	1975 Percent[a]	1977 Percent[a]	1975 Percent[a]	1977 Percent[a]	1975 Percent[a]
New England	6	4	5	6	6	5	6	5
Middle Atlantic	17	17	21	23	15	15	18	19
East North Central	14	14	16	16	18	18	15	16
West North Central	4	2	5	2	5	4	4	2
South Atlantic	15	13	12	11	21	23	14	13
East South Central	3	3	4	5	5	5	4	4
West South Central	13	15	11	13	7	6	11	13
Mountain	11	12	8	7	8	9	9	9
Pacific	18	19	18	18	15	15	17	18
Total, all regions[b]	100	100	100	100	100	100	100	100

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Numbers may not add to 100 due to independent rounding.

[b]Including U.S. possessions.

Table 8-17. U.S. Government Funding by Employment Field: Energy-Related Doctoral Scientists and Engineers, Employed Populations, 1977 versus 1975

Employment Field	Percent of Energy-Related Reporting U.S. Government Support[a] 1977	1975
Mathematics/computer science and physical sciences	57	55
Earth, environmental, and marine sciences	44	39
Engineering		
Civil	41	29
Chemical	34	24
Electrical, electronic	44	46
Nuclear	62	64
Mechanical	50	41
Other engineering	52	49
Total, engineering	48	43
Life sciences	65	72
Psychology and social sciences	41	45
All other and not reported	36	32
Total, all fields	50	47

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Indicates at least partial support or sponsorship of work activities by the U.S. government.

Table 8-18. Sources of U.S. Government Support: Energy-Related Doctoral Scientists and Engineers, Employed Populations, 1977 versus 1975

U.S. Government Funding Sources	Energy-Related Doctorates Receiving U.S. Government Support[a]			
	1977		1975	
	Number	Percent[b]	Number	Percent[b]
National Science Foundation	2,159	15	1,765	18
Environmental Protection Agency	610	4	493	5
Energy Research and Development Administration	8,954	63	5,085	52
Nuclear Regulatory Commission	944	7	699	7
Department of the Interior	1,030	7	982	10
Department of Defense	1,754	12	1,395	14
All other sources	3,546	25	2,757	28
Total, all sources[c]	14,234	100	9,810	100

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Indicates at least partial support or sponsorship of work activities by the U.S. government.

[b]Numbers may not add to 100 due to independent rounding.

[c]Number of individuals reporting one or more sources of U.S. government funding support. Because some individuals reported multiple sources of U.S. government support, the sum of individuals reported for all sources is larger than the total number receiving support.

Table 8-19. U.S. Government Funding by Type of Employer: Energy-Related Doctoral Scientists and Engineers, Employed Populations, 1977 versus 1975

Type of Employer	Percentage of Energy-Related Doctorates Receiving U.S. Government Support[a]	
	1977	1975
Business/industry	28	23
Educational institutions	61	69
All other and not reported	92	92
Total, all employers	50	47

Source: U.S. Department of Energy, based on National Academy of Sciences data.

[a]Indicates at least partial support or sponsorship of work activities by the U.S. government.

APPENDIX A - 1977 SURVEY OF DOCTORATE RECIPIENTS QUESTIONNAIRE AND SPECIALTIES LIST

OMB No. 099-RO294

1977 SURVEY OF DOCTORATE RECIPIENTS

CONDUCTED BY THE NATIONAL RESEARCH COUNCIL WITH THE SUPPORT OF THE NATIONAL SCIENCE FOUNDATION, THE NATIONAL ENDOWMENT FOR THE HUMANITIES, AND THE NATIONAL INSTITUTES OF HEALTH

THE ACCOMPANYING LETTER requests your assistance in this biennial survey of Ph.D.'s in the humanities, sciences, and engineering.

PLEASE READ the instructions for each question carefully and answer by printing your reply or checking the appropriate box.

PLEASE CHECK the pre-printed information to be certain that it is correct and complete.

PLEASE RETURN the completed form in the enclosed envelope to the Commission on Human Resources, JH 638, National Research Council, 2101 Constitution Avenue, N.W., Washington, D.C. 20418.

NOTE: THIS INFORMATION IS SOLICITED UNDER THE AUTHORITY OF THE NATIONAL SCIENCE FOUNDATION ACT OF 1950, AS AMENDED. ALL INFORMATION YOU PROVIDE WILL BE TREATED AS CONFIDENTIAL AND USED FOR STATISTICAL PURPOSES ONLY. INFORMATION WILL BE RELEASED ONLY IN THE FORM OF STATISTICAL SUMMARIES OR IN A FORM WHICH DOES NOT IDENTIFY INFORMATION ABOUT ANY PARTICULAR PERSON. YOUR RESPONSE IS ENTIRELY VOLUNTARY AND YOUR FAILURE TO PROVIDE SOME OR ALL OF THE REQUESTED INFORMATION WILL IN NO WAY ADVERSELY AFFECT YOU.

_____

_____

_____

If your name and address are incorrect, please enter correct information above. Include ZIP CODE. (10)

If there is an alternate address through which you can always be reached, please provide it on the line below.

C/O Number Street City State ZIP Code (11)

1. Date of Birth Mo. Day Year (12-16)	2. State or Foreign Country of Birth (17-18)	3. Citizenship 0 ☐ U.S.A. 1 ☐ Non-U.S.A., Specify Country _____ (19) (20-21)	4. Sex 1 ☐ M 2 ☐ F (22)

5. What is your racial background?

0 ☐ American Indian or Alaskan Native
1 ☐ Asian or Pacific Islander
2 ☐ Black
3 ☐ White

(23)

5a. Is your ethnic heritage Hispanic?

0 ☐ Yes
1 ☐ No

(24)

6. List in the table below all collegiate and graduate degrees, excluding honorary degrees, that have been awarded to you. Please check the pre-printed information, including the number and name of the specialty from the list on page 4, to be certain that it is correct and complete.

Type of Degree	Granted Mo. Yr.	Major Field (Use Specialties List) Name Number	Institution Name	City (or Campus) & State
Bachelor's				
Master's				
Doctorate				
Other (Specify) _____				

7. What was your employment status as of February 6-12, 1977? (Check only one category.)

- Employed full-time in field of Ph.D. ☐ 1
- Employed full-time in field other than field of Ph.D. ☐ 2
- Employed part-time ☐ 3
  - Were you seeking full-time employment? 1 ☐ Yes 2 ☐ No (66)
- Postdoctoral appointment (fellowship, traineeship, research associateship, etc.) ☐ 4
- Unemployed and seeking employment ☐ 5
- Not employed and not seeking employment ☐ 6
- Retired and not employed ☐ 7
- Other, specify: _____ ☐ 8

(65)

7a. If you were employed full-time during February 6-12, 1977, in a field other than your field of Ph.D., what was the MOST important reason for taking the position?

- Preferred position outside Ph.D. field ☐ 1
- Promoted out of position in Ph.D. field ☐ 2
- Better pay ☐ 3
- Locational factors ☐ 4
- Position in Ph.D. field not available ☐ 5
- Other, specify: _____ ☐ 6

(67)

If you checked 5, 6 or 7, ANSWER ONLY 8a, 9a, 13, 14 and 17 of the following questions.

8. **Which category below best describes the type of organization of your principal employment OR postdoctoral appointment during February 6-12, 1977?** (Check only one category.)

- Business or industry ☐ 1
- Junior college, 2-year college, technical institute ☐ 2
- Medical school ☐ 3
- 4-Year college ☐ 4
- University, other than medical school ☐ 5
- Elementary or secondary school system ☐ 6
- Private foundation ☐ 7
- Museum or historical society ☐ 8
- Research library or archives ☐ 9
- Hospital or clinic ☐ 10
- U.S. military service, active duty, or Commissioned Corps, e.g., USPHS, NOAA ☐ 11
- U.S. government, civilian employee ☐ 12
- State government ☐ 13
- Local or other government, specify: _____ ☐ 14
- Non-profit organization, other than those listed above ☐ 15
- Other, specify: _____ ☐ 16

(68-69)

8a. **Which of the above categories best describes the type of organization related to your first position following the receipt of your doctorate?** (List only one category)

_____
Type of Organization (70-71)

9. **What percent of time did you devote to each of the following activities during the week of February 6-12, 1977?** (Total should equal 100%) **What were your primary (A) and secondary (B) work activities?** (Check only one in each column.)

	%	A	B
Management or administration of			
Research and development	_____ (10)	☐ 1	☐
Other than research and development	_____ (12)	☐ 2	☐
Both	_____ (14)	☐ 3	☐
Basic research	_____ (16)	☐ 4	☐
Applied research	_____ (18)	☐ 5	☐
Development of equipment, products, systems, data	_____ (20)	☐ 6	☐
Development of humanities resource materials	_____ (22)	☐ 7	☐
Design	_____ (24)	☐ 8	☐
Teaching	_____ (26)	☐ 9	☐
Writing, editing	_____ (28)	☐ 10	☐
Curatorial	_____ (30)	☐ 11	☐
Production	_____ (32)	☐ 12	☐
Consulting, specify: _____	_____ (34)	☐ 13	☐
Professional services to individuals	_____ (36)	☐ 14	☐
Quality control, inspection, testing	_____ (38)	☐ 15	☐
Sales, marketing, purchasing, estimating	_____ (40)	☐ 16	☐
Other, specify: _____	_____ (42)	☐ 17	☐
	Total = 100%	(44-47)	

9a. **Which of the above categories best describes the primary work activity related to your first position following the receipt of your doctorate?**

_____
Primary Work Activity Number (48-49)

10. **From the Degree and Employment Specialties List on page 4 select and enter both the number and title of the employment specialty most closely related to your principal employment or postdoctoral appointment during the week of February 6-12, 1977. Write in your specialty if it is not on the list.**

_____
Number Title of Employment Specialty (50-52)

11. **Please give the name of your principal employer (organization, company, etc. or, if self employed, write "self"), and actual place of employment as of the week of February 6-12, 1977.**

_____
Name of Employer (53-58)

_____
Number Street

_____
City State ZIP Code (59-63)

12. **What was the basic annual salary* associated with your principal professional employment during the week of February 6-12, 1977? If you were on a postdoctoral appointment (e.g., fellowship, traineeship, research associateship), what was your annual stipend plus allowances?**

$ _____ per year (64-66)

*NOTE: Basic annual salary is your annual salary before deductions for income tax, social security, retirement, etc., but does not include bonuses, overtime, summer teaching, or other payment for professional work.

IF ACADEMICALLY EMPLOYED:

a. Check whether salary was for ☐ 9-10 months or ☐ 11-12 months. (67)

b. Did you hold a tenured position during February 6-12, 1977? 0 ☐ Yes 1 ☐ No (68)
If Yes, what year was tenure granted? _____ (69-70)

c. What was the rank of your position? (Check only one.)

- 1 ☐ Professor
- 2 ☐ Associate Professor
- 3 ☐ Assistant professor
- 4 ☐ Instructor
- 5 ☐ Lecturer
- 6 ☐ Other, specify: _____ (71)

d. What, if any, administrative position did you hold?

- 1 ☐ Dean
- 2 ☐ Department Chairman
- 3 ☐ President or Chancellor
- 4 ☐ Vice-President or Vice-Chancellor
- 5 ☐ Other, specify: _____
- 6 ☐ Does not apply

(72)

13. How many full-time equivalent years of professional work experience, including teaching, have you had? _____ Year(s)
(73-74)

14. Following completion of your doctorate have you ever held a fellowship, traineeship, or research associateship? 0 ☐ Yes 1 ☐ No
(75)

15. Listed below are selected topics of national interest. If you devoted a proportion of your professional time which you considered significant to any of these problem areas during the week of February 6-12, 1977, please check the box for the one on which you spent the MOST time.

1 ☐ Health
2 ☐ Defense
3 ☐ Environmental protection, pollution control
4 ☐ Education
5 ☐ Space
6 ☐ Crime prevention and control
7 ☐ Energy and fuel
8 ☐ Food and other agricultural products
9 ☐ Natural resources,other than fuel or food
10 ☐ Community development and services
11 ☐ Housing (planning, design, construction)
12 ☐ Transportation, communications
13 ☐ Cultural life
14 ☐ Other area, specify: _____
15 ☐ Does not apply
(10-11)

16. Was any of your work in the week of February 6-12, 1977 supported or sponsored by U.S. Government funds?

0 ☐ Yes 1 ☐ No 2 ☐ Don't know (12)

If Yes, which of the following federal agencies or departments were supporting the work? (Check all that apply.)

13 ☐ Agency for International Development
14 ☐ Energy Research & Development Administration
15 ☐ Environmental Protection Agency
16 ☐ National Aeronautics & Space Administration
17 ☐ National Endowment for the Arts
18 ☐ National Endowment for the Humanities
19 ☐ National Science Foundation
20 ☐ Nuclear Regulatory Commission
21 ☐ Smithsonian Institution
22 ☐ Department of Agriculture
23 ☐ Department of Commerce
24 ☐ Department of Defense

Department of Health, Education, and Welfare
25 ☐ National Institutes of Health
26 ☐ Alcohol, Drug Abuse & Mental Health Administration
27 ☐ National Institute of Education
28 ☐ Office of Education
29 ☐ Other, specify: _____
30 ☐ Department of Housing and Urban Development
31 ☐ Department of the Interior
32 ☐ Department of Justice
33 ☐ Department of Labor
34 ☐ Department of State
35 ☐ Department of Transportation
36 ☐ Other agency or department, specify: _____
37 ☐ Don't know source agency.

17. If you received your doctoral degree in science or engineering or are employed as a scientist or engineer, please check all that apply below:

☐ (a) Changed positions during the period 1973 to 1976.
☐ (b) Received doctoral degree in 1965 or later and employed sometime since receiving your doctoral degree in industry, government, or as non-faculty academic staff.
☐ (c) Held a postdoctoral appointment any year during 1970-1976 inclusive.
☐ (d) None of the above apply. (38-41)

If you have checked a, b, or c, please give a brief career history starting with the position prior to your present position and continuing back in time for a maximum of four positions after receiving your doctoral degree (Include postdoctoral appointments).

Name and Location (City and State) of Employer	Position Title	Dates Held	Primary Work Activity*	Employment Specialty (Use Degree & Employment Specialties List)	Reason for Leaving Position
1.					
2.					
3.					
4.					

*Enter code (1-17) from the list given in Item 9.

(a) Of the positions described above, as well as your present position, please check any in which your doctoral training was/is not being used.
☐ Position 1 ☐ Position 2 ☐ Position 3 ☐ Position 4 ☐ Present Position ☐ None

(74-79)

DEGREE AND EMPLOYMENT SPECIALTIES LIST

MATHEMATICAL SCIENCES

) - Algebra
) - Analysis & Functional Analysis
__) - Geometry
030 - Logic
040 - Number Theory
052 - Probability
055 - Math. Statistics (see also 544, 670, 725, 729)
060 - Topology
082 - Operations Research (see also 478)
085 - Applied Mathematics
089 - Combinatorics & Finite Mathematics
091 - Physical Mathematics
098 - Mathematics, General
099 - Mathematics, Other*

COMPUTER SCIENCES

071 - Theory
072 - Software Systems
073 - Hardware Systems
074 - Intelligent Systems
079 - Computer Sciences, Other

PHYSICS & ASTRONOMY

101 - Astronomy
102 - Astrophysics
110 - Atomic & Molecular Physics
120 - Electromagnetism
130 - Mechanics
132 - Acoustics
134 - Fluids
135 - Plasma Physics
136 - Optics
138 - Thermal Physics
140 - Elementary Particles
150 - Nuclear Structure
160 - Solid State
198 - Physics, General
199 - Physics, Other*

CHEMISTRY

200 - Analytical
210 - Inorganic
215 - Synthetic Inorganic & Organometallic
220 - Organic
225 - Synthetic Organic & Natural Products
230 - Nuclear
240 - Physical
245 - Quantum
250 - Theoretical
255 - Structural
260 - Agricultural & Food
265 - Thermodynamics & Material Properties
270 - Pharmaceutical
275 - Polymers
280 - Biochemistry (see also 540)
285 - Chemical Dynamics
298 - Chemistry, General
299 - Chemistry, Other*

EARTH, ENVIRONMENTAL AND MARINE SCIENCES

301 - Mineralogy, Petrology
305 - Geochemistry
310 - Stratigraphy, Sedimentation
320 - Paleontology
330 - Structural Geology
341 - Geophysics (Solid Earth)
350 - Geomorph. & Glacial Geology
391 - Applied Geol., Geol. Engr. & Econ. Geol.
395 - Fuel Tech. & Petrol. Engr. (see also 479)
___ - Hydrology & Water Resources
___ - Oceanography
___ - Marine Sciences, Other*
381 - Atmospheric Physics & Chemistry
382 - Atmospheric Dynamics
383 - Atmospheric Sciences, Other*
388 - Environmental Sciences, General (see also 480, 528)
389 - Environmental Sciences, Other*
398 - Earth Sciences, General
399 - Earth Sciences, Other*

ENGINEERING

400 - Aeronautical & Astronautical
410 - Agricultural
415 - Biomedical
420 - Civil
430 - Chemical
435 - Ceramic
440 - Electrical
445 - Electronics
450 - Industrial & Manufacturing
455 - Nuclear
460 - Engineering Mechanics
465 - Engineering Physics
470 - Mechanical
475 - Metallurgy & Phys. Met. Engr.
476 - Systems Design & Systems Science (see also 072, 073, 074)
478 - Operations Research (see also 082)
479 - Fuel Technology & Petrol. Engr.
480 - Sanitary & Environmental
486 - Mining
497 - Materials Science Engr.
498 - Engineering, General
499 - Engineering, Other*

AGRICULTURAL SCIENCES

500 - Agronomy
501 - Agricultural Economics
502 - Animal Husbandry
504 - Fish & Wildlife
505 - Forestry
506 - Horticulture
507 - Soils & Soil Science
510 - Animal Science & Animal Nutrition
511 - Phytopathology
517 - Food Science & Technology (see also 573)
518 - Agriculture, General
519 - Agriculture, Other*

MEDICAL SCIENCES

520 - Medicine & Surgery
522 - Public Health & Epidemiology
523 - Veterinary Medicine
524 - Hospital Administration
526 - Nursing
527 - Parasitology
528 - Environmental Health
534 - Pathology
536 - Pharmacology
537 - Pharmacy
538 - Medical Sciences, General
539 - Medical Sciences, Other*

BIOLOGICAL SCIENCES

540 - Biochemistry (see also 280)
542 - Biophysics
543 - Biomathematics
544 - Biometrics, Biostatistics (see also 055, 670, 725, 729)
545 - Anatomy
546 - Cytology
547 - Embryology
548 - Immunology
550 - Botany
560 - Ecology
562 - Hydrobiology
564 - Microbiology & Bacteriology
566 - Physiology, Animal
567 - Physiology, Plant
569 - Zoology
570 - Genetics
571 - Entomology
572 - Molecular Biology
573 - Food Science & Technology (see also 517)
574 - Behavior/Ethology
576 - Nutrition & Dietetics
578 - Biological Sciences, General
579 - Biological Sciences, Other*

PSYCHOLOGY

600 - Clinical
610 - Counseling & Guidance
620 - Developmental & Gerontological
630 - Education
635 - School Psychology
641 - Experimental
642 - Comparative
643 - Physiological
650 - Industrial & Personnel
660 - Personality
670 - Psychometrics (see also 055, 544, 725, 729)
680 - Social
698 - Psychology, General
699 - Psychology, Other*

SOCIAL SCIENCES

700 - Anthropology
703 - Archeology
708 - Communications*
709 - Linguistics
710 - Sociology
720 - Economics (see also 501)
725 - Econometrics (see also 055, 544, 670, 729)
729 - Social Statistics (see also 055, 544, 670, 725)
740 - Geography
745 - Area Studies*
751 - Political Science
752 - Public Administration
755 - International Relations
770 - Urban & Regional Planning
775 - History & Philosophy of Science
798 - Social Sciences, General
799 - Social Sciences, Other*

HUMANITIES

802 - History & Criticism of Art
804 - History, American
805 - History, European
806 - History, Other*
808 - American Studies
830 - Music
831 - Speech as a Dramatic Art (see also 885)
833 - Religion (see also 881)
834 - Philosophy
836 - Comparative Literature
878 - Humanities, General
879 - Humanities, Other*
891 - Library & Archival Sciences

LANGUAGES & LITERATURE

811 - American
812 - English
821 - German
822 - Russian
823 - French
824 - Spanish & Portuguese
826 - Italian
827 - Classical*
829 - Other Languages*

EDUCATION & OTHER PROFESSIONAL FIELDS

938 - Education
801 - Art, Applied
881 - Theology (see also 833)
882 - Business Administration
883 - Home Economics
884 - Journalism
885 - Speech & Hearing Sciences (see also 831)
886 - Law, Jurisprudence
887 - Social Work
897 - Professional Field, Other*

899 - OTHER FIELDS*

*Identify the specific field in the space on the questionnaire.

APPENDIX B - 1975 SURVEY OF DOCTORATE RECIPIENTS QUESTIONNAIRE AND SPECIALTIES LIST

1975 SURVEY OF DOCTORAL SCIENTISTS AND ENGINEERS

OMB No. 099-R0294

CONDUCTED BY THE NATIONAL RESEARCH COUNCIL WITH THE SUPPORT OF THE NATIONAL SCIENCE FOUNDATION

THE ACCOMPANYING LETTER requests your assistance in this biennial survey of doctoral scientists and engineers – including the fields of the natural and social sciences, mathematics, and engineering.

PLEASE READ the instructions for each question carefully and answer by printing your reply or entering an 'X' in the appropriate box.

PLEASE CHECK the pre-printed information to be certain that it is correct and complete.

PLEASE RETURN the completed form in the enclosed envelope to the Commission on Human Resources, JH 638, National Research Council, 2101 Constitution Avenue, N.W., Washington, D.C. 20418.

NOTE: ALL INFORMATION YOU PROVIDE WILL BE TREATED AS CONFIDENTIAL AND USED IN GROUP COMPARISONS FOR RESEARCH PURPOSES ONLY.

_____

_____

_____ (10)

If your name and address are incorrect, please enter correct information on the lines provided above. Include ZIP CODE.

If there is an alternate address through which you can always be reached, please provide it on the line below.

_____

C/O Number Street City State ZIP CODE (11)

1. Date of Birth Mo. Day Year (12-16)	2. State or Foreign Country of Birth (17-18)	3. Citizenship (19) USA 0☐ Non-USA, specify country 1☐ _____ (20-21)	4. Sex (22) 1☐ Male 2☐ Female

5. Racial/Ethnic Identification (23)
0☐ White/Caucasian 1☐ Black/Negro/Afro-American 2☐ American Indian 3☐ Mexican-American/Chicano 4☐ Puerto Rican-American 5☐ Oriental 6☐ Other Asian 7☐ Other, specify _____

6. List in the table below all collegiate and graduate degrees, excluding honorary degrees, that have been awarded to you. Please check the pre-printed information, including the number and name of the specialty from the list on page 3, to be certain that it is correct and complete.

Type of Degree	Granted Mo. Yr.	Major Field (Use Specialties List) Name Number	Institution Name	City (or campus) & State
Bachelor's				
Master's				
Doctorate				
Other, Specify				

PLEASE NOTE that in items 7-10 information is requested for both the current year, as of the week of February 9-15, 1975, and last year, as of the week of February 10-16, 1974.

7. What was your employment status as of the periods indicated? (Check only one category in each year.)

	1974	1975
Employed full-time, science or engineering related position	☐ 1	☐
Employed full-time, nonscience or nonengineering related position	☐ 2	☐
Employed part-time, science or engineering related position	☐ 3	☐
Employed part-time, nonscience or nonengineering related position	☐ 4	☐
Postdoctoral appointment (fellowship, traineeship, research associateship, etc.)	☐ 5	☐
Unemployed and seeking employment	☐ 6	☐
Specify number of months unemployed: _____ (66-67)		
Unemployed and not seeking employment	☐ 7	☐
Retired and not employed	☐ 8	☐
Specify year of retirement: _____ (68-69)		
Other, specify: _____	☐ 9	☐
	(64)	(65)

7a. If you were employed full-time during February 9-15, 1975, in a position unrelated to science or engineering, what was the MOST important reason for taking the position?

	1975
Prefer nonscience or nonengineering position	☐ 1
Promoted out of science or engineering position	☐ 2
Pay is better	☐ 3
Locational preference	☐ 4
Science or engineering position not available	☐ 5
Other, specify: _____	☐ 6
	(70)

7b. If you were employed part-time during February 9-15, 1975, were you seeking full-time employment? 1☐ Yes 2☐ No (71)

Please do not write in this space

1 1 2-9 ctr # C

10 11

12 13 14 15 16

17 18 19 20 21

22 23

B

24 25 26

27 28 29

30 31 32 33 34 35

M

36 37 38

39 40 41

42 43 44 45 46 47

D

48 49 50

51 52 53

54 55 56 57 58 59

O

60 61 62 63

64 65

66 67 68 69

70 71

8. Which category below best describes the type of organization of your principal employment OR postdoctoral appointment?

(Check only one category in each year.)

	1974	1975
Business or industry	☐ 1	☐
Junior college, 2-year college, technical institute	☐ 2	☐
Medical school	☐ 3	☐
4-year college or university, other than medical school	☐ 4	☐
Elementary or secondary school system	☐ 5	☐
Hospital or clinic	☐ 6	☐
U.S. military service, active duty, or Commissioned Corps, e.g., USPHS, NOAA	☐ 7	☐
U.S. government, civilian employee	☐ 8	☐
State government	☐ 9	☐
Local or other government, specify: _____	☐ 10	☐
International Agency	☐ 11	☐
Non-profit organization, other than hospital, clinic, or educational institution	☐ 12	☐
Other, specify: _____	☐ 13	☐
	(72-73)	(74-75)

9. What were the primary (A) and secondary (B) work activities related to your position?

(Check only one box in each column.)

	1974 A	1974 B		1975 A	1975 B
Management or administration of:					
Research and development	☐	☐	1	☐	☐
Other than research and development	☐	☐	2	☐	☐
Both	☐	☐	3	☐	☐
Basic research	☐	☐	4	☐	☐
Applied research	☐	☐	5	☐	☐
Development of equipment, products, systems, data	☐	☐	6	☐	☐
Design	☐	☐	7	☐	☐
Teaching	☐	☐	8	☐	☐
Report or other technical writing, editing	☐	☐	9	☐	☐
Production	☐	☐	10	☐	☐
Consulting, specify: _____	☐	☐	11	☐	☐
Professional services to individuals	☐	☐	12	☐	☐
Quality control, inspection, testing	☐	☐	13	☐	☐
Sales, marketing, purchasing, estimating	☐	☐	14	☐	☐
Other, specify: _____	☐	☐	15	☐	☐
	(10-13)			(14-17)	

10. From the Degree and Employment Specialties List on page 4, select and enter both the number and title of the scientific specialty most closely related to your principal employment or postdoctoral appointment. Write in your specialty if it is not on the list.

1974 _____ (18-20)
Number Title of Specialty

1975 _____ (21-23)
Number Title of Specialty

Please answer items 11 through 13 regarding your employment during the week of February 9-15, 1975.

11. What percent of time did you devote to each of the following activities?

	%
Management or administration of:	
Research and development	_____ (24)
Other than research and development	_____ (26)
Both	_____ (28)
Basic research	_____ (30)
Applied research	_____ (32)
Development	_____ (34)
Design	_____ (36)
Teaching	_____ (38)
Consulting	_____ (40)
Other, specify: _____	_____ (42)
TOTAL	100%

12. Please give the name of your principal employer (organization, company, etc., or, if self-employed, write "self"), and actual place of employment.

_____ (44-49)
Name of Employer

_____
Number Street

_____
City State ZIP Code (50-54)

13. What was the basic annual salary* associated with your principal professional employment during the week of February 9-15, 1975? If you were on a postdoctoral appointment (e.g., fellowship, traineeship, research associateship), what was your annual stipend plus allowances?

$_____ per year (55-57)

*NOTE: Basic annual salary is your annual salary before deductions for income tax, social security, retirement, etc., but does not include bonuses, overtime, summer teaching, or other payment for professional work.

If academically employed:

a. Check whether salary was for ☐ 9-10 months or ☐ 11-12 months. (58)

b. Did you hold a tenured position during February 9-15, 1975? 0 ☐ Yes 1 ☐ No. (59) If yes, what year was the tenure granted? _____ (60-61)

c. What is the rank of your position?

1 ☐ Professor	4 ☐ Instructor	7 ☐ President or Chancellor
2 ☐ Associate Professor	5 ☐ Lecturer	8 ☐ Other, specify: _____
3 ☐ Assistant Professor	6 ☐ Dean	9 ☐ Does not apply (62)

72 73 74 75
2 1 2-9 ctr #
10 11 12 13
14 15 16 17
18 19 20
21 22 23
24 25 26 27 28 29
30 31 32 33 34 35
36 37 38 39 40 41
42 43
44 45 46 47 48 49
50 51 52 53 54
55 56 57
58
59 60 61
62

14. How many years of professional work experience, including teaching, have you had? _____Year(s) (63-64)

15. Have you ever held a postdoctoral appointment? 0 ☐ Yes 1 ☐ No (65)

If yes, list below the time periods of your most recent postdoctoral appointments.

Appointment	Starting Year	Total Months
Most Recent	_____ (66-67)	_____ (68-69)
Second Most Recent	_____ (70-71)	_____ (72-73)
Third Most Recent	_____ (74-75)	_____ (76-77)

How many other postdoctoral appointments have you held? _____ (78)

16. Have you ever been a full-time employee (excluding summer employment) of business or industry since earning your doctorate?

0 ☐ Yes 1 ☐ No (10)

If yes,

a. For how many years?

_____Year(s) (11-12)

b. If you were employed by business or industry in February, 1975, check here ☐. If not, how many years ago did you leave your most recent business or industry employment?

_____Year(s) (14-15)

17. Have you ever been a full-time employee (excluding summer employment) of an academic institution or organization since earning your doctorate?

0 ☐ Yes 1 ☐ No (16)

If yes,

a. For how many years?

_____Year(s) (17-18)

b. If you were employed by an academic institution or organization in February, 1975, please check here ☐. If not, how many years ago did you leave your most recent academic employment?

_____Year(s) (20-21)

18. Have you ever been a full-time employee (excluding summer employment) of government (federal, state, or local) since earning your doctorate?

0 ☐ Yes 1 ☐ No (22)

If yes,

a. For how many years?

_____Year(s) (23-24)

b. If you were employed by government in February, 1975, check here ☐. If not, how many years ago did you leave your most recent government employment?

_____Year(s) (26-27)

---

19. Listed below are selected topics of critical national interest. If you devoted a significant proportion of your professional time to any of these problem areas in February, 1975, please check the box for the one on which you spent the MOST time.

Education:
1 ☐ Teaching
2 ☐ Other
3 ☐ Health
4 ☐ Defense
5 ☐ Environmental protection, pollution control
6 ☐ Space
7 ☐ Crime prevention and control
8 ☐ Food production and technology
9 ☐ Energy and fuel
10 ☐ Other mineral resources
11 ☐ Community development and services
12 ☐ Housing (planning, design, construction)
13 ☐ Transportation, communications
14 ☐ Other, specify: _____

(28-29)

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20. Was any of your work in February, 1975, supported or sponsored by U.S. Government funds?

0 ☐ Yes 1 ☐ No 2 ☐ Don't know (30)

If yes, which of the following federal agencies or departments were supporting the work? (Check all that apply.)

31 ☐ NASA
32 ☐ National Science Foundation
33 ☐ Environmental Protection Agency
34 ☐ Energy Research & Development Administration (AEC)
35 ☐ Nuclear Regulatory Commission (AEC)
36 ☐ Agency for International Development
37 ☐ Department of the Interior
38 ☐ National Institutes of Health, HEW
39 ☐ Alcohol, Drug Abuse & Mental Health Administration, HEW
40 ☐ Office of Education, HEW
41 ☐ Other HEW, specify: _____
42 ☐ Department of Defense
43 ☐ Department of Commerce
44 ☐ Department of Agriculture
45 ☐ Department of Transportation
46 ☐ Department of Justice
47 ☐ Department of Housing and Urban Development
48 ☐ Other agency or department, specify: _____
49 ☐ Don't know source agency

63 64 | 65 | 66 67 | 68 69 | 70 71 | 72 73 | 74 75 | 76 77 | 78 | 3 | 1 | 2-9 ctr # | 10 | 11 12 | 13 | 14 15 | 16 | 17 18 | 19 | 20 21 | 22 | 23 24 | 25 | 26 27 | 28 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49

DEGREE AND EMPLOYMENT SPECIALTIES LIST

MATHEMATICAL SCIENCES

000 - Algebra
010 - Analysis & Functional Analysis
020 - Geometry
030 - Logic
040 - Number Theory
052 - Probability
055 - Math, Statistics (see also 544, 670, 725, 729)
060 - Topology
080 - Computing Theory & Practice
082 - Operations Research (see also 477)
085 - Applied Mathematics
089 - Combinatorics & Finite Mathematics
091 - Physical Mathematics
098 - Mathematics, General
099 - Mathematics, Other*

ASTRONOMY

101 - Astronomy
102 - Astrophysics

PHYSICS

110 - Atomic & Molecular Physics
120 - Electromagnetism
130 - Mechanics
132 - Acoustics
134 - Fluids
135 - Plasma Physics
136 - Optics
138 - Thermal Physics
140 - Elementary Particles
150 - Nuclear Structure
160 - Solid State
198 - Physics, General
199 - Physics, Other*

CHEMISTRY

200 - Analytical
210 - Inorganic
215 - Synthetic Inorganic & Organometallic
220 - Organic
225 - Synthetic Organic & Natural Products
230 - Nuclear
240 - Physical
245 - Quantum
250 - Theoretical
255 - Structural
260 - Agricultural & Food
265 - Thermodynamics & Material Properties
270 - Pharmaceutical
275 - Polymers
280 - Biochemistry (see also 540)
285 - Chemical Dynamics
298 - Chemistry, General
299 - Chemistry, Other*

EARTH, ENVIRONMENTAL & MARINE SCIENCES

301 - Mineralogy, Petrology
305 - Geochemistry
310 - Stratigraphy, Sedimentation
320 - Paleontology
330 - Structural Geology
341 - Geophysics (Solid Earth)
350 - Geomorph., Glacial Geology
360 - Hydrology
370 - Oceanography
381 - Atmospheric Chemistry & Physics
382 - Atmospheric Dynamics
391 - Applied Geology, Geol. Engr., Econ. Geol.
388 - Environmental Sciences, General
389 - Environmental Sciences, Other*
397 - Marine Sciences, Other*
398 - Earth Sciences, General
399 - Earth Sciences, Other*

ENGINEERING

400 - Aeronautical & Astronautical
410 - Agricultural
415 - Biomedical
420 - Civil
430 - Chemical
435 - Ceramic
440 - Electrical
445 - Electronics
450 - Industrial, Manufacturing
455 - Nuclear
460 - Engineering Mechanics
465 - Engineering Physics
470 - Mechanical
475 - Metallurgy & Phys. Met. Engr.
477 - Operations Research, Systems (see also 082)
479 - Fuel Technology, Petrol Engr.
480 - Sanitary/Environmental
486 - Mining
497 - Materials Science Engr.
498 - Engineering, General
499 - Engineering, Other*

AGRICULTURAL SCIENCES

500 - Agronomy
501 - Agricultural Economics
502 - Animal Husbandry
504 - Fish & Wildlife
505 - Forestry
506 - Horticulture
507 - Soils & Soil Science
510 - Animal Sciences
511 - Phytopathology
517 - Food Science & Technology (see also 573)
518 - Agriculture, General
519 - Agriculture, Other*

MEDICAL SCIENCES

520 - Medicine & Surgery
522 - Public Health
523 - Veterinary Medicine
524 - Hospital Administration
527 - Parasitology
534 - Pathology
536 - Pharmacology
537 - Pharmacy
538 - Medical Sciences, General
539 - Medical Sciences, Other*

BIOLOGICAL SCIENCES

540 - Biochemistry (see also 280)
542 - Biophysics
543 - Biomathematics
544 - Biometrics, Biostatistics (see also 055, 670, 725, 729)
545 - Anatomy
546 - Cytology
547 - Embryology
548 - Immunology
550 - Botany
560 - Ecology
562 - Hydrobiology
564 - Microbiology & Bacteriology
566 - Physiology, Animal
567 - Physiology, Plant
569 - Zoology
570 - Genetics
571 - Entomology
572 - Molecular Biology
573 - Food Science & Technology (see also 517)
574 - Behavior/Ethology
578 - Biological Sciences, General
579 - Biological Sciences, Other*

PSYCHOLOGY

600 - Clinical
610 - Counseling & Guidance
620 - Developmental & Gerontological
630 - Educational
635 - School Psychology
641 - Experimental
642 - Comparative
643 - Physiological
650 - Industrial & Personnel
660 - Personality
670 - Psychometrics (see also 055, 544, 725, 729)
680 - Social
698 - Psychology, General
699 - Psychology, Other*

SOCIAL SCIENCES

700 - Anthropology
703 - Archeology
708 - Communications*
709 - Linguistics
710 - Sociology
720 - Economics (see also 501)
725 - Econometrics (see also 055, 544, 670, 729)
729 - Social Statistics (see also 055, 544, 670, 725)
740 - Geography
745 - Area Studies*
750 - Political Science, Public Administration
755 - International Relations
770 - Urban & Reg. Planning
775 - History & Phil. of Science
798 - Social Sciences, General
799 - Social Sciences, Other*

ARTS & HUMANITIES

841 - Fine & Applied Arts (including Music, Speech, Drama, etc.)
842 - History
843 - Philosophy, Religion, Theology
845 - Languages & Literature
846 - Other Arts and Humanities*

EDUCATION & OTHER PROFESSIONAL FIELDS

938 - Education

882 - Business Administration
883 - Home Economics
884 - Journalism
885 - Speech and Hearing Sciences
886 - Law, Jurisprudence
887 - Social Work
891 - Library & Archival Science
898 - Professional Field, Other*

899 - OTHER FIELDS*

*Identify the specific field in the space provided on the questionnaire.

*U.S. GOVERNMENT PRINTING OFFICE : 1980 O-311-119/166

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WASHINGTON, D.C. 20585