MATHEMATICAL AND COMPUTER SCIENCES

The mathematical and computer sciences are a union of old and new that is altering both fields. Computer science is a young and interdisciplinary field with theoretical roots in mathematics and close ties to engineering. Computer science emerged from mathematical computer theory during the 1960s. Research in the two fields is intimately connected. For this reason, they are profiled in a section of their own.

Mathematics is closely tied to advances in computer theory and applications. In turn, high-speed computer graphics and numerical analysis have spurred new advances and directions in mathematical research. Because of close ties in research, theory, and financial support, it is difficult to separate data and analysis of degrees, the work force, and financial support in the two fields. For example, the 15-year decline in mathematical degrees has been accompanied by an increase in computer science degrees.

In addition, much of industry demand for computer scientists has been interchangeable with demand for electrical engineers. Data and trends in computer science are related to computer engineering, the fastest growing engineering specialty.

In 1984, the David Report argued vigorously for increased Federal support of mathematical research as a resource to other fields.[28] The recent Griffiths Report on the mathematical sciences reinforces this view:

> Mathematics is the underpinning of revolutionary changes taking place in all scientific and engineering fields as a result of the advent of powerful computers. The development of scientific computing has not only highlighted a host of critical new mathematical matical problems, it has introduced new tools for mathematicians.[29]

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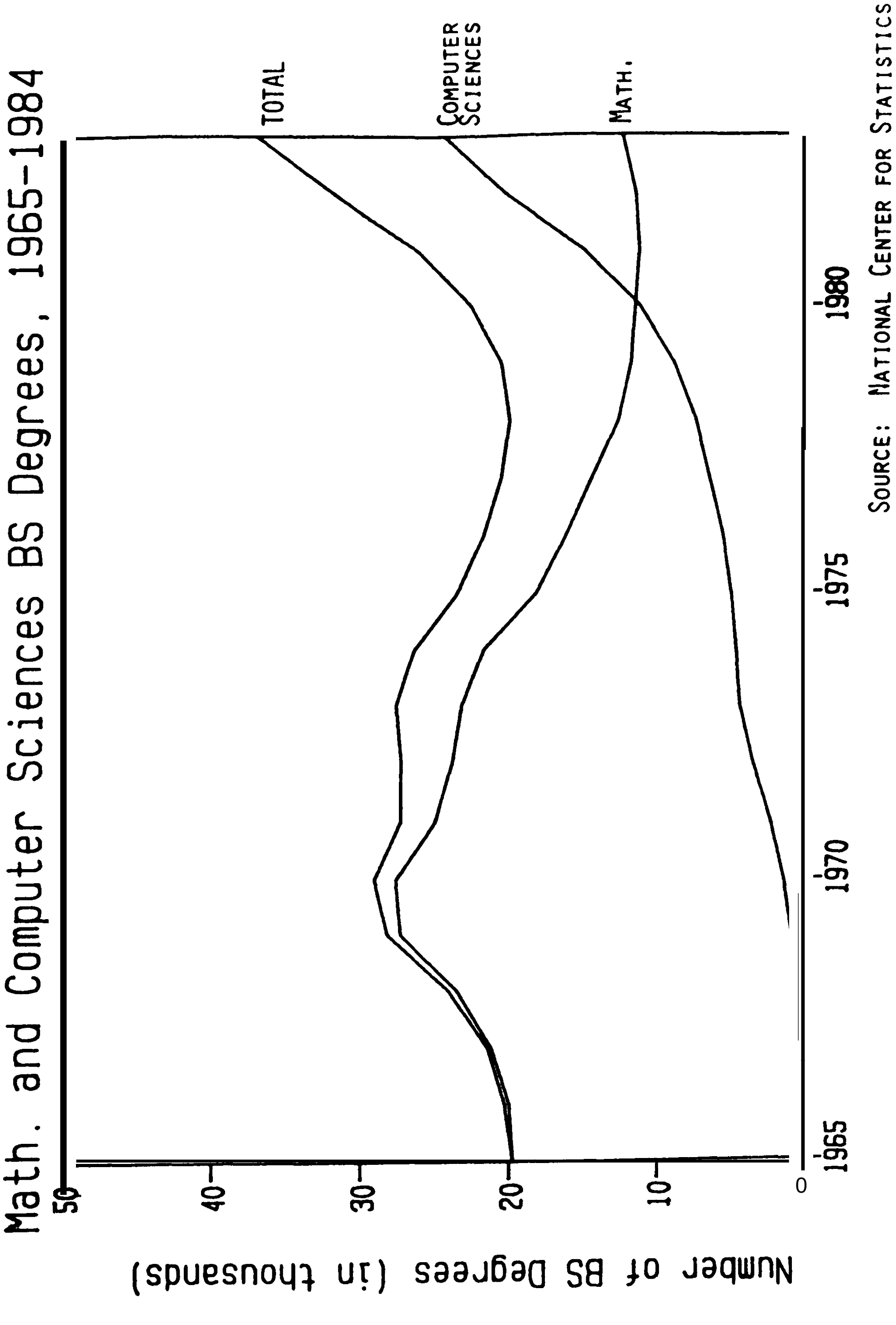
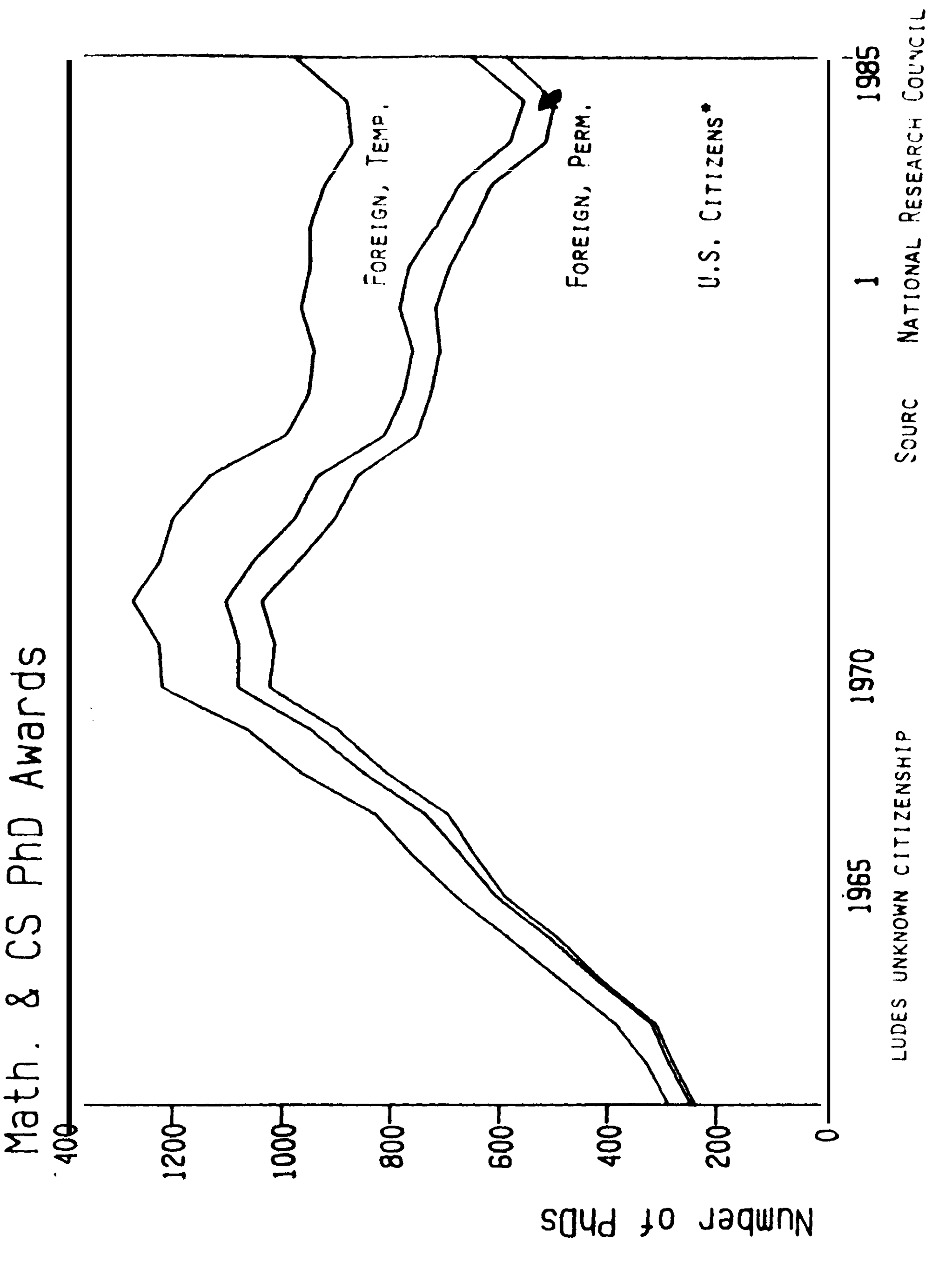
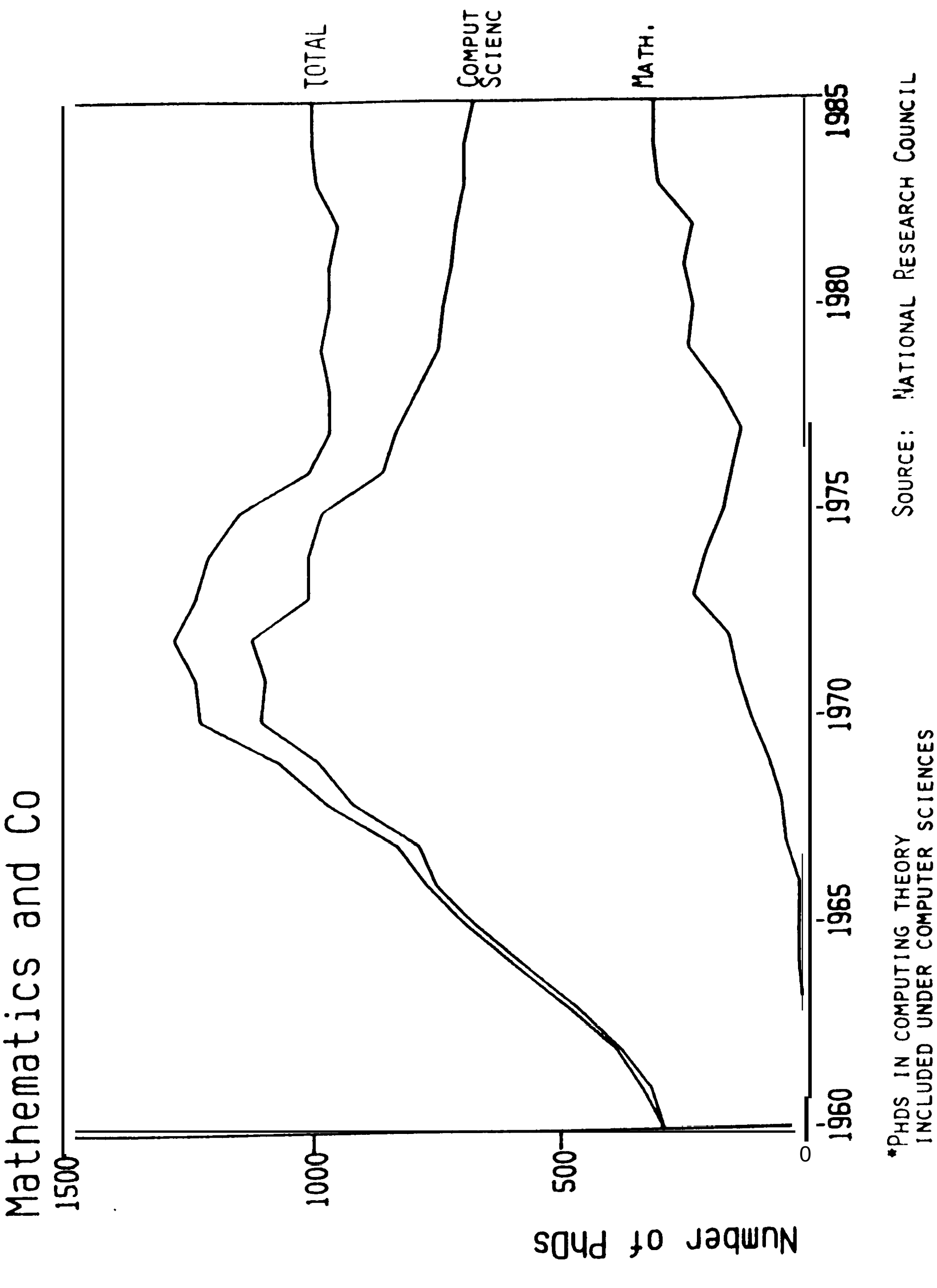
28. National Research Council, Renewing U.S. Mathematics: Critical Resource for the Future (Washington, DC: National Academy Press, 1984).
29. National Research Council, Panel on Mathematical Sciences, Mathematical Sciences: A Unifying and Dynamic Resource (Washington, DC: National Academy Press, 1986), p. 5.

For these reasons alone, education and employment in the mathematical and computer sciences are seen as especially vital to the future health of U.S. science and technology.


Math. and Computer Sciences BS Degrees, 1965-1984
Number of BS Degrees (in thousands)
50
40
30
20
10
0
1965
1970
1975
1980
TOTAL
COMPUTER SCIENCES
MATH.
SOURCE: NATIONAL CENTER FOR STATISTICS



Math. & CS PhD Awards
Number of PhDs
0
200
400
600
800
1000
1200
400
1965
1970
1
1985
FOREIGN, TEMP.
FOREIGN, PERM.
U.S. CITIZENS*
LUDES UNKNOWN CITIZENSHIP
SOURC NATIONAL RESEARCH COUNCIL


Mathematics and Co
Number of PhDs
1500
1000
500
0
1960
1965
1970
1975
1980
1985
TOTAL
COMPUT SCIENC
MATH.
*PHDS IN COMPUTING THEORY INCLUDED UNDER COMPUTER SCIENCES
SOURCE: NATIONAL RESEARCH COUNCIL

MATHEMATICAL SCIENCES

Employment/Demand

- *In* 1986, there are estimated to be 116,400 mathematicians and statisticians employed in the United States. Ninety percent are employed in science and engineering (S/E) positions, with one-third working in industry, one-half in academia, and most others in the Federal Government.[30]
- The basic research community in the mathematical sciences numbers between 4,000 and 7,000, representing over 90 percent of the mathematics college and university faculty.[31] Research in applied mathematics and Statistics Often extends to problems in other fields such as engineering, computer science, optics, and biology.
- Mathematicians are the most likely of all doctorate scientists to be academically employed. In 1986, one-half of all mathematicians are estimated to be working principally in teaching. Based on the 1985 the National Research Council survey, three out of four Ph.D. mathematicians are employed in educational institutions.[32] Ph.D. statisticians, however, are less likely to work in academia. Mathematicians have the highest tenure rate of all scientists, 70 percent.

Education/Supply

- Ph.D. awards in mathematics peaked in 1970 (at 1,236), sharing in the across-the-board proliferation in science funding and enrollment during the 1960s.[33] These

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30. National Science Foundation, Division of Science Resources Studies, preliminary 1986 estimates, unpublished data, Tables B-land B-13.
31. National Research Council, Panelon Mathematical Sciences, op. cit., p. 34.
32. National Research Council, Office of Scientific and Engineering Personnel, unpublished data, 1985.
33. National Science Foundation, Science and Engineering Degrees: 1950-80. A Source Book, NSF 82-307 (Washington, DC': 1982), p. 49, Table 29; and National Research Council, Office of Scientific and Engineering Personnel, unpublished data, 1985.

graduates created a substantial bulge in the supply of mathematicians; while Federal support fell (in real terms) during the 1970s, the number of mathematical researchers doubled.

- Ph.D. awards dropped 41 percent between 1970 and 1980 and a further 7 percent from 1980 to 1985.[34] Surveys by the Mathematical Association of America indicate that the demand for undergraduate mathematics teaching exceeds the supply of fully qualified teachers. More undergraduates are being taught by part-time faculty.
- There are about 10,000 enrolled graduate students, but only about 700 Ph.D.s are awarded in mathematics each year. The average length of graduate study for those who do get degrees is nearly 7 years.
- In 1983, one in five math Ph.D.s planned postdoctoral study. A higher proportion of foreign students go on to a postdoctorate; in 1985 one-half of the mathematics postdoctorates were foreign nationals.[35]
- Mathematics bachelor% and master% degrees peaked in 1970 and 1969, respectively, dropped precipitously through the 1970s, and have rebounded slightly in the 1980s. Graduate enrollments have also risen slightly, though the rebound has not increased Ph.D. awards.
- It is important to look at mathematics and computer sciences degree data together, since the decline in mathematics degrees during the late 1970s was accompanied by an increase in computer science degrees. At the bachelor% level, a rapid rise in computer sciences during 1975 to 1985 masked a continuing drop in mathematics

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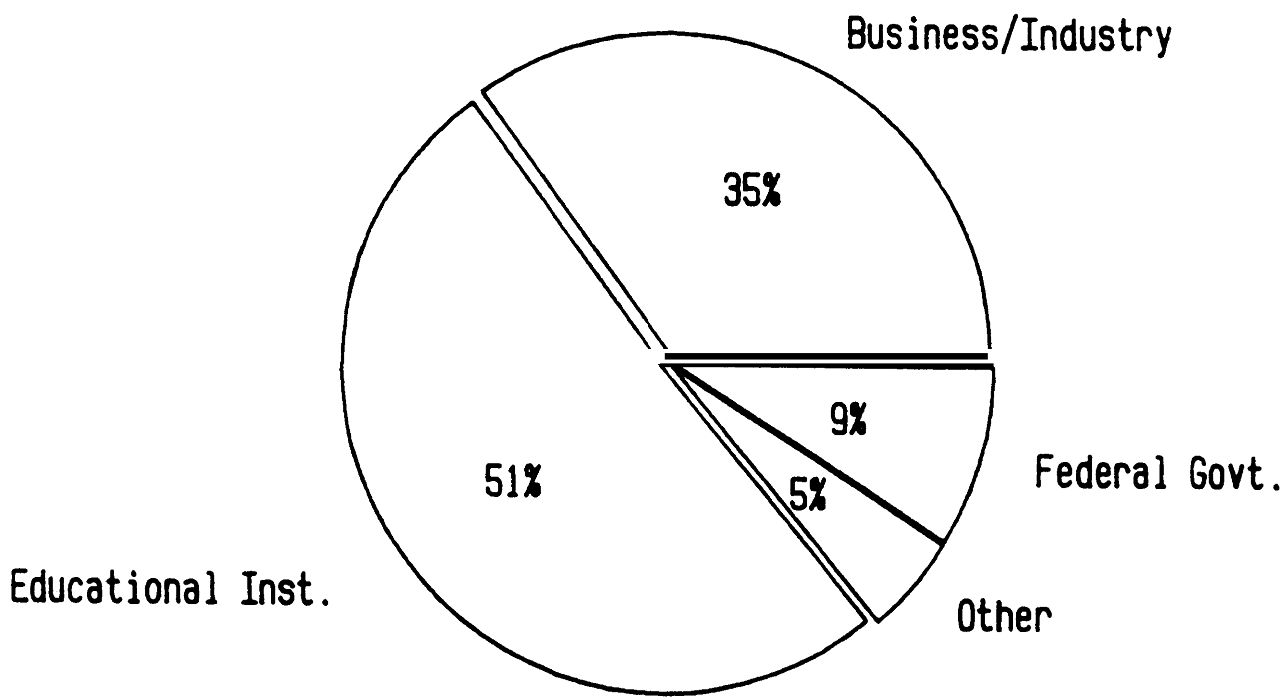
34. Ibid.; data for 1981-84 from the National Research Council, Office of Scientific and Engineering **Personnel,** annual surveys of doctorate recipients from U.S. universities, 1985 unpublished data (does not include **Ph.D.s in** computer science).
35. National Science Foundation, Division of Science Resources Studies, “Selected Data on Graduate Science/Engineering Students and Postdoctorates by Citizenship" op. cit., Table A-24.

Where Math. Sc ent t Work, 1



DEGRE

URCE: NATIONAL SCIENCE FOUNDATION

degrees. By 1983, bachelor% degrees had started rising and the drop in mathematics Ph.D.s had slowed.

Foreign Nationals

- The proportion of mathematics Ph.D.s awarded to non-U.S. citizens is substantial and increasing. In 1985, one in three mathematics Ph.D.s were awarded to non-U.S. citizens on temporary visas, up from one in five in 1976, Between 1980 and 1984, the number of mathematics Ph.D.s awarded to non-U.S. citizens rose 30 percent, while the total number of mathematics Ph.D.s fell.[36]
- Half as many U.S. citizens received mathematical sciences Ph.D.s in 1985 as in 1973. Of foreign mathematics Ph.D. recipients with temporary visas, perhaps one-half stay in the United States for some time. For those who had firm post-graduation plans, 60 percent planned to stay in the United States for study or work in 1982, up from 40 percent in 1972.[37]
- Over 90 percent of new foreign Ph.D.s on permanent visas stay in the United States. In 1982, 5 percent of employed mathematicians were foreign nationals and more than 10 percent were naturalized citizens.[38]

Women and Minorities

- Women have long had a significant presence in mathematics, particularly at the bachelor% level. One in five employed mathematicians is a woman.[39] Although

36. National Science Foundation, Science and Engineering Doctorates: 1960-82, **op.cit.,** pp. 44-45, Table 2. Data for the 1981-85 period from, National Research Council, Office of Scientific and Engineering Personnel, op. cit.
37. National Science Foundation, Division of Science Resources Studies, Directorate for Scientific, Technological, and International Affairs, Foreign Citizens in U.S. Science and Engineering (Washington, DC: 1985), p. 63, Chart 3.10.
38. Oak Ridge Associated Universities, Labor and Policy Studies Program, Foreign National Scientists and Engineers in the U.S. Labor Force, 1972-1982 (Oak Ridge, TN: June 1985), p. 42, Table A-17.
39. National Science Foundation, “U.S. Scientists and Engineers: 1984, ’’op. cit., p. 57, Table B-6.

over 40 percent of bachelor% degrees are awarded to women, only 30 percent of employed baccalaureate mathematicians, and less than 10 percent of employed Ph.D. mathematicians are women.[40]

- The 1984 unemployment rate for women in mathematics was 2.8 percent; for men it was 2 percent. The 1984 underemployment rate was 6.1 percent for women and 2 percent for men.
- Women receive about one-third of master's degrees in mathematics. This share has been fairly steady since the beginning of the 1970s, and was not much lower during the 1960s.
- Women receive about 15 percent of the Ph.D.s in mathematics and only recently have achieved even this level of participation. (The picture is similar in statistics.) The advance of women in the mathematical sciences seems to have plateaued during the 1980s.
- Seven blacks received mathematics Ph.D.s in 1985— about 1 percent of the mathematics Ph.D.s granted that year.[41] Blacks receive about 5 percent of bachelor% degrees in mathematics. Minority students, and to a lesser extent women, are handicapped by their lower exposure to mathematics in high school.
- Blacks represent less than 5 percent of all employed mathematicians at all degree levels. This proportion is the same for Asians, but even smaller for Hispanics. In addition, blacks and Asians are more likely to be in teaching and less likely to be in research and development.

40. National Science Foundation, Science and Engineering Degrees: 1950-80, op. cit., p. 49, Table 29; and National Science Foundation, Science and Engineering Personnel: A National Overview, op. cit., p. 115, Table B-12b.
41. National Research Council, Office of Scientific and Engineering Personnel, op. cit.

Education/Supply

- Computer science is the fastest growing science. Between 1977 and 1985, the number of computer science graduate students rose more than 15 percent per year, from 9,000 to nearly 30,000.[42]
- In 1985, about 315 computer science Ph.D.s were awarded. Over the past 3 years, computer science Ph.D. awards have increased 5-15 percent per year, and the rate is accelerating.[43]
- Graduate students in computer science come from a wide variety of undergraduate degrees and the majority of practicing computer scientists do not have a formal degree in the area. Less than 20 percent of recent computer science Ph.D.s have a bachelor% in computer science.
- Significant in-mobility of Ph.D.s into computer science is from mathematics and physics. With a declining supply of mathematics Ph.D.s and a growing pool of computer science Ph.D.s, this influx should dwindle through the 1980s as the field matures.[44]
- More than half of computer science graduate students in 1985 were part time, by far the highest of all sciences and engineering. Computer science also has the smallest proportion of postdoctorates of any science or engineering field.
- Over 6,000 master% degrees in computer science were granted in 1984, more than doubling since 1978. But the most explosive growth in computer science has been

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42. National Science Foundation, Academic Science/Engineering: Graduate Enrollment and Support, Fall 1983, op. cit., p. 62, Table B-1; and unpublished data.
43. National Research Council, Office of Scientific and Engineering Personnel, annual survey of doctorate recipients in U.S. universities, unpublished data, 1985.
44. The Computer Science Board, Committee on Research Funding in Computer Science, Imbalance Between Growth and Funding in Academic Computer Science: Two Trends Colliding (April 9, 1986), pp. 8-9.

at the bachelor% level. There ‘were 32,000 bachelor% degrees awarded in 1984, compared to less than 5,000 in 1975, an annual growth rate of 20 percent. And this pace has accelerated since 1980 to 30 percent per year.[45] Many universities are limiting undergraduate computer science enrollments while expanding their faculty to meet continuing demand.[46] This trend, however, will probably not continue* Only half the number of freshmen in 1985 as in 1983 indicated plans for a computer science major.

Employment/Demand

- Just under half of recent computer science Ph.D.s work in universities and colleges, and just under half in industry research and development. Demand for computer scientists is high, particularly at the Ph.D. level where it is three or four times current production.[47]
- Ph.D. computer scientists earn the highest salaries among scientists at the same experience level. Academic salaries are also well above the average and approach those of engineering and business faculty.
- Academic demand is still high and will continue to increase, though it has eased significantly from the near-crisis of the 1970s when potential faculty and graduate students flocked to lucrative jobs in industry.
- Federal funding and industry financial and equipment support have improved academic departments. The number of graduate departments of computer science increased from 91 in 1976 to 146 in 1983.[48]
- Departments are still understaffed, and shortages for computer science faculty in 4-year colleges are particularly high. One analyst estimates that only half of

45. National Center for Statistics, unpublished data, 1984, Table 112.
46. The Computer Science Board, op. cit., p. 6.
47. [bid., p. 8.
48. Ibid., p. 25, Table la.

current computer science faculty have a Ph. D., and only half of these have their Ph.D. in computer science.[49]

- Competition among universities, colleges, high-paying industry, and large research institutes for a limited pool of Ph.D.s is brisk. Fifteen percent of academic positions for computer science went unfilled in 1981-83.[50]
- Computer scientists are the youngest and least tenured of academic scientists. Almost 40 percent of faculty in graduate departments are assistant professors, with 35 percent full professors.[51]
- Over three-quarters of baccalaureate computer scientists go directly into industry, where salary offers are the highest among the sciences and almost as high as engineering.

Foreign Nationals

- Foreign students have joined the technological gold rush to computer science. Foreign students on temporary visas received one-third of the computer science Ph.D.s awarded in 1985, up from 11 percent in 1977. This pace is similar to that in engineering.[52]
- Forty percent of full-time graduate students in Ph.D. schools are foreign. Foreign students receive about 5 percent of bachelor% and 20 percent of master% degrees in computer science.

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49. John W. Hamblen, Computer Manpower — Supply and Demand by States, 1984 (Tallahassee, FL: Quad Data Corp, 1984), cited in The Computer Science Board, op. cit., p. 10.
50. Scientific Manpower Commission, The Technological Marketplace: Supply and Demand for Scientists and Engineers, 3rd ed. (Washington, DC: May 1985), p. 38, Table 29.
51. David Gries, The Computer Science Board, The 1984-85 Taulbee Survey (Ithaca, NY: Department of Computer Science, Cornell University, June 1986), p. 6.
52. Ibid.; The Taulbee Survey reports 122 foreign nationals out of a total of 326, 0r37 percent, in 1985. The National Research Council, Office of Scientific and Engineering Personnel, annual survey of doctorate recipients in U.S. universities, 1985, unpublished data, reports 89 foreign nationals out of 311, or29 percent.

- Most foreign computer scientists — at both the bachelor% and Ph.D. levels — remain to work in the United States, more than in any other field.[53] Foreign computer scientists are important as new hires in the electronics and computer industries as well as academia. In Silicon Valley companies, they may constitute as much as one-third of the work force.[54]
- Foreign computer scientists comprise over one-third of university faculty, a proportion unmatched across the sciences or engineering.

Women and Minorities

- Computer science has been an accepting field of graduate study and employment for women. Nine percent of employed computer science Ph.D.s are women, the highest proportion outside the social and biological sciences. Women earned 10 percent of the Ph.D.s in 1985 and over one-third the bachelor% degrees in 1984.[55] one-quarter of full-time graduate students are women, as are those the National Science Foundation (NSF) classifies as "computer specialists."
- Minorities, with the exception of Asians, have not shared in the expansion of the field. Blacks have made no gains in the past 5 years; they currently receive 5-6 percent of Bachelor's degrees and less than 1 percent of Ph.D.s. Hispanics receive about 3 percent of bachelor's degrees and 1-2 percent of Ph.D.s.
- Asians have doubled their participation over the past 5 years to over 5 percent of bachelor's and Ph.D. computer science degrees.

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53. U.S. General Accounting Office, Plansof Foreign Ph.D. Candidates: postgraduate Plans of U.S. Trained Foreign Students in Science/Engineering, GAO/RCED-86-102FS (Washington, DC: February 1986), p. 3.
54. National Science Foundation, Foreign Citizens in U.S. Science and Engineering: History, Status, and Outlook, op. cit., p. 75, Charts 5.1 and 5.2.
55. National Research Council, Office of Scientific and Engineering Personnel, annual survey of doctorate recipients in U.S. universities, 1985, unpublished data, reports 33 of 311 Ph.D.s, or 10.6 percent, and the Computer Science Board, reports 32 women out of 326 Ph.D.s, or 9.8 percent; bachelor's data from National Center for Statistics.

- Among NSF "computer specialists" 6 percent are Asian, 3 percent black, 2 percent Hispanic, and 0.4 percent American Indian. Under NSF/Bureau of Labor Statistics definitions, the single largest area of employment of minority scientists and engineers is computers.

LIFE SCIENCES

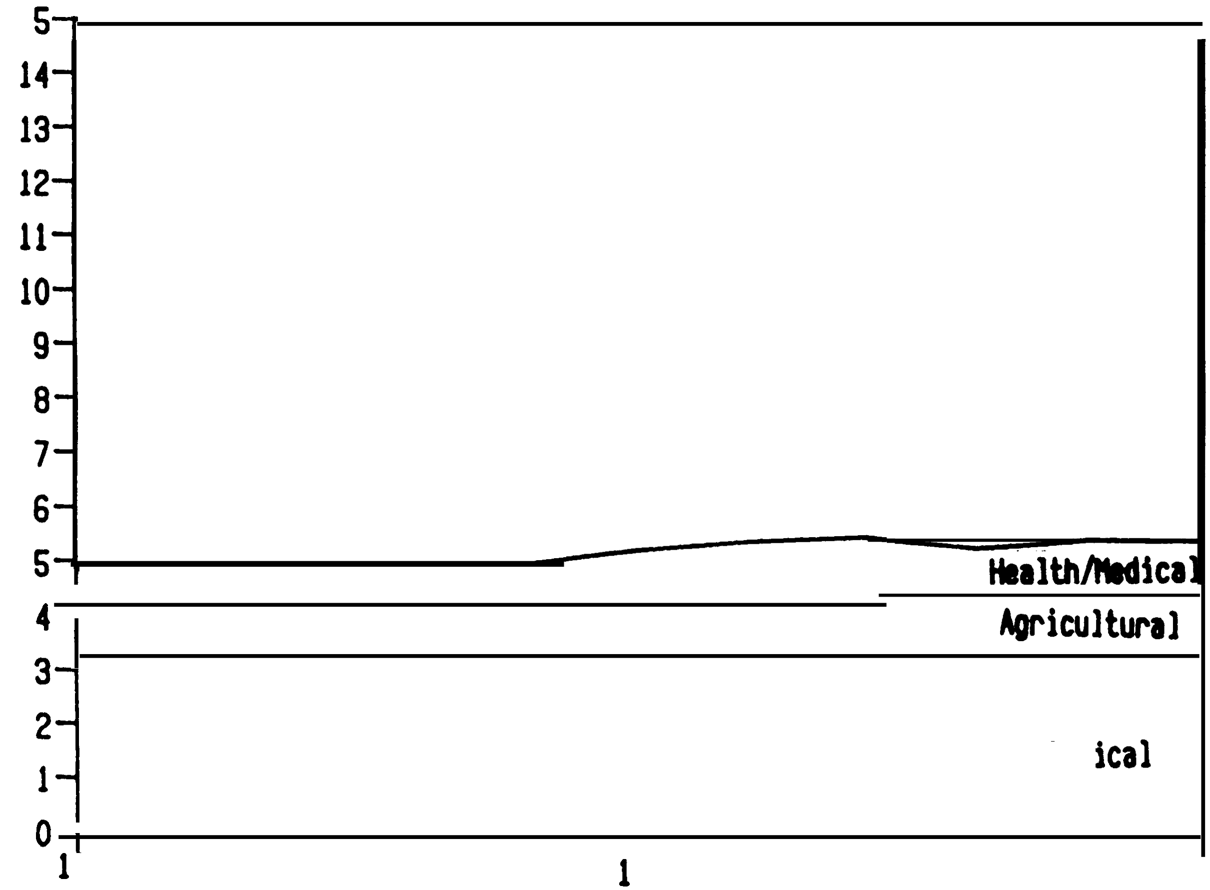
The life sciences represent a large number of fields that span the biological sciences, the health/medical sciences, and the agricultural sciences. Life sciences specialties are classified differently by data source. Their assignment to the biological or the health sciences sometimes depends on the academic department, school, or college which offers the program leading to the Ph. D., making comparisons difficult.

The biological sciences are comprised of a core set of disciplines devoted to the understanding of human and animal life. As the application of new and sophisticated instrumentation and the pace of biological discovery have accelerated, the boundaries between fields continue to blur. Basic biological fields represent the largest and most vibrant segment of the life sciences. In 1985, the biological sciences accounted for two-thirds of all life sciences Ph.D.s. Biochemistry is the largest disciplinary specialty; biochemistry plus microbiology, molecular biology, and physiology represented 41 percent of all life sciences Ph.D.s in 1985.

The health/medical sciences are a diverse set of health-related research specialties not directly involved in clinical care. These include environmental and public health, epidemiology, pathology, pharmacology, and nursing. Pharmacy/pharmacology represented one-third of all health/medical sciences doctorates awarded in 1985. These plus nursing and public health accounted for roughly three of every five health/medical sciences Ph.D.s conferred in 1985.

The agricultural sciences also consist of an array of fields and specialties. These include agronomy, animal science, plant science, soil science, food science and technology, range “science, horticulture, fish and wildlife science, and forestry. The agricultural sciences represented one-fifth of the life sciences Ph.D.s awarded in 1985. Four broad specialties — agronomy, animal science, plant science, and food science — accounted for almost two-thirds of the 1985 agricultural sciences doctorates. This category does not include agricultural economics. The National Science Foundation science and engineering work force data count this field as asocial science. About 160 Ph.D.s in agricultural economics are awarded each year (which the National Research Council classifies under the agricultural sciences).

The Nation% colleges and universities continue to produce large numbers of agricultural sciences graduates. Despite the currently widespread depression of the U.S. food and agricultural economy, agricultural products continue to constitute a large portion of U.S. exports and about 20 percent of U.S. civilian jobs are in food and agricultural industries. Much of the growth and relative stability in the employment of agricultural scientists is in the extensive nationwide network of U.S. Department of Agriculture research facilities and the State agricultural experiment stations associated with the land-grant universities.



SOURCE: NATIONAL RESEARCH COUNCIL

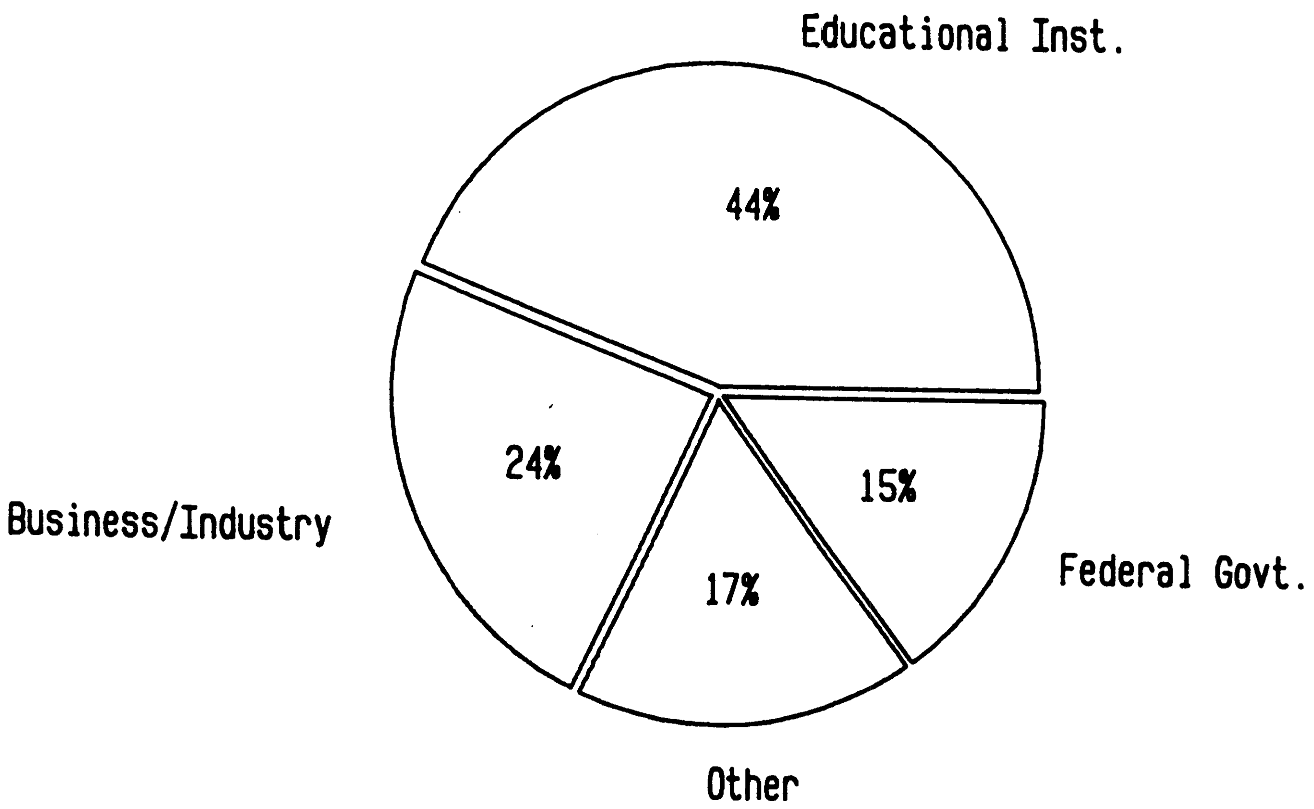
BIOLOGICAL SCIENCES

Employment

- There are 90,000 to 275,000 biological scientists employed in the United States. Of these, over 80 percent are employed in science and engineering (S/E) positions.[56]
- Less than one-half of the biological sciences S/E work force is employed by educational institutions. Industry employs about one-quarter and the Federal Government 15 percent.[57]
- About 40 percent of biological scientists in the S/E work force are engaged primarily in research and development (R&D), with more than half of them conducting basic research. One-fifth are in various management and teaching positions respectively .58
- There are about 66,500 Ph.D.s in the biological sciences work force — about a quarter of the total; master% degrees holders represent another one-third of this work force.[59]
- More than one-half of biological sciences Ph.D.s are principally employed in R&D positions, with over 20 percent in teaching, and 10 percent in various management positions.[60]

56. The Bureau of Labor Statistics reports 90,000 in 1985 (unpublished data); the National Science Foundation estimates 272,000 in 1986. National Science Foundation, Division of Science Resources Studies, preliminary 1986 estimates, Table B-1, unpublished data.
57. National Science Foundation, Division of Science Resources Studies, preliminary 1986 estimates, Table B-13, unpublished data.
58. Ibid.
59. Ibid., Table B-Ii.
60. National Science Foundation, Science and Engineering Personnel: A National Overview, op. cit., pp. 116, 120, Table=-=

Where Bioscientists* Work, 1986



DEGREES

SOURCE: NATIONAL IENCE FOUNDAT ON

Education

- The number of bachelor% degrees awarded in the biological sciences has followed an erratic path. In 1950, slightly more than 24,000 bachelor's degrees were conferred. This number declined steadily through 1955 and began an increase to over 40,000 in 1970. The number of degrees peaked in 1976 at 59,000 and has declined each year since then. In 1984, 38,640 bachelor% degrees were awarded.[61]
- The number of Ph.D.s conferred in the biological sciences doubled between 1950 and 1960 to about 1,200 a year, reaching 2,100 in 1966. Between 1974 and 1985 the number of Ph.D.s has been between 3,100 and 3,500 each year.[62]
- The number of full-time graduate students in the biological sciences enrolled in doctorate-granting institutions declined slightly between 1977 and 1983, but has since turned upwards.[63]

Women, Minorities, and Foreign Nationals

- Women's share of biological sciences bachelor% degrees increased from about 20 percent in 1950 to about 45 percent in 1984.[64] In 1985, women accounted for one in three Ph.D.s conferred in the biological sciences.[65]
- In 1986, women constitute one-fourth of the biological sciences work force and one-fifth of the doctorate-level contingent of this work force.[66]

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61. National Science Foundation, Science and Engineering Degrees: 1950-80, op. cit., p. 53, Table 33. Data for 1981-84 from the U.S. Department of Education," National Center for Statistics, unpublished.
62. Ibid.; Ph.D. data for 1981-85 from National Research Council, Office of Scientific and Engineering Personnel, Doctorate Recipients From United States Universities (Washington, DC: National Academy Press, annually).
63. National Science Foundation, Academic Science/Engineering: Graduate Enrollment and Support, Fall 1983, op. cit., p. 113, Table C-14; National Science Foundation, Division of Science Resources Studies, 'Selected Data on Graduate Science/Engineering Students by Enrollments Status, Fall 1985/' unpublished data, Tables A-land C-6.
64. National Science Foundation, Science and Engineering Degrees: 1950-80, op. cit, and National Center for Statistics, unpublished data.
65. National Research Council, Office of Scientific and Engineering Personnel, Doctorate Recipients From United States Universities, op. cit.
66. National Science Foundation, Division of Science Resources Studies, preliminary

- Blacks are severely underrepresented in the biological sciences. They represent only 2 to 3 percent of the biological sciences work force and **1.5** percent of the doctorate-level employees.[67]
- **0ver 15 percent of the 38,000 full-time graduate students in the biological sciences in 1985 were foreign citizens— up from about 10 percent in 1976.**[68]
- **In 1985, foreign students** on temporary visas received 11 percent of Ph.D.s award in the biological sciences.[69]
- **Of** the biological sciences Ph.D.s conferred in **1985, Asians accounted for** 4 percent, black and Hispanics each under 2 percent.[70]

1986 estimates, Tables B-l, B-11, unpublished data.
67. ibid.,TableB-12.
6a. National Science Foundation, Academic Science/Engineering: Graduate Enrollment and Support: **Fall** 1983, op. cit., pp. 130-31, Tables **C27 and C28, and** National Science Foundation, Division of Science Resources Studies, **"Selected** Data on Graduate Science/Engineering Students and Postdoctorates by Citizenship/top. cit., Table A-9.
69. National Research Council, Office **of** Scientific and Engineering Personnel, Doctorate Recipients From United States Universities, op. cit.
70. Ibid.

HEALTH/MEDICAL SCIENCES

Employment

- There are an estimated 32,000 to 47,000 health/medical scientists employed in the United States. Of these, over 90 percent are employed in S/E positions.[71]
- About 60 percent of the health/medical sciences S/E work force is employed by educational institutions. Industry and nonprofit institutions account for about 17 percent each and the Federal Government for 4 percent.[72]
- About 40 percent of the health/medical sciences S/E work force is engaged primarily in R&D, with 25 percent in some form of management and in teaching, respectively.[73]
- About two-thirds of health/medical scientists hold a doctorate. Less than 1 percent hold a master% degree.[74] Of the employed doctorate holders, one in three is engaged in R&D, one in five in teaching, and in some form of management.[75]

Education

- The number of Ph.D.s awarded annually in the health/medical sciences increased between 1975 and 1982 by 50 percent. [n 1985, 1,082 Ph.D.s were conferred.[76]

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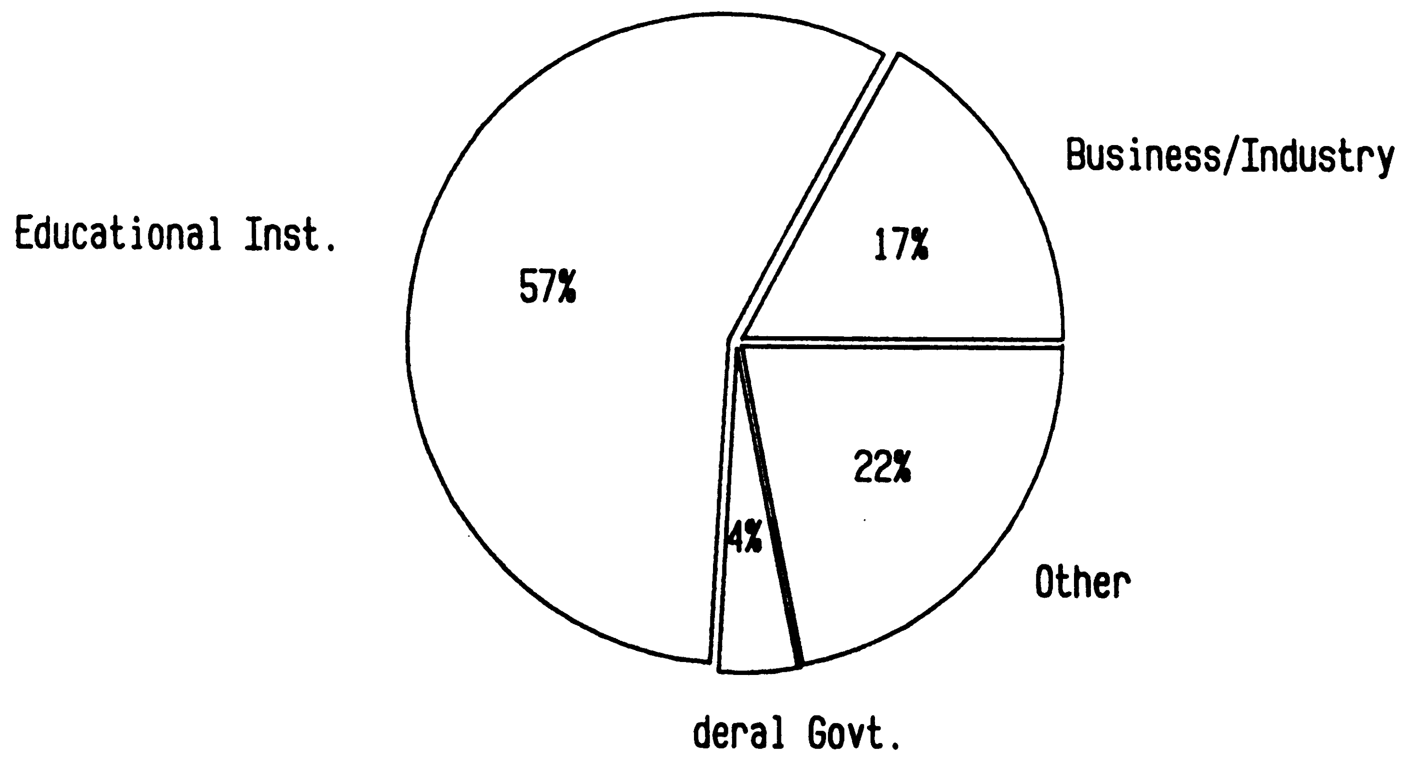
71. The Bureau of Labor Statistics reports 47,000 in 1985 (unpublished data); National Science Foundation estimates 32,000 in 1986. National Science Foundation, Science Resources Studies Division, preliminary 1986 estimates, Table B-1, unpublished data.
72. Ibid., Table B-13.
73. Ibid.
74. Ibid., Table B-11.
75. National Science Foundation, Science and Engineering Personnel: A National Overview, op. cit., pp. 116, 120, and 124, Table B-12b.
76. National Research Council, Office of Scientific and Engineering Personnel, Doctorate Recipients from United States Universities: Summary Report 1983, op. cit., p. 47, Appendix Table B. Data for 1985 are unpublished. Certain changes in the National Research Council doctorate fields were made to parallel National Science Foundationts occupational categories; degrees awarded in parasitology, pathology, and pharmacology were subtracted from the biological sciences and added to the health sciences.

Where Health Scientist Work, 1986



*ALL DEGREES

SOURCE: NATIONAL SCI FOUNDATION

- The number of full-time graduate students in the health/medical sciences enrolled in doctorate-granting institutions increased between 1976 and 1980, declined slightly and has now plateaued.[77]

Women, Minorities, and Foreign Nationals

- Women earn a majority of the health/medical sciences doctorates. [n 1985, women represented 60 percent of the Ph.D.s conferred in these fields.[78]
- Women's recent gains in earning doctorates have not yet shown up in the workplace. In 1984, women were over 20 percent of both the employed health/medical scientists and of the work force holding doctorates.[79]
- Blacks and Hispanics are severely underrepresented in these fields. In 1986, blacks and Hispanics each constituted slightly over 1 percent of the health/medical science work force and of the doctorate-holders in that work force.[80] In 1985, blacks received 3 percent of the health sciences Ph.D.s awarded.[81]
- The number of foreign full-time graduate students enrolled in doctoral programs has steadily increased since 1976, representing 11 percent of the health/medical sciences enrollment in 1985.[82]
- In 1985, foreign citizens on temporary visas received 13 percent of the health sciences Ph.D.s awarded.[83]

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77. National Science Foundation, Academic Science/Engineering: Graduate Enrollment and Support, Fall 1983, op. cit., p. 113, Table C-14; and unpublished data.
78. National Research Council, Ph.D. data for 1985 from Office of Scientific and Engineering Personnel, unpublished data.
79. National Science Foundation, U.S. Scientists and Engineers: 1984, op. cit., pp. 37, 110, Tables B-1 and B-11.
80. National Science Foundation, Division of Science Resources Studies, preliminary 1986 estimates, Table B-12, unpublished data.
81. National Research Council, Office of' Scientific and Engineering Personnel, unpublished data.
82. National Science Foundation, Division of Science Resources Studies, "Selected Data on Graduate Science/Engineering Students and Postdoctorates by Citizenship," op. cit., Table A-15.
83. National Research Council, Ph. D. data for 1985 from the Office of Scientific and Engineering Personnel, unpublished data.

AGRICULTURAL SCIENCES

Education and Supply

- The number of students earning bachelor% degrees in agricultural and natural resources fields declined markedly between 1950 and 1961 from 15,000 to under 6,000 annually. After 1961 the fields showed steady growth, peaking at 22,000 in 1979 and declining slightly each year to about 19,000 in 1984. Master% degrees have followed a similar pattern since 1970 with over 4,000 conferred in 1984.[84]
- The number of Ph.D.s awarded nearly doubled between 1960 and 1970 to 800. Despite sharp fluctuations in the last 15 years, Ph.D. production has increased. Over l,l00 were awarded in 1985.
- No single discipline within the agricultural sciences accounts for more than 20 percent of the Ph.D.s. In 1985, the distribution was plant science and animal sciences, 18 percent each; food science, 12 percent; soil science and forestry, 9 percent each; and horticulture, and fish and wildlife, 7 percent each.

Employment

- There are an estimated 65,000 to 102,000 agricultural scientists employed in the United States. Of these, almost 80 percent are employed in S/E positions.[85]
- Nearly one-half of the agricultural science S/E work force is employed in industry. About one-third are employed in academia and 10 percent in the Federal Government.[86]

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84. National Science Foundation, Science and Engineering Degrees: 1950-80. A Source Book, op. cit., p. 52, Table 32 and National Center for Statistics, unpublished data.
85. The Bureau of Labor Statistics reports 65,000 in 1985 (unpublished); National Science Foundation estimates 101,900 in 1986. National Science Foundation, Science Resources Studies Division, preliminary 1986 estimates, Table B-1.
86* Ibid., Table B-13.

- Slightly less than one-third of the agricultural science S/E work force are primarily engaged in R&D activities. About one-quarter are in various management positions and over one-fifth are involved in production/inspection. Less than 10 percent are engaged in teaching.[87]

Women, Minorities, and Foreign Nationals

- Women increased as a proportion of the agricultural sciences S/E work force from 4 percent in 1976 to 19 percent in 1986. The majority of female agricultural scientists are employed in business and industry and 20 percent by educational institutions. About 30 percent preengaged in R&D activities.[88]
- only 5 percent of agricultural science doctorates employed in 1986 are women, even though the proportion of Ph.D.s granted to women in agricultural science fields tripled from 5 to 15 percent in the 1975-85 decade.
- Minorities are likewise underrepresented. Blacks, Asians, and Hispanics each account for only 2 percent of the agricultural sciences work force in 1983. In 1985, Asians earned over 2 percent of the Ph.D.s awarded, blacks 1.4 percent, and Hispanics less than l percent (10 out of 1,100).[89]
- Foreign nationals receive about one-third of the Ph.D.s awarded, a proportion unchanged since 1975. The vast majority return to their country of origin after completing doctoral study.

87. Ibid.
88. National Science Foundation, Science and Engineering Personnel: A National Overview, op. cit., Table B-2, p. 54 and National Science Foundation, Division of Science Resources Studies, preliminary 1986 estimates, Tables B-4 and B-6, unpublished data.
89. National Research Council, Office of Scientific and Engineering Personnel, 1985 unpublished data from the survey of doctorate recipients in United States universities.

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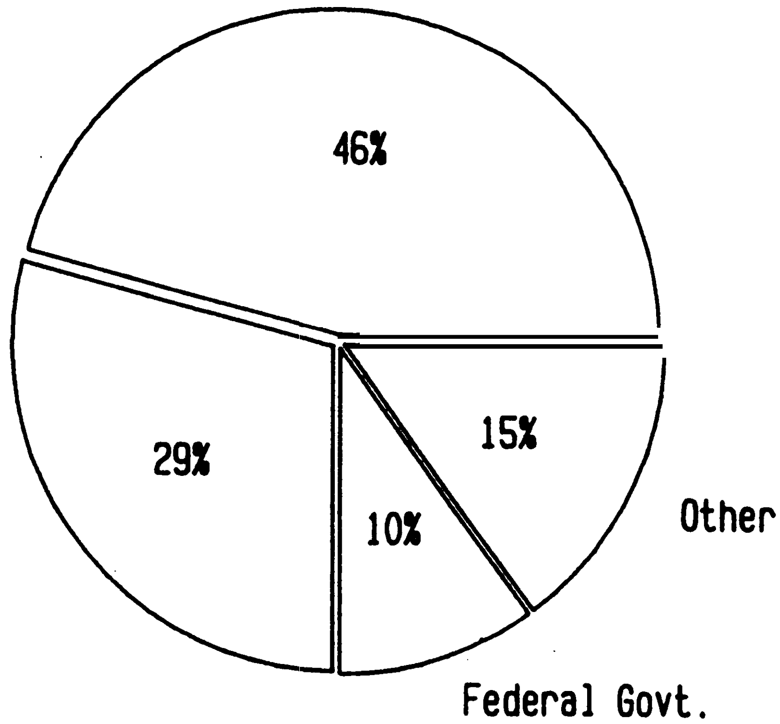

DEGREES

SOURCE NAT ONA SCIENCE FOUNDATION