O-8 / Occupational / Industry Data

N—LABOR FORCE STATUS, BY PRESENCE AND
960 TO 1987

nd over, thereafter 16 years old and over. Based on Current
on 1 and Appendix III]

18	CHILDREN 6-17 ONLY			CHILDREN UNDER 6		
...ced	Married[1]	Separated	Divorced	Married[1]	Separated	Divorced
(NA)	4.1	(NA)	(NA)	2.5	(NA)	(NA)
1.1	6.3	.4	.6	3.9	.3	.3
2.3	8.4	.6	1.6	5.2	.4	.5
2.7	8.3	.7	1.8	5.7	.5	.6
2.8	8.3	.6	1.8	5.9	.5	.6
3.0	8.3	.7	1.9	6.2	.4	.6
3.3	8.5	.7	2.0	6.4	.4	.6
3.5	8.8	.6	2.0	6.6	.5	.7
3.4	9.0	.7	2.0	7.0	.4	.7
(NA)	39.0	(NA)	(NA)	18.6	(NA)	(NA)
.7	49.2	60.6	82.4	30.3	45.4	63.3
.4	61.7	66.3	82.3	45.1	52.2	68.3
.6	63.2	68.4	83.6	48.7	55.2	67.2
.7	63.8	68.7	82.2	49.9	53.8	68.7
.5	65.4	70.1	84.1	51.8	53.9	67.7
.1	67.8	70.9	83.4	53.4	53.2	67.5
.1	68.4	70.6	84.7	53.8	57.4	73.8
.9	70.6	72.6	84.5	56.8	55.1	70.5
(NA)	3.9	(NA)	(NA)	2.3	(NA)	(NA)
.0	6.0	.4	.5	3.6	.3	.2
.2	8.1	.6	1.5	4.8	.4	.5
.5	7.7	.6	1.7	5.1	.4	.5
.6	7.7	.5	1.5	5.2	.3	.5
.8	7.9	.6	1.7	5.7	.3	.5
.1	8.1	.6	1.8	5.9	.3	.5
.3	8.3	.5	1.9	6.1	.4	.6
.2	8.6	.6	1.9	6.5	.3	.3
[illegible]	4.9	(NA)	(NA)	7.8	(NA)	(NA)
[illegible]	4.8	5.9	6.5	7.9	13.3	5.2
[illegible]	4.4	10.6	6.7	8.3	12.3	13.6
[illegible]	7.0	14.6	9.2	10.1	20.1	13.5
[illegible]	6.7	20.0	12.8	10.9	27.6	16.8
[illegible]	5.0	13.1	9.7	8.9	25.0	14.3
[illegible]	5.5	14.6	9.0	8.0	22.9	12.1
[illegible]	4.8	11.7	8.2	7.6	16.5	12.9
[illegible]	4.9	14.8	6.1	5.9	15.7	13.8

ch specific category in the labor force.

Nos. 13, 130, and 134, Bulletin 2163, and unpublished

ES, HUSBAND PRESENT, BY AGE OF OWN
TO 1987

. Based on Current Population Survey; see text, section

WHITE				BLACK			
1975	1980	1985	1987	1975	1980	1985	1987
43.7	**49.3**	**53.4**	**54.9**	**54.3**	**59.3**	**64.2**	**65.6**
43.5	45.5	47.5	47.9	47.7	51.2	56.1	53.2
43.9	53.2	60.0	62.8	58.8	65.6	71.5	76.1
35.0	43.5	52.3	55.5	56.4	63.4	69.3	74.2
30.9	40.0	49.8	53.1	52.2	57.7	65.7	71.3
29.2	37.7	48.6	51.2	50.0	52.9	63.7	70.3
15.1	46.1	52.7	57.7	56.4	71.0	69.9	73.8
0.3	49.4	56.6	59.3	61.7	72.3	73.8	77.9
9.0	48.4	52.7	57.5	62.7	73.4	72.3	76.4
8.7	49.8	58.4	60.8	64.9	66.4	70.6	75.0
3.8	50.4	59.9	60.1	56.3	77.8	79.1	82.9
0.8	61.4	67.7	69.6	64.9	71.8	73.5	80.7
3.6	60.6	66.3	70.0	51.0	58.4	74.1	71.0

986, and unpublished data.

0-8
1

No. 626. CIVILIAN EMPLOYMENT IN OCCUPATIONS WITH THE LARGEST JOB GROWTH AND IN THE FASTEST GROWING AND FASTEST DECLINING OCCUPATIONS: 1986 AND 2000

[In thousands, except percent. For occupations employing 100,000 or more in 1986. Includes wage and salary jobs, self-employed and unpaid family members. Estimates based on the 1983 through 1985 Occupational Employment Statistics Surveys. See source for methodological assumptions. Minus sign (−) denotes decrease]

OCCUPATION	EMPLOYMENT				PERCENT CHANGE, 1986–2000		
	1986	2000[1] Low	2000[1] Moderate	2000[1] High	Low	Moderate	High
Total[2]	**111,623**	**126,432**	**133,030**	**137,533**	**13**	**19**	**23**
LARGEST JOB GROWTH[3]							
Salespersons, retail	3,579	4,563	4,780	4,871	28	34	36
Waiters and waitresses	1,702	2,360	2,454	2,503	39	44	47
Registered nurses	1,406	1,951	2,018	2,077	39	44	48
Janitors and cleaners[4]	2,676	3,144	3,280	3,382	17	23	26
General managers and top executives	2,383	2,820	2,965	3,052	18	24	28
Cashiers	2,165	2,616	2,740	2,798	21	27	29
Truck drivers, light and heavy	2,211	2,599	2,736	2,811	18	24	27
General office clerks	2,361	2,688	2,824	2,916	14	20	23
Food counter, fountain, and related workers	1,500	1,879	1,949	1,985	25	30	32
Nursing aides, orderlies, and attendants	1,224	1,584	1,658	1,691	29	35	38
Secretaries	3,234	3,470	3,658	3,789	7	13	17
Guards	794	1,104	1,177	1,241	39	48	56
Accountants and auditors	945	1,251	1,322	1,371	32	40	45
Computer programmers	479	758	813	850	58	70	78
Food preparation workers	949	1,227	1,273	1,300	29	34	37
Teachers, kindergarten and elementary	1,527	1,778	1,826	1,883	16	20	23
Receptionists and information clerks	682	913	964	997	34	41	46
Computer systems analysts, EDP	331	544	582	607	64	76	83
Cooks, restaurant	520	727	759	778	40	46	50
Licensed practical nurses	631	835	869	891	32	38	41
Gardeners and groundskeepers, except farm	767	964	1,005	1,033	26	31	35
Maintenance repairers, general utility	1,039	1,205	1,270	1,314	16	22	26
Stock clerks, sales floor	1,087	1,255	1,312	1,333	15	21	23
First line supervisors and managers	956	1,106	1,161	1,200	16	21	25
Dining room, cafeteria attendants, barroom helpers	433	607	631	644	40	46	49
Electrical and electronics engineers	401	544	592	616	36	48	54
Lawyers	527	676	718	748	28	36	42
Cooks, short order and fast food	591	748	775	788	27	31	33
Carpenters	1,010	1,134	1,192	1,252	12	18	24
Bartenders	396	530	553	566	34	40	43
Financial managers	638	747	792	824	17	24	29
Food service and lodging managers	509	628	663	685	24	30	35
Teachers, secondary schools	1,128	1,246	1,280	1,320	10	13	17
Electrical and electronic technicians, technologists	313	428	459	473	37	46	51
Real estate sales agents	313	422	451	468	35	44	49
Computer operators, exc. peripheral equipment	263	364	387	403	39	47	53
Social workers	365	468	485	500	28	33	37
Medical assistants	132	239	251	258	81	90	96
Marketing, advertising, pub. relations managers	323	402	427	444	25	32	38
Legal assistants, tech., exc. clerical	170	258	272	282	51	60	66
FASTEST GROWING							
Medical assistants	132	239	251	258	81	90	96
Home health aides	138	236	249	258	71	80	87
Computer systems analysts, EDP	331	544	582	607	64	76	83
Computer programmers	479	758	813	850	58	70	78
Radiologic technologists and technicians	115	183	190	196	58	65	70
Legal assistants and technicians exc. clerical	170	258	272	282	51	60	66
Dental assistants	155	231	244	250	49	57	61
Guards	794	1,104	1,177	1,241	39	48	56
Electrical and electronics engineers	401	544	592	616	36	48	54
Computer operators, except peripheral equipment	263	364	387	403	39	47	53
Restaurant cooks	520	727	759	778	40	46	50
Dining room, cafeteria attendants, barroom helpers	433	607	631	644	40	46	49
FASTEST DECLINING							
Electrical and electronic assemblers	249	105	116	119	−58	−54	−52
Industrial truck and tractor operators	426	265	283	296	−38	−34	−31
Stenographers	178	123	128	133	−31	−28	−26
Farmers	1,182	810	850	871	−31	−28	−26
Textile draw-out and winding machine operators[5]	219	156	164	175	−28	−25	−20
Farm workers	940	705	750	779	−25	−20	−17
Data entry keyers, except composers	400	315	334	347	−21	−16	−13
Typists and word processors	1,002	820	862	892	−18	−14	−11
Sewing machine operators, garment	633	526	541	567	−17	−14	−10
Welding machine setters, operators, tenders	126	101	112	115	−20	−12	−9
Child care workers, private household	400	334	362	367	−16	−10	−8
TV and cable TV installers and repairers	119	102	108	115	−15	−9	−4

[1] Based on low, moderate, or high trend assumptions. [2] Includes other occupations, not shown separately. [3] Based on absolute employment change 1986 to 2000. [4] Includes maids and housekeepers. [5] Includes tenders.

Source: U.S. Bureau of Labor Statistics, *Monthy Labor Review*, September 1987.

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No. 627. Employed Persons, by Sex, Race, and Occupation: 1986

[For civilian noninstitutional population 16 years old and over. Annual average of monthly figures. Based on Current Population Survey; see text, section 1 and Appendix III. Persons of Hispanic origin may be of any race]

OCCUPATION	Total employed (1,000)	PERCENT OF TOTAL		
		Female	Black	Hispanic
Total	**109,597**	**44.4**	**9.9**	**6.6**
Managerial and professional specialty	**26,554**	**43.4**	**6.0**	**3.5**
Executive, administrative, and managerial [1]	12,642	36.8	5.2	3.7
Officials and administrators, public	467	42.0	8.4	3.8
Financial managers	409	38.4	3.0	4.3
Personnel and labor relations managers	114	48.8	5.5	3.5
Purchasing managers	100	29.4	4.1	3.0
Managers, marketing, advertising and public relations	440	24.9	2.5	2.3
Administrators, education and related fields	500	47.7	8.9	3.5
Managers, medicine and health	127	62.2	8.1	2.7
Managers, properties and real estate	362	44.2	5.2	5.6
Management-related occupations	3,449	46.3	6.7	3.9
Accountants and auditors	1,257	44.9	5.6	4.0
Professional specialty [1]	13,911	49.4	6.7	3.3
Architects	132	9.7	3.2	4.1
Engineers [1]	1,749	6.0	3.7	2.5
Electrical and electronic	550	6.9	4.2	2.1
Mechanical	287	3.5	3.6	1.0
Mathematical and computer scientists	631	36.2	7.2	2.5
Computer systems analysts, scientists	385	34.4	6.6	2.4
Natural scientists	384	22.5	2.5	3.2
Health diagnosing occupations [1]	728	15.0	3.3	3.2
Physicians	489	17.6	3.3	4.1
Dentists	132	4.4	5.5	2.0
Health assessment and treating occupations [1]	2,026	85.3	7.0	2.8
Registered nurses	1,488	94.3	6.7	2.4
Therapists	257	74.2	7.8	4.4
Teachers, college and university	639	36.0	4.0	3.2
Teachers, except college and university [1]	3,559	73.4	9.5	3.6
Prekindergarten and kindergarten	359	98.3	13.9	6.1
Elementary school	1,340	85.2	10.8	3.4
Secondary school	1,195	54.9	7.8	3.4
Counselors, educational and vocational	173	53.9	12.9	4.7
Librarians, archivists, and curators	212	82.9	7.4	1.8
Librarians	194	85.9	7.5	1.7
Social scientists and urban planners	312	46.0	5.5	2.8
Psychologists	165	52.5	6.8	3.1
Social, recreation, and religious workers	911	46.9	12.5	5.3
Social workers	480	65.0	17.8	7.3
Lawyers and judges	650	18.1	3.0	1.9
Writers, artists, entertainers, and athletes	1,781	45.0	5.2	4.0
Technical, sales, and administrative support	**34,354**	**64.7**	**8.5**	**5.3**
Technicians and related support	3,364	47.0	8.2	4.0
Health technologists and technicians	1,124	84.1	12.4	3.7
Licensed practical nurses	417	97.5	17.2	2.9
Engineering and related technologists and technicians	937	17.7	6.3	5.3
Electrical and electronic technicians	328	12.6	7.0	4.5
Science technicians	208	27.9	7.0	4.2
Technicians, except health, engineering, and science	1,095	37.6	5.8	3.1
Computer programmers	549	34.0	5.9	2.2
Sales occupations	13,245	48.2	5.7	4.9
Supervisors and proprietors	3,493	30.5	4.0	4.4
Sales representatives, finance and business services [1]	2,255	41.5	3.9	3.4
Insurance sales	562	28.7	5.8	3.9
Real estate sales	737	50.6	2.1	3.3
Securities and financial services sales	283	24.5	3.1	2.6
Sales representatives, commodities, except retail	1,505	18.3	2.2	3.4
Sales workers, retail and personal services	5,927	68.6	8.2	6.1
Cashiers	2,310	82.9	12.3	6.8
Sales-related occupations	65	64.6	4.6	2.4
Administrative support, including clerical	17,745	80.4	10.7	5.8
Supervisors	727	59.3	10.8	5.1
Computer equipment operators	859	68.5	14.0	6.1
Computer operators	853	68.6	14.0	6.0
Secretaries, stenographers, and typists [1]	4,940	98.2	8.5	5.1
Secretaries	4,023	99.0	6.9	4.8
Typists	870	95.2	16.3	6.5
Information clerks	1,326	89.7	8.4	6.7
Receptionists	724	97.1	7.4	6.7
Records processing occupations, except financial	845	81.4	14.4	7.0
File clerks	311	84.5	17.6	9.6
Financial records processing	2,473	90.8	5.4	4.1
Bookkeepers, accounting, and auditing clerks	2,007	91.8	4.1	3.8

See footnotes at end of table.

Stat Abstract of US, 1988

, AND OCCUPATION: 1986

[... average of monthly figures. Based on Current ... of Hispanic origin may be of any race]

Total employed (1,000)	PERCENT OF TOTAL Female	Black	Hispanic
109,597	44.4	9.9	6.6
26,554	43.4	6.0	3.5
12,642	36.8	5.2	3.7
467	42.0	8.4	3.8
409	38.4	3.0	4.3
114	48.8	5.5	3.5
100	29.4	4.1	3.0
440	24.9	2.5	2.3
500	47.7	8.9	3.5
127	62.2	8.1	2.7
362	44.2	5.2	5.6
3,449	46.3	6.7	3.9
1,257	44.9	5.6	4.0
13,911	49.4	6.7	3.3
132	9.7	3.2	4.1
1,749	6.0	3.7	2.5
550	6.9	4.2	2.1
287	3.5	3.6	1.0
631	36.2	7.2	2.5
385	34.4	6.6	2.4
384	22.5	2.5	3.2
728	15.0	3.3	3.2
489	17.6	3.3	4.1
132	4.4	5.5	2.0
2,026	85.3	7.0	2.8
1,488	94.3	6.7	2.4
257	74.2	7.8	4.4
639	36.0	4.0	3.2
3,559	73.4	9.5	3.6
359	98.3	13.9	6.1
1,340	85.2	10.8	3.4
1,195	54.9	7.8	3.4
173	53.9	12.9	4.7
212	82.9	7.4	1.8
194	85.9	7.5	1.7
312	46.0	5.5	2.8
165	52.5	6.8	3.1
911	46.9	12.5	5.3
480	65.0	17.8	7.3
650	18.1	3.0	1.9
1,781	45.0	5.2	4.0
34,354	64.7	8.5	5.3
3,364	47.0	8.2	4.0
1,124	84.1	12.4	3.7
417	97.5	17.2	2.9
937	17.7	6.3	5.3
328	12.6	7.0	4.5
208	27.9	7.0	4.2
1,095	37.6	5.8	3.1
549	34.0	5.9	2.2
13,245	48.2	5.7	4.9
3,493	30.5	4.0	4.4
2,255	41.5	3.9	3.4
562	28.7	5.8	3.9
737	50.6	2.1	3.3
283	24.5	3.1	2.6
1,505	18.3	2.2	3.4
5,927	68.6	8.2	6.1
2,310	82.9	12.3	6.8
65	64.6	4.6	2.4
17,745	80.4	10.7	5.8
727	59.3	10.8	5.1
859	68.5	14.0	6.1
853	68.6	14.0	6.0
4,940	98.2	8.5	5.1
4,023	99.0	6.9	4.8
870	95.2	16.3	6.5
1,326	89.7	8.4	6.7
724	97.1	7.4	6.7
845	81.4	14.4	7.0
311	84.5	17.6	9.6
2,473	90.8	5.4	4.1
2,007	91.8	4.1	3.8

No. 627. Employed Persons, by Sex, Race, and Occupation: 1986—Continued

[See headnote, page 376]

OCCUPATION	Total employed (1,000)	PERCENT OF TOTAL Female	Black	Hispanic
Technical, sales, and administrative support—Con.				
Administrative support, including clerical—Con.				
Duplicating, mail and other office machine operators	77	61.9	16.9	7.2
Communications equipment operators	230	87.4	17.5	5.5
Telephone operators	220	87.9	17.4	5.6
Mail and message distributing occupations	903	34.4	20.3	6.2
Postal clerks, except mail carriers	299	43.5	29.8	7.1
Material recording, scheduling, and distributing clerks	1,639	39.5	11.8	8.1
Adjusters and investigators	824	72.3	11.1	5.7
Miscellaneous administrative support [1]	2,902	84.9	13.4	6.5
General office clerks	740	80.5	13.0	6.1
Bank tellers	482	91.8	7.8	5.3
Data entry keyers	343	91.1	19.6	8.1
Teachers' aides	381	94.2	17.9	10.8
Service occupations	14,680	60.7	16.9	8.8
Private household [1]	981	96.0	23.9	12.9
Child care workers	400	97.4	8.3	6.1
Cleaners and servants	527	95.3	35.5	17.8
Protective service [1]	1,787	12.4	15.0	5.6
Firefighting and fire prevention	218	2.2	7.3	4.5
Police and detectives	666	10.9	14.6	5.2
Guards	741	18.4	19.0	6.4
Service except private household and protective	11,913	65.0	16.6	9.0
Food preparation and service occupations [1]	5,127	62.8	12.1	8.8
Bartenders	322	48.8	3.1	5.2
Waiters and waitresses	1,403	85.1	5.1	6.2
Cooks, except short order	1,563	50.6	17.2	9.6
Short-order cooks	111	36.8	22.6	6.1
Food counter, fountain, and related occupations	340	78.5	12.6	5.3
Kitchen workers, food preparation	126	76.3	18.2	11.1
Waiters' and waitresses' assistants	332	39.2	15.1	14.8
Health service occupations	1,823	89.9	25.1	5.7
Dental assistants	167	99.0	4.2	7.1
Health aides, except nursing	357	83.4	18.8	7.8
Nursing aides, orderlies, and attendants	1,299	90.5	29.5	5.0
Cleaning and building service occupations [1]	2,861	41.5	23.8	12.8
Maids and housemen	583	84.8	29.8	13.9
Janitors and cleaners	2,075	30.9	22.9	12.7
Personal service occupations [1]	2,101	80.0	10.3	7.2
Barbers	92	16.6	9.6	7.2
Hairdressers and cosmetologists	719	88.8	7.3	7.3
Attendants, amusement and recreation facilities	121	43.1	8.3	3.8
Public transportation attendants	71	77.1	7.3	6.2
Welfare service aides	87	91.7	22.5	12.9
Child care workers, except private household	762	96.5	11.4	6.9
Precision production, craft, and repair	13,405	8.6	7.5	7.7
Mechanics and repairers	4,374	3.5	7.3	6.9
Mechanics and repairers, except supervisors [1]	4,127	3.2	7.4	7.1
Vehicle and mobile equipment mechanics and repairers	1,787	1.0	6.7	7.6
Automobile mechanics	871	1.0	7.6	8.4
Electrical and electronic equipment repairers	710	9.0	7.9	6.0
Telephone installers and repairers	228	13.3	8.1	6.0
Construction trades	4,924	2.0	7.1	7.4
Construction trades, except supervisors	4,309	2.1	7.6	7.9
Carpenters	1,327	1.4	5.3	6.7
Extractive occupations	171	2.4	3.7	11.0
Precision production occupations	3,936	22.8	8.5	8.8
Operators, fabricators, and laborers	17,160	25.4	15.1	10.5
Machine operators, assemblers, and inspectors [1]	7,911	40.3	14.7	12.1
Textile, apparel, and furnishings machine operators [1]	1,323	79.8	21.4	15.9
Textile sewing machine operators	737	90.6	17.1	21.0
Pressing machine operators	136	71.9	33.7	13.2
Fabricators, assemblers, and hand working occupations	1,849	32.4	12.7	10.8
Production inspectors, testers, samplers, and weighers	817	49.6	13.6	9.5
Transportation and material moving occupations	4,564	8.9	14.0	7.5
Motor vehicle operators	3,380	10.8	14.8	7.4
Trucks, heavy and light	2,452	4.3	13.3	7.7
Transportation occupations, except motor vehicles	203	2.1	3.9	4.3
Material moving equipment operators	981	3.6	13.6	8.7
Industrial truck and tractor operators	386	5.0	19.4	11.1
Handlers, equipment cleaners, helpers, and laborers [1]	4,685	16.3	16.6	10.5
Freight, stock, and material handlers	1,713	15.8	17.0	8.2
Laborers, except construction	1,128	17.7	18.0	9.6
Farming, forestry, and fishing	3,444	15.9	6.5	10.5
Farm operators and managers	1,337	14.1	1.4	1.1
Other agricultural and related occupations	1,917	18.1	9.7	17.4
Farm workers	940	23.6	8.6	21.1
Forestry and logging occupations	112	4.4	16.8	3.5
Fishers, hunters, and trappers	77	9.0	(Z)	11.7

Z Less than .05 percent. [1] Includes other occupations, not shown separately.

Source: U.S. Bureau of Labor Statistics, *Employment and Earnings*, January 1987.

0-8
3

NO. 631. EMPLOYMENT BY SELECTED INDUSTRY, 1970 TO 1986, AND PROJECTIONS, 2000

[In thousands, except percent. Figures may differ from those in other tables since these data exclude establishments not elsewhere classified (SIC 99); in addition, agriculture services (SIC 074, 5, 8) are included in agriculture, not services. See source for details]

SIC [1] code	INDUSTRY	EMPLOYMENT				ANNUAL AVERAGE RATE OF CHANGE		
		1970	1980	1986	2000 [2]	1970–1980	1980–1986	1986–2000 [2]
(x)	**Total**	**81,664**	**102,019**	**111,623**	**133,029**	**2.3**	**1.5**	**1.3**
(x)	Nonfarm wage and salary	70,725	90,043	99,044	119,156	2.4	1.6	1.3
(x)	Goods-producing (excluding agriculture)	23,578	25,659	24,681	24,678	.8	−.6	-
10–14	Mining	623	1,027	783	724	5.1	−4.4	−.6
15–17	Construction	3,588	4,346	4,904	5,794	1.9	2.0	1.2
20–39	Manufacturing	19,367	20,286	18,994	18,160	.5	−1.1	−.3
24, 25, 32–39	Durable	11,210	12,188	11,244	10,731	.8	−1.3	−.3
24	Lumber and wood products	646	691	711	693	.7	.5	−.2
25	Furniture and fixtures	440	465	497	563	.6	1.1	.9
32	Stone, clay, and glass products	644	662	586	535	.3	−2.0	−.6
33	Primary metal industries	1,260	1,142	753	574	−1.0	−6.7	−1.9
331	Blast furnaces and basic steel products	627	512	275	202	−2.0	−9.8	−2.2
34	Fabricated metal products	1,560	1,613	1,433	1,313	.3	−2.0	−.6
35	Machinery, except electrical	1,984	2,494	2,059	2,129	2.3	−3.1	.2
3573	Electronic computing equipment	194	354	418	503	6.2	2.8	1.3
36	Electrical and electronic equipment [3]	1,871	2,091	2,124	2,128	1.1	.3	-
3662	Radio and TV communication equipment	362	378	505	542	.4	4.9	.5
3674	Semiconductors and related devices	(NA)	223	268	289	(NA)	3.1	.5
37	Transportation equipment	1,852	1,900	2,016	1,697	.3	1.0	−1.2
371	Motor vehicles	799	788	865	749	−.1	1.6	−1.0
38	Instruments and related products	527	712	707	771	3.1	−.1	.6
39	Miscellaneous manufacturing	426	418	362	329	−.2	−2.4	−.7
20–23, 26–31	Nondurable	8,157	8,098	7,750	7,429	−.1	−.7	−.3
20	Food and kindred products	1,786	1,708	1,617	1,456	−.4	−.9	−.7
21	Tobacco manufactures	83	69	59	46	−1.8	−2.6	−1.8
22	Textile mill products	974	847	706	607	−1.4	−3.0	−1.1
23	Apparel and other textile products	1,364	1,264	1,105	924	−.8	−2.2	−1.3
26	Paper and allied products	705	693	675	655	−.2	−.4	−.2
27	Printing and publishing	1,104	1,252	1,458	1,706	1.3	2.6	1.1
28	Chemicals and allied products	1,049	1,107	1,023	950	.5	−1.3	−.5
29	Petroleum and coal products	192	198	169	127	.3	−2.6	−2.0
30	Rubber and miscellaneous plastics products	580	727	789	861	2.3	1.4	.6
31	Leather and leather products	320	233	152	98	−3.1	−6.9	−3.1
(x)	Service-producing	47,147	64,384	74,363	94,478	3.2	2.4	1.7
40–42, 44–49	Transportation and public utilities	4,517	5,146	5,244	5,719	1.3	.3	.6
40–42, 44–47	Transportation	2,696	2,962	3,041	3,500	.9	.4	1.0
48	Communications	1,130	1,357	1,279	1,222	1.8	−1.0	−.3
49	Public utilities	691	827	924	998	1.8	1.9	.6
50–51	Wholesale trade	3,993	5,275	5,735	7,266	2.8	1.4	1.7
52–59	Retail trade	11,048	15,035	17,845	22,702	3.1	2.9	1.7
58	Eating and drinking places	2,575	4,626	5,879	8,365	6.0	4.1	2.6
60–67	Finance, insurance, and real estate	3,646	5,159	6,297	7,917	3.5	3.4	1.7
70–86, 89	Services [3]	11,390	17,528	22,531	32,545	4.4	4.3	2.7
70	Hotels and other lodging places	(NA)	1,076	1,401	1,971	(NA)	4.5	2.5
72	Personal services	989	901	1,104	1,357	−.9	3.4	1.5
73	Business services [3]	1,676	3,092	4,781	8,121	6.3	7.5	3.9
734	Services to dwellings and other buildings	295	495	681	1,020	5.3	5.5	2.9
736	Personnel supply services	(NA)	563	1,017	1,851	(NA)	10.4	4.4
737	Computer and data processing services	(NA)	304	591	1,203	(NA)	11.7	5.2
7391, 2, 7	Research, management, and consulting services	(NA)	539	788	1,301	(NA)	6.5	3.6
79	Amusement and recreation services	468	764	915	1,204	5.0	3.1	2.0
80	Health services	[3] 3,053	5,278	6,551	9,774	5.6	3.7	2.9
801–4	Offices of health practitioners	(NA)	1,211	1,672	3,061	(NA)	5.5	4.4
805	Nursing and personal care facilities	(NA)	997	1,250	2,097	(NA)	3.8	3.8
806	Hospitals, private	1,863	2,750	3,038	3,513	4.0	1.7	1.0
807–9	Outpatient facilities and health services, n.e.c.[4]	(NA)	320	591	1,103	(NA)	10.7	4.6
81	Legal services	236	498	748	1,267	7.8	7.0	3.8
82	Educational services	940	1,138	1,428	1,620	1.9	3.9	.9
83, 4, 6, 9	Social, membership, and miscellaneous services	(NA)	3,704	4,296	5,569	(NA)	2.5	1.9
(x)	Government	12,553	16,241	16,711	18,329	2.6	.5	.7
(x)	Federal government	2,731	2,866	2,899	3,000	.5	.2	.2
(x)	State and local government	9,822	13,375	13,812	15,329	3.1	.5	.7
01, 2, 7, 8, 9	Agriculture	3,506	3,426	3,252	2,917	−.2	−.8	−.8
88	Private households	1,794	1,256	1,241	1,215	−3.5	−.2	−.1
(x)	Nonfarm self-employed and unpaid family workers	5,639	7,294	8,086	9,741	2.6	1.7	1.3

− Represents or rounds to zero. NA Not available. X Not applicable. [1] Standard Industrial Classification; see text, section 13. [2] Projections based on assumptions of moderate growth; see source for details. [3] Includes other industries, not shown separately. [4] N.e.c. means not elsewhere classified.

Source: U.S. Bureau of Labor Statistics, *Monthly Labor Review*, September 1987.

Stat Abstract of US, 1988 ed

BEST JOBS FOR THE FUTURE

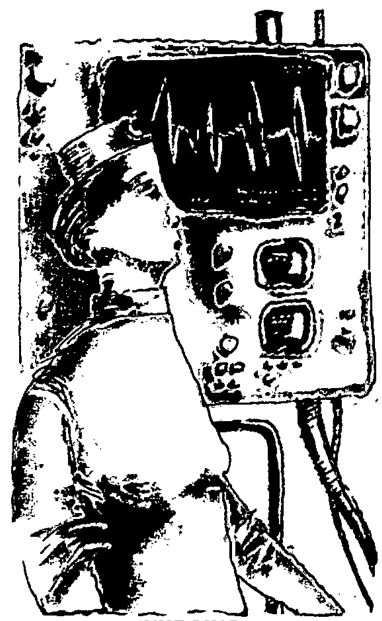
Whether you're counting the days until you get your sheepskin or your pension, you're about to feel the earth move. The first mild tremor should come from a recession; then hang on for a real upheaval—one that will go on for many years. The landscape of the job market is changing under economic and demographic pressures nearly as inexorable as the geological forces that shape the face of the earth. Advancing technology, increasing demand for services and an aging population are just some of the forces burying some occupations and creating high ground for others.

As the economy goes, so goes the job market. Today's mostly sunny economic weather, which has resisted being blown away by the winds of the stock-market crash, is deceptive. Most economists see a recession coming in 1989. And 1 in 5 economists surveyed by *Blue Chip Economic Indicators,* a Sedona, Ariz., newsletter, believes it will happen this year.

Recession parches the economy by drying up demand. Construction workers and makers of durable items would likely feel the pinch first, since buyers of houses and washing machines could quickly postpone their purchases if they sensed

HOTEL MANAGEMENT

As hotel chains expand, you can share in their growth



NURSING

A critical shortage won't go away yet hasn't produced high pay

The one-company career is all but obsolete. Now you have to be nimble–to know what kinds of jobs to go after and when to look for another as conditions change. Here's a guide.

JOBS ON THE RISE

Fastest-growing occupations (1986-2000)

Biggest percentage increases		Most jobs added	
Paralegals	103.7%	Retail salespeople	1.2 mil.
Medical assistants	90.4%	Waiters, waitresses	752,000
Physical therapists	87.5%	Registered nurses	612,000
Physical and corrective-therapy assistants and aides	81.6%	Janitors, cleaners, housekeepers	604,000
Data-processing-equipment repairers	80.4%	General managers, top executives	582,000
Home-health aides	80.1%	Cashiers	575,000
Podiatrists	77.2%	Truckdrivers	525,000
Computer-systems analysts	75.6%	General office clerks	462,000
Medical-records technicians	75.0%	Food-counter and related workers	449,000
Employment interviewers, private or public-employment service	71.2%	Nurses' aides, orderlies, attendants	433,000
Computer programers	69.9%	Secretaries	424,000
Radiological technologists, technicians	64.7%	Security guards	383,000
Dental hygienists	62.6%	Accountants, auditors	376,000
Dental assistants	57.0%	Computer programers	335,000
Physician assistants	56.7%	Food-preparation workers	324,000

USN&WR—Basic data: U.S. Dept. of Labor

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Ford Tempo GLS

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danger. No matter what the industry, fatter, less competitive companies will find themselves poorly equipped to survive an economic downturn and will lay off workers.

But this short-haul potential economic gloom doesn't have to spell career doom. Even if the economy stumbles, changing technology and demographics will bring new opportunities. Says Ronald Kutscher, an associate commissioner in the Office of Economic Growth and Employment Projections, a part of the Bureau of Labor Statistics: "Motivation and interest are always important, but the next step is to examine those professions that offer prospects of growing faster than average."

Examples abound. The American population is aging, and so job opportunities in health care are looking up. By the end of the century, the number of people age 85 and older will have grown at an annual rate of 4 percent as opposed to just 1 percent for the population in general. Many new retirees will head south, where they eventually will need care as well as housing, recreation and a host of services. Florida, with its coastal retirement communities, will be the single most recessionproof area of the country, say Marvin Cetron and Owen Davies, authors of *The Great Job Shakeout*, a guide to career planning in tough economic times, to be published by Simon & Schuster this fall. As the end of the century nears, 12 of the fastest-growing occupations will be in the health-services field.

ACCOUNTING

Number crunchers will find lots of openings in coming years

ENGINEERING

Electrical and mechanical will be especially hot specialties

ILLUSTRATIONS BY EUGENE YELCHIN FOR USN&WR

The insatiable demand for all services will generate 20 million new jobs by the year 2000, according to the Bureau of Labor Statistics. The hotel, restaurant and other industries in the business of selling convenience to a population on the go will flourish. The boom, in fact, already is under way. The Marriott Corporation, a major hotel-and-restaurant chain, has grown at an annual rate of about 20 percent in each of the past five years, and the company sees no letup, says Kathleen Alexander, vice president of personnel services. As the service sector grows, the ripples will spread to second-tier companies that service the service industry. Contract cleaning of buildings, management consulting and agencies that supply temporary workers, for example, all will share in the boom.

New products, new businesses

The expanding service sector offers risk takers another dimension of opportunity—entrepreneurship. In his book *Job Creation in America* (Free Press, New York, 1987), David Birch, president of marketing consultants Cognetics, Inc., in Cambridge, Mass., notes that most jobs created in the next few years will be in the realm of small businesses. Many of those jobs will be centered around universities and research centers—places such as Austin, Tex.; Raleigh-Durham, N.C.; Washington, D.C., and Boston. Research in these brain-trust sites often spawns new products and spins off fledgling businesses to market them. College towns also tend to supply talented, creative employes.

Competition among employers for the bright minds will get tougher. Workers ages 16 to 24 made up 20 percent of the labor force in 1986 but by 2000 will account for a mere 16 percent. As the millennium approaches, the labor force will be shaped more decisively by women and minorities. While the share of white male workers falls, women will make up 47 percent of the labor force by the year 2000—up from 44 percent in 1986. The percentage of minorities will climb to 26 percent, up from 21 percent. Professional and management slots should grow to 23.1 percent of the total work force from today's 21.6 percent. Result: The white, Old Boy network will have to be more receptive to the advancement of women and minorities. Progressive employers already are offering on-site child care and other perks to attract and keep women.

While demographic and technological changes should open some doors, others will close. Despite the rust-belt revival sparked by a weak dollar and growing exports, the manufacturing sector is expected to lose 834,000 jobs by the year 2000. Robots are now doing the painting in car factories. Companies need highly skilled workers to install and repair robots, and fewer semiskilled people to paint cars.

The more education and technical skills you have, the better your chances of employment. Of the 3,000 new college graduates hired by IBM last year, for example, about 55 percent were placed in technical areas. Cities that are home to technology-related businesses will do well; Los Angeles, Anaheim and Minneapolis are all expected to prosper in the coming years, for instance.

Sometimes even education can't combat economic forces. While mushrooming technology has made employers eager for electrical and mechanical engineers, dribbling oil prices have cooled enthusiasm for petroleum engineers. They're not the only casualties. In the wake of the

JOBS IN DECLINE

Shrinking occupations (1986-2000)

Biggest percentage decreases

PBX installers, repairers	–23.1%
Textile-machine operators, tenders	–25.2%
Statistical clerks	–26.4%
Farmers	–28.1%
Stenographers	–28.2%
Chemical-plant and system operators	–29.6%
Chemical-equipment controllers, operators	–29.7%
Telephone-station installers, repairers	–31.8%
Shoe-sewing-machine operators, tenders	–32.1%
Industrial truck, tractor operators	–33.6%
Gas, petroleum-plant and system jobs	–34.3%
Railroad brake, signal, switch operators	–39.9%
Railroad conductors, yardmasters	–40.9%
Electronic-semiconductor processors	–51.1%
Electrical, electronic assemblers	–53.7%

Most jobs lost

Machine workers	–19,000
Retail-delivery drivers	–20,000
Stock clerks	–23,000
Payroll, timekeeping clerks	–25,000
College, university faculty	–32,000
Child-care workers, private household	–38,000
Stenographers	–50,000
Textile draw-out and winding-machine operators, tenders	–55,000
Data-entry keyers, except composing	–66,000
Sewing-machine operators, clothing	–92,000
Typists, word processors	–140,000
Industrial truck, tractor operators	–143,000
Farm workers	–190,000
Farmers	–332,000

USN&WR—Basic data: U.S. Dept. of Labor stock-market plunge, many new M.B.A.'s with finance majors are walking Wall Street, not working on it. Marketing M.B.A.'s, however, are getting offers from old standbys like auto makers and the food industry.

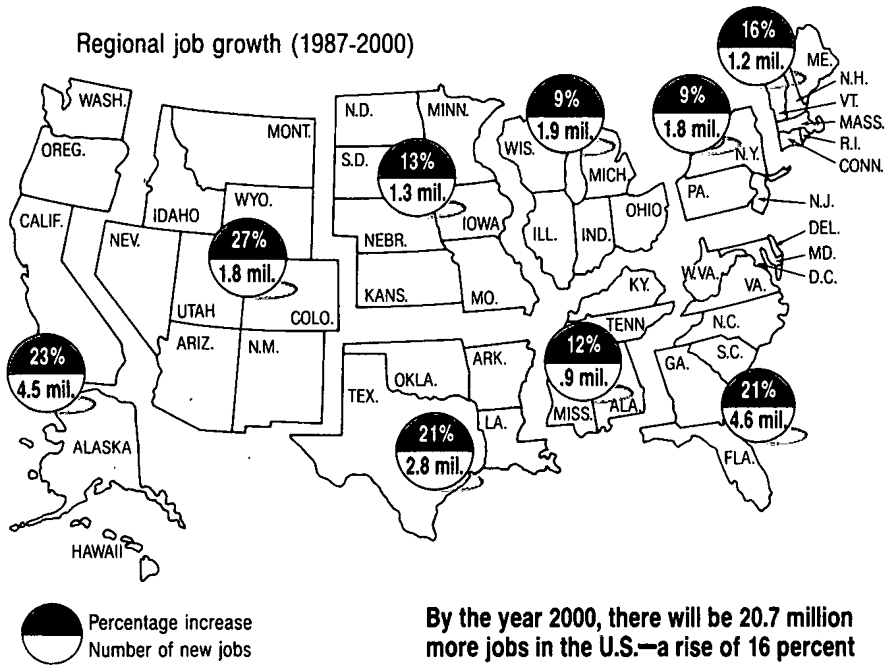
Because of changing economics and technology, count on acquiring new skills and training throughout your career if you want to succeed. "Not that long ago you could get out of school and not go to more-formal training," says Esther Schaeffer, vice president of policy for the National Alliance of Business, a nonprofit group focused on human-resource issues, "but now learning is a lifelong situation."

Whether you have to change jobs or simply choose to, you won't be alone. The Bureau of Labor Statistics estimates that the average worker will have six employers in the course of a lifetime. Today's college graduates are even taught to expect to face these changes. Victor Lindquist, director of placement for Northwestern University, coaches his students: "It's wonderful to start as a chemical engineer—but do you really think you'll retire as one?" Between changing technology and shifting demographics, don't bet on it. ■

by Jill Rachlin

A geographical guide to the jobs of the future

MAPPING THE MARKETS



By the year 2000, there will be 20.7 million more jobs in the U.S.—a rise of 16 percent

USN&WR—Basic data: NPA Data Services, Inc.

USN&WR MAP BY CHRISTOPHER WORSLEY

FEW NEW JOBS

U.S. metropolitan areas with slowest projected employment growth, 1987-2000

	Change in number of jobs	Percentage change
Decatur, Ill.	3,000	4.5%
Dubuque, Iowa	3,000	5.9%
Great Falls, Mont.	3,000	7.3%
Hagerstown, Md.	3,000	5.4%
Kankakee, Ill.	3,000	6.5%
Kenosha, Wis.	3,000	6.3%
Muncie, Ind.	3,000	5.1%
Muskegon, Mich.	3,000	4.7%
Terre Haute, Ind.	3,000	4.5%
Anderson, Ind.	2,000	3.2%
Beaver County, Pa.	2,000	2.9%
Cumberland, Md.–W.Va.	2,000	4.7%
Danville, Va.	2,000	3.7%
Gadsden, Ala.	2,000	4.7%
Kokomo, Ind.	2,000	3.5%
Sharon, Pa.	2,000	3.8%
St. Joseph, Mo.	2,000	4.3%
Williamsport, Pa.	2,000	3.4%
Elmira, N.Y.	1,000	2.3%
Jackson, Mich.	1,000	1.7%
Pueblo, Colo.	1,000	2.1%
Benton Harbor, Mich.	0	0
Steubenville, Ohio–Weirton, W.Va.	0	0
Battle Creek, Mich.	-1,000	-1.7%
Jersey City, N.J.	-3,000	-1.1%

USN&WR—Basic data: NPA Data Services, Inc.

THE URBAN GAINERS

U.S. metropolitan areas with greatest projected job growth (1987-2000)

Most jobs created	New jobs	Percentage change
Los Angeles–Long Beach, Calif.	724,000	15.1%
Anaheim–Santa Ana, Calif.	616,000	45.6%
Washington, D.C.	522,000	21.4%
Houston, Tex.	515,000	30.7%
Dallas, Tex.	472,000	31.1%
Atlanta, Ga.	452,000	28.1%
Boston, Mass.	396,000	15.9%
San Diego, Calif.	351,000	29.3%
San Jose, Calif.	349,000	35.8%
Phoenix, Ariz.	347,000	34.3%
Denver, Colo.	291,000	29.0%
Minneapolis–St. Paul, Minn.	290,000	19.9%
Tampa–St. Petersburg, Fla.	286,000	30.0%
Seattle, Wash.	278,000	25.4%
Chicago, Ill.	261,000	7.6%
Nassau–Suffolk, N.Y.	259,000	18.6%
Philadelphia, Pa.	256,000	10.0%
Fort Lauderdale, Fla.	216,000	37.5%
San Francisco, Calif.	215,000	18.2%
Orlando, Fla.	215,000	39.1%
Riverside–San Bernardino, Calif.	198,000	26.3%
Oakland, Calif.	196,000	19.4%
Sacramento, Calif.	193,000	28.6%
Miami–Hialeah, Fla.	188,000	18.5%
Baltimore, Md.	180,000	13.8%

Largest percentage increase	Percentage change	New jobs
Naples, Fla.	53.7%	36,000
Fort Myers, Fla.	51.8%	71,000
Fort Pierce, Fla.	48.9%	46,000
Anaheim–Santa Ana, Calif.	45.6%	616,000
West Palm Beach, Fla.	42.5%	172,000
Bradenton, Fla.	41.4%	36,000
Boulder–Longmont, Colo.	39.1%	54,000
Orlando, Fla.	39.1%	215,000
Ocala, Fla.	38.4%	28,000
Santa Rosa–Petaluma, Calif.	37.6%	65,000
Fort Lauderdale, Fla.	37.5%	216,000
San Jose, Calif.	35.8%	349,000
Bryan–College Station, Tex.	35.0%	21,000
Sarasota, Fla.	34.8%	46,000
Las Vegas, Nev.	34.5%	113,000
Phoenix, Ariz.	34.3%	347,000
Santa Cruz, Calif.	34.0%	35,000
Oxnard–Ventura, Calif.	33.9%	92,000
Fort Collins–Loveland, Colo.	33.7%	28,000
Portsmouth, N.H.	33.1%	56,000
Reno, Nev.	32.5%	52,000
Austin, Tex.	32.2%	133,000
Tucson, Ariz.	32.0%	91,000
Gainesville, Fla.	31.5%	34,000
Dallas, Tex.	31.1%	472,000

USN&WR—Basic data: NPA Data Services, Inc.

Moving out of the classroom

Employers are clamoring for talented graduates who are well-rounded—and can think beyond a specialty

The class of '88 is in luck. Although graduates will step out of ivied walls into shifting sands—an economy where no career path is secure—they will find entry-level job openings plentiful. Schools, hospitals, corporations and, yes, even investment banks are recruiting zealously. Accounting firms, which tend to set the salary pace for business professions, are offering new hires as much as $28,000—or 20 percent more than last year. "It's going to be a good year," says Sharon Baughan, head of career counseling and placement at Johns Hopkins University.

Indeed, while mergers and restructurings have put many middle managers out on the pavement, neophytes have an edge: They can be hired for less money than seasoned candidates. Fresh out of the starting gate, they tend to be enthusiastic and competitive. In some professions—computer science and construction engineering, for example—recent graduates may be more qualified than experienced pros because of their state-of-the-art knowledge.

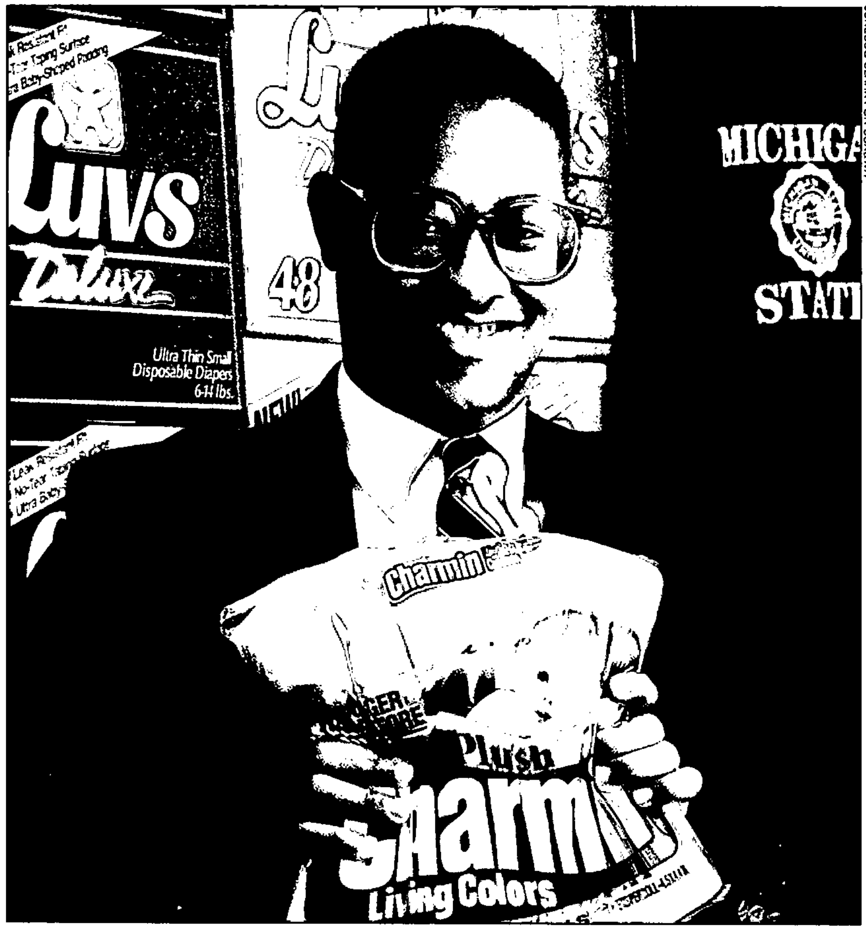
Where demand is hot

Furthermore, entry-level positions are constantly opening as employes move up or out. Even on Wall Street, where the postcrash retrenchment has led to layoffs of some 25,000 people since October, investment banks still need a regular fix of research analysts, who typically join the firms for a two-year stint and then move on. Right now, graduates are being actively recruited on campus for analyst-training programs. "A snowstorm at O'Hare Airport did more to disrupt recruiting efforts than the stock-market crash," notes Dan Blanco, a coordinator for career development and placement at Iowa State University. Demand is particularly hot this year for people to fill entry-level positions in accounting, management-information systems, computer science, purchasing and marketing. Consumer-goods manufacturers, hotel chains, airlines and financial-services firms are among those clamoring most loudly for new hires.

Still, a rosy immediate-term job outlook doesn't mean that college students and recent graduates can afford to assume that their futures are secure. The days are past when a degree and a first job in just about any given field were first steps along an orderly, predictable career path—one that often led from the lower echelons to the upper reaches of the same organization. Indeed, young workers could find themselves back at square one if they're unprepared to keep a sharp eye on their company's health, to jump to another firm if necessary or to get further training as advancing technology overtakes their skills. New, computer-aided technology has virtually eliminated the need for architectural drafters, for example, and modular-construction techniques have cooled the need for carpenters. Most new entrants in the job market can look forward to a career that progresses with all the predictability of a ball ricocheting inside a pinball machine, says Howard Figler, director of the career center at the University of Texas at Austin and author of *The Complete Job Search Handbook* (Henry Holt, $11.95). To get ahead, he says, "you may have to bounce somewhere else."

In fact, unless you're aiming for a

continued on page 66



JUNEBUG CLARK FOR USN&WR

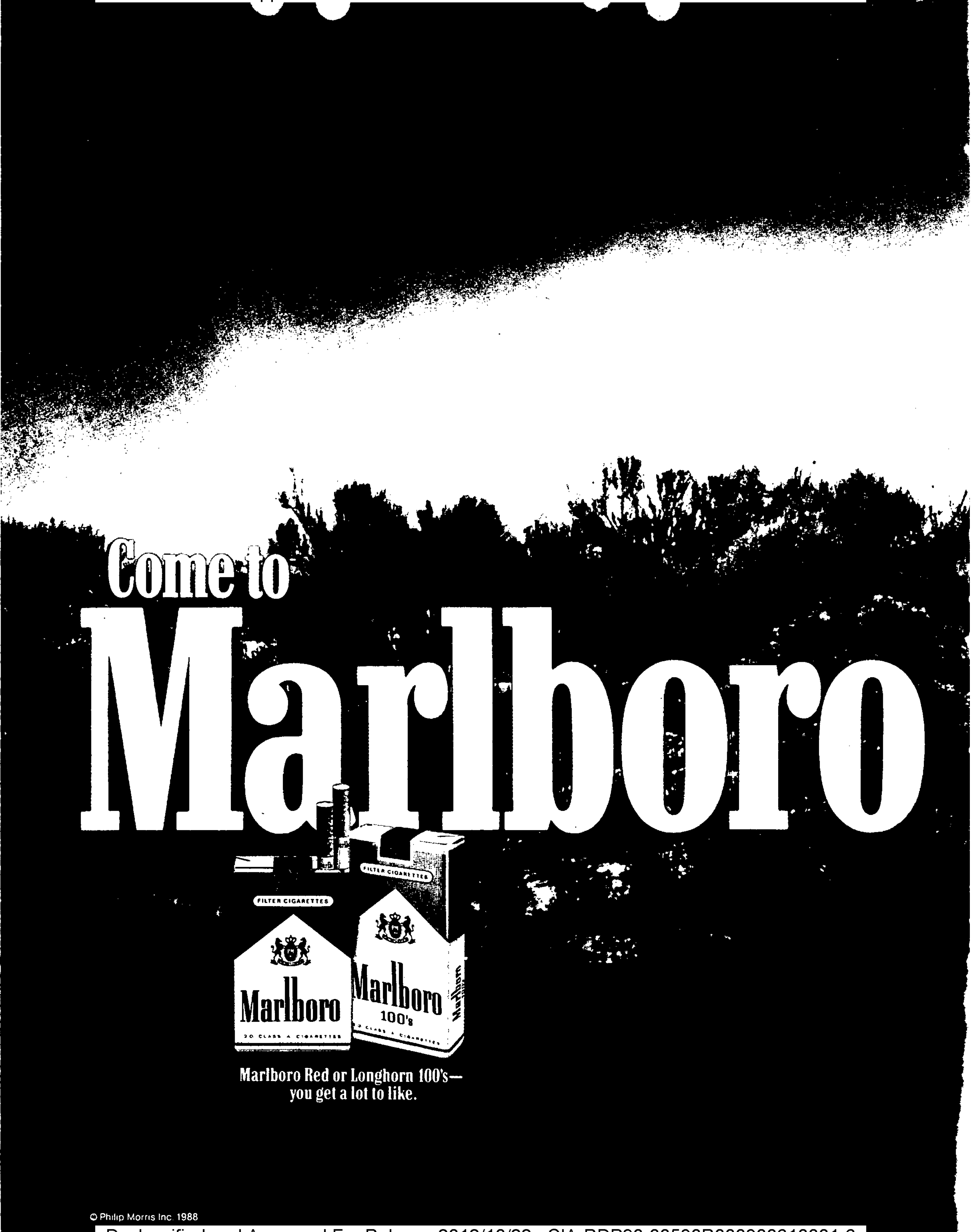
June graduate Vincent Clark is getting set to sell for Procter & Gamble

JUNEBUG CLARK FOR USN&WR

Fitzpatrick

SUMMER WORK DOES COUNT

When employers look at two competent students, they'll ask, 'Which one knows the job?' " says Edwin Fitzpatrick, acting director of placement services at Michigan State University. At least in this case, the answer is MSU senior Clark, who interned at Procter & Gamble last summer. His performance selling paper products sent his superiors a clear message—so Clark, 22, will join the company as a sales rep, at a salary of about $25,000.



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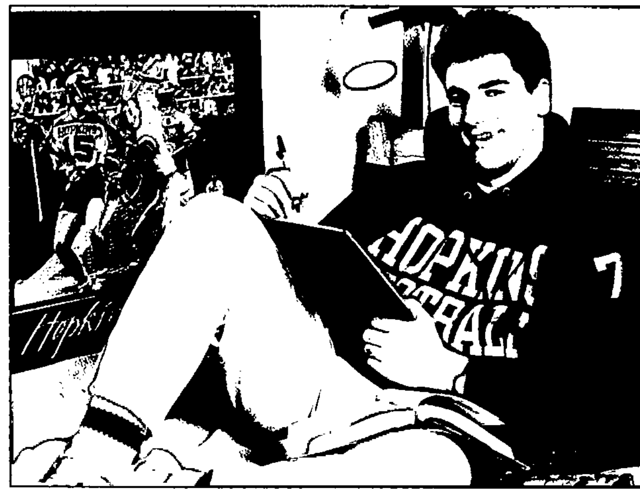
BILL GILLETTE FOR USN&WR

Iowa State senior Marcia Mohr is off to consult in Chicago

MANUELLO PAGANELLI FOR USN&WR



Liberal-arts grad Alexis Malas is bound for Wall Street

KEEP YOUR OPTIONS OPEN

"Be versatile," says Howard Figler, chief of the University of Texas Austin career center. Mohr, 21, who grew up in depressed farm country, learned that lesson. A math degree got her a job with Arthur Andersen—but she has a teaching certificate just in case because "teachers are always in demand."

ZACH RYALL FOR USN&WR

Figler

DON'T OVERSPECIALIZE

A broad education gives flexibility—and attracts employers, says Patricia Rose, head of placement at the University of Pennsylvania. Johns Hopkins senior Malas, 22, prepared for his job as a Goldman, Sachs financial-analyst trainee by salting his liberal-arts course load with economics.

SCOTT THODE—USN&WR

Rose

position in a technically oriented field such as computer programing, your strongest selling point—and your life preserver in an economic downturn—may be a *lack* of specialization. One of the qualities employers in the business world look for in new hires is the ability to flex—to transfer skills from one function to another. Recruiters in fields from banking to sales increasingly prefer applicants with a liberal-arts education. They feel that someone who has studied politics, philosophy, the sciences and the humanities and who has learned how to question has a broader perspective on problem solving and the ability to become competent in a variety of jobs. Says Glenn Blake, director of employment and management development at General Mills: "People who are too narrowly focused are in the 'greatest risk' category." Blake looks for students with many interests who want to run a business and can move into a variety of management positions. He would rather hire someone for an accounting slot who is educated in the arts and has some training in accounting than an accounting major with a 3.9 average and no background in anything else.

Successful practice in motivating people counts, too. "We see companies looking more for a personality type than a degree," says Pamela Bolen, director of the office of career planning and placement at New York University. Procter & Gamble, for example, wants "impact players"—highly motivated students who are leaders on campus.

PAYCHECKS FOR '88

Average starting salary, by degree

Bachelor's degrees	
Engineering	$29,820
Computer science	$28,331
Physics	$24,276
Economics, finance	$23,136
Accounting	$22,838
Chemistry	$22,647
Marketing, sales	$21,472
Mathematics	$21,246
General business administration	$20,335
Journalism	$19,843
Social science	$19,672
Agriculture	$19,401
Personnel administration	$19,319
Liberal arts, arts and letters	$19,213
Advertising	$18,983
Education	$18,850
Hotel/restaurant management	$18,693
Communications	$18,120
Human ecology, home economics	$17,398
Natural resources	$17,271
Retailing	$17,035
Geology	$16,649
Master's degrees	
M.B.A. with technical B.S.	$38,412
M.B.A. with nontechnical B.A.	$36,120
Engineering	$34,776
Other technical fields	$30,936
Other nontechnical fields	$30,840
Accounting	$29,700
Doctorates, other advanced degrees	
M.D.'s	$85,630
D.D.S.'s	$40,190
J.D.'s, LL.B.'s	$32,757
Ph.D.'s	$31,479

Note: Figures are 1988 projections except those for M.D.'s, D.D.S.'s and J.D.'s, which are actual 1986 averages.
USN&WR—Basic data: Northwestern University Lindquist-Endicott Report 1988; Michigan State University *Recruiting Trends 1987-88; Medical Economics*, Sept. 7, 1987; National Association for Law Placement; American Dental Association

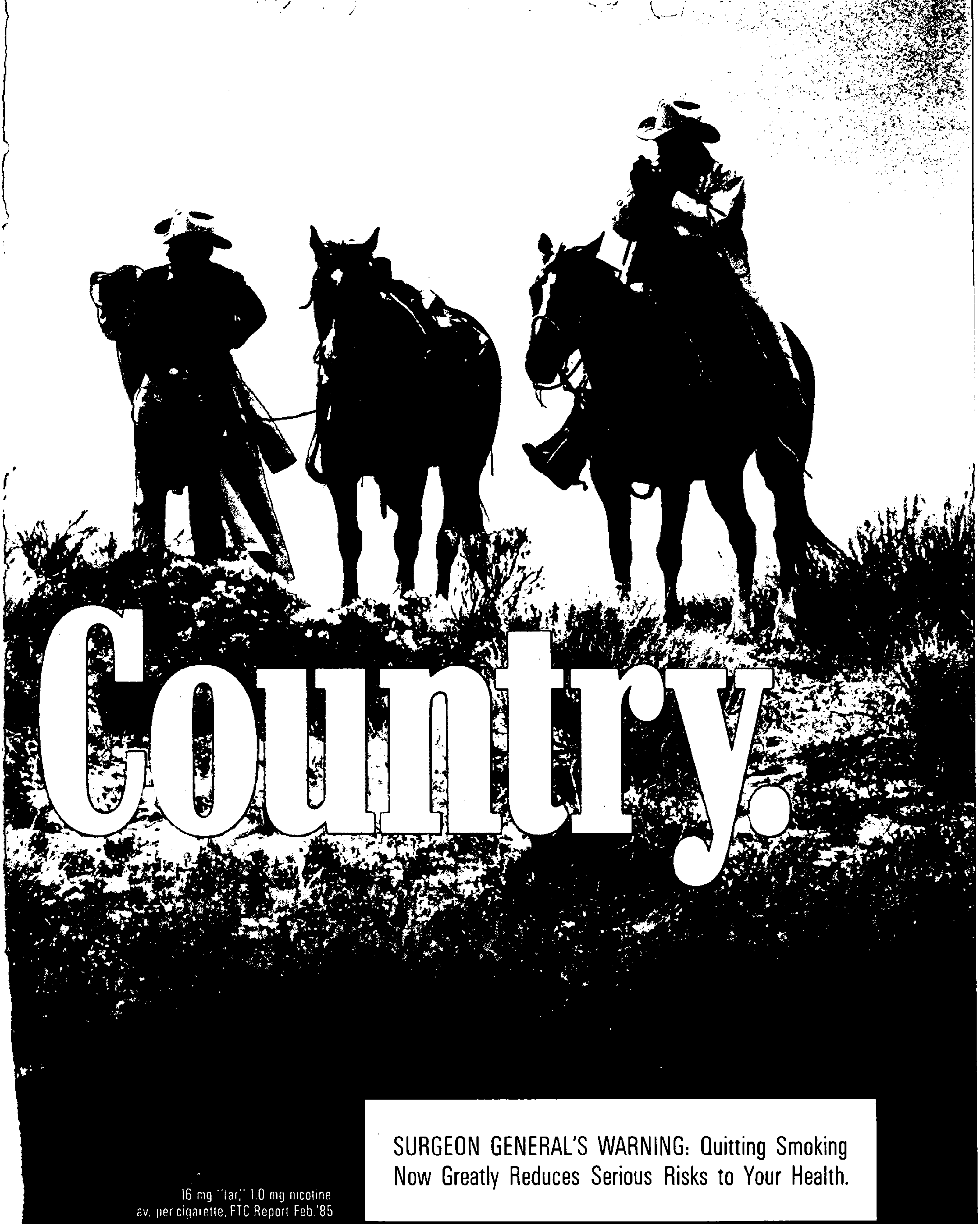
That said, industry has been forced by rapid technological change to compete for those capable of designing and applying the technology. Consequently, the top starting salaries go to graduates with specialized engineering degrees. At Michigan State University, for example, electrical-engineering graduates are getting average salary offers of $29,300. But a recent study by AT&T shows that about seven years down the road, the more generally educated worker tends to catch up and pass—both in pay and responsibility—the worker with only technical training.

Finding all those openings

Sales experience may offer the generalist the best odds of gaining that responsibility. "The sales function is probably the fast track into management," says Vincent Clark, a 1988 graduate of Michigan State University who has accepted a job in sales with Procter & Gamble. "Ultimately, that's where I'd like to end up." Career counselors point out that salespeople are tapped later for

continued on page 70

SALARY SURVEY, pages 68-69: A sampling of pay in jobs across the country



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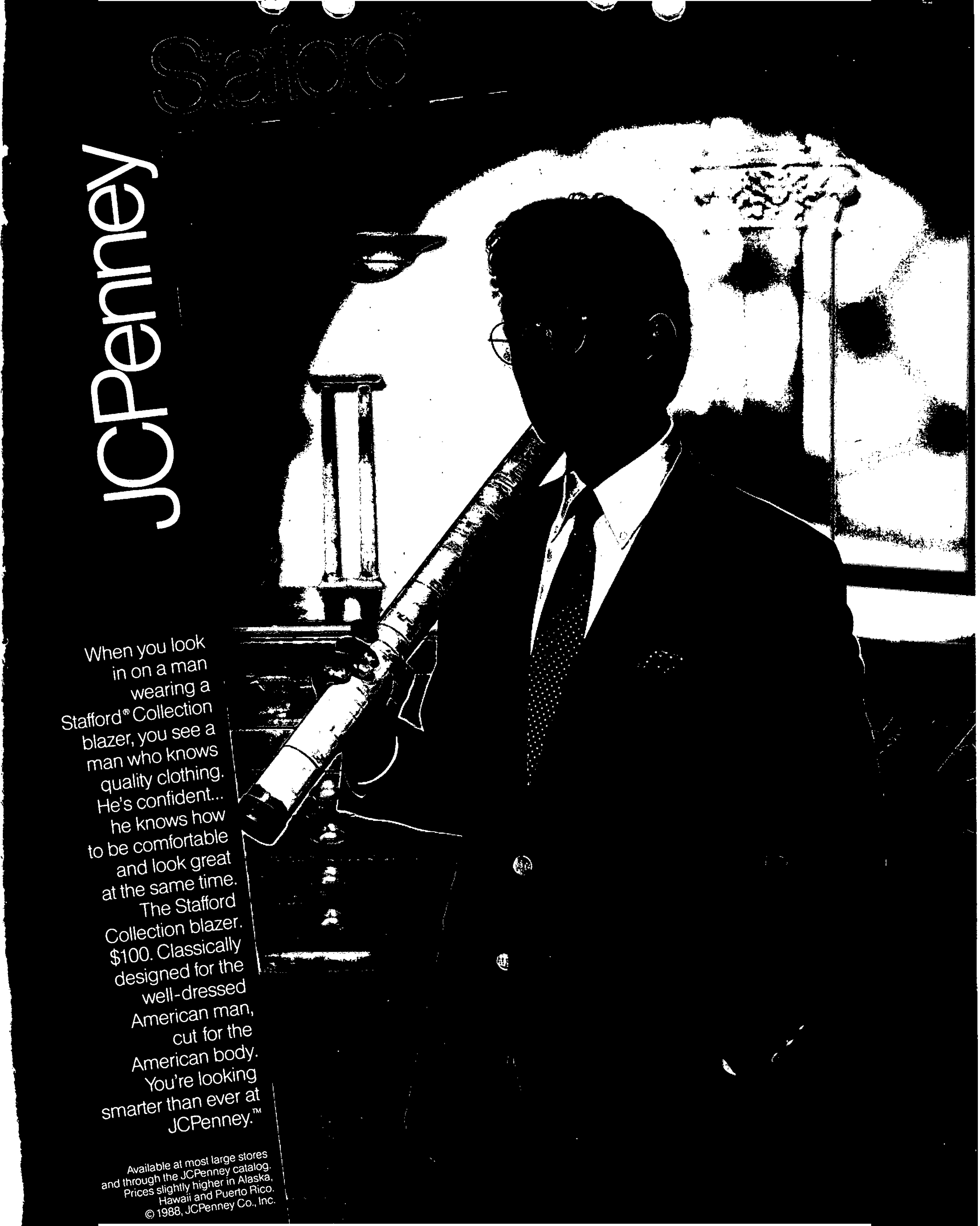
What jobs are worth around the country

How much people make has much to do with where they make it. That was an important finding of our 10-city survey of 10 jobs at 3 career levels.

	ATLANTA *Georgia*	AUSTIN *Texas*	CHICAGO *Illinois*	LOS ANGELES *California*
Tax attorney in private practice				
Starting associate	$52,900	$48,000	$55,000	$60,000
First-year partner	$90,000	$100,000	$120,000	$125,000-150,000
Senior partner	$100,000-300,000	$270,000	$250,000	$350,000-600,000
Computer programer				
Starting systems or software programer	$28,800	$24,900	$26,800	$29,500
Senior analyst	$42,700	$35,200	$38,000	$42,000
Computer-systems director	$63,600	$66,000	$83,000	$75,000
Financial manager, Fortune 1,000 company*				
Beginning manager (with M.B.A.)	$34,000	$20,600-27,300	$27,000-40,000	$41,000
Dept. or division chief (with M.B.A.)	$48,000	$38,100-51,400	$50,000-74,000	$104,000
Chief financial officer (with M.B.A.)	$180,000	$59,000-86,000	$160,000-243,000	$450,000
Hotel manager				
Beginning assistant manager	$24,500	$20,900	$24,500	$20,000-22,000
Department manager	$37,000-60,000	$31,400-49,300	$37,000-60,000	$40,000
General manager	$74,000	$60,500	$74,000	$100,000
Journalist for a daily newspaper				
Starting reporter	$22,100	$19,500	$30,000	$19,000
Assistant city editor	$45,700	$40,000-45,000	$49,800	$35,000-45,000
Managing editor	$100,000	$75,000-100,000	$100,000	$120,000-140,000
Mechanical engineer				
Starting engineer	$19,000**	$29,000	$29,000	$28,000
Senior engineer (5-10 years' experience)	$32,000	$42,000	$42,000	$38,000
Director or department manager	$60,000	$50,000	$50,000	$65,000
Police officer				
Police officer	$21,400	$20,800	$24,900	$30,400
Sergeant	$24,000	$32,000	$30,600	$44,400
Captain	$30,500	$42,500	$38,100	$60,700
Secretary in Fortune 1,000 company*				
Beginning secretary	$19,800	$12,300-14,100	$14,400-21,600	$17,300
Midlevel secretary	$20,800	$15,300-17,700	$16,400-24,700	$24,800
Executive secretary	$25,000	$20,600-24,000	$18,700-28,100	$29,800
Teacher in a public school				
Beginning teacher (with bachelor's degree)	$21,000	$19,500	$18,400	$23,400
Teacher at 10 years (with master's degree)	$29,800	$26,500	$31,800	$32,600
Teacher at 30 years (with master's degree)	$33,200	$31,000	$36,500	$32,600***
Urban planner				
Beginning planner	$24,000	$21,300	$19,800	$30,200
Midlevel planner	$33,000	$31,100	$26,600	$49,300
Director or senior planner	$45,500	$67,400	$37,200	$98,600

*The Fortune 1,000 is the combination of the Fortune 500 industrial and Fortune 500 service firms. **Salaries are from a very small firm. ***Salary after 10 years increases only with post-master's-degree course work.

Note: Figures are representative salaries at each level, from actual companies or executive-search firms. Police officer, teacher and urban planner are public-sector jobs. Compensation for attorneys, CFO's and hotel managers does not include bonuses, stock options or other



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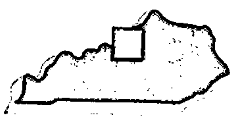
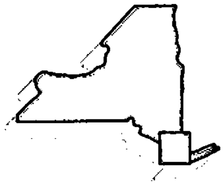
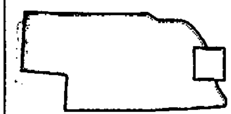
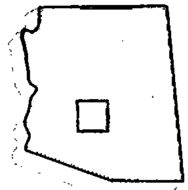
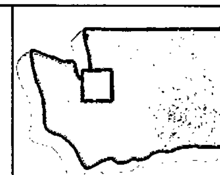
	 **LOUISVILLE** *Kentucky*	 **MANCHESTER/NASHUA** *New Hampshire*	 **NEW YORK** *New York*	 **OMAHA** *Nebraska*	 **PHOENIX** *Arizona*	 **SEATTLE** *Washington*
	$40,000 $90,000 $170,000	$35,000 $65,000-100,000 $100,000-150,000	$71,000 $200,000-240,000 $600,000	$38,000 $75,000 $225,000	$47,000 $90,000 $175,000	$45,000 $95,000-125,000 $180,000-250,000
	$29,600 $34,000 $55,000	$29,700 $38,000 $61,200	$34,000 $46,500 $99,800	$27,900 $36,100 $66,600	$29,500 $38,000 $64,000	$30,000 $36,200 $65,000
	$38,500 $53,500 $225,000	$28,000-30,000 $50,000-60,000 $80,000-100,000	$28,900 $93,900-117,400 $229,000	$37,000 $46,900 $150,000-200,000	$26,000 $36,000 $238,000	$28,800-45,600 $32,300-51,700 $120,000-192,000
	$20,000-22,000 $35,000-40,000 $40,000-45,000	$20,000-22,000 $30,000-33,000 $33,000-38,000	$22,500 $34,000-54,000 $67,000	$20,900 $31,400-49,300 $60,500	$20,000-22,000 $40,000 $85,000	$22,500 $34,000-54,000 $67,000
	$18,200-22,100 $41,600-46,800 $75,000-80,000	$23,600 $33,600 $39,000-45,000	$42,200 $46,800 $90,000-150,000	$15,600 $28,600 $40,300	$22,400 $34,700-52,500 $57,200-83,200	$24,700 $38,000-50,000 $58,000-84,000
	$28,000 $41,000 $55,000	$24,000 $36,000 $47,500	$28,000 $47,000 $60,800	$26,000 $43,000 $54,000	$28,000 $41,000 $60,000	$29,100 $40,700 $61,700
	$16,300 $23,500 $33,900	$21,600 $25,200 $30,400	$26,000 $41,500 $46,800	$23,600 $32,300 $43,700	$23,200 $29,300 $39,400	$27,800 $37,500 $46,800
	$15,700 $19,300 $21,500	$14,400 $16,600-24,000 $18,100-28,400	$15,500-20,600 $24,200-30,300 $26,700-33,300	$19,800 $30,100 $34,200	$16,000 $17,400 $20,000	$15,900-23,900 $17,500-26,200 $19,400-29,200
	$16,200 $25,000 $30,400	$18,000 $29,200 $32,600	$21,700 $34,700 $43,100	$17,800 $26,000 $28,500	$19,900 $31,700 $34,000	$17,100 $26,700 $32,400
	$19,500 $36,800 $42,000	$29,100 $34,200 $48,500	$27,800 $40,000 $68,000	$27,100 $37,500 $41,500	$23,500 $33,300 $53,100	$25,900 $34,000 $37,800

ɪrofit-sharing arrangements. Attorneys are at medium-to-large firms relative to others in that .ity. Computer-programer salaries are from Source Edp, a computer-industry placement firm; computer-systems directors are from firms with more than 40 employes. Hotel managers work for national chains in hotels with at least 200 rooms. Journalists work at metropolitan-area newspapers.

USN&WR—Compiled by Lynn Y. Anderson, Michael H. Gallagher and Orli Low

LEE BALGEMANN FOR USN&WR

M.B.A. student Deborah Green will work in the insurance industry

BILL GILLETTE FOR USN&WR

Blanco

BE TRUE TO YOURSELF

Pick a profession compatible with your aptitude and interests," says Dan Blanco, an Iowa State University placement coordinator. Green, an M.B.A. candidate at the University of Chicago, will join the Home Group as a financial analyst—a goal she began forming as a freshman, when she fell in love with accounting. "You have to level with yourself," says Green, 27. "When you look for a job, you're prepared. When they ask, 'Why do you want to work for me?' you know the answer."

managerial positions in marketing and finance because they have front-line combat experience, intimate knowledge of a firm's products and exposure to the way a business operates.

There's a conundrum at work this year: While openings may be plentiful, they won't be as easy to find as in years past. The high cost of campus recruiting has tended to force companies to limit their college visits to the biggest schools or to those with the greatest diversity of graduates. Only three years ago, for example, Westinghouse Electric Corporation fanned out to about 200 campuses across the country; it now targets just 75 schools proven to be sources of high-quality hires. Recruiters identify job candidates by talking to faculty members about student leaders, then inviting those leaders to dine with company representatives for preliminary interviews. You'll most likely attract recruiters if you were active in campus clubs and service organizations, held an elective office or worked as a residence-hall adviser.

But if you don't hear from a campus recruiter, don't despair: Recruiters represent a minute portion of all employers seeking new graduates. Companies with fewer than 500 employes—which rarely send recruiters to campuses—account for 3 out of 5 new jobs created in the private sector, and nearly half of those are professional, technical or managerial. Marcia Fox, senior vice president at Drake Beam Morin, a New York career-counseling service, estimates that some 75 percent of job seekers get jobs by asking for referrals and contacts from personal acquaintances—and from acquaintances of acquaintances.

Before you start placing calls, though, here's a tip: The key to job satisfaction is self-knowledge. Furthermore, interviewers will not be impressed if you communicate vagueness ("I'd like to work with people") or confusion about what you want to accomplish ("I'm not really sure what I want to do, but I like your company"). It's important to define your goals as best you can, keeping in mind your aptitudes, values, interests and the lifestyle you seek. Your college placement office may be able to assist in this. Through testing and discussion, counselors can help you focus your job search. *Getting to the Right Job,* by Steve Cohen and Paulo de Oliveira (Workman Publishing, $6.95), offers written exercises to help you pin down your aptitudes. If you have a personal computer, $95 and several hours to invest, consider Career Navigator, a software program designed by Drake Beam Morin and sold at most campus bookstores. It forces you to inventory your skills, then produces an outline of your résumé.

Many students put off the job search until the last semester of their senior year. That's a mistake. "The student who comes meandering in to the placement office two weeks before commencement will find most of the positions filled," warns Edwin Fitzpatrick, acting director of placement services at Michigan State University. You can find clues to potential openings by reading newspapers and trade journals for information about the economy and about specific companies. A news tidbit disclosing formation of a new division at a company that interests you or announcing a new product may translate as an immediate need for staff. Family, friends and acquaintances are all possible sources for connections. It may be wise to invest in an answering machine, since few employers will bother to write to invite you for an interview.

It's easy, once you're immersed in an interview, to get caught up in impressing a prospective employer and to neglect to find out if you want that position—or that company. Tough questions demand answers: Is the business in a secure, high-growth industry? Or is the company at least a market leader in a slow-growth industry? Can the firm give you a straightforward answer about your prospective career track? Does the job promise added responsibility later on? Does the corporate culture appeal to you?

Developing fast feet

Snaring the right job the first time is a major achievement, but it's only the beginning of a never ending process. Circumstances will change—your employer may be acquired or merged, the economy will expand or contract, your personal interests will develop—and the survivors will be those fast enough on their feet to respond quickly and creatively to the challenges. You must stay abreast of changes in the business climate, in technology and in your company's fortunes that might affect your career. And you'll need to reassess periodically whether it's time to change employers or industries—or even to go back to school. According to Drake Beam Morin research, some 70 percent of the work force between the ages of 25 and 35 returns for more education.

"You want to have long-term goals—but anyone who sticks to them is crazy," says Patricia Rose, director of career planning and placement at the University of Pennsylvania. No matter what career stage you're in, success depends on your keeping a sharp eye for opportunity and having the agility to grab it. □

by Terri Thompson

Judging the perennial favorites

Business, medicine and engineering may not be recessionproof–but they're not hurting, either

It's time to look at a few current truisms: That the M.B.A. is in decline, that medicine is becoming too crowded for newcomers and that engineering careers faded with the cutbacks in the space program. In fact, all three fields are still hot—and deservedly so. It's just a matter of looking beyond Wall Street, recognizing the rivulets and streams that make up the broad river that is the economy—and planning accordingly.

Business

An M.B.A. along with a technical degree equals a combination that few employers can resist

DRAWING POWER OF AN M.B.A.

Average starting salaries of 1988 M.B.A. graduates, by industry

	With nontechnical B.A., B.S.	With technical B.S.	Average
Accounting	$28,872	$30,432	$29,652
Banking, investment banking	$34,524	$41,676	$38,100
Consulting services	$35,832	$52,164	$43,998
Computer and business-machine manufacturing	$30,516	$33,156	$31,836
Electrical manufacturing	$31,608	$30,396	$31,002
Insurance	$29,196	$35,724	$32,460
Merchandising	$24,504	NA	$24,504
All-industry M.B.A. average	$30,480	$37,116	$33,798

NA=Not available. Note: Figures are averages based on offers to students reported to college placement offices by March, 1988. All-industry averages include other industries not mentioned. "Technical" refers to degrees in science and engineering.
USN&WR—Basic data: College Placement Council

It has been six months since the stock market's 508-point plunge, and members of the M.B.A. crash class of '88 are breathing again—even though this year's graduates won't be heading off en masse to Wall Street.

The damage wreaked on job prospects beyond Manhattan turned out to be minor. "Investment companies were hurt; other industries were bruised but not beaten," says Patrick Scheetz, Michigan State's assistant placement director. His postcrash study, *Recruiting Trends, 1987-88,* predicts M.B.A. hiring will inch up 0.4 percent over last year. Consulting, accounting, commercial banking, insurance, real estate, hotels and other service industries will spearhead the boost. And manufacturers such as chemicals, electronics, petroleum and auto makers will be hiring M.B.A.'s, says Scheetz.

Still, the crash was a jolt. Investment banks pared their fall recruiting schedules, curbed bonuses and made fewer job offers. Only 8 percent of the graduating M.B.A.'s at Northwestern University's Kellogg Graduate School of Management got investment-banking offers—fewer than half as many as last year. Wharton's business school will send only 12 percent of its class to investment-banking firms, down from 25 percent a year ago.

The business-school atmosphere has relaxed—somewhat. "Offers are coming in, and people are starting to play golf," says Susanna Bolten, 26, a Kellogg student. "But students are thinking hard before they go to investment banking."

Not that Wall Street is a dead end. Jobs have ebbed in municipal finance and stock sales and trading, but major firms' real-estate subsidiaries, says Harvard investment-banking Prof. Samuel Hayes, need M.B.A.'s to examine tax shelters, arrange mortgage financing and market mortgage-backed securities. Takeover-and-acquisition activity is still hot, according to Merrill Lynch recruiting manager Roy Cohen, so corporate-finance skills are in demand. And Wall Street firms still need M.B.A.'s to work as securities analysts, portfolio managers and marketers.

M.B.A.'s worried about job security can transfer their finance skills to corporate America. This year, 20 more firms recruited at Northwestern, and 23 more offers arrived, primarily in consulting, consumer products, commercial banking, pharmaceuticals and accounting.

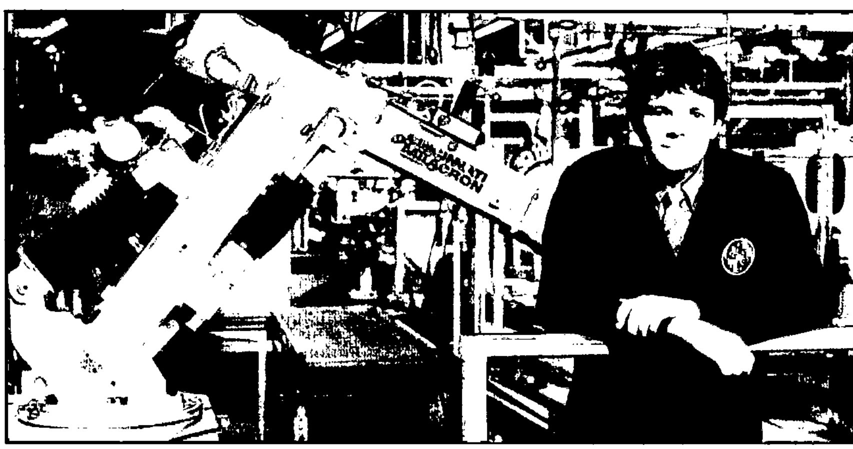
The most secure route for M.B.A.'s

MICHAEL PATRICK FOR USN&WR

Walt Tracy, 26, has put his Wharton M.B.A. to use as a consultant

ADVICE FOR GOOD TIMES AND BAD

Tracy prepared for his eventual position, as a management consultant for Touche Ross in Atlanta, by getting an M.B.A. in finance, with a healthy diet of courses in marketing and management. He has been assigned to work with a team of staff members at clothing maker Signal Apparel Corporation in Tazewell, Tenn., to improve the way the company's computer system tracks the movement of garments and bolts through the plant. Consulting appealed to Tracy, he says, because of "the diversity of the work. You work with different companies in different functional areas. It's a continual challenge."



WILLIAM STROBE FOR USN&WR

Douglas King, 28, thinks manufacturing engineering is the place to be

FROM DRAFTING TABLE TO PLANT FLOOR

King works for General Electric as a "computer-integrated-manufacturing systems engineer." In layman's terms, he is a manufacturing engineer who oversees the operation of some 85 robots and programmable computers used to make appliances at GE's plant in Louisville, Ky. An engineering graduate of Purdue University with some training in biomedical engineering, King chose the stodgier field of manufacturing because he enjoys watching and working with machines in motion. "It's not the glory field, but I find it more of a challenge than research and development. It's not a desk job. I get out and get my hands dirty."

may be consulting. In boom times, consultants focus on expansion strategies—marketing and acquisition—while in bust times the work is in reorganization and investment. Starting salaries range up to $60,000.

Stocking up on M.B.A.'s

Consumer-product companies, such as PepsiCo and Procter & Gamble, also appeal to Street-shocked M.B.A.'s. These recession-resistant makers of food and health-care products offer steady, long-term career paths—particularly in brand management and product marketing.

Reinvigorated manufacturing firms are restocking their M.B.A. ponds as well. All three auto makers made more offers this year than last, according to Joyce Watts, Kellogg's placement director. Students going into industrial companies are primarily taking marketing or finance jobs in the controller and treasury departments. And technology-driven firms like Hewlett-Packard offer jobs in product R&D, sales, cost and inventory analysis.

Developing technology has created a global economy—and a demand for M.B.A.'s with an understanding of international markets. AT&T, for example, is expanding its global interests and seeks out M.B.A.'s who can market its products abroad. More M.B.A.'s are learning a second language, and applications for study-abroad programs at Wharton are up about 10 percent this year. Foreign banks are becoming more visible on campus, says Wharton placement director James Beirne. He expects such firms to hire more than the usual 8 to 10 percent of graduates this year. And a global marketplace makes information management and computer skills pivotal.

What has changed most in the after-crash era is that the M.B.A. no longer is a near automatic entree to the executive ranks. Says James Challenger, president of the Chicago outplacement firm Challenger, Gray & Christmas, Inc.: "M.B.A.'s are looked upon as thinkers rather than doers." The degree is now considered a minimum credential—one that must be accompanied by relevant work experience and a track record of job accomplishments.

That reality may have been dawning even before the crash. Few of the students at the nation's top business schools arrived without solid work experience. Some 67,000 M.B.A.'s graduated last year, and applications at many business schools are up. Labor Department projections to the year 2000 show overall job growth of 24 percent or more for accountants and managers in personnel, marketing, advertising and finance. But to be effective in an increasingly high-tech and global market, M.B.A.'s should mix skills in traditional management fields with studies in engineering, law or medicine. Says Bob LoPresto, senior partner with the executive-recruiting firm Korn Ferry International: "Schools have to become more reality based, with course work in how to compete abroad. That's where the future is." ■

by Lisa J. Moore

Engineering

The folks who design hefty robots and tiny computer chips are in big demand and short supply

NEW ENGINEERS

Average starting salaries for 1988 engineering graduates

	With B.S.	With M.S.
Aerospace	$27,864	$34,632
Chemical	$30,768	$33,252
Civil	$24,948	$28,872
Electrical	$29,316	$35,196
Manufacturing	$28,248	$32,496
Mechanical	$29,388	$34,392
Petroleum	$33,840	NA

NA = Not available
Note: Averages are based on actual offers to students reported to college placement offices by March, 1988. Manufacturing engineering is the same as industrial engineering for purposes of this table.
USN&WR—Basic data: College Placement Council

Engineers are in the catbird seat. As America overhauls its industrial base, the new buzzwords—competitiveness, productivity, quality—translate directly into a need for the key players who put emerging technologies like superconductivity to practical use. And engineering is an excellent background for those who hope to become managers of technology-based corporations.

Demand for new engineers has been soft the last five years as corporations have trimmed their staffs. But the Bureau of Labor Statistics expects engineering to be one of a handful of occupations to prosper, increasing by 32 percent by 2000 even with modest economic growth. Yet fewer undergraduates study engineering, simply reflecting the shrinking pool of college-age Americans. So those who do will be eagerly sought—some more than others. "If you want the most opportunities four or five years down the road, the best choices would be electrical or mechanical engineering," says Mario Gonzalez, an associate dean of engineering at the University of Texas at Austin.

The proliferation of electronics in gadgets from washing machines to satellites is why electrical engineering is the hottest specialty, accounting for nearly a third of the graduates. Electrical engineers work on anything involving electricity, including its generation and transmission. They design microchips and the computers and other electronic devices that use them.

Mechanical engineers make up a fifth of all graduates. Most are employed by industrial companies seeking to turn out increasingly sophisticated products to compete in a world market. They typically develop machines with moving parts, a process that has become increasingly complex. Mechanical engineers working in the field of electromechanical systems, for example, apply sophisticated electronics to control the action of machines like robots.

Demand for products competitive in price, quality and features with those made overseas has boosted the status of manufacturing engineers—the factory designers and managers long regarded as being at the bottom of the pile. "The Japanese have shown us that the action is in manufacturing," says William Butcher of the National Science Foundation. IBM, for example, has poured $50 million into universities since 1983 to stimulate training of manufacturing engineers. Today they help designers craft products that not only meet a need but are easy to manufacture within a budget. Then they develop the computer-driven machinery and factories in which to build those products. And manufacturing experience is becoming highly desirable in advancing to management.

Few jobs, big pay

Civil engineering, by contrast, has declined as fewer massive public projects like the interstate highway system are constructed. Careers in petroleum engineering crashed along with oil prices. Petroleum engineers who do find jobs, however, enjoy the highest starting salaries, nearly $34,000. That's because they often start working on offshore oil platforms or in remote places like Alaska and the Middle East.

One worrisome trend is a recent drop-off—after rapid growth in the 1970s and early 1980s—in the number of women and minorities, other than Asian Americans, who choose to enter engineering. The American Society of Mechanical Engineers noted recently that blacks, Hispanics and women in engineering are "underemployed and underpaid" compared with white males. The growing proportion of foreign-born engineering professors complicates the problem for women, says Betty Vetter, executive director of the Commission on Professionals in Science and Technology. "They don't treat women as worthy of being taught," she says. "Bright American women don't have to put up with that any more. They can go into business or law."

The men and women who persevere will dictate tomorrow's technology—a heady calling. Says Robert White: "If you look at the modern industrial world, technology is in control of just about everything." ◘

by William J. Cook

Medicine

The need for doctors and dentists won't go away, and getting into medical or dental school is easier now

With baby-boomers all grown up, the competition to get into medical and dental schools has eased. Nursing-school enrollment is down 30 percent since 1983. And because the boomers are aging—there will be 6 million more people over 65 to celebrate the millennium than there are today—the strong job market for doctors, dentists, nurses and other health professionals is getting even healthier.

The length of the training involved makes it hard for college students intent on becoming doctors or dentists to assess the market simply by looking a few years ahead. Even so, and despite warnings of a white-coat glut, doctors and dentists in training are unlikely to wind up on the unemployment lines.

It's not clear, for one thing, that there will be any glut. In 1980, a government task force predicted 150,000 extra M.D.'s by the year 2000. But a study in the April 7 issue of the *New England Journal of Medicine* forecasts a 7,000-doctor shortfall. There could indeed be an oversupply, say experts, in some high-paying specialties, such as radiology, and in desirable cities and suburbs. If you're willing to go into a less lucrative field such as family practice, or set up a rural or inner-city practice, you won't have to fight for patients.

Prospective dentists, too, will have to see a need—and fill it. It's true that the growth of dental hygienists, overexpansion of dental schools, fewer cavities and the 1981-82 recession all portended a grim future. In the mid-1970s, there were 2.7 applicants for every dental-school opening, and now it's only 1.3. But these worries are unfounded, says Dr. Chester Douglass, chairman of the Department of Dental Care Administration at the Harvard School of Dental Medicine. Better dental insurance and the increase in the number of elderly people, more of whom keep their teeth because of improved care, mean that different types of dentists will be needed, not fewer dentists. Restorative dentistry—making and fixing crowns, bridges and partial dentures—will be hot, Douglass predicts.

With fewer applicants besieging medical and dental schools, there's less weeding out than there used to be. While only 35 percent of medical-school applicants were accepted in 1974, 61 percent made it in 1987. But paying the bill isn't getting much easier. The average yearly tuition at a private medical school is now $15,023; at public medical schools, it's $4,574. In constant dollars, that's roughly three times the fees of 18 years ago. Dental schools check in with $13,324 and $3,783. The federal government, moreover, has cut back on support, so the average debt carried by a 1987 medical-school graduate is $35,621, compared with a 1978 grad's $14,622 debt.

The health professionals of the hour—the ones wooed in classified ads with offers of free tuition and parking—are nurses. This year's 75 nursing graduates of the University of Pennsylvania have already been recruited by 150 hospitals. "If you want a job in nursing," says Patricia Rose, director of career planning and placement at the University of Pennsylvania, "sit back. You'll get one."

Yet the demand hasn't produced a comparable surge in pay—one reason for the nursing shortage. Starting salaries for nurses averaged $20,964 in 1987; the average maximum is $29,088. Workweeks

continued on page 76

DAN WHITE FOR USN&WR

Nurse Ginny Hagedorn provides primary care

NEW ROLE FOR NURSES

Hagedorn, an adult-care nurse practitioner, examines patient Marvin Langford at Prime Health, a Kansas City, Mo., health-maintenance organization. Hagedorn is one of the country's 30,000 nurses with graduate training in specific areas such as gerontology or community health. The nurse-practitioner specialty, only about 20 years old, lets nurses take on primary-care duties formerly restricted to doctors.

STATE OF HEALTH PAY

Average starting salaries in the healing professions

Physicians	
Anesthesiologist	$129,225
General surgeon	$101,815
Radiologist	$98,734
Obstetrician-gynecologist	$84,076
Internist	$61,500
Family practitioner	$60,000
Pediatrician	$55,735
Dentist	$40,190
Optometrist	$39,282
Clinical psychologist	$30,000
Physician assistant	$26,500
Physical therapist	$22,500
Dental hygienist	$22,090
Occupational therapist	$22,059
Registered nurse	$20,964
Speech pathologist	$19,997
Licensed practical nurse	$14,000

Note: Physician figures are 1986 averages for physicians in group practice with under three years' experience. Dentist figure is 1986, age 30 and under; optometrist is 1986; psychologist, 1985. Others are 1987. Dental-hygienist figure is based on average 30-hour workweek, under five years' experience. Nurses are hospital based.

USN&WR—Basic data: *Physician Compensation Survey Report*, Medical Group Management Association, American Dental Association, American Optometric Association, American Psychological Association, American Academy of Physician Assistants, American Physical Therapy Association, American Dental Hygienists' Association, American Occupational Therapy Association, American Nurses' Association, American Speech-Language-Hearing Association and American Licensed Practical Nurses Association of 50 to 60 hours for hospital nurses, especially those just starting out, are commonplace. Newcomers also tend to get the graveyard shift or weekend hours.

The persistent shortage is beginning to persuade employers to lift salaries. Carol Grimaldi, a spokeswoman for the American Nurses' Association, notes that California nurses working for Kaiser Permanente just won a contract that by 1990 will pay $42,228 to nurses with five years' experience.

The same geriatric boom likely to swell the need for nurses, doctors and dentists will put other health professionals to work. The American Physical Therapy Association claims that there is virtually no unemployment among physical therapists, who diagnose and treat physical disabilities. Salaries start at $20,000 to $25,000, but unlike nursing, you can more than double your pay over the course of your career. Government statistics project an increasing need in other areas, such as nutrition, audiology, speech pathology and optometry.

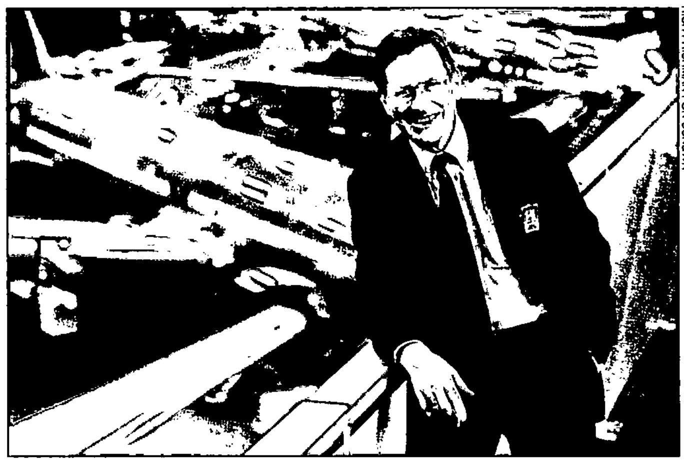
Changes in health-care costs and payment systems could reshuffle the job picture. A push by health insurers to limit hospital costs has spurred hospitals to cut down on nurses' aides, for example; that not only cuts down on those jobs but also adds to nurses' workloads. Future changes could cause further shifts. If the government decides to provide home care for the elderly, the demand for licensed practical nurses could skyrocket. But while there may be some internal changes, the healing professions appear to have a hearty future—the government estimates there will be a million more jobs added to the current 2.6 million by the year 2000. □

by Joanne Silberner

How to keep from getting mired

JONATHAN LEVINE FOR USN&WR

RICH FRISHMAN FOR USN&WR



Fenn Putman of Dean Witter, left, and John Headlund of Boeing have each thrived in their industries by staying on their toes

LEVERAGE YOUR EXPERIENCE

You've got to adapt to get ahead, says career expert Lois Meerdink of the University of Arizona. When the bond department Putman ran at Salomon Brothers was dissolved a week before the October 19 crash, he moved right over to beef up competitor Dean Witter's bond department—and took along 25 colleagues.

KIM NEWTON FOR USN&WR

Meerdink

SEEK DIFFERENT ASSIGNMENTS

To advance within one company, says Meerdink, broaden your skills. Headlund, a 36-year man with Boeing, started as a junior engineer and now is a senior design engineer with 70 employes. He has run projects involving electrical engineering, navigation, propulsion and mechanics. Now he is expert in administration, too.

You can head out, up or sideways, but your career route should be up to you and not the economy

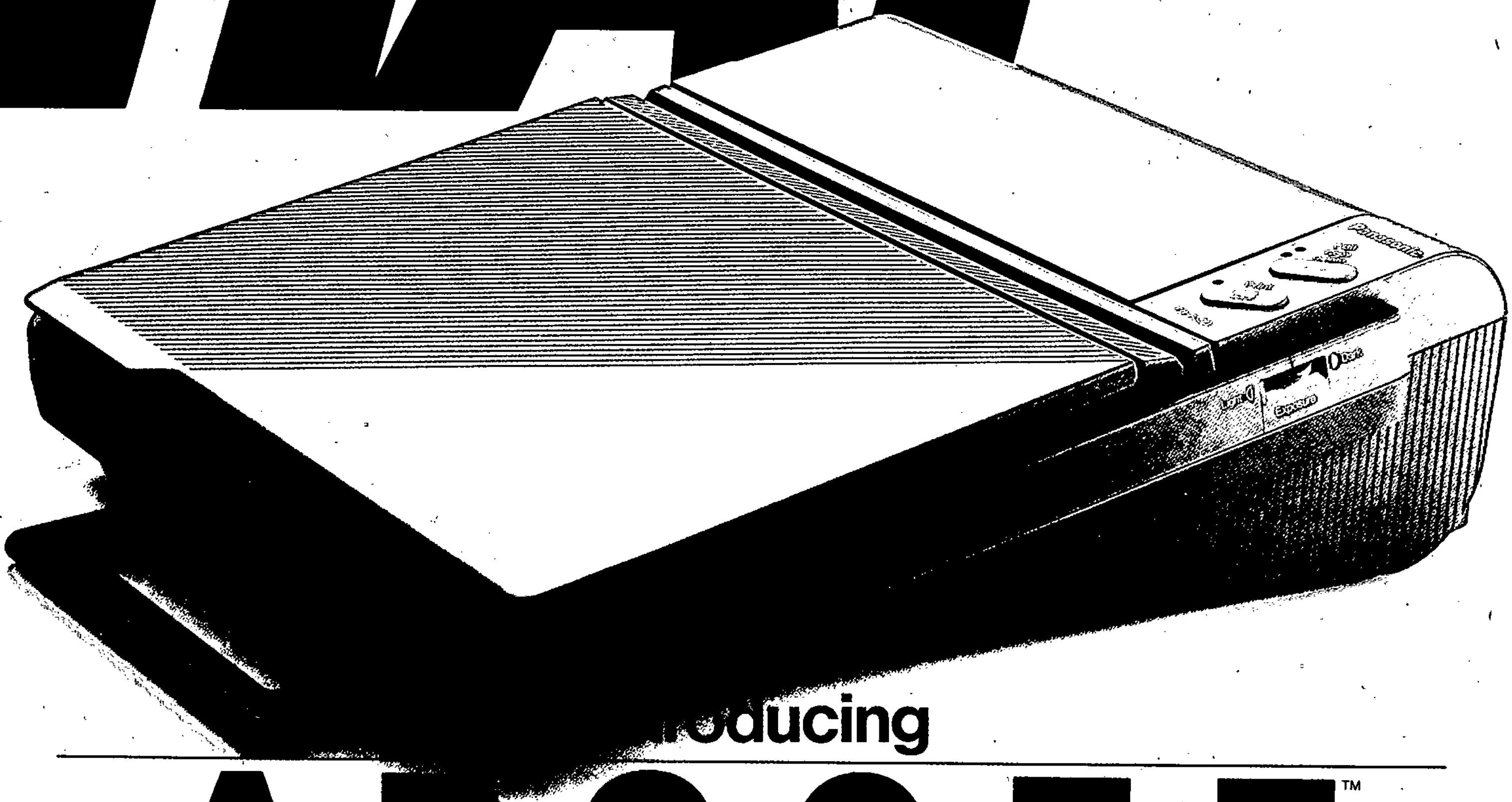
Last year, after eight years with AT&T—and a climb from strategic planner to product manager in the company's Parsippany, N.J., office—Michael Halberstadt, 41, took stock. "I realized that the corporate environment was not where I wanted to be," he says. He moved to Los Angeles, took a position teaching business and accounting at Santa Monica College and is now preparing to launch his own financial-planning company. He expects his experience analyzing financial markets for AT&T to provide a solid base when it comes to selecting investments for clients.

Halberstadt made three smart moves: He saw the need to make a career switch and acted before stagnating personally and professionally. He leveraged skills he already had into a different set of responsibilities that give him greater satisfaction. And he picked a field—financial services—that should grow dramatically in coming years.

Climbing into and through the ranks of middle management is probably tougher than it has ever been, what with corporate downswings and baby-boomers clogging the management channels. A growing number of professionals are reacting by finding new employers, by making lateral shifts into new departments within their companies or by going off on their own.

The number of executives who have worked for one corporation for more than 25 years declined from 31 percent to 24 percent between 1979 and 1985, according to a study by Korn-Ferry, an executive-recruiting firm, and the UCLA Graduate School of Management. At the same time, the number of executives working with their current employers for less than five years in-

HA!



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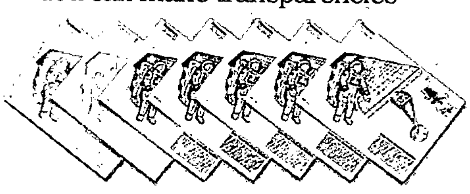

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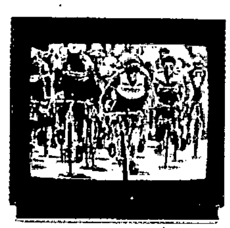

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creased from 15 percent in 1979 to 21 percent in 1985.

Negotiating your own route to professional success, whether with one company or by moving on, calls for keeping an eye on the big picture. It's vital to understand how competitive your firm is in its industry and what its chances are of riding out a recession. Might it be a takeover candidate? If so, you could become a bit player, or no player at all, in the new corporate structure. Even if your firm's future looks bright, your own could be dimmed by other circumstances. Perhaps you're doomed to a holding pattern by the baby-boom bulge—your superiors are only slightly older than you, and there's no chance of promotion. Computers have already reduced the need for managers—greater efficiency means one manager can supervise 21 people today, up from only six, according to futurist Marvin Cetron.

Fewer heads, same load

Ironically, downsizing can also create opportunities for career builders who stay with one company for the long run. "The head count drops during a downsizing, but the workload doesn't," says Washington, D.C., management consultant Robert Tomasko. This allows employes to prove themselves by taking on additional responsibilities that formerly were divided among many workers.

To survive and thrive in uncertain times, you're going to have to concentrate on gaining visibility and being fast on your feet, says Robert Wegmann, professor of sociology at the University of Houston in Clear Lake and author of *Looking for Work in the New Economy* (Olympus, Salt Lake City, $14.95).

One way is to demonstrate your skills and initiative by example. Offer to take up some of the office slack—preparing departmental reports or overseeing projects, for example—when the workload in your department is high. This initiative will be especially valuable when companies are scaling back and individual workloads increase.

Taking on tasks that aren't part of your job description both gains you recognition and prepares you for a possible career switch. Tomasko cites a market researcher who would rather be working in the human-resources department of his East Coast-based company, which runs fast-food chains and supermarkets. The researcher recently noticed that the human-resources department was having trouble attracting employes for fast-food jobs. He suggested that they apply market-research techniques to zero in on the wants and needs of potential employes—in effect treating them like customers and the jobs that needed to be filled like products. He has yet to officially move over, but he's primed. Rather than being one of hundreds of market researchers at his company, he has caught the eye of superiors and is more likely to be considered than his peers when a job opens up.

One way to pinpoint the skills you can leverage into a different and better job—in or out of the company you work for—is to examine the way your current responsibilities mesh with those of business contacts. Jeffrey Allen, author of *Surviving Corporate Downsizing* (John Wiley & Sons, $12.95), recommends a "reciprocal" approach to job switching, particularly for people in highly specialized fields. A contracts administrator whose job involves negotiating contracts with customers, for example, could look across his desk and see a possibile career as a purchasing agent. The turf is exactly the same; only the point of view is different. "For nearly every job, there is a flip side or reciprocal position that a person could tailor his résumé to," says Allen.

You'll probably be better equipped to hurdle obstacles to upward mobility if you cultivate a mentor, who will take a personal interest in your development and help you move within the company. The direct approach is best, say career counselors. Choose someone you respect who knows your work and approach him or her from time to time for help in solving problems. Once you convince your mentor of your abilities, he or she will be more apt to recommend you for challenging assignments.

Three years out of law school, for instance, Joseph Byrne took a job as an assistant legal counsel for Vons Supermarkets in Los Angeles. His enthusiasm led his boss, a senior vice president, to let Byrne handle negotiations for new stores. "Those are opportunities to watch for," Byrne advises. "Overworked top executives are glad to pass off responsibility." He has parlayed the real-estate savvy he gained from those negotiations into the presidency of an Oakland, Calif., property-management and real-estate-marketing company. Mentors don't just create chances, says Byrne: "They also kept me from making any major mistakes."

Lacking an obvious mentor, you still can work where your efforts are appreciated and your position is relatively secure during tough times. Aiming your skills at a target where they'll be needed most is the best approach, says John Crystal, chairman of the Crystal-Barkley Corporation, one of the nation's largest career-counseling firms. Talented computer programers, for example, will probably be more valued at a software firm than in the data-processing department of a large company, where they would be support staff and individual initiative would be valued less.

Moving to a new employer means *continued on page 79*

CHUCK NACKE—PICTURE GROUP FOR USN&WR

Cell biologist Stuart Flashman, now a first-year law student, hits the books

JOAN LIFTIN FOR USN&WR

Crystal

ACKNOWLEDGE A DEAD END

"Free yourself of the idea that you pick a career as a youth and are locked into it for life," advises consultant John Crystal. When research biologist Flashman, 40, was laid off by a chemical company last year, he decided that opportunities in his field were limited—so he enrolled in law school. Armed with a law degree and a knowledge of toxic substances, he plans to deal with legal issues of pollution.

Declassified and Approved For Release 2012/10/22 : CIA-RDP90-00530R000300610001-6

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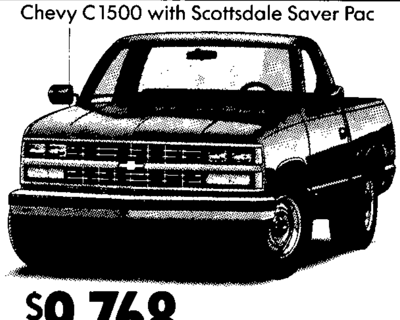

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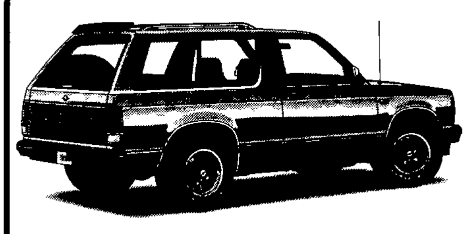

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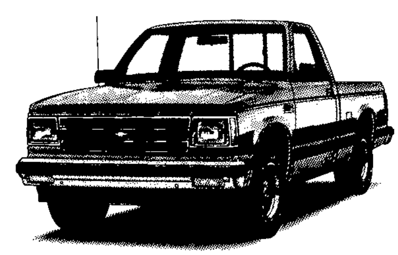

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THE *Heartbeat* OF AMERICA TODAY'S CHEVY TRUCK


MICHAEL ABRAMSON—WOODFIN CAMP FOR USN&WR

Extra schooling took Stephen Alexander from steel mill to Chicago's city hall


DAN FORD CONNOLLY FOR USN&WR

Wegmann

THE POWER OF A GOOD CONTACT

When you need a job, become known beforehand," says career expert Robert Wegmann. "Employers hate to hire strangers." Alexander faced a dicey future as a steelworker when he went back to school in 1979 to get bachelor's and master's degrees in economics. At a discussion on the steel industry, he met a faculty member who became commissioner of the city's department of economic development. Today Alexander is a deputy commissioner.

networking—getting the word out that you're looking. Seminars, conferences and professional meetings can turn up endless contacts for networking: When the formal presentations end, don't leave. That's the time to meet the speakers and participants, and each is a thread in a network of possible job leads. They'll be more than happy to talk with you since you're a contact, too.

The familiarity factor

When you're ready to call on employers, zero in on the one or two managers in each organization who can do you the most good. Arrange a meeting with each of them if possible—and attend professional conferences where you'll be in a position to talk to managers you want to meet as a peer. You'll find it much easier to promote your experience to them in an informal setting, and when it comes time to make a job proposal, you won't be a stranger. If a spot opens up, the qualified candidate a harried manager already knows will have a big edge on the competition.

You can find plenty of help, for a price. Career counselors can tune up your résumé writing and interview savvy, analyze your skills and personality and otherwise aid in sculpting a new career. Fees range from between $25 and $75 an hour for private sessions to thousands of dollars for lengthy workshops. Crystal-Barkley in New York, for example, charges anywhere from $1,500 to $4,000 for five days of intensive group sessions and up to six months of individual consultations. Many companies that cut back their work force hire these firms to help retrain and relocate employes.

But before signing on with a counselor, a bit of scrutiny is in order. Twenty-five states require counselors to have a general-counseling license before they can practice. Investigate by calling your state bureau of regulations and licensing. A license, of course, doesn't guarantee results. In fact, many successful and respected counseling firms operate in states that don't require licensing. Checking with references and the local Better Business Bureau for complaints that may have been filed against the counselor is a logical precaution. A counselor who claims that all of his clients move into higher-paying jobs, or who asks for the full fee up front, warrants suspicion. So does a counselor who has "secret" methods of career building that aren't generally used by others in the field—or who promises to do all the job hunting for you. Counselors give advice. You'll be doing all the hard work.

Headhunters' prey

Career counselors shouldn't be confused with recruiters. Most of the time, headhunters are hired by companies looking for employes. Companies pay recruiters a fee ranging from a third to a full year's salary for the position they're trying to fill. It won't cost anything to contact a recruiter, but most don't work for individuals, and you shouldn't waste your time unless you're on the top rungs of your organization. They usually concentrate on managers and executive officers in the $75,000-and-up salary range.

For the stout of heart, the best way to jump start a stalled career may be to strike off alone. But it's not a route to be traveled on whim. The economy is now in its sixth year of expansion, and what goes up eventually comes down. In 1987, 61,209 businesses, about half of which had been in business less than five years, went under. That was 15 percent fewer than the year before, but the number of business failures rose sharply in the 1981-82 recession, and another economic lull invariably will send the failure rate rising again.

Furthermore, turning an entrepreneurial dream into reality takes cash, and a lot of it. According to a 1987 study done for the National Federation of Independent Business in Washington, D.C., the average new business uses $20,000 to get under way—before unforeseen expenses wreck the game plan. Dennis Neier, a consultant to owner-managed businesses with Spicer & Oppenheim in New York, figures that you'll need at least $100,000 in ready capital to buy a going concern that will net about $35,000 the first year.

Even if you're sure you'll be the next Steve Jobs, rushing headlong into a venture without a meticulous business plan is surely suicidal. Especially with the possibility of recession looming, the business you're thinking of needs to be researched carefully to make sure the market for your idea is sound. For example, William Dunkelberg, dean of the School of Business and Management at Temple University, advises hesitating before going into a business that services defense contractors. As defense expenditures soften, contractors may suffer.

To up the odds that your business will survive infancy, use your own business experience to carve out a specialized

CHUCK NACKE—PICTURE GROUP FOR USN&WR

John Noble left corporate life for the good life

GEOFFREY BIDDLE—ARCHIVE FOR USN&WR

For June Halper, layoff was a lucky ticket to career independence

PRUDENT RISK, BIG REWARD

ANDREW POPPER FOR USN&WR

Potter

Self-employment can yield great rewards, but it's not for the faint of heart, says Steven Potter, managing director of executive-recruiting firm Russell Reynolds Associates. Noble has sunk more than $100,000 into his small ad agency since he escaped the oppressive bureaucracy of a large New York agency last fall. "It's a crapshoot," he says—happily. June Halper didn't leave her human resources consulting job by choice, but when she realized she could count many potential clients among her contacts, she was confident she could do the same job on her own. "It was scary as hell," she says. "But I've never been happier."

niche. If you know the beverage industry inside out, for example, you also probably know which aspects of the business are the thirstiest for supplies or services. Staying in an area you know well also helps ease the shock of trading the cushiony security of a large organization for your new roles as chief executive officer, bookkeeper and janitor.

For all the personal anxiety that's part of starting a small business, the expanding service economy will create opportunities in everything from travel to legal services. Kevin and Rosa Lee Jones of Fulton, Miss., for instance, have carved a profitable niche by providing much-needed trade information to growing regional industries without established networks. Their two trade journals, *Catfish News* and *Aquaculture News,* are aimed at the growing farm-raised-catfish industry and the commercial-seafood industry, respectively. Supplying or servicing the paper or chemical industries, perhaps by providing office cleaning or computer-service contracts, might also be a wise choice, says Dunkelberg. Even if the economy sags, the weak dollar should buoy export potential and keep these industries afloat. You don't have to market yourself directly to paper or chemical companies to benefit—even opening a barber shop in a paper-mill town lets you tie your income to a strong local industry.

Watching for trends

You'll also benefit by choosing a business that exploits inexorable demographic trends. Michael Gonzales opened his minority employment agency and executive-search firm in Dallas, Tex., four years ago—just the right moment, it turns out, since Bureau of Labor Statistics projections show minorities growing to as much as 26 percent of the work force by the year 2000. And services targeted to the aged, of course, will hardly lack for customers.

A franchise is one easy way to get into a growth area. These insta-businesses offer a tested strategy as well as advice and support from the parent firm. But it'll hardly be a soft ride on the back of a paternal sponsor. A franchise buys you a brand name, but you have to supply the customers. Still, fewer than 4 percent of franchises are discontinued annually, and Dennis Neier points out that franchises that are convenience-oriented aren't hurt as much by economic downturns. Starting up a maintenance-and-cleaning service calls for a median cash investment of $10,000, a convenience store $40,000 and a restaurant $75,000.

There's risk—and then there's *risk.* Twenty years ago, Richard Bernstein was a 34-year-old industrial engineer with severe diabetes. By learning to monitor the effects of changes in his insulin intake and diet, he tamed his diabetes—and was inspired to become a doctor. At 45, he says, "I was the oldest medical freshman in the country." But now Richard Bernstein, M.D., specializes in helping other diabetics control the disease.

The powerful economic and demographic crosswinds that will affect the career courses of millions of Americans in the years to come are obviously beyond anyone's control. But you can gain a measure of control over your own career. You'll have to take risks to do so, but at least that will be your choice, not the economy's. □

by Robb Deigh, Jill Rachlin and Amy Saltzman

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Modern Language Association of America 5

Contact: Richard Brode
212-475-9500

The number of people in foreign language studies increased recently, after a decline in the 1970s. Their organization deals with language studies in college, mostly the graduate level. While they see the increase in people studying, this doesn't equate to an increase in future labor pool.

The languages most on the "way up" are Chinese, Japanese and Russian, with Spanish also doing well. University language professors are more aware of foreign language positions in the intelligence fields, as more of their students have been recruited. Whether this will have any kind of a multiplier effect is uncertain.

There is a new organization under Johns Hopkins University -- the National Foreign Language Center. Richart Lambert of that group may have started some research on skill shortages in foreign languages. 202-667-8100. (1619 Mass Ave, NW)

Institute of Advanced Studies for Research on Foreign Language Pedagogy

In the tradition of other advanced study programs, NFLC provides a setting in which specialists from various disciplines—including humanists, social scientists, and public policy makers, as well as linguists and other language scholars—come together to work on the improvement of foreign language pedagogy. In addition to pursuing their individual research interests, they participate in and help guide the Center's research program.

The Andrew W. Mellon Foundation has provided funds to support a residential fellowship program primarily for research scholars whose work bears upon foreign language learning and utilization. Creative individuals not specifically concerned with language issues will also be invited because of their special expertise in one of the research interests in the Center.

Senior Scholars and Teachers: In order to assure a firm and visible link with the nation's elementary, middle, and secondary schools, outstanding foreign language teachers and administrators from those educational systems will be provided with research opportunities, sabbaticals, or advanced training in their second language.

Distinguished Fellow
Eleanor H. Jorden

Funding Sources
Exxon Education Foundation
The Ford Foundation
Andrew W. Mellon Foundation
The Pew Charitable Trusts

National Advisory Council

William Bader
SRI International
Gerald L. Baliles
Commonwealth of Virginia
Ernest L. Boyer
The Carnegie Foundation For The Advancement Of Teaching
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"Sorry, I don't speak. . ."
(Fill in the blank)

NFLC

The National Foreign Language Center
at The Johns Hopkins University

1619 Massachusetts Avenue, N.W.
4th Floor
Washington, DC 20036
(202) 667-8100

Most Americans speak English, period. Although we, as a nation, spend lots of time and billions of dollars teaching foreign languages—usually French, Spanish, or German—the end result is often the same: "Sorry, I don't speak. . . ."

In today's increasingly international environment, we have a growing realization that this isn't good enough. It's not good enough for the businessperson in the international marketplace. It's not good enough for the diplomat, the language teacher, the social scientist, or the military officer.

In order to participate effectively in the critical global exchange of ideas and to compete effectively in world trade and finance, we must develop new strategies to strengthen this nation's foreign language competence.

This is the principal objective of **The National Foreign Language Center** at The Johns Hopkins University.

At no other time in our history has there been such widespread agreement on the urgent need for a higher level of foreign language competence on a much broader scale. There is renewed interest in foreign language instruction in our schools and universities, as well as in government and in the competitive arenas of business and finance. This interest reflects a consensus that we have put ourselves at a disadvantage in the international community by being resolutely monolingual. Non-western languages, especially those with unfamiliar orthographies, pose a special challenge.

The NFLC is a nationally oriented institution conducting empirical research and development in foreign language pedagogy. Its projects are specifically selected to have a high priority from a national perspective, to facilitate improvement in the overall language teaching system, and to address questions relatively unattended elsewhere.

The United States already has a substantial resource in the many institutions and individuals involved with foreign language teaching and learning. The role of NFLC is to assist and, where necessary, supplement their activities. Not all the necessary research can or should be carried out at the Center itself. Some will be funded by NFLC for implementation by other professionals.

A shared effort will result in a national, comprehensive, systematized strategy for raising foreign language proficiency to a level enabling genuine use.

The National Foreign Language Center's priorities include:

► task forces to define areas of investigation—for example, the cost effectiveness of various teaching strategies and how to minimize the loss of foreign language skills;

► conferences on pivotal topics such as the assessment of adult language skills and the difficult issues of translating meaning across language and other cultural barriers;

► methods and exemplary materials for less commonly taught languages such as Japanese, Chinese, Arabic, and Swahili;

► valid instruments to measure the results of different teaching and learning strategies in a variety of experimental classrooms and other research settings;

► empirical research on the best way to produce a higher level of understanding, speaking, reading, and writing competence, especially in foreign language-intensive professions:

► innovative learning environments, including computer-based, interactive problem solving, and the use of expert systems in teaching and learning;

► dissemination of its findings, as well as those resulting from experimentation in language instruction elsewhere.

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(Full book attached)

POINTS OF LEVERAGE

An Agenda for a National Foundation for International Studies

Richard D. Lambert

NFLC
The National Foreign Language Center
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Washington, D.C. 20036
202-667-8100

Richard D. Lambert
Director

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SOCIAL SCIENCE RESEARCH COUNCIL

NEW YORK

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FOREIGN LANGUAGE COMPETENCIES

The Need

Nowhere is the lack of international training for American business executives more apparent, nowhere are the long-term costs of the current situation more damaging, than with respect to the very limited command of foreign languages by American business leaders. To do business with us, all others must learn our language. If they can't manage it, we will hire or require them to hire someone of their own nationality who speaks both their and our language to translate for us. And yet they must buy our products.

What makes this arrogance possible is the widespread diffusion throughout the world of varying amounts of English. America is both blessed and cursed by the fact that English has become almost universal as the common language of business. It is a blessing in that it enables English-speaking American business leaders to travel widely throughout the world and find people who have spent many years struggling to learn enough English to communicate with them. They can send and receive communications relatively safe in the belief that most of the time both the sending and the receiving will be in English. The worldwide availability of English is an enormous advantage for American business, one envied by every non-English-speaking country of the world. It is difficult to imagine the remarkable spread of American business throughout the world without it.

The wide pervasiveness of English in the international business community is also a curse. It appears to make it unnecessary for American business leaders to acquire a competency in foreign languages. Study after study[5] indicates the low value

[5]For a full review of the literature on this topic, see Marrianne Inman, "Foreign Languages and the Multinational Corporation," in James E. Perkins, *The Presidential Commission on Foreign Languages and International Studies: Background Papers and Studies* (Washington DC: Government Printing Office, 1979), pp. 247-310.

given to foreign language competency by American business through the mid-1970s, and as recently as the mid-1980s companies were still not using foreign language competency as a criterion for selecting executives for overseas service, nor giving it much importance in the recruitment of new personnel.[6]

One reason for the relatively low importance given to foreign language competency by many American corporations in recruiting American managers for overseas assignments is that it is possible to live and conduct some business in most countries with just a knowledge of English and a smattering of household and travel phrases in the local language. Local colleagues, servants, and the coterie of hangers-on that adorns the edge of any foreign community serve as intermediaries between monolingual American business leaders and the society that surrounds them. Moreover, for official business, company policy can assure that English is used for all of the official documents and correspondence that the American will see. And when an American business leader walks into a conference, the language of discussion immediately changes to English.

All American business leaders know that this pattern is immensely limiting; the monolingual American is a captive of the people who commmand his or her language. This is most dramatic in countries where English is hardly used at all, as in China or Japan, but it occurs elsewhere as well. All of the real business can go on in the native language around the American business executives, across them, and over their heads, with only what is filtered through a translator available to them. As anybody with any foreign experience knows, that filter is often highly selective and skewed. In negotiations, the lack of a command of the local language can be fatal. Moreover, company after company is discovering that crucial communication with foreign affiliates within the multinational firm can often be immensely improved if both sides have some command of several languages.[7]

Whatever the limitations and advantages of the present system of English as a business lingua franca, it is not likely to continue into the indefinite future. For one thing, alas, more and more countries—not just the French—in more and more situa-

[6]Kobrin, *International Expertise*, chap. 4.
[7]Ibid.

tions are unwilling to switch into English when an American is involved. Our monolingualism is increasingly seen as our own problem, not theirs. In the future, if not now, American business will be a prime victim of our devout monolingualism and of the overall ineffectiveness of our national foreign language teaching and learning system.

The implication of this situation is that business has a major stake in the general improvement of foreign language instruction in the United States. It cannot provide within the company all or even a large part of the foreign language skills that a fully effective overseas-based manager requires; for many languages the learning-time demands are too great, and it is too late in life for employees to start learning foreign languages anyhow. More job applicants must appear at the personnel office with a more effective command of a foreign language. Hence, business should participate heavily in the implementation of the general agenda for improving the national foreign language teaching system capacity in our school system as a whole. It has a major stake in the outcome.

A Business Specific Foreign Language Agenda

In addition to a concern for the general improvement of foreign language instruction in the United States, there are specific portions of that national agenda that are of particular importance to business. Here is that subset of items selected from the overall national language agenda, together with an indication of their special relevance to business needs. The items are presented in the order of importance given to them by most business leaders.

Higher-level language skills. While a fair amount of the current demand by business executives for foreign language instruction is for relatively low levels of skill in that language, enough to travel and cope at a level a little above that of a tourist, we need to bring at least some American business leaders to a near-native level of skill in a foreign language. At present, neither the teaching technology nor the language instructional facilities to accomplish this goal exist.

There are prototypes for the provision of skill level training—for instance, the overseas advanced language training schools such as those supported by the U.S. Department of Education in Taipei, Tokyo, and Cairo. However, they serve academic clienteles almost exclusively. In addition, there are a few such advanced-level language training facilities for federal employees, largely those in the Department of State and the intelligence agencies. There are no equivalent schools available for American business executives. Surely, we have a major national interest in moving more American business leaders beyond what might be called "abominable fluency" to a high level of skill in foreign languages. To accomplish this goal will require the creation of new facilities specially geared to the needs of business, or the admission of business executives to the existing facilities.

Adult-oriented language learning resources. Business employees who discover as adults that their jobs require a knowledge of a foreign language should compose the primary clientele for adult-oriented language learning establishments. This is in fact the case in many other countries of the world, where a large number of learning centers and television and correspondence schools have been set up to cater to this need. We have no equivalent institutions, although there are a few proprietary language schools in the United States that will give executives a few weeks of introductory instruction in the major European languages. However, their effectiveness has never been tested, and their use is sporadic and uncoordinated. It is unfortunate that our formal educational system does not serve the needs of adult learners of foreign languages. By and large, our colleges and universities are organized to teach only their own full-time students, and their courses are given in a nonintensive fashion spread over several semesters or years. In addition, most of them seek to teach students only enough language to meet the foreign language requirement, or perhaps to study literature. The needs of business executives just do not fit the time schedule, the objectives, or the technology of traditional college and university courses. Either specialized teaching programs geared to business needs will have to be developed on campuses—as indeed is now being done in a few places for Japanese language instruction—or new mechanisms outside of the current formal educational system need to be established.

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Under the general heading of adult language education is an aspect of language instruction that is equally if not more important to business leaders whose work demands occasional rather than continuous contact with other countries. For them, the depreciation of an important occupational asset through the attrition over time of language competencies is a special problem. Our national inattention to the maintenance and rejuvenation of language skills once acquired is especially damaging for American business executives.

Individualized instruction. No matter how much can be accomplished in setting up language schools, the needs of individual business executives, given the nature of their assignments, will often require language learning strategies that can be administered by the students themselves. We have now had several decades of experience in developing self-instructional programs; there is even a national association that encourages and administers such programs on many campuses. There is no reason why a similar set of programs cannot be established for business. Moreover, recent advances in the development of computer-assisted videotape or videodisc instruction programs hold great promise of making language teaching a much more flexible, much less classroom-bound enterprise. Given the fact that the demand for foreign language instruction among business executives is likely to continue to be dispersed and occasional, and to vary from one individual to another, investment by business in the development of these more flexible teaching technologies would be well worth the cost.

Less commonly taught languages. The time and effort demanded of learners seeking to acquire a fluency in the commonly taught languages—mainly French, Spanish, and German—are relatively low. Hence, it is possible to bring substantial numbers of American business executives to genuinely useful levels of language competency in those languages even after their employment by a firm. This is so both because the languages are intrinsically less difficult for English speakers to learn, and because many educated Americans have had a base-line exposure to them in the course of their formal education. This situation does not hold true for those requiring a working knowledge of

[redacted]

one of the less commonly taught languages. To reach fluency in these "difficult languages"—mainly Japanese, Chinese, and Arabic—takes much longer and requires much greater effort. Learning them from scratch while fully employed in business is extremely difficult.

American business can, of course, throw up its hands and allow the present situation to continue in which almost no American executive has the ability to communicate in any of the difficult languages. If, however, we wish to remedy this situation, there are two options available. Either business will have to invest both the resources and the time to make the learning of difficult languages possible for their employees—and there are indications that a number of firms are willing to do just that, for the Japanese language at least—or they will have to recruit those who have already had a great deal of instruction in those languages before they come into business, adding the requisite technical skills and company experience after employment rather than the other way around. There is some indication that this is also happening particularly with reference to Japanese.

Whichever way business chooses to go—that is, either providing language training to individuals selected solely for their technical competency and experience in the company, or recruiting with foreign language competency in mind and adding the technical or company-specific skills later—the result will depend on the availability of a cadre of effective teachers. Given the obvious need, it is a national tragedy that the immense resources of our campus-based language and area studies centers, where the less commonly taught languages are already available—a national resource unparalleled anywhere else in the world—are not tapped for this purpose. This is especially true for the rarest of the less commonly taught languages. The only places in the country, and for some languages the only places in the world, one can go to for English-medium instruction in some of the African languages, the languages of Southeast Asia, South Asia, Central Asia, and Eastern Europe, are the American language and area studies programs.

Accordingly, business, through the Foundation, should encourage a number of language and area studies centers to establish language teaching facilities geared specifically to the time and functional demands of business. The teaching of business

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French, German, and Spanish is now fashionable on many campuses. It is with respect to the less commonly taught languages for business use that we will have a special need, and our existing facilities will give us a comparative advantage over the rest of the world.

Special business language training units should be developed within one or two campus-based language and area studies centers for each world area. These centers would be chosen on a competitive basis, and should include both domestic and overseas language training. This is a very favorable time for such a development. A decline in student demand for instruction in many of the less commonly taught languages, and increasingly constrained university budgets, may cause many of those languages to be dropped from the curriculum. It will be ironic if in 10 years, as our economic relations inevitably expand into more and more countries, campus-based resources to provide business executives with the necessary training in the languages of those countries will have disappeared. Now is the time to consider fresh ways to encourage the language and area studies centers to serve the language training needs of international business.

A common metric. Little progress can be made in the improvement of the level of foreign language competency of American business executives unless it is included as part of the job requirements for positions in major American corporations. This, in turn, requires two things: first, the recognition that foreign language competency is important, and second, a way of expressing that competency in a uniform fashion so that there can be agreement on its meaning. Hence, business has an interest in the development and widespread use of a scale to measure objectively and consistently an individual's ability to perform in a foreign language. Indeed, business, along with government—for which a similar need is apparent—should take the lead in setting universal standards of measured foreign language proficiency in as many languages as possible, and in helping to construct the mechanisms for national test administration that would make this possible. The adoption of clearly stated criteria tied to occupational use in business would not only further the development of a common metric for the society as a whole, but would dramatize the importance of real language competency for students in the schools and colleges in a way that nothing else could.

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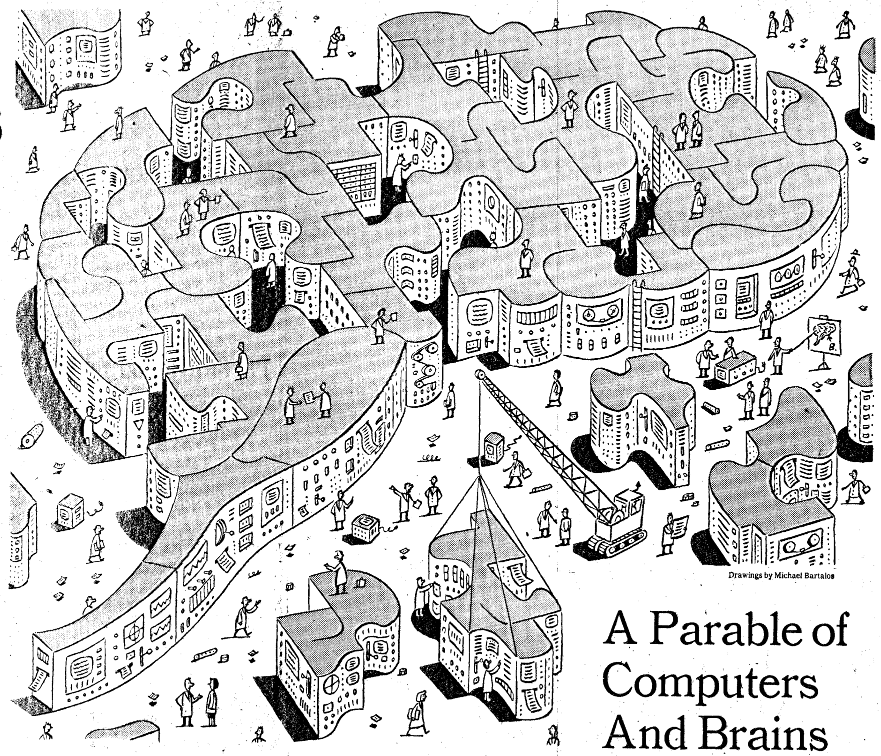
Declassified and Approved For Release 2012/10/22 : CIA-RDP90-00530R000300610001-6

Can Machines Learn to Think?

Ideas & Trends



Drawings by Michael Bartalos

WHEN the computer scientist John McCarthy coined the term artificial intelligence in the late 1950's, he did not mean to imply that there would be anything second rate about mechanical minds. However, three decades later computers still do not think. Is this because of the technological failings of the computer industry? Or is artificial intelligence theoretically impossible? Finally, since most of the research is financed by the Pentagon, will smarter computers lead to more efficient ways of killing people? Three reports follow.

The Artificial Intelligence Industry Is Retrenching

By JOHN MARKOFF

DURING the early 1980's, scientists at Teknowledge, Intellicorp and the other ambitiously named companies in the fledgling artificial-intelligence industry boasted of a bright future in which computers would match people in their ability to make important business decisions.

In the last few years, such optimism has gradually faded. Bringing the visionary technologies of artificial intelligence to the market has proved far more difficult than had been anticipated. Many of the original artificial-intelligence companies — including Teknowledge, Intellicorp, the Carnegie Group and the Inference Corporation — have suffered losses. Several others have gone out of business.

While the industry is far from developing machines that bring to problem-solving the kind of creativity and flexibility humans use, many of the techniques developed in the early stages of the quest have begun to filter into the mainstream computer industry. Rather than trying to develop computers with rudimentary reasoning abilities, a new generation of companies is concentrating on ways of making conventional computers a little bit "smarter" and easier to use than they were before.

"It's a Darwinian process — the first generation is dying because of complete lack of fitness," said Alain Rappaport, president of Neuron Data, a four-year-old Silicon Valley firm that made a profit of more than $2 million in 1987.

Artificial intelligence began during the late 1950's as an academic discipline dedicated to the possibility that computers could be programmed to think like people. Financed largely by the Defense Department, scientists pursued a variety of "blue sky" possibilities: machines that could recognize objects or understand written — and even spoken — English. By the late 1970's a few entrepreneurs began turning their attention to making commercial products such as "expert systems," programs that would diagnose diseases, for example, or give investment advice.

It was a captivating vision, and companies as diverse as General Motors and Procter & Gamble experimented with programs that would help executives make decisions or control various industrial processes. But even large companies, which could afford to dabble in the art, found that development costs often outweighed potential rewards. Many expert systems were written in exotic programming languages and would run only on specialized computers costing as much as $100,000 each.

In addition, developing expert systems required a cadre of "knowledge engineers," highly paid computer scientists who could translate the expertise of a human specialist into a set of rules that could be programmed into a machine. This task was so daunting that some scientists talked about developing computerized knowledge engineers — expert systems whose expertise was developing expert systems.

But nothing nearly so sophisticated has emerged. So far, expert systems have been useful only to solve the most narrowly defined problems, such as diagnosing malfunctioning electronic equipment.

Recently, however, there has been new enthusiasm about the promise of intelligent machines. With the advent of the 32-bit microprocessor, a computer-on-a-chip that is as fast and powerful as room-sized machines were five years ago, many corporations are routinely buying far more advanced computers. To cater to this market, software sellers are rewriting their expert systems to run on this new machinery.

A Sense of Modesty

Artificial intelligence also is increasingly being folded into mainstream programs, such as word processors, making them easier to use and amplifying their computing power. For example, Q&A, a popular personal computer database manager — a kind of filing system for the computer illiterate — uses artificial-intelligence technology to allow users to retrieve information by typing in English sentences, not cryptic computer commands.

The second generation of artificial-intelligence companies has scaled back the overly optimistic claims of its predecessors, which often sounded as though they were about to deliver the equivalent of a brain in a box.

"We don't make artificially intelligent machines in much the same way that the Boeing Company doesn't make artifical birds," said Harry Reinstein, president of Aion Corporation, a Palo Alto, Calif., company that sells expert systems designed for I.B.M. computers. Rather than trying to re-create human intelligence, the companies are taking cues from how people think and using them to design better software.

Progress in building intelligent machines is also coming from a new group of researchers who are attempting to merge neurobiology and semiconductor manufacturing technology. In the past most developments in artificial intelligence have been in the software rather than in the hardware; whatever intelligence there was existed in the programs not in the machines. Researchers are now trying to use recent theories about how the brain works to make complex, neuron-like chips that might be used for machine vision and speech recognition.

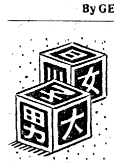
These fresh approaches suggest that fundamental breakthroughs in machine intelligence may yet be possible. Last year computer scientists, biologists and mathematicians met in Los Alamos, N.M., to discuss the possibility of "artificial life," machines that would evolve over seconds rather than eons, to become ever more intelligent.

The problem in the past, says Apple computer scientist Alan Kay, is that researchers have spent their time designing systems that attempt to imitate adult thought processes.

Time could be better spent, he argues, trying to recreate the manner in which children learn.

A Parable of Computers And Brains

By GEORGE JOHNSON



WHILE many scientists question whether people are smart enough to make machines that think, few of them doubt that artificial intelligence is at least theoretically possible.

Computers are programmed to simulate war, weather and other phenomena. They can even mimic other computers. If a computer is someday used to simulate the biological information processor we call the brain, then couldn't the machine be said to think?

John Searle, a philosopher at the University of California, Berkeley, has tried to refute this argument with a story, the parable of the Chinese Room.

Suppose that you are locked in a room and given several baskets filled with slips of paper marked with Chinese symbols. Though you don't understand a word of Chinese, you are given a thick book of instructions, written in English, for how to manipulate the symbols to produce various patterns. A typical rule might be: "Take a squiggle-squiggle sign from basket No. 1 and put it next to a squoggle-squoggle sign from basket No. 2."

From time to time a courier enters the room, dumps more symbols in your "in" basket and collects the symbols from your "out" basket.

Now suppose, Dr. Searle says, that the people outside the room call the incoming stream of symbols questions, and the outgoing stream answers — and they have trained you so thoroughly, according to such clever rules, that your responses are indistinguishable from those of a Chinese speaker.

The room in the parable could just as easily be replaced by a computer and the rule book by a sophisticated computer program. But just as you, the symbol shuffler, do not understand Chinese, Dr. Searle argues, neither would a suitably programmed machine. "No one supposes that computer simulations of a five-alarm fire will burn the neighborhood down," he has written. "Why on earth would anyone suppose that a computer simulation of understanding really understood anything?"

An Infinite Regress

Dr. Searle's argument cuts to the heart of the artificial-intelligence community's fundamental assumption: that the mind can be broken into functions and the functions broken into functions until each one is simple and mindless enough to be performed by a machine. Even something as difficult as understanding language can, in principle, be described by rules embodied in a computer program.

According to this view, it is not the human in Dr. Searle's parable who understands Chinese, but the room itself. That may sound absurd, but consider what must be going on in a human brain. Presumably there are assemblies of neurons that decode the appropriate visual information. While those neurons shuffle electrochemical pulses instead of scraps of paper, they do not *themselves* understand language. Still, they are part of a system that does.

Unless we have in our heads the neurological equivalent of a Chinese room, then there must be circuitry that actually understands language. And how would this mysterious device operate unless it contained an even smaller device imbued with the strange power of comprehension?

Can we deny that mind arises from mechanism without falling into an infinite regress?

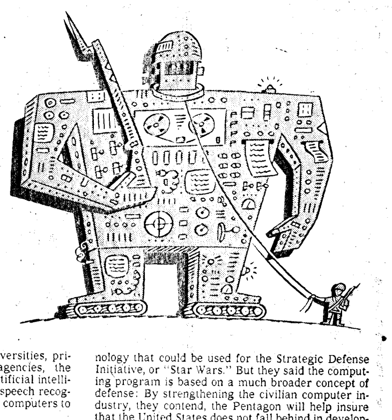
Hubert Dreyfus, a colleague of Dr. Searle's, argues that artificial intelligence is impossible because reality itself cannot be formalized. Since the days of Plato, he believes, we have been deluded into believing that everything can be modeled by abstract systems. Whether we use mathematics to describe an economy, or quantum theory to describe an atom, something essential will always slip through the cracks of our simulations.

By insisting that artificial intelligence is impossible, Dr. Dreyfus, Dr. Searle and a few other philosophers question the premise of Western science: that the world we live in and the world inside our heads can be understood by the human mind.

Pentagon Plan

The Battle to Mechanize the Military Mind

By WARREN E. LEARY



WASHINGTON

ON a roadway near Denver, an armored personnel carrier creeps along at 12 miles an hour, slows to avoid some obstacles and continues on its way. Unexceptional except that there is no driver aboard. In a simulated air battle with a distant enemy fighter plane, a pilot asks an assistant to prepare for a possible counterstrike. But there is no one in the copilot's seat.

Still in their early stages, the "autonomous land vehicle" and the "pilot's associate" are examples of a Pentagon effort to develop intelligent computers for warfare. Begun in 1983 as a 10-year project, the Strategic Computing Initiative is passing its halfway point. So far, about $500 million has been spent on research in areas with military applications as well as very basic research that may not have immediate practical use.

With awards and contracts to universities, private companies and Government agencies, the project is financing work not only in artificial intelligence, but also in computer vision and speech recognition and in programs that would allow computers to recognize English.

Some scientists question the wisdom of the Pentagon's sponsoring the largest computer research project in the country. They wonder whether using machines for some aspects of military decision-making will increase the likelihood of war. The Pentagon has always paid for most artificial-intelligence research. Now it is seeking a return on its investment.

Defense Department officials said the branches of the military spend about $50 million a year supplementing computing initiative projects, including technology that could be used for the Strategic Defense Initiative, or "Star Wars." But they said the computing program is based on a much broader concept of defense: By strengthening the civilian computer industry, they contend, the Pentagon will help insure that the United States does not fall behind in developing sophisticated technologies that are necessary not only for military defense but also for economic survival. "Over all, we've gotten a lot from the program, and the country already is benefiting," said Dr. Jack Schwartz, director of the Information Science and Technology Office of the Pentagon's Defense Advanced Research Projects Agency, which is sponsoring the effort.

The greatest achievement so far has not been in artificial intelligence but in large-scale parallel computing, Dr. Schwartz said. Conventional computers use a single processing chip to solve problems one step at a time. By using numerous processors, a computer can simultaneously work on different parts of a problem, reducing the time it takes to solve it. "The success of work like this justifies the investment," Dr. Schwartz said. "American companies are ahead in parallel processing, with a number of machines available on the market now. We're getting ready for computers performing at levels 100 times larger than the largest present supercomputer." Supercomputers are the powerful machines used for such complex jobs as weather forecasting and aircraft design.

The Pentagon project began largely in response to an effort by the Japanese Government to develop supercomputers more powerful than those in the United States. The Japanese also set out to develop a revolutionary, fifth-generation computer with rudimentary reasoning power.

Making Weapons 'Brilliant'

In addition to basic research, the American project has concentrated on the autonomous land vehicle, the pilot's associate, a computer system to help plan and control large naval operations and other military goals. Research is aimed at developing "brilliant" weapons even more sophisticated than the current "smart" bombs and missiles, which seek out and identify targets. Scientists are also working to create an Army "battle management system" and computer programs that would automatically interpret radar signals and surveillance photographs.

The project, which received $131 million in fiscal 1988, is viewed with suspicion by some computer experts. But even many critics are reconciled to the fact that computer scientists have always been — and likely always will be — dependent on the Pentagon. Computer Professionals for Social Responsibility, a group based in Palo Alto, Calif., questions whether software will ever be reliable enough to make life-and-death decisions. Gary Chapman, executive director of the group, said that while the role of the military in computing is "worrisome," the basic research it supports is productive and "it would be a mistake to cut all funding from the program."

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(full book attached)

Foreign and Foreign-Born Engineers in the United States

[redacted]

INFUSING TALENT, RAISING ISSUES

Committee on the International Exchange
and Movement of Engineers

Office of Scientific and Engineering Personnel

National Research Council

NATIONAL ACADEMY PRESS
Washington, D.C. 1988

EXECUTIVE SUMMARY

Introduction

Immigrants have provided a transfusion of new talent throughout U.S. history to support our nation's economic and cultural growth and development. Their presence has generally been accepted as the norm in the United States, and immigrants have helped our nation to become the effective pluralistic society that it is today. However, the absorption of these successive groups of immigrants has often been accompanied by issues associated with their integration into our work force and our society.

In recent years, there has been a marked increase in foreign and immigrant engineers and engineering students, individuals especially qualified by advanced education and professional skills. A large proportion of these individuals remain in the United States and are becoming an increasingly important component of our engineering work force. Once more, their presence is creating not only real opportunities, but also possibly problems.

Motivated by a growing interest in the implications of the increasing prevalence of these foreign-born engineers in our society,[1] the National Academy of Engineering asked the Office of Scientific and Engineering Personnel (OSEP) to undertake a preliminary examination of the issues associated with this international movement. In particular, OSEP was asked to identify the major issues associated with this movement, to assess their validity or importance, and to suggest follow-on studies that may be needed for proper evaluation of the issues involved. The Committee on the International Exchange and Movement of Engineers (CIEME) was created to undertake this task. The work of the Committee included the compilation of relevant data, the commissioning of a set of papers examining the implications of this influx of foreign-born engineers on various sectors of the economy, and the convening of a workshop at which the data and papers were reviewed and discussed by the participants. The Committee's findings, conclusions, and

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1 See Committee on the Education and Utilization of the Engineer, Commission on Engineering and Technical Systems, National Research Council, *Engineering Education and Practice in the United States: Foundations of Our Techno-Economic Future,* Washington, D.C.: National Academy Press, 1985.

recommendations are based on the information gathered through these activities.

Findings

Three basic findings emerged from the factual data examined by the Committee. First, there has been a gradual but substantial increase in the overall proportion of foreign-born engineers residing and working in the United States. For example, noncitizens constituted 3.5 percent of the total engineering labor force in 1982, about the same as in 1972, while the proportion of naturalized citizens grew from 5 percent in 1972 to 14 percent in 1982. The fraction of the engineering work force that is foreign-born has continued to increase since 1982.[2] The prevalence of these foreign-born engineers varies considerably with their level of academic achievement. ~~In 1982, [illegible] and naturalized citizens together accounted for 15 percent of the bachelor degree holders, 22 percent of the masters, and 36 percent of the Ph.D.s in the American engineering labor force.~~ The continuing increase in the number of foreign and foreign-born engineers reflects two facts: (1) many foreign students and professionals enter the United States with the primary goal of becoming permanent U.S. residents, and (2) many of the foreign engineering students, who initially came here to study, later changed their goals and decided to remain because of better living conditions and more attractive employment opportunities than are available in their home countries.

The second finding is that the ~~recent increase in the number of foreign-born engineers has occurred disproportionately in the academic sector.~~ For example, the proportion of foreign assistant professors of engineering younger than age 35 has increased from 10 percent in 1972 to over 50 percent during the period 1983-1985.[3] ~~About two thirds of the postdoctoral university appointees are not U.S. citizens.~~ Also, ~~the number of foreign applicants for graduate study in engineering is greater than the number of U.S. applicants, and about [illegible] percent of foreign students obtaining Ph.D. [illegible] degrees in the United States remain here.~~ Over 90 percent of undergraduates in engineering but only about 45 percent of new engineering Ph.D.s are U.S. citizens (about 4 percent of this latter group were naturalized citizens). The latter proportion is

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[2] The most reliable source of data on the foreign engineering labor force is the National Science Foundation's (NSF) Postcensal Survey, which in 1982 surveyed a representative sample of the total 1980 U.S. science and engineering labor force. These data are preferentially used in this report. The NSF makes available more recent estimates, which are model-generated and based on updated surveys of the postcensal cohorts and a number of more recent surveys. The latter, however, miss recent immigrants and some recent graduates of U.S. universities, especially those with foreign addresses.

[3] The number of foreign-born assistant professors who have become naturalized citizens is small (less than 5 percent).

small, even with selected efforts to restrict the number of foreigners admitted to graduate engineering education through imposition of admission ceilings at a number of major universities.

The third finding relates to the origin of these foreign-born engineering students. A disproportionately large number come from countries where the language and cultural backgrounds are likely to be significantly different from those of most native-born Americans. In 1985, for example, 31 percent of the foreign engineering students in U.S. schools came from the Far East, 6 percent from India, and 20 percent from the Middle East.

Issues

Dependence on Foreign-Born Engineers

Very significant, positive aspects arise from the presence of foreign-born engineers in our society. It must be recognized that with these foreign engineers the United States is attracting an unusually gifted group of individuals with high intellectual competence and diligence. The diversity of intellectual backgrounds and experience that other foreign-born engineers have brought in the past greatly contributed to U.S. engineering competence, and there are no reasons to believe that new immigrants will not contribute similarly.

Since these engineers provide definitely needed supplements to our labor force, their absence would lead to curtailment of important programs.[4] Without the preponderence of foreign-born individuals among faculty and graduate students in academe, American engineering schools would be unable to provide educational and research programs of the current magnitudes. The influence of foreign-born engineers has become highly significant also in industrial research and development (R&D), particularly in disciplinary areas that were viewed to be of secondary importance in the United States several years ago but are now critical to our international competitiveness in selected fields, such as nonlinear optics and the associated manifold applications of laser technologies. A survey of the R&D directors of 20 firms that account for a large fraction of the technological output of the United States (see Peter Cannon, Appendix D) indicated that "their particular industries are, in fact, dependent upon foreign talent and that such dependency is growing." Thus, it is clear to the Committee that these foreign-born engineers enrich our culture and make substantial contributions to U.S. economic well-being and competitiveness and that without the use of noncitizen and foreign-born engineers, universities and industries would experience difficulty in staffing current educational, research, development, and technological programs.

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4 This information was presented by numerous participants at the committee-sponsored workshop and the commissioned papers included in Appendix D, particularly "Foreign Engineers in U.S. Industry" by Peter Cannon.

Foreign Engineering Students

As already noted, about 45 percent of engineering graduate students in 1985 were foreigners with temporary visas, about another 10 percent held permanent residence visas, and 4 percent were foreign-born citizens. The relatively large proportions of foreign students in graduate engineering programs reflect a lack of interest on the part of American students in such programs. The well-paying employment opportunities for engineers with new bachelor's degrees are one of the major causes of this lack of interest in graduate education by American engineers. The potential pool of foreign graduate students is considerably larger than that of Americans, and their academic records and test scores are very high. Thus, American graduate students could become an even smaller fraction of the engineering graduate-student population without continuation of the current preferential treatment for American students or some financial incentives for Americans to enter graduate studies instead of immediate employment upon receipt of their bachelor's degrees.

Effects on Engineering Education

The productivity, growth, and international competitiveness of the U.S. economy are influenced by many factors. Although it was beyond the scope of this study to rank the relative significance of these factors, the Committee has taken as a premise that the quality and effectiveness of the U.S. engineering education system is important in maintaining and improving the current U.S. position in world affairs.

Troublesome problems could arise if the quality and character of engineering education were not maintained. Three particular issues surfaced during the course of this study. First, the large-scale use of foreign teaching assistants (TAs) has been reported to be detrimental to the instructional programs offered in major engineering schools because of language difficulties. It is clear, of course, that language and communication difficulties should be resolved before foreign teaching personnel are allowed to assume responsibility for classroom teaching. It has even been suggested that, because of their cultural backgrounds, some foreign-born engineering TAs may discourage female and minority students from entering the engineering profession. For this supposition, the Committee found both anecdotal support and counterexamples. The third issue arises from the fact that in some foreign cultures, science and technology training tends to be preferentially slanted toward engineering science rather than toward practice.

One of the strengths of the American system of engineering education has been and continues to be its acceptance of pragmatic solutions to engineering problems and its recognition of the importance of hands-on training in the design and operation of engineering systems. Thus, there is some concern that, as a result of the large and growing ranks of new foreign faculty members, some of the character of American engineering education could be changed (it must, of course, be remembered that new engineering junior faculty are selected by mostly U.S.-born faculty members). However, the Committee has not examined possible changes in engineering education and their potential, long-term effects. It should be noted that the suggestion has been made that U.S. engineering education does not respond properly to current needs and requires drastic revitalization of the type that occurred in the 1950s, when broadly based engineering-science curricula were first introduced. Just what this revitalization should involve is properly the subject of another study.

Given the importance of teaching personnel in the training of an essential engineering talent pool, any adverse effects could span generations. Consequently, careful monitoring of the development and performance of the academic engineering establishment--both indigenous and foreign-born--must be viewed as a continuing, high-priority obligation.

Limitations in the Engineering Supply Available to the National Security Sector

While the national security sector (both industrial and governmental) employs only about 20 percent of the total U.S. engineering work force, its intellectual health and vitality are essential for the maintenance of an adequate level of defense. A major issue has emerged from the increased prevalence of foreign engineers (temporary visas) among the new advanced-engineering graduates in our education system (27 percent of master's degrees and about 45 percent of doctorates) and the foreign-born constituent of our engineering labor force (22 percent of master's and 36 percent of doctorates). These individuals, especially foreign nationals and immigrants with close relatives in foreign countries, are reported to encounter long-term difficulties in receiving special-access security clearances. Therefore, a substantial fraction of the most highly skilled talent of this nation may not be available to enter critical areas of defense research and engineering. As a consequence, the necessary work in this sector may have to be undertaken by less highly trained engineers than is desirable. The net result is certainly a less than optimal use of available talent and, possibly, a reduced level of effort. Another consequence is a larger concentration of foreign engineers within the academic sector than might otherwise be the case.

International Interactions of American Engineers

Considerable concern was expressed at the workshop and by Committee members that both new American engineering Ph.D.s and engineers already in the U.S. labor force do not spend sufficient time abroad to benefit from the highly developed technologies of many foreign countries. In the case of the employed engineers, the view was frequently expressed that managers who initiated or approved foreign trips frequently did not appreciate the importance of these foreign visits. Available data on this type of foreign interaction indicate that only 1 percent of new engineering doctorates in 1983 selected postdoctoral study abroad. The Committee believes that, in a world where other nations' technological competence has increased significantly, international contacts among scientists and engineers are imperative for effective national development and international competitiveness.

Data Gaps

The study of this Committee was handicapped by major gaps in available data. Almost no quantitative information was found on the international movement of American engineers, career patterns of foreign graduates who returned to their home countries, and the exact magnitude of foreign applicants for engineering graduate education. More generally, data gaps exist on the value to the United States of educating foreign nationals, on the extent of the deficiency in foreign visitations by American engineers, and on the full imbalance in the pool of potential engineering graduate students. Procedures to overcome this data deficiency were identified by the Committee and should be implemented.

Decreased Work Opportunities for U.S. Engineers

The Committee became aware of a belief that salaries of U.S. engineers are substantially depressed by the willingness of foreign engineers to work for lower wages, or that U.S. engineers lose job opportunities to foreign engineers. This concept does not appear to be supported by evidence available to the Committee. Since foreign engineers as a group represent only 3.5 percent of the total U.S. engineering labor force, they are not displacing Americans to a significant extent. As for salary depression, a study of 13,000 engineers showed no evidence that foreign engineers earned either more or less than their American colleagues. One may, however, conjecture that salaries of U.S.-born engineers would have been somewhat higher, especially among Ph.D.s, if the foreign-born pool of applicants had not been available.

Subsidization of Foreign Students

A notion exists that foreign students, whether they remain in the United States or not, are unfairly subsidized. Although the Committee had only limited information on the issue, it did not consider the issue to be a valid one. The basis for this judgment lies in the Committee's findings that a substantial fraction of these trained students remain in this country and become productive members of our society.

An additional consideration motivating the Committee's conclusion was that most of these students received their undergraduate training abroad. The costs of this foreign investment constitute an offset to any subsidy provided for graduate training in the United States. Furthermore, if there were only U.S. students, current excess capacity in graduate engineering programs would be even larger, making the current marginal costs of educating foreign students relatively low.

Exclusion of U.S. Graduate Students or Junior Faculty

There is a concern that qualified U.S. citizens are being excluded from scarce openings in engineering graduate schools. This concern is at variance with the preferred treatment accorded to qualified indigenous applicants through the use of either formal or informal ceilings on the number of foreign graduate students admitted. However, operation of normal engineering school appointment practices, which frequently favor expertise in engineering science and theoretical studies, may be limiting the appointments of U.S. Ph.D. engineers to faculty positions at major research universities because of the availability of a pool of especially well-qualified, foreign-born engineers.

Broader Considerations and Recommendations

During its investigation, the Committee discussed several issues that are of central importance in assessing the long-term impact of foreign engineers on the United States. These issues include the quality and appropriateness of the engineering curriculum in the United States, particularly at the undergraduate level; the need to make a larger part of the American public sensitive to the interactions between technology and society; and the relationships among engineering curricula, advanced training, and international competitiveness. These issues, although important, are beyond the scope of this study. They should, however, form the bases for subsequent inquiries by other groups.

Specific recommendations derived from this study are as follows:

- Competitive fellowship programs for U.S. students in engineering should be evaluated to determine what stipends are needed to make graduate study an attractive, cost-effective alternative to immediate employment. This approach could provide a significant increase in the number of American engineering graduate students.[5]

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[5] See Committee on the Education and Utilization of the Engineer, Commission on Engineering and Technical Systems, National Research Council, *Engineering Education and Practice in the United States: Foundations of Our Techno-Economic Future,* Washington, D.C.: National Academy Press, 1985, pages 56-59.

- University officials should rigorously monitor language proficiency of all teaching personnel, especially teaching assistants, and insist that communication problems be resolved before individuals are placed in teaching positions.

- It has been suggested that some foreign-born engineering teaching assistants may discourage female and minority students from entering the engineering profession. Although there is anecdotal evidence both to support and to refute the existence of such discouragement, the implications are sufficiently serious to warrant efforts to develop a firmer factual basis for evaluating the validity of this issue.

- Although the Committee recognizes the need for necessary and appropriate security clearances, the U.S. Department of Defense should examine ways to make the most effective use possible of the foreign and foreign-born talent pool that is potentially available for defense engineering.

- Major efforts are needed to improve the scientific and mathematical content and standards of precollege education for a larger portion of the population. Such improved training would provide students with better preparation for intelligent citizenship in a highly complex, technological society. Also, better trained precollege students are more likely to enter both undergraduate and graduate technical studies, and this influx is likely to augment the number of highly qualified, U.S.-born graduate engineering students. This influx may be important in view of demographic changes that will reduce the traditional cohort populations of U.S. undergraduates.

- Efforts should be made to fill data gaps on career patterns of foreign students who have left the United States, on the international movements and interactions of American engineers, and on foreign applicants to engineering graduate education. We should also obtain quantitative data on the reasons that such large numbers of foreigners choose to come to the United States for graduate education in engineering.

- More extensive studies should be initiated to assess or determine the reasons for the failure of many qualified American engineering undergraduates to enter graduate studies; the appropriate engineering curricula for the 1990s and beyond; and the relationships among engineering, engineering education, the international flow of engineers, and international competitiveness.

FOREIGN ENGINEERS IN THE U.S. LABOR FORCE*

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INTRODUCTION

During the first half of the 1980s, U.S. universities awarded more engineering doctorates to foreign nationals than to U.S. citizens. Most of these foreign nationals entered the U.S. work force, boosting the number of work force entrants with doctorates to a level that was at least 50 percent higher than it would have been if the foreign nationals had all left the United States after graduation. Yet in spite of this very large foreign inflow to the United States labor market, the market for engineering doctorates was still very tight in 1985. They still earn the highest salaries, and the number of doctorates employed as engineers is still about 4 percent higher than the number who earned doctorates in engineering. To me, this illustrates several points about the role of foreign engineers in our labor market:

- We have a strong market for engineering graduates in spite of large foreign inflows.
- We would have a serious shortage if foreign nationals did not enter our work force.
- Although salaries would be even higher without the foreign inflow, engineering salaries are still higher than the salaries paid to college graduates choosing almost any other major.
- It is difficult to discuss the increasing U.S. dependence on foreign engineers without asking why we do not have more U.S.-born students being educated to meet these needs.

* The work described in this paper was and is being supported in large part by the National Science Foundation. Its support is gratefully acknowledged. Oak Ridge Associated Universities operated under United States Department of Energy Contract No. DE-AC05-760R00033. All opinions expressed in this paper are the author's and do not necessarily reflect policies and views of the United States Department of Energy or Oak Ridge Associated Universities.

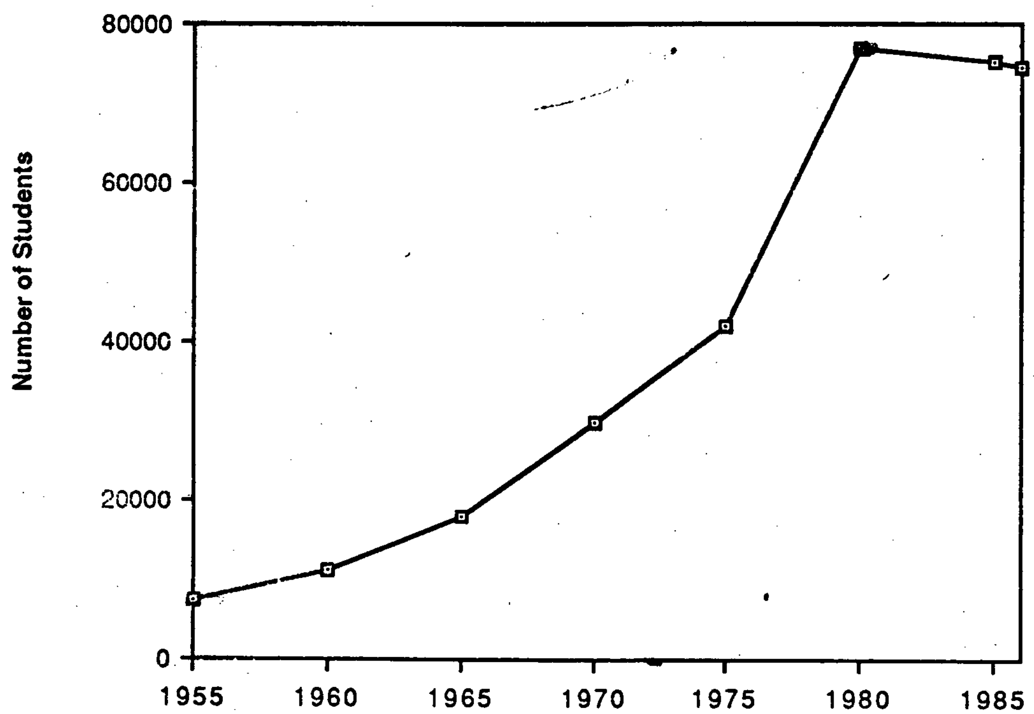
o Employers have few problems with foreign engineers because most of those hired were trained in the United States.

There is widespread agreement on these points when applied to engineering Ph.D.s. The agreement lessens as we move toward the B.S. segment of the engineering market. I discuss these assertions in more detail below. I also deal with related issues such as our ability to retain foreign engineers after they enter the United States work force.

A few definitions are in order first. I use "foreign" to mean all who are not U.S. citizens. There is a much larger group of "foreign-born" engineers because so many become naturalized citizens.

ENROLLMENTS AND DEGREE AWARDS

Figure D-1 shows the steady rise in foreign engineering enrollments. Foreign enrollments have been rising at all levels, but they have been most noticeable at the graduate level, particularly the doctoral level. The 1983 estimates of the Engineering Manpower Commission put foreign enrollments at 7, 33, and 43 percent, respectively, for un-



SOURCE: M. Zikopoulos (ed.), *Open Doors, 1985-86,* New York: Institute of International Education, 1986.

FIGURE D-1 Number of foreign engineering students at all levels, 1955-1986.

dergraduates, master's candidates, and doctoral candidates, and these would be slightly higher at each level if they included foreigners who are permanent residents of the United States (Ellis, 1985). During the 1960s less than 25 percent of our doctoral engineering degrees were awarded to foreign nationals, but that changed very rapidly during the 1970s. The percentage of doctoral degrees awarded to foreigners passed the 50 percent mark in 1981 and continued to climb to 57 percent in 1985 (NSF, 1983; Coyle, 1986).

Given the strong labor market for engineers over the past decade, it has generally been the case that foreign engineering graduates of U.S. schools have had relatively little difficulty staying in the United States to work, especially if they wanted to stay for graduate work.

What seems to shock people about the rising importance of foreign nationals in U.S. engineering are the statistics at the graduate level. What is going on here? Is there something wrong with U.S. students that we have had such a strong shift to foreign enrollments? I am not the first to ask this question, and I do not claim to have the complete answer. But I would like to offer a couple of observations for your consideration when thinking about this phenomenon.

The percentage of foreign students at the doctoral level has increased mostly because of the decline in U.S. degree awards. We had a record level of degree awards to U.S. citizens from 1969-1975. Unfortunately, that has been the only period since 1950 when real research and development (R&D) growth has been slow in the United States. Also, there was a downturn in undergraduate enrollments during that period. If we acknowledged any planning of these things, we would have to admit to a colossal failure in that we managed to get a record level of supply during the period of weakest demand.

Since 1975 we have had real R&D growth averaging more than 5 percent annually, and this has probably shifted toward the kind of work that employs more graduate engineers (e.g., defense, energy, electronics). Also, we have had a sharp rebound in undergraduate enrollments, though it is unclear how much of this has been translated into effective demand for more teachers, as the faculty/student ratio has been allowed to decline sharply (Coyle, 1986). Altogether, the demand for engineers with graduate degrees is strong. Salaries reported by new engineering doctorates have increased significantly in real terms since 1979 and have increased faster than the average of salaries in science fields. The science fields that look most like engineering in this respect are "math/computer science" and physics, and they too have large and growing foreign enrollments.

One explanation for the inability to attract more U.S. citizens to engineering graduate school is the strong market for baccalaureate engineers. No doubt, this is part of the explanation, though I see little or no increase in the salaries of B.S. engineers relative to those of Ph.D. engineers.

I think we may not have paid enough attention to other possible explanations. One of those we might consider is federal policy on graduate student support. The number of graduate students supported on federal fellowships and traineeships peaked during the late 1960s and

TABLE D-1: Full-Time Engineering Graduate Students in Doctorate-Granting Institutions, by Federal Support Status, 1979 and 1985

Status	1979	1985
Total, full-time students	39,344	55,997
Total federally supported students	10,757	11,226
Federally funded fellowships	659	777
Federally funded traineeships	500	237
Federally funded research assistantships	8,002	8,391
Other federally supported students	1,596	1,821
Federally supported as percentage of total	27.3	20.0

SOURCE: Unpublished data from the National Science Foundation, Survey of Graduate Science and Engineering Students and Postdoctorates.

declined sharply thereafter. There was a definite shift in federal policy away from fellowships to individual students, with the expectation that increasing numbers would be supported as research assistants on projects supported by the federal government. I suggest that one unintended consequence of this shift away from fellowship support is increased federal support for foreign nationals. With few exceptions the federal fellowship programs are restricted to U.S. citizens. In contrast, research assistantships are awarded by universities, and there seems to be little or no discrimination on the basis of citizenship. Universities can defend the practice of awarding federally supported research assistantships to foreign nationals. It is not my aim here to argue that they should discriminate on the basis of nationality. However, it is clear that the federal government would have more influence if it were supporting more graduate students through fellowships, which have more citizenship restrictions, rather than through R&D funding to universities, which generally does not have citizenship restrictions.

This shift in federal policy may be part of the explanation of increasing foreign dominance of doctoral programs, but it is important to recognize that federal influence in this regard would be limited today even if federal fellowships were to grow rapidly from their present level. Federal fellowship support to engineering in 1985 supported fewer than 2 percent of the full-time graduate students in doctorate-granting institutions. Total federal support of all kinds supports only 20 percent of these students (Table D-1). The proportion of engineering graduate students with federal support has fallen since 1979 because student enrollments grew faster than the number of students with federal support.

TABLE D-2: Foreign Nationals as a Percentage of All Ph.D. New Entrants to the U.S. Labor Force, 1980-81

Field	Percent
Engineering and computer science	36.1
Civil engineering	38.7
Chemical engineering	45.9
Electrical engineering	36.6
Mechanical engineering	44.5
Aeronautical/industrial engineering	32.5
Computer engineering/computer science	23.5
All other engineering	34.4
Life sciences	7.5
Social sciences (including psychology)	5.5
Physical science/mathematics	14.9

NOTE: Includes only doctorate recipients from U.S. universities during 1980-81.
SOURCE: Michael G. Finn, *Foreign National Scientists and Engineers in the U.S. Labor Force, 1972-1985,* (ORAU-244), Oak Ridge, Tenn.: Oak Ridge Associated Universities, June 1985.

HAS IMMIGRATION BEEN CONCENTRATED IN "SHORTAGE" AREAS?

The evidence seems clear for recent graduates with U.S. doctorates. We cannot seem to agree on an operational definition of shortage. However, the fields in which employers most frequently report shortages to National Science Foundation (NSF) surveys tend to correlate quite well with the fields with high inflows of foreign nationals (see Table D-2). In particular, the social sciences and most of the life sciences are fields where employers seldom report shortages, where salaries are relatively low, and where the foreign nationals make up a relatively small proportion of the new entrants into our work force each year, when compared with engineering. The exceptions to these generalizations are almost all exceptions that prove the general point; for example, economics is unlike the other social sciences in that it has higher salaries and more foreign students.

Within engineering, however, it is not so clear that immigration has been concentrated in areas of relative shortage. In nearly every field of engineering examined, foreign nationals make up between one-third to one-half of the people entering the U.S. work force with new

Ph.D.s.[1] Where a field lies within that range does not seem to be related to relative degree shortage.

If we look at the data for all scientists and engineers at all degree levels, there is only weak evidence of a correlation between shortages reported by employers and percentage of foreign nationals in the work force (Finn, 1985, p. 3).

A labor certification requirement (that the U.S. Department of Labor certify that an employer has made a good-faith effort to hire a U.S. citizen) applies to many foreign students who wish to stay in the U.S. to work (IEEE, 1984). However, during the early 1980s, the labor certification process showed only a weak correlation between reports of employer shortage and number of labor certifications by field of science or engineering. When the number of employers reporting shortages fell sharply after 1981, the number of labor certifications fell too, but not as sharply. And the number fell entirely because of a fall-off in the number of applications--the turndown rate for individuals stayed below 5 percent in 1982 and 1983. The number of labor certifications seems to contain an element that is not very sensitive to changing labor market conditions. This government mechanism to restrict immigration in "nonshortage" areas seems to have some effect. However, the effect seems to come about because the certification process imposes a significant price on any employer who wants to hire an alien requiring certification. The price is presently in the form of paperwork and delays and is something many employers avoid if they can by hiring someone who is already a permanent resident or U.S. citizen.

ESTIMATES OF IMMIGRATION AND EMIGRATION

We have good estimates of the immigration of foreign engineers into the United States. Statistics from the Immigration and Naturalization Service (INS) indicate immigration of about 7,200 engineers annually from 1982 to 1985 (NSF, 1986). My own research suggests that an estimate of nearly 10,000 foreign national engineers entered the U.S. work force in 1981, though some were working on temporary visas and therefore would not be counted as immigrants by the INS or the U.S. Department of Labor (Finn, 1985). However, we have virtually no data on emigration of scientists and engineers from the U.S. work force. This is needed before we can really assess the role of foreign nationals in the U.S. work force.

Anecdotal reports indicate that some foreign nationals who work in the United States for large U.S.-headquartered, multinational firms will be transferred to foreign sites within the same multinational firm. Firms might, for example, be starting a new laboratory outside the United States and wish to provide training and experience at a similar U.S. facility beforehand. The recent strong growth of Korea in manufacturing has been accompanied by the return of Korean natives who had

[1] This assertion is based on 1982 data (see Finn, 1985) and on an examination of trends in degree awards since 1982.

worked as engineers in the United States prior to their return. We could compile many bits and pieces of this movement from such anecdotal reports, but this is only enough to suggest that the flow is not trivial. We cannot get a good measurement this way.

I am conducting some research in an attempt to estimate the emigration of foreign-born scientists and engineers from the U.S. work force during the period 1981-1986. While efforts are not complete, I can present some results for doctorate engineers from 1981 to 1985. Using the response rate to the 1981 Survey of Doctorate Recipients (SDR) as a point of departure, I obtained special tabulations of 1981 response rates for those with engineering doctorates. I then examined the 1983 and 1985 response rates for all of the 1981 respondents, calculating response rates separately for those born in the United States, those born abroad but who were U.S. citizens in 1981, foreign nationals on permanent visas in 1981, and foreign nationals with temporary visas in 1981. I hypothesize that emigration would be greater for the foreign-born and, within this group, that emigration would be greatest for those here on temporary visas in 1981. Emigration does not always result in nonresponse to the SDR, so I also recorded responses from abroad and treated an increase in foreign responses the same as an increase in nonresponse.

The estimates in Table D-3 are based on two important assumptions: (1) there is no net emigration by native-born, U.S.-citizen engineering doctorates from 1981 to 1985, and (2) all of the change in nonresponse for others relative to the native-born reference group is the result of emigration. While perhaps not perfectly accurate, I find these to be reasonable assumptions. I am not assuming no difference in response rate behavior for foreign-born individuals living is the United States. That can show up in our 1981 base-year calculation. I am simply assuming that the 1981 to 1985 *increase* in the nonresponse for foreign-born relative to U.S. natives indicates emigration of foreign-born. Given that the foreign-born typically have more opportunities for em-

TABLE D-3: Four-Year Emigration Rate Estimates from Nonresponse to the 1981 and 1985 Surveys of Doctorate Recipients

Status	Percentage
Naturalized U.S. citizen	1.3
Non-U.S. citizens in 1981	
Permanent visas	13.8
Temporary visas	45.0

SOURCE: Calculated by author from special tabulations from the National Research Council's 1981 and 1985 Surveys of Doctorate Recipients.

TABLE D-4: Estimated Emigration Versus Estimated Immigration of Doctorate Engineers, 1981-1985

Classification	Number
Emigration losses	700
"Immigration gains"	
No U.S. degree	800
U.S. degree	3,900
Total immigration	4,700

NOTE: Immigration here includes anyone entering the U.S. work force, even those who are working in the United States on temporary visas. Immigration gains are obtained by estimating a 1-year rate and multiplying this by four. This leads to some overestimation of net immigration during the 4-year period because, due to emigration, the 4-year immigration rate can be expected to be lower than four times the 1-year rate.

ployment abroad and also have more family ties, this seems like a reasonable interpretation. In defense of the reasonableness of this interpretation, I note that the data behave as might be expected in several respects. One, shown in Table D-3, is that our estimates show emigration rates increasing with citizenship status in 1981 in the expected fashion—that is, higher emigration estimates for non-U.S. citizens than for citizens and, among the noncitizens, much higher emigration rates for those who were on temporary visits in 1981.

Also, I examined estimated nonresponse rates by region of birth and obtained what I believe are not surprising results: the highest rate of nonresponse in 1985 was for those engineers who were born in East Asia. Doctorate engineers born in this region are relatively young and have ties to a rapidly industrializing region, so it seems reasonable to interpret their nonresponse as signaling emigration. In contrast, by country of origin, the highest response rate in 1985 was for those born in Western Europe or Canada. These engineering doctorates tend to be relatively older compared with other immigrant engineers, have probably been in the United States for a longer period of time, and thus might be expected to have a lower emigration rate.[2]

Another way to examine the plausibility of the emigration rate estimates shown in Table D-3 is to use them to estimate total emigration during the period. Such estimates are shown in Table D-4, which suggests that emigration of foreign-born doctorates from the U.S. work

[2] I excluded Ph.D.s over 58 years of age in 1981 altogether because emigration associated with retirement from the labor force is not our primary interest.

force is significant in relation to the number entering the U.S. work force. Over a 4-year period, I estimate that emigration losses amounted to about 15 percent of the number who entered the U.S. work force. To me this is plausible, as my "immigration" estimates include not only legal immigrants but also persons who enter the work force while still on temporary visas. This estimate can be contrasted with estimates that total emigration is about one-third of all immigration (Warren and Kraly, 1985).

A number of issues are worth considering, assuming, as I do, that these numbers are reasonably accurate. First, we need to verify these preliminary estimates; and if confirmed, this means that the Doctorate Records File, based on the annual Survey of Earned Doctorates and maintained by the National Research Council (NRC), needs to be modified. At present, the NRC and the NSF are, I believe, assuming that people I call "emigrants" are nonrespondents. The consequence of this is that they overestimate the number of engineering doctorates in the United States, especially the number of foreign-born engineering doctorates. Second, I believe that, if confirmed, an outflow of foreign-born engineers of this magnitude strengthens the argument for a public policy to encourage greater enrollments of U.S. citizens in graduate schools of engineering.

EARNINGS OF FOREIGN ENGINEERS RELATIVE TO THOSE OF U.S. CITIZENS

I think the evidence is clear that foreign engineers do not work for less than comparable engineers who are U.S. citizens. I have examined this question with two completely different data sets. One was a large representative sample of experienced workers interviewed by the Bureau of the Census for the NSF. In that study I examined the earnings of over 13,000 engineers and controlled for years of work experience, type of employer, degree field, degree level, and several other relevant factors. I found no support at all for the notion that foreign nationals working in the United States without any degrees from U.S. universities might earn less; but this is a small group, and even if we accepted this weak evidence (not significant at the 0.05 level), it pointed to an earnings differential for this subgroup of only 3 percent. I am willing to assume that a small differential such as this might be due to such factors as language ability or school quality, for which we were not able to control (Finn, 1985).

I also analyzed recent science and engineering graduates who earned B.S. or M.S. degrees from U.S. universities during 1982 and 1983. The results are unpublished but support fully my conclusions from analyzing NSF's experienced sample.

I know that there are some engineers who are convinced that foreign engineers do work for less and do depress earnings for those native-born U.S. citizens. The main evidence I have seen offered to prove their point is employment advertisements that offer low wages. I reject these because I know that there is quite a bit of variance in earnings at every experience level. It is not surprising that we should see ads for jobs that pay 30 or 40 percent less than the median wage.

These jobs are at the low end of the pay scale, experience a lot of turnover, and consequently are advertised relatively frequently. I have seen no better evidence offered to support the contention that foreign engineers work for less.

I do, however, concur that foreign engineers probably depress earnings below what they would be in their absence. Based on existing empirical research of the engineering labor market, I think the following is hard to disagree with: if foreign engineers had not been allowed to enter the U.S. labor market over the past decade, we would have seen an increase in engineering salaries above current levels. The increase in salaries would have been greatest for Ph.D.s and would have resulted in an increase in Ph.D. enrollments. However, the increased enrollments would not have been enough to offset completely the loss of the foreign workers, with the result that salaries would remain higher than they are now.

While I can understand why some would prefer higher salaries for engineers, I think it is worth pointing out that engineering salaries are higher than salaries in nearly all other occupations. Further, the legal immigration of engineers is only a small fraction of total legal immigration and, presumably, an even smaller fraction of total immigration, legal and illegal. Engineers account for 1-2 percent of the U.S. work force with the precise percentage in that range depending on whether we use statistics from NSF or the Bureau of Labor Statistics (BLS) on the number of engineers. Engineers account for 1-2 percent of legal immigration as well, and that might fall if we could get a good estimate of illegal immigration. If we restricted entry of engineers without restricting total immigration, we would probably reduce the overall quality of our work force and depress wages in some of the occupations that already offer substantially less than engineering. In short, I do not think it is relevant to consider a scenario where the only thing different is that we have fewer engineering immigrants and higher engineering wages. Restricting immigration generally to lower levels is an issue beyond the scope of this paper. However, I would note that a strong argument has been made that such restrictions would not necessarily raise U.S. wages or would raise wages by a very small amount (Borjas and Tienda, 1987; Johnson and Orr, 1981).

DO FOREIGN ENGINEERS DISPLACE U.S. NATIVES IN ENGINEERING SCHOOLS?

Remarkably little research has been directed to this issue, but I think that the evidence suggests a displacement effect. The more interesting questions are: How great is the displacement effect? and So what? I say this because the evidence from the labor market studies support the view that (1) other things equal, salaries would be higher with fewer graduating engineers, and (2) engineering enrollments are responsive to the economic incentive of higher salaries (Freeman and Breneman, 1974; and Shamia, 1984).

We really do not have the research that we need to estimate the displacement effect. The model that comes closest to what we would need is in Shamia's 1984 Ph.D. dissertation, which builds on earlier work by Hansen, et al. (1980), Freeman and Breneman (1974), and Scott (1979). Shamia's model has four equations--one each for the number of enrollments, number of graduates, salary, and total employment. For the question at hand, two parameters from Shamia's model are especially relevant: the elasticity of engineering enrollments with respect to salaries and the elasticity of salaries with respect to enrollments 5 years earlier. Using his estimates of these parameters over the period 1959-1980, we can obtain an estimate of the effect of increasing foreign enrollments on salaries and thus on domestic enrollments. Assuming that 60 percent of the foreign engineering Ph.D.s stay in the United States to work, a 1.0 percent increase in enrollment by recruiting foreigners can be expected to cause a 0.2 percent drop in salaries and this, in turn, would cause a decline in U.S. citizen enrollments of 0.16. This is the short-run impact. With several years to adjust, Shamia's model produces estimates of enrollment elasticity of 1.28 (instead of 0.81 in the short run), and this can be used to produce an estimate of a longer-run displacement effect of 0.26. Thus, increasing foreign enrollments by 100 increases total enrollments by only 84 (74 in the longer run). If one wants to increase total enrollments by 100 though, foreign enrollments could be increased by 119 (135 in the longer run).

Let me be the first to criticize the estimate just provided. Shamia's estimates of enrollment elasticities were calculated for total enrollments, not U.S.-citizen enrollments. He did not design the model to address this question. It is plausible that the effect for U.S. citizens' response to salary changes is greater, since the total effect reflects some averaging of the response to salary changes in the U.S. market by foreign and U.S.-citizen students. If this is so, we would expect the displacement effect to be somewhat larger than estimated here. Perhaps more important, I would argue that Shamia's results may not be robust. Would we get the same results with a different time period, with a slightly different model specification, with salary data other than the salary offer data reported by the College Placement Council? We do not know. We do know, however, that his parameter estimates are not out of line with other estimates of the market for Ph.D.s.[3] If there is a more appropriate model of the engineering Ph.D. labor market, I am not aware of it.

Suppose we accept that there is a displacement effect. Let us, for the purpose of discussion, even say it is around 0.25--that if foreign enrollments go up by 100, then U.S. enrollments will fall by 25. So what? What difference does it make? Would it affect our view of the desirability of foreign engineers in the U.S. labor market?

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[3] Enrollment elasticities measure the percentage change in enrollments in response to a 1 percent change in salaries. Shamia (1984) estimated enrollment elasticities of 0.81 (short term) and 1.28 (longer term). This is somewhat lower than the 2.0 that Freeman and Breneman (1974) assert to have been the case in the physical sciences, but close to what Scott (1979) found for Ph.D. economists (0.89).

I think there is a need for more engineers in the United States. I think we should encourage more young people to go into science and engineering. If we are successful, employers will be hiring fewer foreign engineers. We should do this because our young people want the kinds of jobs engineers get, but many who want those jobs are not preparing themselves properly and cannot get in or cannot stay in engineering school.

We would have a difficult choice if estimates of displacement were so high that the admission of foreign engineering students could be expected to reduce the size of our total engineering work force in subsequent years. Consider the arithmetic for Ph.D. engineers. Suppose that admission of 100 foreign students does displace 25 U.S. students on the margin. Suppose that 62 percent of the foreign nationals who get doctorates stay here to work, then (assuming U.S. natives all work here) our work force would have a net gain of 62 - 25 = 37. What about emigration? If some of the foreign nationals emigrate, would that reduce the net gains to the United States from admitting foreign students? Yes, but to the extent that they emigrate, the displacement effect is smaller (they are not here having a depressing effect on salaries). I have examined different stay rates and emigration rates applied to those who do stay, and I cannot find any combination where the total Ph.D. engineering work force is smaller because of foreign students. Unless we come up with some estimates of displacement effects that are very different from those produced using Shamia's dissertation, I can imagine only one scenario where foreign enrollments reduce total supply: we could get a temporary decrease in supply if the stay rate for foreigners declined sharply. It might take several years before the graduate schools could recruit and graduate more U.S. students, and in the meantime total Ph.D. supply would probably be less than it would have been if a smaller number of foreign students had been admitted in the first place.

NET BENEFITS OF FOREIGN ENGINEERS

The emigration of foreign-born engineers may be a problem for the United States if these engineers transfer technology to our military or commercial adversaries. The displacement of U.S.-native engineering students is a problem too. But both of these can be exaggerated. The cost of technology transfer is difficult to measure, and the steps that are sometimes used to reduce the flow have, it has been argued, often been more costly to us than the problem that they are intended to cure. It is not even clear what we might accomplish in this regard if the number of foreign graduate students in engineering were limited to some arbitrary but positive percentage of the total student body. Would technology transfer be reduced if the number of foreign students were cut in half? I doubt it.

On the other hand, there are some very real benefits to the U.S. economy from the foreign engineers who do stay here. Scholars who have looked at the total immigration picture are not in complete agreement but tend to conclude that immigration on balance benefits the U.S. economy (Johnson and Orr, 1981). These conclusions are generally based on benefits other than productivity increase because immigration tends to increase productivity only if the average immigrant is more highly skilled than the average worker in the U.S. labor force. Borjas' studies indicate that, at least in recent years, immigration on the whole appears not to be increasing the average skill level of the labor force because so many immigrants are low-skilled (Borjas and Tienda, 1987). The immigration of engineers and scientists is an important element of immigration, tending to offset the lower productivity of low-skilled immigrants. To see the benefit of foreign engineers, consider what would happen if the entry of foreign engineers were restricted. The total immigration quota would almost certainly be filled, but the average skill level of immigrants would decline. To the extent that immigrants do depress wages, this would probably still happen; but it would happen more in other (already lower-paid) occupations. The U.S. economy would almost certainly be worse off.

On a final note, let me add to the evidence indicating that foreign-born scientists and engineers are enriching the quality of our work force. Lerner and Roy (1984) documented that foreign-born engineers and scientists are overrepresented among the memberships of the National Academy of Engineering and the National Academy of Sciences and also among U.S. winners of the Nobel prize. I believe that our science and engineering immigrants are also contributing to the quality of our work force through the achievements of their children. I inquired of the Westinghouse Science Search Organization and found that nearly one-third (13) of the 40 high school seniors that it honored this year were the children of immigrants, mostly Asian Americans. I did not get data on their parents' occupations, but it seems a safe bet that most of their parents are among the small minority of immigrants who were themselves trained as scientists and engineers.

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Summary Report 1981

DOCTORATE RECIPIENTS FROM UNITED STATES UNIVERSITIES

Declassified and Approved For Release 2012/10/22 : CIA-RDP90-00530R000300610001-6

HIGHLIGHTS

- The total number of doctorates awarded in 1981 was 31,319, a one percent increase from the 31,016 doctorates awarded in 1980.

- The proportion of doctorates granted to women increased from 30.3 percent of the total in 1980 to 31.5 percent in 1981, continuing a trend that began in 1965. The number of women increased in all major fields with the exception of the physical sciences where the number remained constant from 1980 to 1981.

- From 1971 to 1981, the number of women doctorates in education more than doubled, while the corresponding number of men decreased 22 percent. If this trend continues, education could become the first major field where the number of doctorates granted to women exceeds the number granted to men.

- The number of doctorates granted to men decreased by less than 1 percent from 1980 to 1981--the smallest decrease in number of men doctorates since 1973. Increases were seen in the physical, life, and social sciences and in engineering, with offsetting decreases in the humanities, professional fields, and education.

- For the first time since the beginning of the questionnaire survey in 1958, the proportion of doctorate recipients in a broad field--engineering--reporting foreign citizenship (49 percent) exceeded the proportion reporting U.S. citizenship (46 percent).

- Three sources of financial support in graduate school--own earnings, teaching assistantships, and research assistantships --were reported by over 60 percent of the doctorate recipients as their primary source of support.

- While considerable variation among fields was found in patterns of support, in general the most frequently reported source in the physical sciences, engineering, and life sciences was the research assistantship, the teaching assistantship in social sciences and humanities, and own earnings in the professional fields and education.

- Women doctorate recipients reported support from "self" sources--own earnings, spouse's earnings, and family contributions--with considerably greater frequency than men, while over twice as many men as women reported research assistantships as their primary source of support.

- Of all the racial/ethnic groups, Asian doctorate recipients reported the greatest frequency of support from university sources--research and teaching assistantships and university fellowships. American Indians reported greatest support from the "self" sources and, along with whites, from federal sources.

Summary Report 1981 DOCTORATE RECIPIENTS FROM UNITED STATES UNIVERSITIES

The Survey of Earned Doctorates is
conducted by the
National Research Council for the
National Science Foundation,
the U.S. Office of Education,
the National Institutes of Health, and
the National Endowment for the Humanities

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Office of Scientific and Engineering Personnel
NATIONAL RESEARCH COUNCIL

NATIONAL ACADEMY PRESS
1982

FOREWORD

Presented in this report is a summary of the results of the 1980-81 Survey of Earned Doctorates. The survey is conducted each year by the Office of Scientific and Engineering Personnel (formerly the Commission on Human Resources) of the National Research Council. The questionnaires are distributed with the cooperation of the graduate deans of U.S. universities and are filled in by the graduates when they complete all requirements for their doctoral degrees. The doctorates reported here were earned during the period July 1, 1980 to June 30, 1981. Research and applied-research doctorates in all fields are included in the survey, but professional doctorates such as M.D., D.D.S., O.D., D.V.M., and J.D. are not. A full list of titles of degrees included is shown on the inside back cover.

Responses were received from 29,924 or 96 percent of the 31,319 doctorates granted in 1981. When completed forms are not received from individual doctorate recipients, abbreviated records are constructed using information from the university's commencement bulletins. As a result, basic information, such as sex, field, institution, and year of Ph.D., is available for all of the 31,319 doctorate recipients.

The Survey of Earned Doctorates has been conducted each year, beginning in 1958. Yearly summaries of data from the survey have been published since 1967; this is the fifteenth in the series. Trend data from earlier periods can be found in the book A Century of Doctorates (National Academy of Sciences, 1978).

The conduct of the Survey of Earned Doctorates questionnaire, the maintenance of the resulting data file, and the publication of this report are supported jointly by the National Science Foundation, the Department of Education, the National Institutes of Health, and the National Endowment for the Humanities. The Office of Scientific and Engineering Personnel (OSEP) thanks these agencies for their assistance. Charles Dickens of the National Science Foundation is the project officer for the agencies; his interest and assistance are appreciated. We also express our thanks to the graduate deans in the doctorate-granting institutions for their continuing interest and assistance in this project.

The Survey of Earned Doctorates is under the direction of Peter Syverson. Elise Brand had continuing responsibility for the development of the summary statistics presented in the present report. In addition, Dr. Dickens of the National Science Foundation, Donald Bigelow of the Department of Education, George Bowden of the National Institutes of Health, and Arnita Jones of the National Endowment for the Humanities have provided constructive advice in the design and analysis of the Survey, a contribution that increases its relevance to national policy issues. Kenneth R. R. Gros Louis, Kumar Patel, and Michael J. Pelczar provided valuable assistance in review of the report. Special appreciation also goes to Doris Rogowski who supervised the coding and editing of the data, to Joseph Finan and George Boyce who were responsible for the computer programming and processing, and to Olivia Waller for her meticulous care in typing the report.

OSEP is concerned with those activities of the National Research Council that contribute to the more effective development and utilization of the nation's scholars and research personnel. Its programs seek to strengthen higher education and to develop better understanding of the educational process. It is hoped that prompt reporting of the present data to educational, governmental, and professional agencies will facilitate planning in higher education. Suggestions for improvement of the content or format of the report and questions or comments are welcomed. Such communications may be directed to the Office of Scientific and Engineering Personnel, National Research Council, 2101 Constitution Avenue, N.W., Washington, D.C. 20418.

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Operations Manager

NOTICE: This report is based on research conducted by the National Research Council with the support of the National Science Foundation, the Department of Education, the National Institutes of Health, and the National Endowment for the Humanities under NSF Contract No. SRS-8112839. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the National Research Council and do not necessarily reflect the views of the sponsoring agencies.

INTRODUCTION

A total of 31,319 research doctorates were awarded by U.S. universities during the period July 1, 1980 to June 30, 1981, an increase of 1 percent or 303 from the 31,016 doctorates granted in 1980 (Text Table A). Displayed in Figure 1 are data on the trend in doctorates awarded over the past two decades. The period from the mid 1960's to 1973 of large annual increases in number of doctorates has been followed by gradual decreases through the 1970's with small increases in 1979 and 1981. Despite these increases, the 1981 total is 7 percent less than the peak of 33,756 doctorates awarded in 1973.

TEXT TABLE A
Doctorates Awarded by U.S. Universities, 1960-1981

Year	Doctorates	Year	Doctorates
1960	9,733	1971	31,867
1961	10,413	1972	33,044
1962	11,500	1973	33,756
1963	12,729	1974	33,047
1964	14,325	1975	32,951
1965	16,340	1976	32,946
1966	17,949	1977	31,718
1967	20,403	1978	30,873
1968	22,936	1979	31,235
1969	25,743	1980	31,016
1970	29,498	1981	31,319

SOURCE: NRC, Office of Scientific and Engineering Personnel, Doctorate Records File

Selected statistics from the 1981 Survey of Earned Doctorates and from past surveys are highlighted in the following pages. Because of current concern with student debt and the financing of graduate study, this report takes as a special theme the sources of support used by doctorate recipients during graduate studies. The Summary Report for 1980, readers of this report may remember, highlighted data on the characteristics of non-U.S. citizen doctorate recipients--their countries of citizenship, fields of study, sources of support in graduate school, and postdoctoral employment and study plans. Statistics on the postgraduation employment plans of Ph.D. recipients and the number of doctorate recipients planning postdoctoral study in foreign countries were examined in the 1979 Summary Report.

TRENDS IN THE NUMBER OF DOCTORATES BY FIELD FOR MEN AND WOMEN

The proportion of doctorates granted to women increased from 30 percent of the total in 1980 to 32 percent in 1981, continuing a trend that began in 1965 when 11 pecent of the new doctorates were women. The number of doctorates granted to women has increased each year since 1965.[1/] While the total number of doctorate recipients in 1981 was about the same as in 1971, the number of women doctorates has more than doubled during the past eleven years from 4,596 to 9,872. Text Table B and

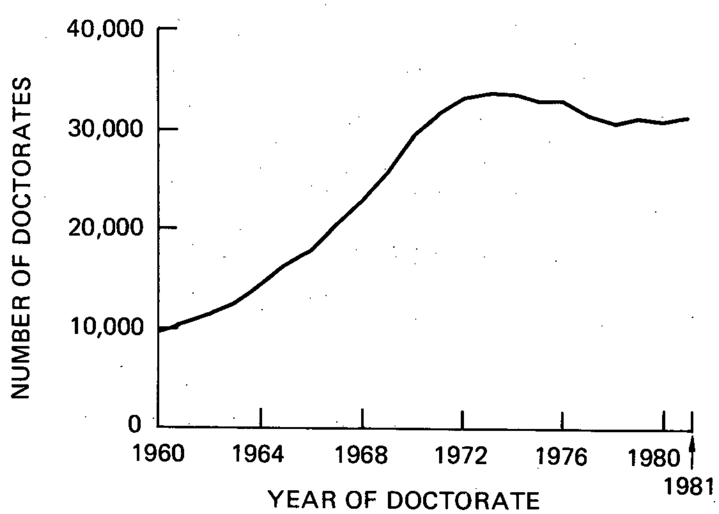


FIGURE 1
Doctorate Recipients from United States Universities, 1960-1981. SOURCE: NRC, Office of Scientific and Engineering Personnel, Doctorate Records File.

1/Data for 1920 to 1970 were published in Summary Report 1975: Doctorate Recipients from United States Universities, p.4, National Research Council, 1976.

Figure 2 show the distribution of doctorate recipients by broad field and sex for the period 1971 to 1981.

The number of women doctorate recipients increased in all broad fields between 1980 and 1981 with the exception of the physical sciences, where the number of women remained constant at 502. The largest numerical increase was in education, where the number of women rose by 151 to 3,534. The "professional"[2] fields showed the largest proportional increase, up 13 percent from 1980. The number of women doctorates in the humanities increased for the first time since 1975. Table 2 on page 33 shows that a greater number of women received doctorate degrees in two humanities disciplines--English and American languages and literature and foreign languages and literature--than did men.

For men, the number of new doctorates decreased slightly, from 21,610 in 1980 to 21,447 in 1981. While this 1 percent decrease is the smallest since 1973, it represents a continuation of the steady decline in the number of men doctorates since 1972. By field, the number of doctorates granted to men increased in the physical, life, and social sciences and in engineering, with countervailing decreases in the humanities, professional fields, and education. The decrease in the number of men doctorates in education--the largest decrease over all broad fields--is in contrast to the increase in the number of women earning doctorates in education. In fact, from 1971 to 1981 the number of men education doctorates decreased 22 percent while the corresponding number of women increased 163 percent. The number of women doctorates in education is now within 11 percent of the number of men. If this trend continues, education may soon become the first broad field where the number of doctorates granted to women exceeds the number granted to men.

PRIMARY SOURCE OF FINANCIAL SUPPORT IN GRADUATE SCHOOL

The following presentation focuses on the sources of financial support doctorate recipients have reported using for their graduate study. This discussion of the sources and distribution of support may help to shed light on the current national situation in the financing of U.S. higher education. While the tables and graphs that follow are by no means exhaustive of the doctoral data, they illustrate some of the many ways the survey results can be used.

Data on sources of support are derived from responses to item 15 on the questionnaire (p. 43). Since the 1978 survey this question has asked the doctorate recipient to identify his or her primary and secondary sources of support and to check all

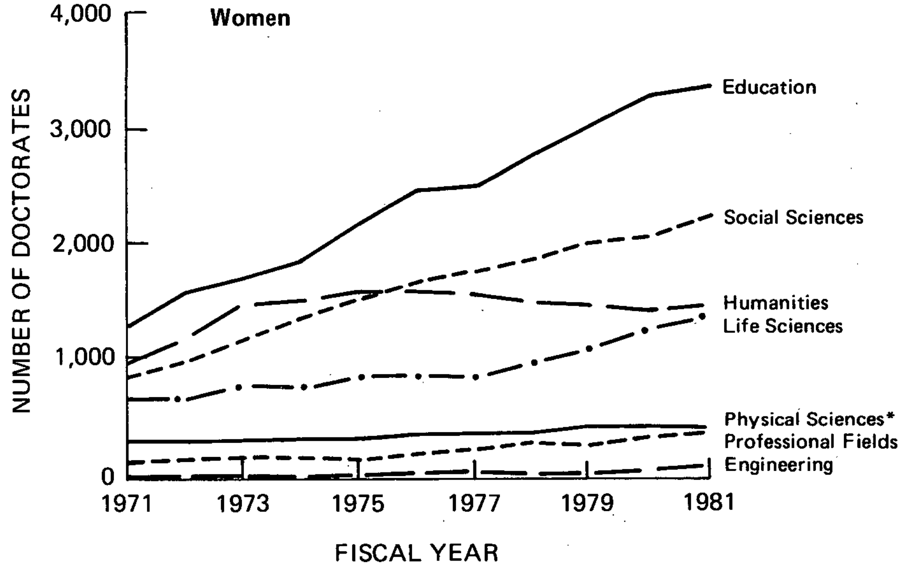
TEXT TABLE B
Number of Doctorates Awarded by United States Universities by Broad Field and Sex, 1971-1981

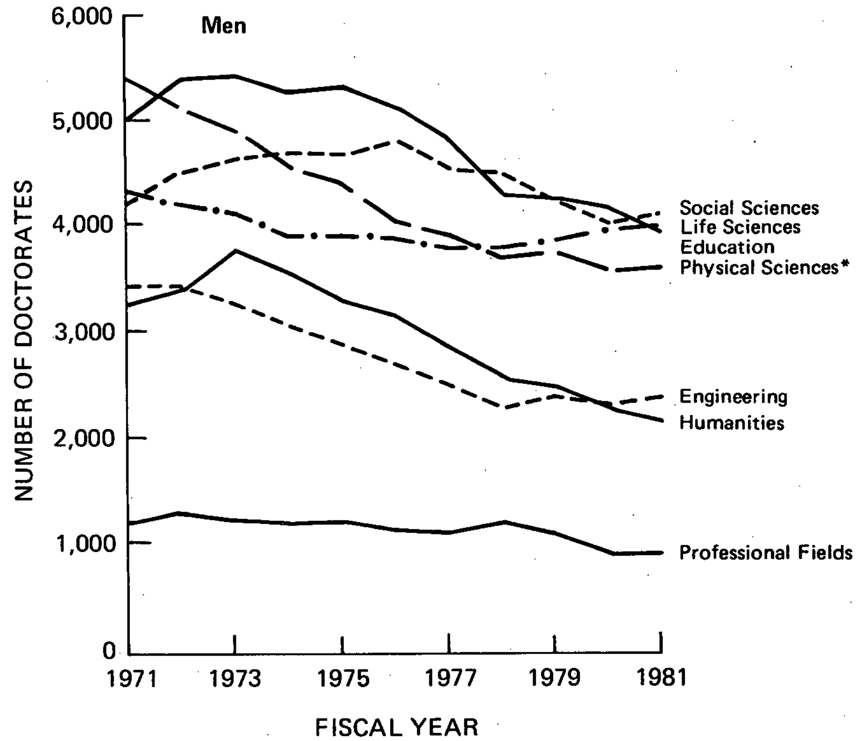
Year	Total		Physical Sciences		Engineering		Life Sciences		Social Sciences		Humanities		Professional Fields		Education	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
1971	27,271	4,596	5,398	341	3,483	15	4,360	715	4,265	924	3,314	1,063	1,262	177	5,089	1,346
1972	27,257	5,287	5,171	367	3,481	22	4,221	731	4,558	1,053	3,440	1,274	1,349	184	5,439	1,646
1973	27,671	6,085	4,929	382	3,318	46	4,140	868	4,692	1,246	3,817	1,547	1,258	201	5,456	1,783
1974	26,594	6,453	4,592	384	3,114	33	3,967	867	4,727	1,446	3,594	1,576	1,226	194	5,302	1,939
1975	25,750	7,201	4,454	403	2,950	52	3,955	950	4,711	1,600	3,359	1,687	1,243	208	5,064	2,295
1976	25,262	7,684	4,089	420	2,780	54	3,922	959	4,856	1,734	3,208	1,673	1,189	290	5,185	2,540
1977	23,860	7,858	3,949	430	2,569	74	3,817	957	4,691	1,837	2,903	1,659	1,045	308	4,870	2,585
1978	22,552	8,321	3,754	439	2,370	53	3,809	1,086	4,510	1,955	2,635	1,596	1,128	330	4,339	2,855
1979	22,299	8,936	3,803	496	2,428	62	3,888	1,196	4,283	2,109	2,546	1,592	1,059	366	4,277	3,107
1980	21,610	9,406	3,609	502	2,389	90	3,991	1,347	4,086	2,168	2,336	1,532	982	376	4,203	3,383
1981	21,447	9,872	3,666	502	2,429	99	4,018	1,443	4,190	2,315	2,198	1,547	964	424	3,995	3,534

*Includes mathematics and computer science.

SOURCE: NRC, Office of Scientific and Engineering Personnel, Doctorate Records File.

[2] The category "professional fields" includes doctorate recipients in fields such as business administration, social work, theology, and speech and hearing sciences. A listing of the subfields included in each broad field can be found inside the back cover.





*Includes mathematics and computer sciences.

FIGURE 2
Number of Doctorates Awarded by U.S. Universities by Broad Field and Sex, 1971-1981. SOURCE: NRC, Office of Scientific and Engineering Personnel, Doctorate Records File.

other sources from which some support was received. Primary source responses were chosen for this analysis because these provide a measure of the relative magnitude of support received, even though data on the monetary value of support are not collected. The differences between tabulations of primary source responses and responses that simply indicate that some support was received from a particular source can be seen by comparing Text Table C (p.13) and Table 3 (p. 38). For example, while 16 percent of all 1981 doctorate recipients reported receiving some measure of support from family contributions, only about 2 percent noted that source as the primary source of support. In contrast, the 7 percent reporting receiving some support from NIH were more closely matched by the 5 percent who reported NIH as their primary support source. Of the 31,319 doctorate recipients in 1981, 29,480 or 94 percent responded to item 15, and 27,769 or 94 percent of those respondents provided usable information on primary source of support.

The 24 sources of support listed in item 15 have been collapsed into the following 13 categories for purposes of this analysis, with subtotals for the federal, university, and self-support sources:

Category	Responses Included
Federal	
NSF NIH Other Federal	NSF Fellowship, NSF Traineeship NIH Fellowship, NIH Traineeship, NDEA Fellowship, Title IX Graduate and Professional Opportunities Program Fellowship, NASA Traineeship, GI Bill, Other Federal Support
U.S. National Fellowship	Woodrow Wilson Fellowship, Other U.S. National Fellowships
University	
University Fellowship	University Fellowship
Teaching Assistantship	Teaching Assistantship
Research Assistantship 3/	Research Assistantship
Business/Industry	Educational Fund of Industrial or Business Firm
Self Support	
Own Earnings	Own Earnings
Spouse's Earnings	Spouse's Earnings
Family Contributions	Family Contributions
Loans	National Direct Student Loans, Other Loans
Other	Other Institutional, Other Sources

Support Source by Field and Year of Doctorate

Displayed in Text Table C are data on primary support source by field for the 1978 to 1981 period. It should be noted that as the median time lapse between baccalaureate and receipt of the doctoral degree ranges from 7.8 years in the sciences to 13.5 years in education (see Table 2, page 32), the patterns of support discernible in these tables were established in the early 1970's and are not likely to be the result of recent changes in the financing of graduate education.

From 1978 to 1981, there appears to be considerable stability in the proportions of doctorates reporting support from each of the 13 sources in Text Table C. The largest change in a single support source was a 2 percent decrease in the proportion of doctorates reporting "other federal" as their primary source. During this time, support from federal sources and spouse's earnings tended to decline, while support from research assistantships, own earnings, family contributions, loans, and the "other" sources increased.

During these years, "own earnings" remained the

3/The question on source of support does not allow for the separation of research assistantships funded by federal agencies from those supported through university sources. Recognizing the significant proportion of research assistantships supported by federal funds (some 56 percent according to the 1981 NSF Survey of Graduate Student Support and Postdoctorals) this support is nevertheless channeled through the university and as a consequence is reported here in combination with teaching assistantships and university fellowships.

most frequently reported source, followed by teaching and research assistantships. These three sources accounted for over 60 percent of all primary source responses (see Figure 3). Own earnings was a significant source of support in all fields, but was particularly important in education, the professional fields, psychology, and humanities. Teaching assistantships were of primary importance in mathematics, the humanities, chemistry, the social sciences, and physics; research assistantships in the physical sciences, engineering, computer science, and the life sciences.

While the other 10 sources were of considerably lower total magnitude, some of them were concentrated in particular fields. NIH support, although eighth largest overall, was first and second in the medical and biological sciences respectively. The category "other sources," which has as a large component support from foreign countries, was important for Ph.D.'s in agricultural sciences, the field with the second largest proportion of non-U.S. citizens. Support from the NSF was concentrated in the physical sciences, mathematics, engineering, computer sciences, and the biological sciences.

Figure 4 presents field profiles of the primary sources of support reported by 1981 doctorate recipients. The physical science fields--physics and astronomy, chemistry, and earth sciences--share a pattern of concentration of support from research assistantships, although in chemistry teaching assistantships are common. The 57 percent of physics doctorates reporting research assistantships as their primary source represents the largest concentration on a single source of support in any field.

Mathematics has nearly a complementary pattern, with teaching assistantships as the major source. Like physics, the 55 percent of mathematics Ph.D.'s reporting teaching assistantships is the largest proportion reporting that source among the Figure 4 fields. Computer science and engineering share nearly the same support pattern, with research assistantships, teaching assistantships, and own earnings as the top three sources. Computer scientists were most likely to report NSF support for graduate study. Not surprisingly, graduate student support from industrial or business firms was most prevalent in engineering and computer science, with 4 percent and 3 percent of students in those fields receiving some assistance from that source.

Support from the NIH and from research assistantships were the two sources most frequently reported by Ph.D.'s in the biological and medical sciences. Own earnings was reported as the primary source by 16 percent of the medical scientists, a comparatively large proportion. The agricultural sciences have a different support pattern from the other life science fields, with research assistantships and "other" as the leading sources. A review

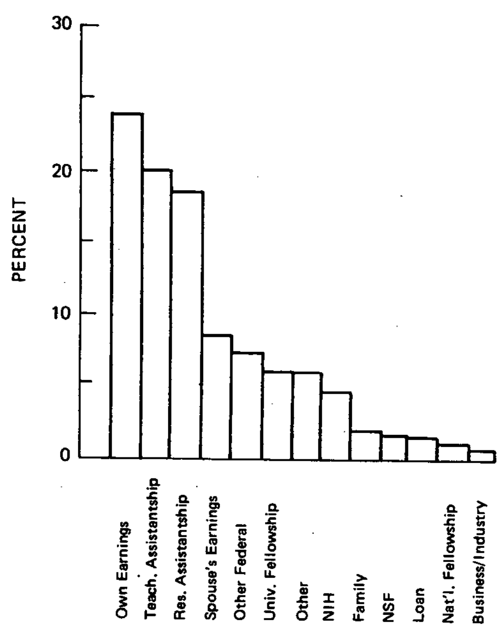


FIGURE 3
Primary Source of Support for 1978-1981 Doctorate Recipients Ranked by Proportion Reporting Each Source.
SOURCE: NRC, Office of Scientific and Engineering Personnel, Doctorate Records File.

of the written-in responses to the "other" item reveals that this category is typically used by non-U.S. citizen Ph.D.'s to denote support from their home countries.

In the social science fields, teaching assistantships and own earnings were the sources of graduate student support most frequently reported. Doctorate recipients in psychology reported own earnings as the primary source more frequently than in all other science and engineering fields, and support from loans more frequently than in all 17 fields.

As in the social sciences, doctorate recipients in the humanities relied primarily on teaching assistantships and own earnings for their support during graduate school. More significantly, three other sources--university fellowship, spouse's earnings, and family contributions--were reported more frequently by humanities Ph.D.'s than by those in any other fields.

Own earnings, teaching assistantships, and spouse's earnings were the major sources reported by doctorate recipients in the professional fields. Their largest source--own earnings--was reported more frequently here than in any of the other fields except education.

Over one-half of the doctorate recipients in education reported primary support from their own earnings, a considerably greater frequency than in all other fields. Teaching assistantships, spouse's earnings, and "other federal"--for the most part from the G.I. Bill--are the other significant sources of support for education doctorates.

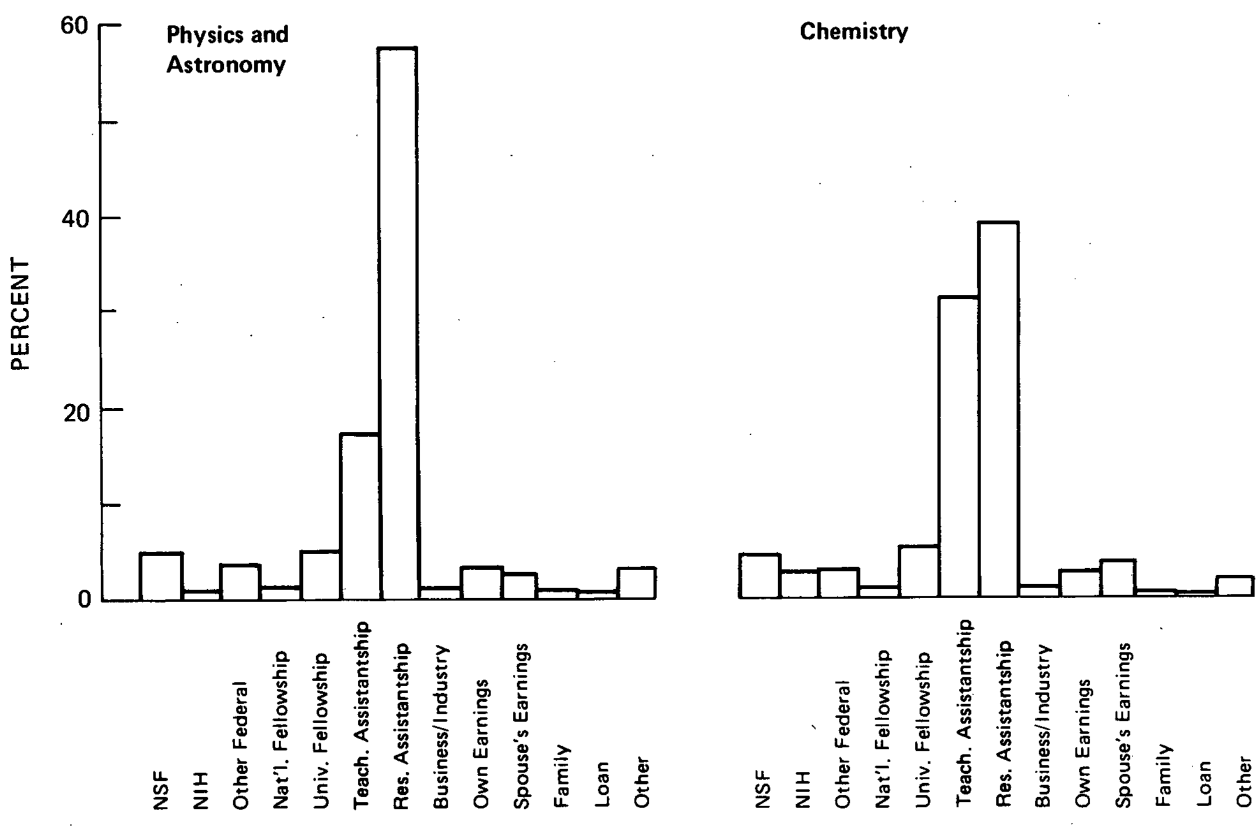


FIGURE 4
Primary Source of Support for 1981 Doctorate Recipients by Field of Doctorate.
SOURCE: NRC, Office of Scientific and Engineering Personnel, Doctorate Records File.

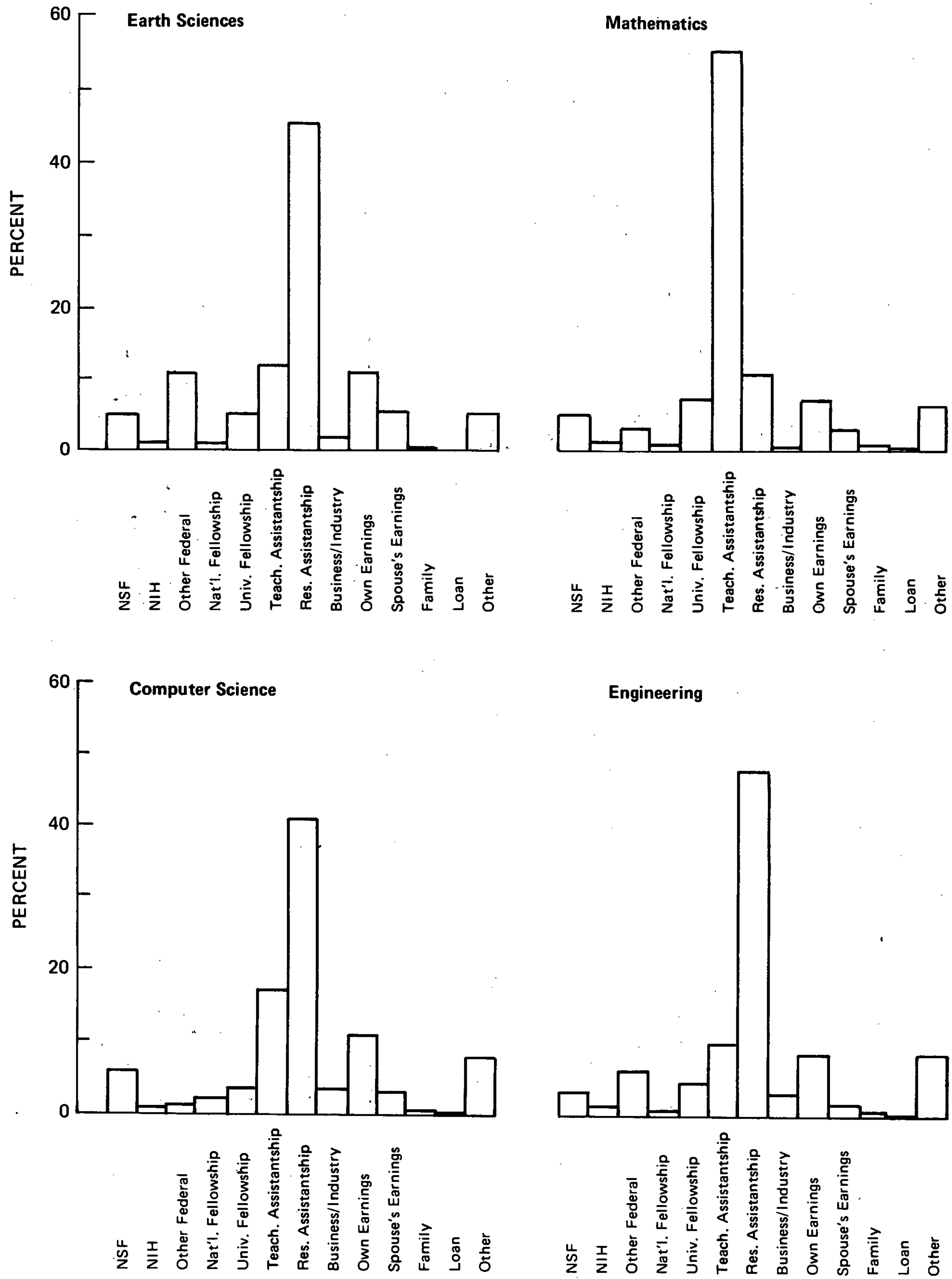


FIGURE 4. Continued

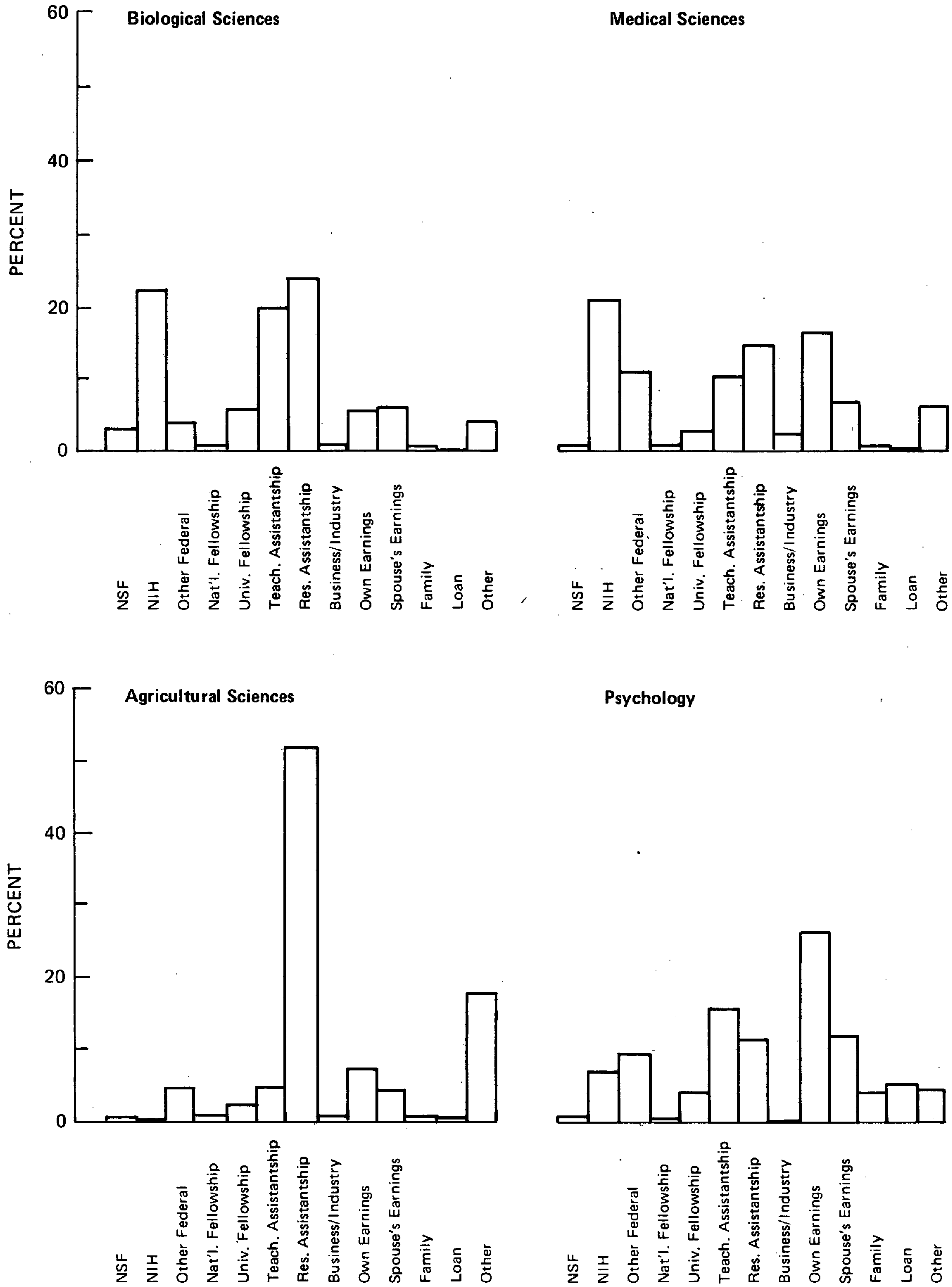


FIGURE 4. Continued

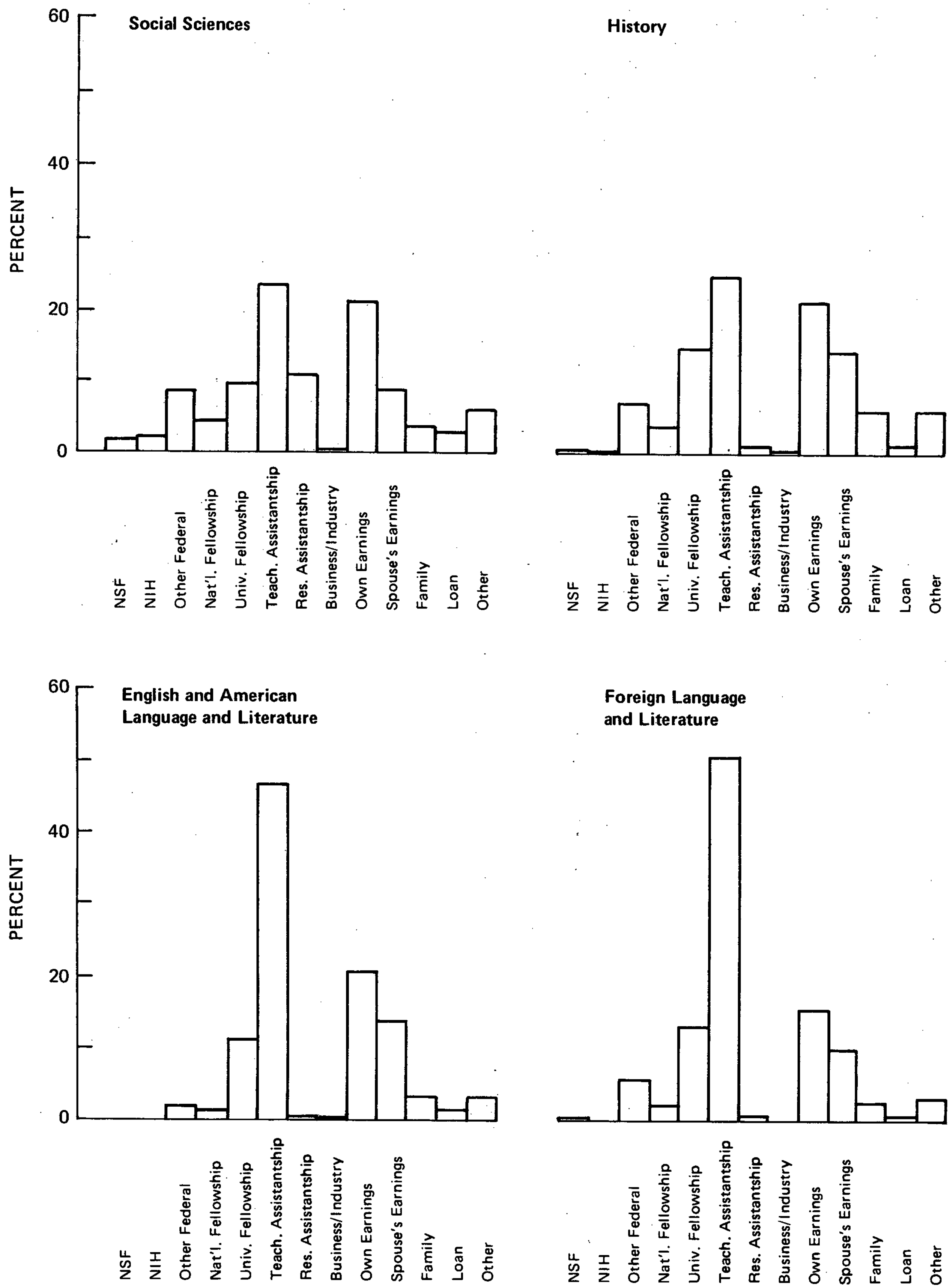


FIGURE 4. Continued

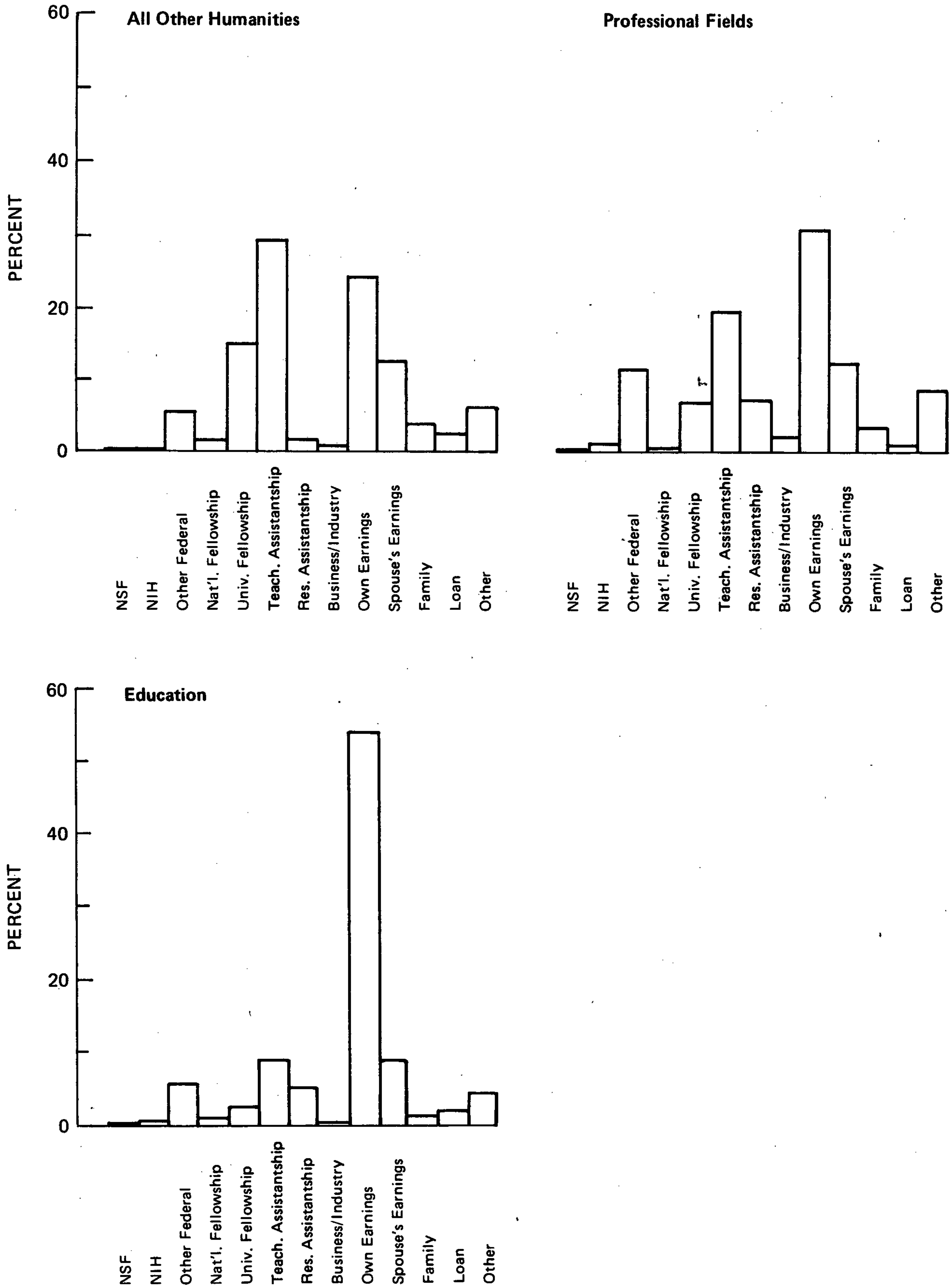


FIGURE 4. Continued

TEXT TABLE C
PRIMARY SOURCE OF SUPPORT IN GRADUATE SCHOOL FOR 1978-1981: PERCENTAGE OF DOCTORATE RECIPIENTS REPORTING PRIMARY SOURCE BY FIELD AND YEAR

	FIELD OF DOCTORATE																	
SUPPORT SOURCE	TOTAL ALL FLDS.	PHYS& ASTR.	CHEM.	EARTH ENV.& MAR. SCI.	MATH.	COMP. SCI.	ENGR.	BIO. SCI.	MED. SCI.	AGR. SCI.	PSYCH.	SOC. SCI.	HIST.	ENG.& AMER. LANG. &LIT.	FOR. LANG. &LIT.	ALL OTHER HUMAN ITIES	PROF. FLDS.	EDUC.
TOTAL FEDERAL																		
1978	14.9*	9.5	9.9	13.7	9.2	9.1	12.2	32.1	38.4	8.9	24.3	16.8	13.9	4.8	14.2	8.3	12.7	8.4
1979	13.7	9.0	9.5	13.6	9.2	6.2	10.0	30.6	38.0	7.3	21.6	15.7	9.7	5.7	9.2	7.8	10.7	7.8
1980	13.4	8.5	11.7	14.2	7.7	7.9	12.0	29.4	33.6	6.9	20.0	13.9	13.8	3.1	7.9	7.1	11.1	7.4
1981	12.7	8.6	11.2	16.2	7.8	8.7	11.1	29.7	34.6	5.7	17.5	12.4	8.0	1.9	5.5	6.2	11.4	6.5
MEAN	13.7	8.9	10.6	14.4	8.5	7.9	11.3	30.4	35.9	7.1	20.7	14.7	11.5	4.0	9.3	7.3	11.5	7.5
NSF																		
1978	1.8	3.7	3.4	3.8	5.2	1.8	4.3	3.4	.5	.9	1.9	2.4	.1			.5	.2	.3
1979	1.8	4.2	3.6	5.4	5.7	3.1	3.2	3.2	1.4	.9	1.4	2.5	.1		.2	.8	.2	.2
1980	1.8	4.4	4.5	3.3	5.0	5.4	3.4	3.5	.9	.5	1.5	2.4	.9		.2	.5	.1	.2
1981	1.7	4.8	4.5	5.4	4.4	6.0	2.7	3.4	1.3	.6	1.1	1.8	.3			.6		.1
MEAN	1.8	4.2	4.0	4.5	5.1	4.4	3.4	3.4	1.1	.7	1.5	2.3	.4		.1	.6	.1	.2
NIH																		
1978	4.9	.6	3.9	.5	.5		2.0	23.0	26.8	.5	9.5	3.5	.3		.2	.2	2.0	.2
1979	4.6	.2	3.4	.3	1.0	.5	1.1	22.6	24.3	.6	9.1	2.7		.1		.1	1.7	.2
1980	4.5	.2	3.5	.3	.9	.5	1.4	20.7	22.4	.3	8.5	3.1	.1			.1	1.2	.2
1981	4.5	.1	3.3	.6	.8	.9	1.6	22.1	21.6	.2	6.9	2.3				.1	1.6	.3
MEAN	4.7	.3	3.5	.4	.8	.6	1.5	22.1	23.5	.4	8.4	2.9	.1			.1	1.7	.2
OTHER FEDERAL																		
1978	8.2	5.2	2.7	9.4	3.4	7.3	6.0	5.7	11.0	7.4	12.8	11.0	13.5	4.8	14.1	7.5	10.4	7.9
1979	7.3	4.6	2.6	7.8	2.4	2.6	5.6	4.8	12.4	5.9	11.2	10.5	9.6	5.6	9.0	6.9	8.8	7.3
1980	7.1	3.9	3.7	10.6	1.8	2.0	7.2	5.2	10.3	6.0	10.1	8.4	12.7	3.1	7.7	6.5	9.8	7.0
1981	6.5	3.8	3.4	10.2	2.7	1.8	6.9	4.2	11.7	4.9	9.5	8.4	7.7	1.9	5.5	5.5	9.7	6.1
MEAN	7.3	4.4	3.1	9.5	2.6	2.9	6.4	5.0	11.3	6.0	10.8	9.6	11.0	3.9	9.2	6.6	9.7	7.1
NATIONAL FELLOWSHIP																		
1978	1.1	1.0	.6	.7	.3	.9	.9	.6	.7	1.5	.6	2.3	4.0	1.3	1.5	2.2	.9	.7
1979	1.0	.5	.5	.3	.9		.6	.9	1.1	1.3	.6	1.8	5.1	1.6	1.0	2.2	.6	.6
1980	1.1	.7	.6	.2	.3	1.5	.5	.5	.4	1.2	.7	2.4	3.7	2.0	1.4	2.9	.6	.7
1981	1.1	1.0	1.0	.6	.3	2.3	.5	.9	1.3	1.6	.7	2.4	3.7	.8	2.0	1.8	.4	.7
MEAN	1.1	.8	.7	.4	.4	1.2	.6	.7	.9	1.4	.6	2.2	4.1	1.5	1.5	2.3	.6	.7
TOTAL UNIVERSITY																		
1978	42.2	76.3	79.2	67.3	65.0	63.6	60.0	49.8	27.0	58.1	32.6	42.4	37.8	53.8	49.7	40.7	29.8	18.7
1979	42.8	77.7	79.0	66.7	70.1	59.8	61.8	48.2	26.9	56.1	32.9	43.2	40.1	54.9	55.8	39.3	34.1	19.0
1980	42.7	77.6	78.1	64.3	74.2	64.9	61.3	51.6	31.3	55.9	31.6	43.1	36.3	55.0	61.7	41.8	33.7	18.4
1981	42.8	78.7	76.9	62.2	73.6	61.9	63.7	49.7	28.7	59.0	30.7	44.0	39.9	57.2	62.8	44.0	32.1	17.8
MEAN	42.6	77.6	78.3	65.2	70.6	62.4	61.7	49.8	28.6	57.3	31.9	43.2	38.5	55.1	57.2	41.4	32.4	18.4
UNIVERSITY F'SHIP																		
1978	6.2	4.0	7.1	5.2	8.1	2.7	4.3	6.9	4.8	2.0	5.0	8.9	12.0	11.5	12.7	14.2	5.2	2.9
1979	5.9	4.5	6.7	6.5	7.2	2.1	3.9	6.3	4.4	2.4	5.2	8.9	11.8	10.0	12.2	12.7	6.0	2.8
1980	5.9	3.7	6.2	4.8	7.9	4.5	4.7	6.1	5.9	2.4	5.0	9.0	11.8	9.9	14.2	12.5	5.3	2.9
1981	5.9	4.2	5.8	5.0	7.8	3.7	5.0	6.0	3.0	2.5	4.0	9.8	14.6	10.8	12.8	14.4	6.4	2.5
MEAN	6.0	4.1	6.4	5.4	7.7	3.3	4.5	6.3	4.5	2.3	4.8	9.2	12.5	10.5	12.9	13.4	5.7	2.8
TEACHING A'SHIP																		
1978	19.0	22.2	37.3	15.1	48.2	21.8	9.5	21.6	10.0	5.5	16.0	22.2	22.7	41.7	35.8	24.2	17.7	10.0
1979	19.2	22.6	32.4	15.3	51.8	21.1	9.9	19.8	8.5	4.4	15.9	23.9	26.6	43.9	42.9	24.5	20.5	10.4
1980	19.2	21.8	33.3	13.2	56.8	14.9	10.4	21.3	10.7	4.2	15.5	24.0	22.6	44.9	46.0	27.1	20.6	10.2
1981	18.7	17.4	31.7	11.9	55.0	17.0	10.6	19.8	10.6	5.0	15.7	23.3	24.5	46.1	49.7	28.2	18.6	9.7
MEAN	19.0	21.0	33.6	13.9	52.8	18.2	10.1	20.6	10.0	4.8	15.8	23.4	24.1	44.0	43.4	26.0	19.3	10.1
RESEARCH A'SHIP																		
1978	17.0	50.1	34.8	46.9	8.7	39.1	46.2	21.3	12.2	50.7	11.5	11.3	3.1	.7	1.2	2.3	6.9	5.8
1979	17.7	50.7	39.9	44.9	11.2	36.6	48.0	22.2	13.9	49.3	11.7	10.4	1.7	1.0	.7	2.1	7.6	5.8
1980	17.6	52.0	38.7	46.3	9.5	45.5	46.1	24.1	14.7	49.4	11.0	10.2	1.8	.2	1.6	2.2	7.9	5.3
1981	18.3	57.1	39.4	45.3	10.8	41.3	48.1	23.9	15.1	51.5	10.9	10.8	.8	.3	.4	1.4	7.1	5.7
MEAN	17.6	52.4	38.3	45.8	10.0	40.9	47.1	22.9	14.1	50.2	11.3	10.7	1.9	.5	.9	2.0	7.4	5.6

*PERCENTAGE OF TOTAL IN FIELD AND YEAR REPORTING PRIMARY SOURCE.

TEXT TABLE C. CONTINUED

FIELD OF DOCTORATE

SUPPORT SOURCE	TOTAL ALL FLDS.	PHYS& ASTR.	CHEM.	EARTH ENV.& MAR. SCI.	MATH.	COMP. SCI.	ENGR.	BIO. SCI.	MED. SCI.	AGR. SCI.	PSYCH.	SOC. SCI.	HIST.	ENG.& AMER. LANG. &LIT.	FOR. LANG. &LIT.	ALL OTHER HUMAN ITIES	PROF. FLDS.	EDUC.
BUSINESS/INDUSTRY																		
1978	.8	.9	.8	.7	1.9	1.8	3.3	.5	1.9	.5	.4	.6	.1	.1	.2	.4	1.1	.5
1979	.9	1.1	1.6	.9	.7	2.6	4.8	.4	.9	.4	.2	.4	.4	.2	.2	.4	1.8	.4
1980	.9	1.0	1.2	1.2	.6	4.5	3.7	.9	1.2	.8	.4	.5	.3		.2	.1	1.2	.5
1981	1.0	1.0	1.5	1.7	.6	4.1	3.4	.9	2.1	1.4	.2	.5	.2	.1		.7	1.9	.6
MEAN	.9	1.0	1.3	1.1	1.0	3.5	3.8	.7	1.5	.8	.3	.5	.3	.1	.1	.4	1.5	.5
TOTAL SELF SUPPORT																		
1978	33.9	8.8	6.3	13.7	16.4	20.0	15.9	12.9	24.3	15.0	36.0	29.4	37.3	36.2	28.6	40.1	46.2	64.2
1979	34.1	8.5	7.2	14.1	14.7	22.7	13.9	14.5	25.0	15.7	37.5	30.4	38.8	34.0	31.5	42.2	42.4	63.8
1980	34.3	8.5	6.2	14.2	12.2	16.8	14.1	12.8	23.6	15.4	40.0	30.6	39.3	35.1	26.6	40.0	45.4	64.2
1981	34.6	7.2	6.9	14.9	11.1	15.1	12.4	13.5	25.0	12.8	41.8	32.5	40.4	35.8	26.6	38.6	45.0	65.6
MEAN	34.2	8.3	6.7	14.2	13.7	18.4	14.0	13.4	24.5	14.7	38.9	30.7	38.9	35.3	28.4	40.2	44.7	64.5
OWN EARNINGS																		
1978	23.3	4.6	2.1	8.1	9.6	13.6	11.9	4.4	15.3	9.9	21.5	18.5	19.1	18.6	17.1	23.0	32.2	52.0
1979	23.5	4.3	2.4	8.7	8.3	17.5	9.9	6.6	14.8	8.7	22.7	19.2	20.8	19.3	17.3	25.5	29.5	51.7
1980	24.0	4.0	1.9	9.3	7.1	12.9	10.3	5.7	14.7	8.5	24.5	19.3	22.2	18.4	16.0	23.6	32.7	52.2
1981	24.3	3.8	3.0	10.2	7.2	11.0	9.1	5.9	16.4	7.7	25.9	20.5	20.3	20.2	14.9	22.9	30.2	54.2
MEAN	23.8	4.2	2.4	9.1	8.1	13.7	10.3	5.6	15.4	8.7	23.7	19.4	20.6	19.1	16.4	23.8	31.2	52.5
SPOUSE'S EARNINGS																		
1978	8.7	3.7	3.7	5.4	5.4	4.5	2.9	7.5	8.0	4.4	11.2	8.6	14.9	14.1	9.9	13.2	11.8	10.3
1979	8.7	4.1	4.7	4.8	4.4	5.2	2.7	7.1	9.0	5.9	11.6	8.9	15.3	11.6	11.9	12.8	11.3	10.2
1980	8.2	4.1	3.8	4.8	4.7	4.0	2.4	6.2	7.6	5.5	10.6	8.9	13.8	13.8	8.9	11.5	10.4	10.0
1981	8.0	2.8	3.8	4.5	3.2	3.7	2.1	6.4	7.2	4.2	11.8	8.3	14.1	13.0	9.7	11.8	11.9	9.6
MEAN	8.4	3.7	4.0	4.9	4.4	4.3	2.5	6.8	7.9	5.0	11.3	8.6	14.6	13.2	10.1	12.3	11.3	10.0
FAMILY CONTRIBUTIONS																		
1978	1.9	.5	.5	.2	1.5	1.8	1.1	1.0	1.0	.7	3.3	2.4	3.3	3.4	1.7	3.9	2.2	1.8
1979	1.8	.2	.1	.7	2.0		1.4	.9	1.2	1.1	3.2	2.4	2.7	3.1	2.3	3.9	1.6	1.9
1980	2.1	.5	.5	.2	.5		1.4	.9	1.2	1.3	4.9	2.4	3.3	2.9	1.8	4.9	2.2	2.1
1981	2.2	.7	.1	.2	.8	.5	1.2	1.2	1.3	.9	4.1	3.8	6.0	2.6	2.0	3.9	2.9	1.8
MEAN	2.0	.5	.3	.3	1.2	.4	1.3	1.0	1.2	1.0	3.9	2.7	3.7	3.0	2.0	4.1	2.2	1.9
LOANS																		
1978	1.2		.2		.4		.3	.1	.8	.8	2.6	1.2	1.8	.6	1.8	2.7	1.2	1.7
1979	1.3		.1	.3	.1		.1	.4	1.2	.1	3.5	1.3	1.5	1.0	.3	1.4	1.3	2.1
1980	1.5			.2	.3	.5	.3	.5	1.2	.3	3.8	1.6	1.3	1.9	.8	1.6	.7	2.4
1981	1.8		.1		.3		.4	.3	.9	.6	5.1	1.4	1.3	1.4	.4	2.7	.9	3.1
MEAN	1.4		.1	.1	.3	.1	.3	.3	1.0	.4	3.8	1.4	1.5	1.2	.8	2.1	1.0	2.3
OTHER SOURCES																		
1978	5.8	3.6	3.1	4.0	6.9	4.5	7.5	4.0	7.0	15.2	3.6	7.2	5.1	3.2	3.9	5.7	8.2	5.9
1979	6.1	3.2	2.0	4.1	4.3	8.8	8.7	5.0	6.9	18.9	3.7	7.2	4.4	2.5	2.0	6.7	9.2	6.3
1980	6.2	3.7	2.1	5.7	4.7	4.0	8.1	4.5	8.8	19.5	3.5	7.8	5.2	2.9	1.4	6.5	7.4	6.4
1981	6.1	3.4	2.4	4.5	6.2	7.8	8.5	4.9	7.4	19.0	4.0	6.8	6.5	2.7	2.7	6.0	8.4	5.8
MEAN	6.0	3.5	2.4	4.5	5.5	6.5	8.2	4.6	7.6	18.2	3.7	7.3	5.2	2.9	2.5	6.2	8.3	6.1
PRIMARY SOURCE REPORTED																		
1978	26625	928	1308	556	743	110	2095	2841	589	915	2585	2834	732	899	597	1391	1276	6214
1979	27481	983	1396	588	699	194	2216	2972	655	903	2701	2856	711	802	597	1468	1256	6466
1980	27621	882	1362	583	662	202	2202	3093	760	976	2735	2776	667	858	507	1374	1210	6755
1981	27769	902	1423	537	664	218	2255	3082	821	1025	3002	2741	601	731	549	1378	1221	6587
TOTAL	109496	3695	5489	2264	2768	724	8768	11988	2825	3819	11023	11207	2711	3290	2250	5611	4963	26022

SOURCE: NRC, OFFICE OF SCIENTIFIC AND ENGINEERING PERSONNEL, DOCTORATE RECORDS FILE.

Support Source by Sex and Field of Doctorate

While many support sources are reported with similar frequency by both men and women, there are some striking differences in the ways that these two groups finance their graduate education (see Figure 5). Women are far more likely to report financial support from the "self" sources--own earnings, spouse's earnings, and family contributions--than men. These categories are primary sources of graduate support for 45 percent of the women but only 30 percent of the men. The proportion of both sexes reporting teaching assistantships as their primary source in 1981 was nearly identical (18.7 percent and 18.5 percent respectively), while the number one source for men--research assistantships--is considered the primary source by over twice as many men (22 percent) as women (10 percent). Only small differences between the two groups can be seen in Figure 5 for the other support sources. The median time from graduate entrance to the completion of the doctorate is somewhat longer for women than for men (see Table 2, pp. 32-37): this difference may account for the greater use of personal resources by women than men to finance their graduate education.

Table D provides source of support data by both field and sex, which allows the reader a control for the concentration of men or women in fields where particular sources of support are the most frequently reported, such as "own earnings" in the field of education. When such a field-specific comparison is made, a number of exceptions to the overall pattern shown in Figure 5 are revealed, particularly in science fields.

In fact, of the physical science and mathematics fields, only earth science follows this general pattern, but even in this field, women report about twice the proportion of support from teaching assistantships as men (21 percent and 11 percent respectively), and 11 percent of men Ph.D.'s and no women Ph.D.'s report primary support from other federal sources. As previously mentioned, much of the support in the "other federal" category comes from military-related sources--the G.I. Bill or educational programs of the military services. In physics, chemistry, and mathematics men and women report support from research assistantships and the self-support sources with nearly equal frequency.

Doctorate recipients in engineering and computer science follow the overall support pattern, with men reporting greater support from research assistantships and women from the self-support

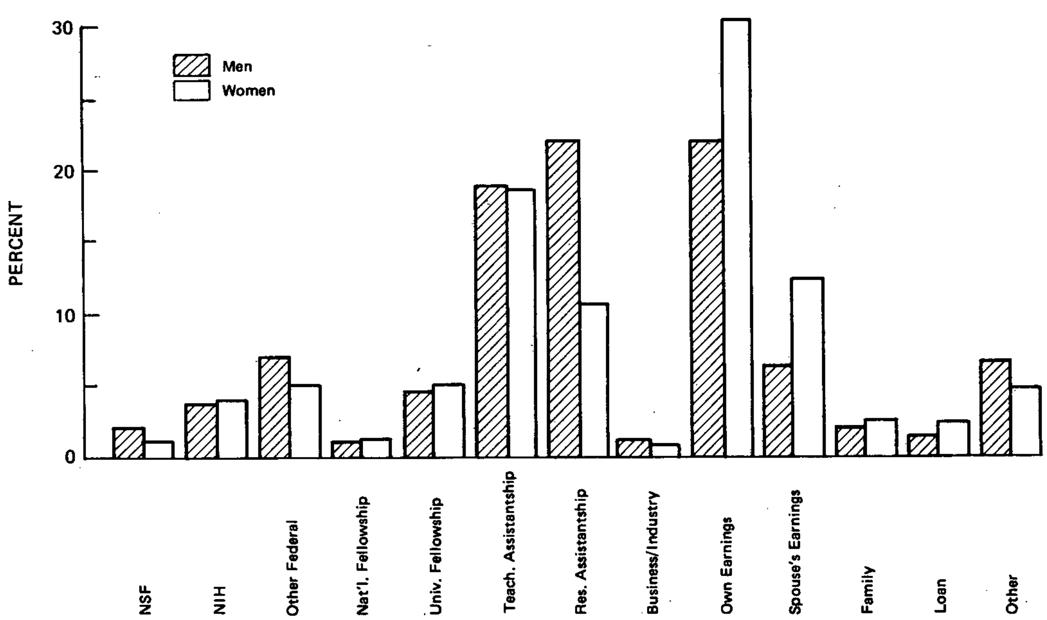


FIGURE 5
Primary Source of Support of 1981 Doctorate Recipients by Sex.
SOURCE: NRC, Office of Scientific and Engineering Personnel, Doctorate Records File.

TEXT TABLE D
PRIMARY SOURCE OF SUPPORT OF 1981 DOCTORATE RECIPIENTS BY SEX

SUPPORT SOURCE	TOTAL ALL FLDS.	PHYS& ASTR.	CHEM.	EARTH ENV.& MAR. SCI.	MATH.	COMP. SCI.	ENGR.	BIO. SCI.	MED. SCI.	AGR. SCI.	PSYCH.	SOC. SCI.	HIST.	ENG.& AMER. LANG. &LIT.	FOR. LANG. &LIT.	ALL OTHER HUMAN ITIES	PROF. FLDS.	EDUC.
	FIELD OF DOCTORATE																	
TOTAL FEDERAL																		
MEN	13.4*	8.9	11.7	17.3	8.7	8.8	11.3	28.9	35.2	5.8	18.4	12.2	9.2	3.4	7.5	7.0	10.6	8.2
WOMEN	11.1	5.9	8.6	5.8	2.9	8.3	6.7	31.3	33.5	4.6	16.4	12.8	4.8	.5	3.7	4.9	13.2	4.5
MEAN	12.7	8.6	11.2	16.2	7.8	8.7	11.1	29.7	34.6	5.7	17.5	12.4	8.0	1.9	5.5	6.2	11.4	6.5
NSF																		
MEN	1.9	4.9	4.6	5.4	5.0	6.2	2.6	3.3	1.3	.6	1.0	1.8	.2			.3		.1
WOMEN	1.1	2.9	3.8	5.8	1.0	4.2	3.4	3.8	1.5	.8	1.3	1.7	.6			1.0		.1
MEAN	1.7	4.8	4.5	5.4	4.4	6.0	2.7	3.4	1.3	.6	1.1	1.8	.3			.6		.1
NIH																		
MEN	4.4		3.4	.6	.9	.5	1.6	20.9	22.3	.1	7.0	1.8				.1	.8	.1
WOMEN	4.9	1.5	2.9			4.2	1.1	25.0	20.0	.8	6.7	3.5				.2	3.4	.4
MEAN	4.5	.1	3.3	.6	.8	.9	1.6	22.1	21.6	.2	6.9	2.3				.1	1.6	.3
OTHER FEDERAL																		
MEN	7.1	4.0	3.7	11.3	2.9	2.1	7.1	4.7	11.5	5.1	10.5	8.7	9.0	3.4	7.5	6.5	9.7	8.0
WOMEN	5.0	1.5	1.9		1.9		2.2	3.0	12.0	3.1	8.3	7.5	4.2	.5	3.7	3.7	9.8	4.0
MEAN	6.5	3.8	3.4	10.2	2.7	1.8	6.9	4.2	11.7	4.9	9.5	8.4	7.7	1.9	5.5	5.5	9.7	6.1
NATIONAL FELLOWSHIP																		
MEN	1.0	1.0	1.0	.6	.2	2.6	.4	.8	1.3	1.7	.5	2.2	3.7	.6	2.7	1.8	.1	.5
WOMEN	1.3	1.5	1.0		1.0		2.2	1.2	1.5	.8	.9	3.0	3.6	1.1	1.4	1.8	1.1	.9
MEAN	1.1	1.0	1.0	.6	.3	2.3	.5	.9	1.3	1.6	.7	2.4	3.7	.8	2.0	1.8	.4	.7
TOTAL UNIVERSITY																		
MEN	46.4	78.8	76.0	61.6	73.3	62.4	63.7	50.9	33.0	58.3	32.3	44.6	37.5	60.8	61.2	44.4	33.2	16.5
WOMEN	35.0	77.9	81.9	67.3	75.7	58.3	62.9	46.8	20.4	63.8	28.6	42.3	46.4	53.7	64.3	43.2	29.6	19.3
MEAN	42.8	78.7	76.9	62.2	73.6	61.9	63.7	49.7	28.7	59.0	30.7	44.0	39.9	57.2	62.8	44.0	32.1	17.8
UNIVERSITY F'SHIP																		
MEN	5.8	4.2	5.7	4.5	8.9	4.1	5.0	5.7	3.5	2.5	3.9	9.9	13.1	12.4	14.5	13.4	6.6	2.1
WOMEN	6.0	4.4	6.2	9.6	1.9		5.6	6.9	2.2	3.1	4.2	9.7	18.7	9.3	11.2	16.2	5.8	3.0
MEAN	5.9	4.2	5.8	5.0	7.8	3.7	5.0	6.0	3.0	2.5	4.0	9.8	14.6	10.8	12.8	14.4	6.4	2.5
TEACHING A'SHIP																		
MEN	18.7	17.4	31.1	10.9	53.5	15.5	10.4	20.0	12.6	4.8	17.0	23.3	23.4	48.5	46.3	29.7	20.2	8.9
WOMEN	18.5	17.6	35.2	21.2	63.1	29.2	13.5	19.5	6.5	6.2	14.1	23.6	27.1	43.9	52.7	25.6	15.1	10.6
MEAN	18.7	17.4	31.7	11.9	55.0	17.0	10.6	19.8	10.6	5.0	15.7	23.3	24.5	46.1	49.7	28.2	18.6	9.7
RESEARCH A'SHIP																		
MEN	21.8	57.2	39.2	46.2	10.9	42.8	48.3	25.3	16.8	51.1	11.4	11.5	.9		.4	1.3	6.4	5.6
WOMEN	10.4	55.9	40.5	36.5	10.7	29.2	43.8	20.4	11.6	54.6	10.3	9.0	.6	.5	.3	1.4	8.7	5.8
MEAN	18.3	57.1	39.4	45.3	10.8	41.3	48.1	23.9	15.1	51.5	10.9	10.8	.8	.3	.4	1.4	7.1	5.7

*PERCENTAGE OF TOTAL IN FIELD AND SEX REPORTING PRIMARY SOURCE.

TEXT TABLE D. CONTINUED

								FIELD OF DOCTORATE										
SUPPORT SOURCE	TOTAL ALL FLDS.	PHYS& ASTR.	CHEM.	EARTH ENV.& MAR. SCI.	MATH.	COMP. SCI.	ENGR.	BIO. SCI.	MED. SCI.	AGR. SCI.	PSYCH.	SOC. SCI.	HIST.	ENG.& AMER. LANG. &LIT.	FOR. LANG. &LIT.	ALL OTHER HUMAN ITIES	PROF. FLDS.	EDUC.
BUSINESS/INDUSTRY																		
MEN	1.1	1.0	1.6	1.2	.5	4.1	3.3	.8	1.5	1.3	.2	.5	.2			.6	2.3	.6
WOMEN	.8	1.5	1.4	5.8	1.0	4.2	6.7	1.2	3.3	1.5	.1	.4		.3		1.0	1.1	.6
MEAN	1.0	1.0	1.5	1.7	.6	4.1	3.4	.9	2.1	1.4	.2	.5	.2	.1		.7	1.9	.6
TOTAL SELF SUPPORT																		
MEN	29.8	7.3	7.0	14.4	10.9	14.4	12.3	13.5	19.6	12.6	40.2	31.4	40.9	31.5	24.3	37.2	43.9	63.8
WOMEN	44.9	5.9	6.2	19.2	12.6	20.8	14.6	13.4	35.6	13.8	44.0	35.5	39.2	39.9	28.6	41.2	47.4	67.6
MEAN	34.6	7.2	6.9	14.9	11.1	15.1	12.4	13.5	25.0	12.8	41.8	32.5	40.4	35.8	26.6	38.6	45.0	65.6
OWN EARNINGS																		
MEN	21.7	4.0	2.8	9.9	7.1	11.3	9.1	6.0	11.9	7.6	26.0	20.2	21.6	20.8	15.3	23.6	30.8	56.5
WOMEN	30.1	1.5	3.8	13.5	7.8	8.3	7.9	5.6	25.5	8.5	25.9	21.3	16.9	19.7	14.6	21.7	28.8	51.6
MEAN	24.3	3.8	3.0	10.2	7.2	11.0	9.1	5.9	16.4	7.7	25.9	20.5	20.3	20.2	14.9	22.9	30.2	54.2
SPOUSE'S EARNINGS																		
MEN	6.1	2.6	4.0	4.3	2.9	2.6	2.0	6.4	6.4	4.4	10.3	7.3	12.4	8.5	7.8	10.4	10.3	5.6
WOMEN	12.2	4.4	2.4	5.8	4.9	12.5	4.5	6.2	8.7	3.1	13.7	10.9	18.7	17.3	11.2	14.1	15.3	14.1
MEAN	8.0	2.8	3.8	4.5	3.2	3.7	2.1	6.4	7.2	4.2	11.8	8.3	14.1	13.0	9.7	11.8	11.9	9.6
FAMILY CONTRIBUTIONS																		
MEN	2.0	.7	.2	.2	.9	.5	1.2	1.1	1.3	.7	3.9	3.9	6.9	2.3	1.2	3.1	2.7	1.7
WOMEN	2.7						2.2	1.7	1.5	2.3	4.4	3.4	3.6	2.9	2.7	5.3	3.2	2.0
MEAN	2.2	.7	.1	.2	.8	.5	1.2	1.2	1.3	.9	4.1	3.8	6.0	2.6	2.0	3.9	2.9	1.8
LOANS																		
MEN	1.6		.1		.4		.5	.3	.9	.7	4.9	1.5	1.6	.8	.8	2.9	.6	3.2
WOMEN	2.3							.3	.7		5.5	1.2	.6	1.9		2.3	1.6	2.8
MEAN	1.8		.1		.3		.4	.3	.9	.6	5.1	1.4	1.3	1.4	.4	2.7	.9	3.1
OTHER SOURCES																		
MEN	6.7	3.1	2.6	4.7	6.1	7.7	8.5	4.8	8.6	19.6	3.4	7.6	6.9	2.8	3.5	6.2	9.4	7.2
WOMEN	4.7	7.4	1.0	1.9	6.8	8.3	6.7	5.2	5.1	15.4	4.6	4.8	5.4	2.7	2.0	5.5	6.1	4.2
MEAN	6.1	3.4	2.4	4.5	6.2	7.8	8.5	4.9	7.4	19.0	4.0	6.8	6.5	2.7	2.7	6.0	8.4	5.8
PRIMARY SOURCE REPORTED																		
MEN	19057	834	1213	485	561	194	2166	2189	546	895	1683	1998	435	355	255	890	843	3490
WOMEN	8712	68	210	52	103	24	89	893	275	130	1319	743	166	376	294	488	378	3097
TOTAL	27769	902	1423	537	664	218	2255	3082	821	1025	3002	2741	601	731	549	1378	1221	6587

SOURCE: NRC, OFFICE OF SCIENTIFIC AND ENGINEERING PERSONNEL, DOCTORATE RECORDS FILE.

Declassified and Approved For Release 2012/10/22 : CIA-RDP90-00530R000300610001-6

sources. In these two fields, however, women are more frequent recipients of support from teaching assistantships.

Because of the generally even distribution of support from research assistantships among men and women in the biological, medical, and agricultural sciences and the low proportion of women reporting support from spouse's earnings, Ph.D.'s in those fields also do not follow the overall support pattern. The considerably higher proportion of women (26 percent) than men (12 percent) in the medical sciences reporting own earnings as their primary source is likely to be a function of their concentration in nursing and public health fields (see Table 1, page 26).

In contrast to the aforementioned science and engineering fields, the distribution of support for men and women doctorate recipients in the social sciences, humanities, professional fields, and education closely follows the overall pattern. In each of these fields, women report spouse's earnings with considerably greater frequency than do men. This relationship is particularly strong in education, where women are two and one-half times more likely to report spouse's earnings as their primary source than are men. Other areas of support where men and women differ significantly include NIH support, where the high proportion of women in the professional fields reporting this source is a product of the large number of women in social work and the speech and hearing sciences (see Table 1, page 27), and "other federal" support in the field of education, where the greater frequency of men reporting this source is the result of their use of benefits under the G.I. Bill.

Support Source by Racial/Ethnic Group and Field of Doctorate

Data on primary source of support by racial/ethnic group for selected fields over the 1979 to 1981 period are presented in Text Table E. Because of the small number of minority doctorate recipients--particularly in the American Indian and Hispanic categories--responses for the past three years have been combined so that an analysis by field of doctorate could be performed. Fields were selected to illustrate the patterns of support typical of each of the major discipline areas. As a consequence of both the high concentration of temporary visa holders among Asian doctorate recipients (see Table 5, pp. 40-41) and the probability that holders of temporary visas will leave the U. S. following completion of studies, this presentation includes only U. S. citizens and non-U. S. citizens residing here on permanent (immigrant) visas.

Over all fields, patterns of support specific to certain racial/ethnic groups were found. Most striking is the dominance of support from university sources for Asian doctorate recipients. In each of the seven fields shown in Table E, Asian Ph.D.'s display the greatest frequency of support from universities. White and Hispanic doctorate recipients reported the second and third most frequent support from university sources. The greatest frequency of primary support by the self sources--own earnings, spouse's earnings, and family contributions--was reported by American Indian Ph.D.'s. Whites, American Indians, and Hispanics showed the greatest support from federal sources. Black Ph.D.'s reported the greatest use of loans and the least overall support from university sources. Blacks, along with Hispanics, also indicated the greatest use of national fellowships, particularly in the social sciences and humanities. The substantial differences between support patterns for the racial/ethnic groups can be seen by the fact that Asian Ph.D.'s reported more than twice as much support from university sources as did American Indians and blacks, and the latter two groups reported self-support over two times as frequently as Asians.

There are, however, several exceptions to the patterns described above. In the biological and medical sciences, psychology, and humanities, blacks, rather than whites, American Indians, or Hispanics, reported the greatest frequency of federal support. In the physical sciences and education, Hispanics reported a considerably higher proportion of support from federal sources than did American Indians or whites. Of particular interest is the over one-fifth of black doctorate recipients in engineering and computer sciences who noted support from business and industry sources. Many of these Ph.D.'s were supported in graduate school by their employing companies.

TEXT TABLE E
PRIMARY SOURCE OF SUPPORT OF 1979-1981 DOCTORATE RECIPIENTS BY RACIAL/ETHNIC GROUP AND FIELD

				FIELD OF DOCTORATE				
SUPPORT SOURCE	TOTAL ALL FLDS.	PHYS. SCI.	ENGR. AND COMP. SCI.	BIO. AND MED. SCI.	PSYCH.	SOC. SCI.	HUMAN-ITIES	EDUC.
FEDERAL								
AMERICAN INDIAN	14.5	7.7	25.0	29.0	20.0	17.9	5.1	13.7
ASIAN	10.3	7.6	6.0	22.8	19.6	8.7	3.8	8.7
BLACK	13.4	13.0	10.9	35.1	25.9	12.3	7.9	8.7
HISPANIC	14.4	15.5	6.6	19.6	19.3	15.2	3.8	19.5
WHITE	14.7	11.7	16.4	34.0	19.8	15.8	7.3	7.0
NATIONAL FELLOWSHIP								
AMERICAN INDIAN	2.8			3.2	2.9		5.1	3.6
ASIAN	.9	.5	.9	1.0	1.8	.9	1.9	.8
BLACK	5.5	9.0	3.6	4.5	6.6	12.3	15.7	2.3
HISPANIC	5.5	.9	1.6	3.7	8.7	12.4	6.2	4.2
WHITE	.7	.4	.6	.6	.3	1.3	1.8	.4
UNIVERSITY								
AMERICAN INDIAN	29.5	69.2	33.3	38.7	22.9	39.3	48.7	12.9
ASIAN	62.6	83.3	74.8	55.1	38.4	52.4	54.8	21.7
BLACK	24.2	57.0	41.8	31.8	28.3	37.9	36.1	14.8
HISPANIC	36.0	67.2	55.7	55.1	27.3	34.5	46.7	15.5
WHITE	41.5	74.2	55.6	44.8	31.8	44.2	47.6	18.4
BUSINESS/INDUSTRY								
AMERICAN INDIAN	.6					3.6		.7
ASIAN	2.2	1.6	4.1	2.1		.9	.6	.4
BLACK	1.5	8.0	23.6	1.9	.3	.7	1.1	.8
HISPANIC	1.4	5.2	3.3	.9	.7	.7	1.0	.5
WHITE	.9	1.1	5.1	.8	.2	.3	.2	.5
SELF								
AMERICAN INDIAN	47.7	15.4	33.3	29.0	42.9	39.3	38.5	64.0
ASIAN	19.9	5.1	12.3	14.2	31.3	33.8	33.8	56.7
BLACK	45.5	9.0	12.7	20.8	28.3	28.6	29.3	62.7
HISPANIC	34.7	8.6	19.7	15.9	34.0	24.8	36.7	51.6
WHITE	37.7	11.1	19.3	16.6	40.8	33.9	38.4	67.6
LOANS								
AMERICAN INDIAN	2.2		8.3		5.7		2.6	2.2
ASIAN	1.1	.2	.4	.2	6.3	.9	2.5	4.7
BLACK	4.1			1.3	5.5	3.0	2.5	5.1
HISPANIC	1.8		1.6		4.7	1.4	1.4	2.6
WHITE	1.5	.1	.2	.5	4.2	1.4	1.4	2.3
OTHER								
AMERICAN INDIAN	2.8	7.7			5.7			2.9
ASIAN	3.0	1.6	1.5	4.7	2.7	2.6	2.5	7.1
BLACK	5.8	4.0	7.3	4.5	5.2	5.2	7.5	5.6
HISPANIC	6.2	2.6	11.5	4.7	5.3	11.0	4.2	6.1
WHITE	3.0	1.4	2.8	2.7	3.0	3.0	3.2	3.8
PRIMARY SOURCE REPORTED								
AMERICAN INDIAN	325	26	12	31	35	28	39	139
ASIAN	2823	564	803	514	112	231	157	254
BLACK	2858	100	55	154	290	269	280	1532
HISPANIC	1365	116	61	107	150	145	289	426
WHITE	62992	7683	3693	9207	7442	6184	8598	15609

*PERCENTAGE OF TOTAL IN FIELD AND RACE REPORTING PRIMARY SOURCE.

SOURCE: NRC, OFFICE OF SCIENTIFIC AND ENGINEERING PERSONNEL, DOCTORATE RECORDS FILE.

Support Source by Carnegie Classification of Doctorate-Granting Institution

The Carnegie Classification System,[4/] developed by the Carnegie Commission on Higher Education, is used here to compare the patterns of student support found in various categories of doctorate-granting institutions. The Carnegie System is based largely on statistics on level of federal support and number of degrees awarded. The following Carnegie categories are used in Figure 6 and Text Table F:

Research Universities I - The 50 leading universities by federal financial support of academic science provided they awarded at least 50 Ph.D.'s in 1973-74.

Research Universities II - Included in the 100 leading institutions in federal support, awarded at least 50 Ph.D.'s in 1973-74 or among the top 50 Ph.D.-granting institutions from 1966 to 1975.

Doctorate-Granting I and II - Awarded at least 10 Ph.D.'s in 1973-74 or one of a few new institutions where expansion of the doctoral program is anticipated.

All Other Classified - Includes all other doctorate-granting institutions. These are primarily, but not exclusively, professional schools in education, medicine, theology, and psychology.

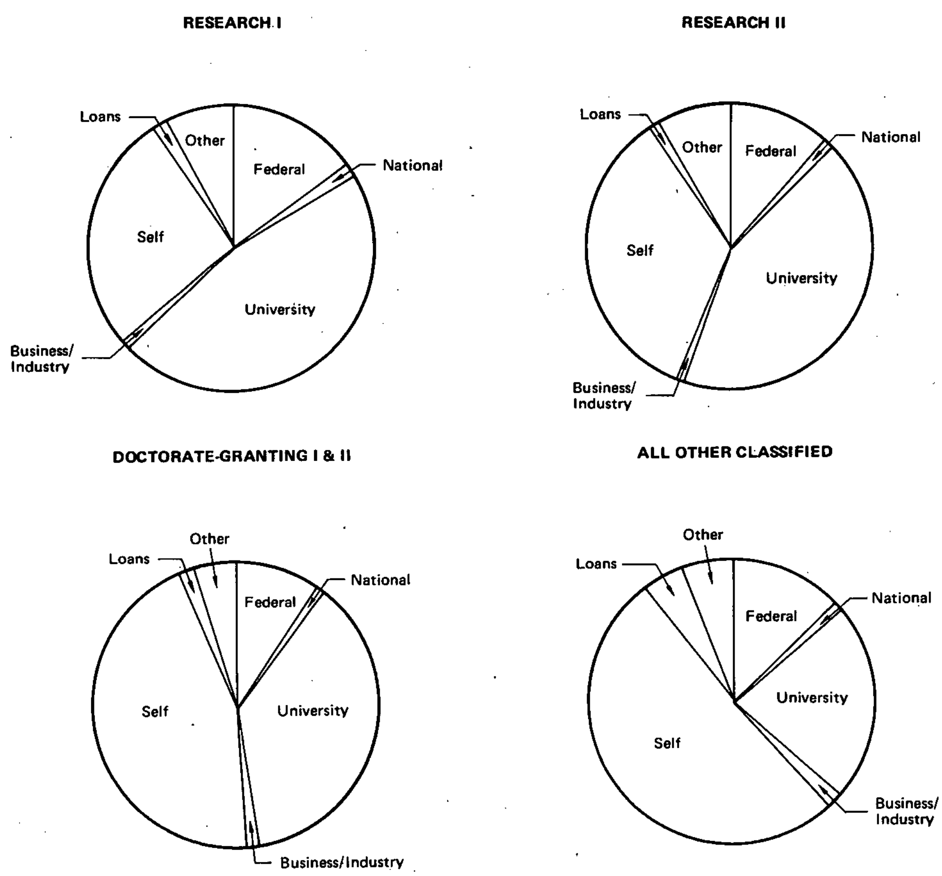


FIGURE 6
Primary Source of Support by Carnegie Classification of Doctorate-Granting Institution, 1981. SOURCE: NRC, Office of Scientific and Engineering Personnel, Doctorate Records File.

4/Carnegie Commission on Higher Education, A Classification of Institutions of Higher Education. Berkeley: Carnegie Foundation for the Advancement of Teaching, 1978.

As can be seen in Figure 6, the main difference between the four institutional categories is the variation in the proportion of doctorate recipients reporting support from university or "self" sources. While nearly one-half of the graduates of Research I institutions report support from their universities, 44 percent of Research II, 38 percent of Doctorate-Granting I and II, and 23 percent of the graduates of All Other Classified institutions report university support as their primary source. Conversely, the proportion of doctorate recipients reporting support from the "self" sources increases over the four institutional groups, from 27 percent of the Research I graduates to 36 percent of Research II, 45 percent of the Doctorate-Granting I and II, and 52 percent of All Other Classified institutions. Support for Ph.D.'s was about equal for the other sources included in Figure 6 except for federal, where Research I and All Other Classified universities show considerable support from NSF and NIH in the physical, biological, and medical sciences.

Text Table F shows that when broken down by both field and detailed source of support, the main differences among the Carnegie institutional categories continue to be found in the distribution of university and self-support. For instance, graduates of Research I institutions report university fellowships and research assistantships with a greater frequency than graduates from the other three institutional categories, and they are third, behind Ph.D.'s from Research II and Doctorate-Granting I and II, in support from teaching assistantships. This difference is particularly large in the physical science, engineering and computer science, and biological and medical science fields, where graduates of Research I institutions report the least support from teaching assistantships.

With the exception of psychology, Research University I graduates had the lowest proportion of support from own earnings over all fields. This utilization of sources other than own earnings was particularly prevalent in the fields of physical sciences, social sciences, and humanities. Again, except for psychology, graduates of All Other Classified universities showed the greatest support from own earnings. Response to the other two self-support categories--spouse's earnings and family contributions--tended to follow a similar pattern, with Other Classified graduates reporting nearly the greatest frequency of self-support, and Research I graduates the least.

Graduates of Doctorate-Granting I and II universities in engineering and computer science reported the highest frequency of support from business or industrial firms. Nearly 16 percent of psychology graduates from All Other Classified universities reported primary support from loans, about three times the frequency for graduates of any of the other Carnegie institutional categories.

Primary Source of Support in Graduate School--A Summary

Data have been presented here on a number of factors that are associated with the sources of support used by graduate students to finance their doctoral education--year and field of Ph.D., sex, racial/ethnic group, and institutional classification. The stability of support patterns over the four-year period (1978-1981) was one of the few exceptions to our general finding that each of the above variables exerted a powerful influence on graduate student support patterns. Despite strong overall trends, each cohort of Ph.D.'s was found to exhibit a singular pattern of response to the primary support question. This was particularly true in the examination of differences among fields, where for example, own earnings--the leading primary source over all disciplines--was one of the least frequently reported sources by Ph.D.'s in the physical and biological sciences. Even within the physical sciences, there was considerable variability in concentration of support from certain sources, with approximately one-half of physics and earth sciences Ph.D.'s reporting primary source from research assistantships while 55 percent of the 1981 Ph.D.'s in mathematics reported teaching assistantships as their primary source.

TEXT TABLE F
PRIMARY SOURCE OF SUPPORT FOR 1981 DOCTORATE RECIPIENTS BY CARNEGIE CLASSIFICATION OF DOCTORATE-GRANTING INSTITUTIONS

SUPPORT SOURCE	FIELD OF DOCTORATE							
	TOTAL ALL FLDS.	PHYS. SCI.	ENGR. AND COMP. SCI.	BIO. AND MED. SCI.	PSYCH.	SOC. SCI.	HUMAN-ITIES	EDUC.
TOTAL FEDERAL								
RESEARCH UNIVERSITY I	15.0*	11.3	11.4	38.6	23.4	14.2	6.4	6.3
RESEARCH UNIVERSITY II	11.0	8.4	10.5	23.3	17.4	9.2	4.9	7.5
DOCTORATE-GRANTING I & II	8.9	9.9	8.8	13.3	13.5	9.9	4.2	5.5
ALL OTHER	12.2	15.6	11.4	27.4	9.2	15.2	1.9	6.7
MEAN	12.7	10.7	10.9	30.7	17.5	12.4	5.5	6.5
NSF								
RESEARCH UNIVERSITY I	2.5	5.6	3.8	4.1	2.4	2.9	.4	.1
RESEARCH UNIVERSITY II	.7	2.6	1.6	1.4	.8	.1	.1	.1
DOCTORATE-GRANTING I & II	1.0	4.1	1.8	2.7	.3	.5	.2	.1
ALL OTHER	.7	4.4	.8	1.5				
MEAN	1.7	4.7	3.0	3.0	1.1	1.8	.3	.1
NIH								
RESEARCH UNIVERSITY I	6.1	1.6	2.0	28.4	10.1	3.1	.1	.4
RESEARCH UNIVERSITY II	3.4	1.2	.4	16.4	7.5	1.3		
DOCTORATE-GRANTING I & II	1.6	1.2	.6	7.0	4.1	.5		
ALL OTHER	5.2	5.0	1.6	18.7	2.8	3.0		.9
MEAN	4.5	1.6	1.5	22.0	6.9	2.3	.1	.3
OTHER FEDERAL								
RESEARCH UNIVERSITY I	6.4	4.2	5.6	6.1	10.9	8.2	5.8	5.8
RESEARCH UNIVERSITY II	6.9	4.6	8.5	5.5	9.2	7.8	4.8	7.4
DOCTORATE-GRANTING I & II	6.3	4.6	6.5	3.6	9.2	8.9	4.0	5.5
ALL OTHER	6.3	6.3	8.9	7.2	6.4	12.1	1.9	5.8
MEAN	6.5	4.4	6.4	5.8	9.5	8.4	5.1	6.1
NATIONAL FELLOWSHIP								
RESEARCH UNIVERSITY I	1.3	.9	.6	1.0	1.1	2.5	2.2	1.0
RESEARCH UNIVERSITY II	1.0	.4	.7	.7	1.1	1.8	2.1	.7
DOCTORATE-GRANTING I & II	.8	.9	.9	1.3	.1	3.0	1.0	.4
ALL OTHER	.8	.6	.8	1.5	.4	3.0	1.3	.4
MEAN	1.1	.8	.6	1.0	.7	2.4	2.0	.7
TOTAL UNIVERSITY								
RESEARCH UNIVERSITY I	47.5	75.6	64.6	40.3	32.6	45.8	51.9	23.1
RESEARCH UNIVERSITY II	43.7	76.4	61.0	53.8	40.5	44.8	46.9	18.2
DOCTORATE-GRANTING I & II	37.7	72.4	62.4	58.6	27.7	41.3	49.1	15.9
ALL OTHER	22.8	59.4	62.6	38.3	11.0	21.2	34.4	4.0
MEAN	42.8	74.5	63.5	45.3	30.7	44.0	49.4	17.8
UNIVERSITY FELLOWSHIP								
RESEARCH UNIVERSITY I	6.6	5.6	4.2	4.3	5.0	11.7	15.7	2.5
RESEARCH UNIVERSITY II	5.0	4.9	4.9	6.6	4.4	7.2	8.7	2.1
DOCTORATE-GRANTING I & II	5.5	6.8	7.4	5.7	3.3	8.4	12.5	3.5
ALL OTHER	4.4	5.0	6.5	8.0	2.1	4.0	12.5	1.1
MEAN	5.9	5.6	4.9	5.4	4.0	9.8	13.3	2.5
TEACHING ASSISTANTSHIP								
RESEARCH UNIVERSITY I	18.1	25.3	9.1	13.0	15.6	22.4	35.3	11.3
RESEARCH UNIVERSITY II	22.1	36.3	10.3	25.2	22.9	26.8	37.1	10.6
DOCTORATE-GRANTING I & II	19.2	36.1	17.1	25.7	14.5	24.5	35.8	9.7
ALL OTHER	10.7	28.1	23.6	18.0	3.5	9.1	21.9	2.1
MEAN	18.7	29.4	11.1	17.9	15.7	23.3	35.2	9.7
RESEARCH ASSISTANTSHIP								
RESEARCH UNIVERSITY I	22.7	44.7	51.3	23.0	12.0	11.6	.9	9.4
RESEARCH UNIVERSITY II	16.7	35.2	45.7	22.0	13.2	10.8	1.0	5.5
DOCTORATE-GRANTING I & II	13.0	29.6	37.9	27.2	9.9	8.4	.8	2.7
ALL OTHER	7.7	26.3	32.5	12.2	5.3	8.1		.8
MEAN	18.3	39.4	47.5	22.0	10.9	10.8	.9	5.7

*PERCENTAGE OF TOTAL IN FIELD AND INSTITUTIONAL CATEGORY REPORTING PRIMARY SOURCE.

TEXT TABLE F. CONTINUED

	FIELD OF DOCTORATE							
SUPPORT SOURCE	TOTAL ALL FLDS.	PHYS. SCI.	ENGR. AND COMP. SCI.	BIO. AND MED. SCI.	PSYCH.	SOC. SCI.	HUMAN-ITIES	EDUC.
BUSINESS/INDUSTRY								
RESEARCH UNIVERSITY I	1.0	.8	2.6	1.1	.2	.7	.2	.6
RESEARCH UNIVERSITY II	.7	1.2	2.5	.6	.2	.1	.7	.4
DOCTORATE-GRANTING I & II	1.3	1.7	8.5	2.1	.2		.4	.6
ALL OTHER	1.7	5.6	4.9	1.7		1.0		1.1
MEAN	1.0	1.2	3.5	1.2	.2	.5	.4	.6
TOTAL SELF SUPPORT								
RESEARCH UNIVERSITY I	27.2	7.4	11.4	13.4	35.4	27.7	32.1	59.3
RESEARCH UNIVERSITY II	35.7	10.4	17.0	16.0	33.4	36.6	39.0	63.9
DOCTORATE-GRANTING I & II	44.8	11.1	12.1	19.2	49.1	40.6	41.2	71.7
ALL OTHER	52.4	15.6	14.6	23.7	60.8	48.5	55.6	76.5
MEAN	34.6	9.0	12.7	15.9	41.8	32.5	36.3	65.6
OWN EARNINGS								
RESEARCH UNIVERSITY I	18.3	3.5	8.1	8.2	22.7	16.7	16.6	47.6
RESEARCH UNIVERSITY II	24.5	6.8	12.8	6.2	19.8	21.7	21.4	51.6
DOCTORATE-GRANTING I & II	33.3	6.8	8.5	8.4	32.7	29.0	27.9	59.5
ALL OTHER	40.2	11.9	13.8	10.9	29.0	38.4	38.1	69.2
MEAN	24.3	5.1	9.3	8.1	25.9	20.5	20.5	54.2
SPOUSE'S EARNINGS								
RESEARCH UNIVERSITY I	7.2	3.6	2.5	4.2	10.0	7.9	11.6	10.0
RESEARCH UNIVERSITY II	8.6	3.2	2.7	7.9	11.0	10.0	13.0	10.2
DOCTORATE-GRANTING I & II	9.2	3.9	1.5	9.3	12.9	7.2	11.6	10.3
ALL OTHER	9.0	3.1		11.7	16.6	7.1	15.0	5.7
MEAN	8.0	3.5	2.3	6.5	11.8	8.3	12.1	9.6
FAMILY CONTRIBUTIONS								
RESEARCH UNIVERSITY I	1.8	.4	.8	1.0	2.7	3.1	3.9	1.7
RESEARCH UNIVERSITY II	2.5	.4	1.6	1.9	2.6	5.0	4.6	2.2
DOCTORATE-GRANTING I & II	2.3	.3	2.1	1.5	3.6	4.5	1.7	1.8
ALL OTHER	3.3	.6	.8	1.1	15.2	3.0	2.5	1.6
MEAN	2.2	.4	1.1	1.3	4.1	3.8	3.7	1.8
LOANS								
RESEARCH UNIVERSITY I	1.5	.1	.4	.4	3.4	1.4	2.4	3.5
RESEARCH UNIVERSITY II	1.4	.1	.4	.2	3.5	1.3	1.1	2.4
DOCTORATE-GRANTING I & II	1.9		.3	.8	5.1	.5	.8	2.0
ALL OTHER	4.4		.8	.4	15.9	5.1	.6	5.3
MEAN	1.8	.1	.4	.4	5.1	1.4	1.7	3.1
OTHER SOURCES								
RESEARCH UNIVERSITY I	6.5	3.8	9.1	5.3	3.9	7.7	4.8	6.2
RESEARCH UNIVERSITY II	6.5	3.2	7.8	5.5	4.1	6.1	5.3	6.8
DOCTORATE-GRANTING I & II	4.7	4.1	7.1	4.6	4.3	4.7	3.3	3.9
ALL OTHER	5.7	3.1	4.9	7.0	2.8	6.1	6.3	6.1
MEAN	6.1	3.7	8.4	5.4	4.0	6.8	4.8	5.8
PRIMARY SOURCE REPORTED								
RESEARCH UNIVERSITY I	13817	2084	1564	2092	1071	1555	1805	2459
RESEARCH UNIVERSITY II	6466	694	446	877	665	683	813	1674
DOCTORATE-GRANTING I & II	5280	588	340	474	983	404	481	1698
ALL OTHER	2206	160	123	460	283	99	160	756

SOURCE: NRC, OFFICE OF SCIENTIFIC AND ENGINEERING PERSONNEL, DOCTORATE RECORDS FILE.

EXPLANATION OF FIVE BASIC TABLES

Table 1	Number of Doctorate Recipients by Sex and Subfield, 1981
Table 1A	Number of Doctorate Recipients by Citizenship, Racial/Ethnic Group, and Subfield, 1981
Table 2	Statistical Profile of Doctorate Recipients by Sex and by Field of Doctorate, 1981 (three tables)
Table 3	Percentage of 1981 Doctorate Recipients by Sources of Support in Graduate School, by Sex and Summary Field
Table 4	Number of 1981 Doctorate Recipients by Sex, State of Doctoral Institution, and Summary Field
Table 5	Statistical Profile of Doctorate Recipients by Racial or Ethnic Group and U.S. Citizenship Status, 1981

Table titles and headings are generally self-explanatory, but a few terms need special definition or explanation. The survey questionnaire is reproduced on pages 42-43.

Tables 1 and 1A

Turning to the standard tables presented from year to year in these reports, we display in Tables 1 and 1A 1981 data by subfield of doctorate, corresponding to the fields specified in the Specialties List on page 44. The "general" field categories, e.g., "chemistry, general," contain individuals who either received the doctorate in the general subject area or who did not specify a particular fine field. The "other" field categories, e.g., "chemistry, other," include those individuals whose specified doctoral discipline was not listed in the Specialties List.

Table 2

There are three two-page tables; one contains data about all doctorate recipients in 1981 and the other two present data by sex. This table provides data by field and also by broader summary field. Refer to the inside of the back cover for the codes included in each broad field and to the Specialties List on page 44 for the codes and names of each subfield. Definitions are as follows:

"Median Age at Doctorate"--One-half received the doctorate at this age or younger.

"Percentage with Master's"--This indicates the percentage of doctorate recipients in a field who received a master's degree in any field before taking the doctorate.

"Median Time Lapse"--"Total Time" refers to total calendar time elapsed between the year of baccalaureate and the year of doctorate; "Registered Time" refers to the total time registered in a university between baccalaureate and doctorate.

Each year's doctorate recipients provide information on postgraduation employment or study plans in response to items 18 and 19 on the survey form. As the questionnaire is filled out at about the time the doctorate is received, these planned activities can be subject to change. However, comparisons with data from the longitudal Survey of Doctorate Recipients have shown these data to be a reasonable reflection of actual employment status in the year following the doctorate.[5/] Postgraduation plans of the doctorate recipients are grouped as:

"Postdoctoral Study Plans" (fellowship, research associateship, traineeship, other), "Planned Employment" (educational institution, industry, etc.), or "Postdoctoral Status Unknown." The sum of these columns of percentages totals 100 percent with allowance for rounding. For example, 3.7 percent of all the engineers plan to go to postdoctoral fellowships, 7.6 percent to research associateships, 1.5 percent to traineeships, 0.4 percent plan on some other form of postdoctoral study support, 80.2 percent plan on employment, and 6.7 percent did not indicate their postgraduation plans. The percentages listed by type of employer (educational institution, industry, etc.) total to the 80.2 percent planning on employment.

The four lines of data beginning with "Definite Postdoctoral Study," first included in the 1974 report, distinguish between individuals who have definite postgraduation plans (item 17:"Am returning to, or continuing in, predoctoral appointment" or "Have signed contract or made definite

[5/] Century of Doctorates: Data Analyses of Growth and Change, National Academy of Sciences, 1978, pp. 92-93.

commitment" in the survey questionnaire) and those who are still seeking employment or postdoctoral study (item 17: "Am negotiating with one or more specific organizations," "Am seeking appointment but have no definite prospects," or "Other"). These four lines when added to the prior line "Postdoctoral Status Unknown" total 100 percent. The two lines "Definite Postdoctoral Study" and "Seeking Postdoctoral Study" add to give the total percentage planning postdoctoral study listed in the table as "Postdoctoral Study Plans," and the two lines "Definite Employment" and "Seeking Employment" add to give the total percentage planning employment in the table as "Planned Employment After Doctorate."

Percentages showing the distribution of doctorate recipients by work activity and by region of employment are based on those who have a definite employment commitment. They exclude those still seeking employment and those planning postdoctoral study as described in the categories above. These data differ from Summary Reports prior to 1974, which included all individuals planning on employment, i.e., those seeking as well as those having definite employment commitments.

Table 3

Displayed in Table 3 are data on all sources of financial support in graduate school reported by doctorate recipients. Although this table duplicates to some extent the analysis presented earlier in the report, it is included here to maintain the continuity of the series of these tables published in each of the fifteen Summary Reports. The question on source of support was answered by 29,480 (94 percent) of the 1981 doctorate recipients. The data in the table should be interpreted as follows: 208 male doctorate recipients in the physical sciences reported financial support from NSF fellowships during graduate school. This number is 6.0 percent of the male physical sciences doctorates who answered the question, and it is 40.2 percent of the males in all fields who reported NSF fellowship support. Since students indicate multiple sources of support, the vertical percentages sum to more than 100 percent.

Table 4

Table 4 shows the number of persons receiving a doctorate from universities in each of the 50 states, the District of Columbia, and Puerto Rico.

Table 5

The 1973 Summary Report was the first to include data for racial and ethnic groups. The tables in that report stimulated many requests for more detailed data by individual racial or ethnic group. Such data are provided in Table 5, first included in the 1974 Summary Report. Table 5 contains data by racial or ethnic group and by U.S. citizenship status for selected variables from Tables 2 and 3. Comparisons between the 1973 data and data for 1974 to 1981 are somewhat tenuous because of the large number of cases (8,952) for which racial or ethnic data were unavailable in 1973.

In 1977, the item on racial or ethnic group in the survey questionnaire was revised to coincide with the question format recommended by the Federal Interagency Committee on Education and adopted by the Office of Management and Budget (OMB) for use in federally-sponsored surveys. An explanation of the effects of these changes is detailed on page 13 of the 1977 Summary Report. Changes in the OMB guidelines prompted the moving of persons having origins in the Indian subcontinent from the white category to Asian in 1978. In 1980, the category Hispanic was subdivided into Puerto Rican, Mexican-American, and Other Hispanic to provide more detail for users of the racial/ethnic data.

An additional revision to this item in 1980 involves the number of categories that may be checked. Prior to 1980, doctorate recipients could check as many categories as applied to indicate their racial/ethnic background. When compiling the data, all persons who checked "white" in addition to one other category, with the exception of "black," were included with those who had provided the single category response. Those whose responses were "black" and who gave an additional response to any other category were designated as "black." Beginning in 1980, respondents were asked to check only one category. Evidence of this change was most pronounced in the "American Indian" group where the majority of the respondents formerly checked "white" in addition to "American Indian."

TABLE 1
NUMBER OF DOCTORATE RECIPIENTS BY SEX AND SUBFIELD, 1981

SUBFIELD OF DOCTORATE	NUMBER OF DOCTORATES		
	MEN	WOMEN	TOTAL
TOTAL ALL FIELDS	21447	9872	31319
PHYSICAL SCIENCES	3666	502	4168
MATHEMATICS	616	112	728
ALGEBRA	40	14	54
ANALYSIS AND FUNCTIONAL ANALYSIS	97	8	105
GEOMETRY	28	1	29
LOGIC	17	1	18
NUMBER THEORY	23	1	24
PROBABILITY, MATH STATISTICS	131	32	163
TOPOLOGY	44	11	55
COMPUTING THEORY AND PRACTICE	14	2	16
OPERATIONS RESEARCH	31	4	35
APPLIED	94	24	118
MATHEMATICS, GENERAL	72	8	80
MATHEMATICS, OTHER	25	6	31
COMPUTER SCIENCES	206	26	232
PHYSICS AND ASTRONOMY	942	73	1015
ASTRONOMY	43	7	50
ASTROPHYSICS	55	4	59
ATOMIC AND MOLECULAR	57	8	65
ACOUSTICS	11	2	13
FLUIDS	11	3	14
PLASMA	63	2	65
OPTICS	53	1	54
THERMAL	7		7
ELEMENTARY PARTICLES	109	8	117
NUCLEAR STRUCTURE	59	3	62
SOLID STATE	230	20	250
PHYSICS, GENERAL	162	10	172
PHYSICS, OTHER	82	5	87
CHEMISTRY	1376	235	1611
ANALYTICAL	199	30	229
INORGANIC	153	35	188
ORGANIC	430	60	490
NUCLEAR	12		12
PHYSICAL	224	51	275
THEORETICAL	27	6	33
PHARMACEUTICAL	47	5	52
POLYMER	57	4	61
CHEMISTRY, GENERAL	171	26	197
CHEMISTRY, OTHER	56	18	74
EARTH, ENVIRONMENTAL AND MARINE SCI	526	56	582
MINERALOGY, PETROLOGY	25	5	30
GEOCHEMISTRY	43	5	48
STRATIGRAPHY, SEDIMENTATION	35	7	42
PALEONTOLOGY	18	1	19
STRUCTURAL GEOLOGY	26	1	27
GEOPHYSICS (SOLID EARTH)	67	5	72
GEOMORPHOL, GLACIAL GEOLOGY	11	2	13
HYDROLOGY AND WATER RESOURCES	20	1	21
OCEAONOGRAPHY	63	7	70
MARINE SCIENCES, OTHER	28	2	30
ATMOSPHERIC PHYSICS AND CHEMISTRY	14	1	15
ATMOSPHERIC DYNAMICS	26	1	27
ATMOSPHERIC SCIENCES, OTHER	30	1	31
ENVIRONMENTAL SCIENCES, GENERAL	27	3	30
ENVIRONMENTAL SCIENCES, OTHER	16	8	24
APPL GEOL, GEOL ENG, ECON GEOL	21		21
EARTH SCIENCES, GENERAL	42	4	46
EARTH SCIENCES, OTHER	14	2	16

SUBFIELD OF DOCTORATE	NUMBER OF DOCTORATES		
	MEN	WOMEN	TOTAL
ENGINEERING	2429	99	2528
AERONAUTICAL AND ASTRONAUTICAL	97		97
AGRICULTURAL	60	2	62
BIOMEDICAL	60	3	63
CIVIL	281	6	287
CHEMICAL	285	11	296
CERAMIC	23	1	24
COMPUTER	63	8	71
ELECTRICAL	397	14	411
ELECTRONICS	67		67
INDUSTRIAL	60	6	66
NUCLEAR	124	6	130
ENGINEERING MECHANICS	77	1	78
ENGINEERING PHYSICS	20	2	22
MECHANICAL	277	5	282
METALLURGY AND PHYSICAL MET	94	5	99
SYSTEMS DESIGN, SYSTEMS SCIENCE	64	4	68
OPERATIONS RESEARCH	73	7	80
FUEL TECH, PETROLEUM	21		21
SANITARY AND ENVIRONMENTAL	67	4	71
MINING	8		8
MATERIALS SCIENCE	102	11	113
ENGINEERING, GENERAL	36	1	37
ENGINEERING, OTHER	73	2	75
LIFE SCIENCES	4018	1443	5461
BIOLOGICAL SCIENCES	2411	986	3397
BIOCHEMISTRY	455	189	644
BIOPHYSICS	89	10	99
BIOMETRICS, BIOSTATISTICS	36	12	48
ANATOMY	108	48	156
CYTOLOGY	33	14	47
EMBRYOLOGY	10	10	20
IMMUNOLOGY	89	60	149
BOTANY	105	42	147
ECOLOGY	145	52	197
MICROBIOLOGY AND BACTERIOLOGY	250	103	353
PHYSIOLOGY, ANIMAL	247	80	327
PHYSIOLOGY, PLANT	57	11	68
ZOOLOGY	150	47	197
GENETICS	95	62	157
ENTOMOLOGY	130	13	143
MOLECULAR BIOLOGY	117	68	185
NUTRITION AND/OR DIETETICS	40	59	99
BIOL SCIENCES, GENERAL	147	60	207
BIOL SCIENCES, OTHER	108	46	154
AGRICULTURAL SCIENCES	1003	147	1150
AGRONOMY	162	15	177
AGRICULTURAL ECONOMICS	155	13	168
ANIMAL HUSBANDRY	19		19
FOOD SCIENCE AND TECHNOLOGY	76	28	104
FISH AND WILDLIFE	57	9	66
FORESTRY	89	6	95
HORTICULTURE	68	17	85
SOILS AND SOIL SCIENCE	83	7	90
ANIMAL SCIENCE AND ANIMAL NUTRITION	132	17	149
PHYTOPATHOLOGY	78	21	99
AGRICULTURE, GENERAL	4	1	5
AGRICULTURE, OTHER	80	13	93
MEDICAL SCIENCES	604	310	914
PUBLIC HEALTH AND EPIDEMIOLOGY	82	73	155
VETERINARY MEDICINE	33	8	41
NURSING	3	84	87
PARASITOLOGY	13	5	18
ENVIRONMENTAL HEALTH	37	6	43
PATHOLOGY	79	27	106
PHARMACOLOGY	211	69	280
PHARMACY	58	11	69
MEDICAL SCIENCES, GENERAL	16	8	24
MEDICAL SCIENCES, OTHER	72	19	91

TABLE 1. CONTINUED

SUBFIELD OF DOCTORATE	NUMBER OF DOCTORATES		
	MEN	WOMEN	TOTAL
SOCIAL SCIENCES (INCL PSYCH)	4190	2315	6505
ANTHROPOLOGY	217	152	369
COMMUNICATIONS	129	92	221
SOCIOLOGY	361	242	603
ECONOMICS	707	100	807
ECONOMETRICS	16	1	17
STATISTICS	32	7	39
GEOGRAPHY	89	20	109
AREA STUDIES	15	5	20
POLITICAL SCIENCE	349	96	445
PUBLIC ADMINISTRATION	120	27	147
INTERNATIONAL RELATIONS	75	12	87
CRIMINOLOGY	26	9	35
URBAN AND REGIONAL PLANNING	77	17	94
SOCIAL SCIENCES, GENERAL	17	5	22
SOCIAL SCIENCES, OTHER	75	58	133
PSYCHOLOGY	1885	1472	3357
CLINICAL	701	555	1256
COUNSELING AND GUIDANCE	191	160	351
DEVELOP AND GERONTOL	80	120	200
EDUCATIONAL	103	77	180
SCHOOL PSYCHOLOGY	60	73	133
EXPERIMENTAL	189	93	282
COMPARATIVE	8	3	11
PHYSIOLOGICAL	68	34	102
INDUSTRIAL AND PERSONNEL	65	22	87
PERSONALITY	23	26	49
PSYCHOMETRICS	17	10	27
SOCIAL	104	76	180
PSYCHOLOGY, GENERAL	148	135	283
PSYCHOLOGY, OTHER	128	88	216
HUMANITIES	2198	1547	3745
ART, HISTORY AND CRITICISM	45	112	157
HISTORY, AMERICAN	171	56	227
HISTORY, EUROPEAN	119	45	164
HISTORY, OTHER	186	88	274
HISTORY AND PHILOSOPHY OF SCIENCE	21	5	26
AMERICAN STUDIES	42	45	87
THEATRE AND THEATRE CRITICISM	71	32	103
MUSIC	260	108	368
SPEECH AS A DRAMATIC ART	25	12	37
ARCHEOLOGY	15	13	28
RELIGION	132	29	161
PHILOSOPHY	224	53	277
LINGUISTICS	98	78	176
COMPARATIVE LITERATURE	58	74	132
LANGUAGES AND LITERATURE	691	766	1457
AMERICAN	66	80	146
ENGLISH	327	343	670
GERMAN	40	49	89
RUSSIAN	14	13	27
FRENCH	49	118	167
SPANISH AND PORTUGUESE	91	93	184
ITALIAN	7	9	16
CLASSICAL	38	24	62
OTHER LANGUAGES	59	37	96
HUMANITIES, GENERAL	14	9	23
HUMANITIES, OTHER	26	22	48
PROFESSIONAL FIELDS	964	424	1388
THEOLOGY	179	22	201
BUSINESS ADMINISTRATION	532	90	622
HOME ECONOMICS	15	70	85
JOURNALISM	12	6	18
SPEECH AND HEARING SCIENCES	56	84	140
LAW, JURISPRUDENCE	27	1	28
SOCIAL WORK	99	110	209
LIBRARY AND ARCHIVAL SCIENCE	24	38	62
PROFESSIONAL FIELDS, OTHER	20	3	23

SUBFIELD OF DOCTORATE	NUMBER OF DOCTORATES		
	MEN	WOMEN	TOTAL
EDUCATION	3955	3534	7489
FOUNDATIONS: SOCIAL, PHILOS	121	87	208
EDUCATIONAL PSYCHOLOGY	209	236	445
ELEMENTARY EDUCATION, GENERAL	60	120	180
SECONDARY EDUCATION, GENERAL	76	60	136
HIGHER EDUCATION	392	279	671
ADULT EDUC AND EXTENSION EDUC	125	108	233
EDUCATION MEAS AND STATISTICS	49	41	90
CURRICULUM AND INSTRUCTION	366	448	814
EDUCATIONAL ADMIN AND SUPERVISION	1039	614	1653
GUIDANCE, COUNS, STUDENT PERSONNEL	296	253	549
SPECIAL ED (GIFTED, HANDICAPPED, ETC)	118	195	313
AUDIO-VISUAL MEDIA	48	29	77
TEACHING FIELDS	762	760	1522
AGRICULTURE	38	4	42
ART	27	36	63
BUSINESS	28	22	50
EARLY CHILDHOOD	11	79	90
ENGLISH	24	39	63
FOREIGN LANGUAGE	10	18	28
HOME ECONOMICS		25	25
INDUSTRIAL ARTS	25	2	27
MATHEMATICS	37	25	62
MUSIC	48	28	76
NURSING		23	23
PHYS ED, HEALTH, AND REC	218	149	367
READING	36	157	193
SCIENCE	71	36	107
SOCIAL SCIENCE	34	15	49
SPEECH	3	9	12
VOCATIONAL	135	78	213
OTHER TEACHING FIELDS	17	15	32
EDUCATION, GENERAL	205	202	407
EDUCATION, OTHER	89	102	191
OTHER AND UNSPECIFIED	27	8	35

SOURCE: NRC, Office of Scientific and Engineering Personnel Doctorate Records File.

TABLE 1A
NUMBER OF DOCTORATE RECIPIENTS BY CITIZENSHIP, RACIAL/ETHNIC GROUP, AND SUBFIELD, 1981

SUBFIELD OF DOCTORATE	TOTAL DOCTORATES	NON-U.S. CITIZENS TEMP. VISAS	U.S. CITIZENS AND NON-U.S. WITH PERMANENT VISAS RACIAL/ETHNIC GROUP1/								
			TOTAL	AMER. IND.	ASIAN	BLACK	WHITE	PUERTO RICAN	MEX-ICAN	OTHER HIS-PANIC	OTHER & UNK
TOTAL ALL FIELDS	31319 2/	3924	26262	89	1062	1104	22400	115	161	249	1082
PHYSICAL SCIENCES	4168	749	3291	2	214	39	2807	14	3	24	188
MATHEMATICS	728	186	523	1	40	9	446	2		3	22
ALGEBRA	54	14	40		2		37				1
ANALYSIS AND FUNCTIONAL ANALYSIS	105	30	75		4	3	67				1
GEOMETRY	29	2	27		2		23			1	1
LOGIC	18	1	17				17				
NUMBER THEORY	24	3	21		1		19				1
PROBABILITY, MATH STATISTICS	163	50	112		10	3	95			1	3
TOPOLOGY	55	10	45		1		40				4
COMPUTING THEORY AND PRACTICE	16	3	13		2		11				
OPERATIONS RESEARCH	35	13	20		1	2	17				
APPLIED	118	27	90		11		73	1			5
MATHEMATICS, GENERAL	80	24	41	1	4	1	29			1	5
MATHEMATICS, OTHER	31	9	22		2		18	1			1
COMPUTER SCIENCES	232	40	188		16	2	162				8
PHYSICS AND ASTRONOMY	1015	200	768		55	6	631	3		5	68
ASTRONOMY	50	5	44				39				5
ASTROPHYSICS	59	3	56		1	1	50	1		1	2
ATOMIC AND MOLECULAR	65	11	53		3	1	44			1	4
ACOUSTICS	13	1	12		2		9				1
FLUIDS	14	5	9		1		8				
PLASMA	65	10	55		4	1	46				4
OPTICS	54	11	41		4		34				3
THERMAL	7	3	4		1		3				
ELEMENTARY PARTICLES	117	21	96		4	1	78	1		1	11
NUCLEAR STRUCTURE	62	16	46		1		39				6
SOLID STATE	250	56	193		15		163	1		2	12
PHYSICS, GENERAL	172	48	83		15	2	53				13
PHYSICS, OTHER	87	10	76		4		65				7
CHEMISTRY	1611	238	1326	1	91	18	1121	7	3	12	73
ANALYTICAL	229	20	209	1	8	1	189	1			9
INORGANIC	188	18	168		7	5	144		1	3	8
ORGANIC	490	62	427		30	3	376	3	1	3	11
NUCLEAR	12	1	11				9			1	1
PHYSICAL	275	35	239		13	2	206	2	1	1	14
THEORETICAL	33	6	27		1		25			1	
PHARMACEUTICAL	52	7	44		3	1	36	1		1	2
POLYMER	61	22	39		14		25				
CHEMISTRY, GENERAL	197	56	100		6	6	60			2	26
CHEMISTRY, OTHER	74	11	62		9		51				2
EARTH, ENVIRONMENTAL AND MARINE SCI	582	85	486		12	4	447	2		4	17
MINERALOGY, PETROLOGY	30	3	27				26				1
GEOCHEMISTRY	48	1	47		1		44			1	1
STRATIGRAPHY, SEDIMENTATION	42	5	37				36	1			
PALEONTOLOGY	19		19				18				1
STRUCTURAL GEOLOGY	27		27				27				
GEOPHYSICS (SOLID EARTH)	72	12	58		4	1	49			1	3
GEOMORPHOL, GLACIAL GEOLOGY	13	1	12				12				
HYDROLOGY AND WATER RESOURCES	21	8	12				12				
OCEAONOGRAPHY	70	6	63		2		56			1	4
MARINE SCIENCES, OTHER	30	3	27				27				
ATMOSPHERIC PHYSICS AND CHEMISTRY	15	1	14			1	12	1			
ATMOSPHERIC DYNAMICS	27	4	23		2		21				
ATMOSPHERIC SCIENCES, OTHER	31	12	19		1		18				
ENVIRONMENTAL SCIENCES, GENERAL	30	3	27		1	1	25				
ENVIRONMENTAL SCIENCES, OTHER	24	6	18			1	17				
APPL GEOL, GEOL ENG, ECON GEOL	21	4	16				16				
EARTH SCIENCES, GENERAL	46	12	28		1		20			1	6
EARTH SCIENCES, OTHER	16	4	12				11				1

1/For more detailed explanation of racial/ethnic groups see item 8 on questionnaire on page 42.
2/Includes 1,133 individuals who did not report their citizenship at time of doctorate.

TABLE 1A. CONTINUED

SUBFIELD OF DOCTORATE	TOTAL DOCTORATES	NON-U.S. CITIZENS TEMP. VISAS	U.S. CITIZENS AND NON-U.S. WITH PERMANENT VISAS RACIAL/ETHNIC GROUP[1/]								
			TOTAL	AMER. IND.	ASIAN	BLACK	WHITE	PUERTO RICAN	MEX-ICAN	OTHER HIS-PANIC	OTHER & UNK
ENGINEERING	2528	943	1467	4	282	19	1092	5	2	9	54
AERONAUTICAL AND ASTRONAUTICAL	97	35	56		6		46				4
AGRICULTURAL	62	41	21		3		17				1
BIOMEDICAL	63	6	57		6	1	46				4
CIVIL	287	135	139	1	26	3	100	2		2	5
CHEMICAL	296	112	171		42	2	122		1		4
CERAMIC	24	8	16		3		13				
COMPUTER	71	24	46		16		30				
ELECTRICAL	411	134	251		50	6	182				13
ELECTRONICS	67	15	51		6	1	41	1		1	1
INDUSTRIAL	66	20	42		6		33			1	2
NUCLEAR	130	49	75		15	1	55				4
ENGINEERING MECHANICS	78	30	45		7	1	34				3
ENGINEERING PHYSICS	22	7	15		3		12				
MECHANICAL	282	114	156	2	36	1	110		1	2	4
METALLURGY AND PHYSICAL MET	99	50	46	1	15		29			1	
SYSTEMS DESIGN, SYSTEMS SCIENCE	68	27	39		3	1	32			1	2
OPERATIONS RESEARCH	80	31	49		10		38				1
FUEL TECH, PETROLEUM	21	13	6		2	1	3				
SANITARY AND ENVIRONMENTAL	71	17	53		2	1	46	2		1	1
MINING	8	1	6		1		5				
MATERIALS SCIENCE	113	35	73		18		51				4
ENGINEERING, GENERAL	37	8	15		3		12				
ENGINEERING, OTHER	75	31	39		3		35				1
LIFE SCIENCES	5461	728	4591	11	212	80	4021	10	15	36	206
BIOLOGICAL SCIENCES	3397	252	3058	6	136	47	2691	6	11	22	139
BIOCHEMISTRY	644	43	584	1	37	9	509		2	4	22
BIOPHYSICS	99	13	85		3		78			1	3
BIOMETRICS, BIOSTATISTICS	48	7	40		2		36				2
ANATOMY	156	4	148		3	1	138			2	4
CYTOLOGY	47	4	42			1	38			1	2
EMBRYOLOGY	20	1	19		1	3	15				
IMMUNOLOGY	149	6	142		11	2	124		1	1	3
BOTANY	147	12	128	1	3	1	116		1		6
ECOLOGY	197	10	184		4		169	1	1	1	8
MICROBIOLOGY AND BACTERIOLOGY	353	32	314	1	16	7	268	2	2	2	16
PHYSIOLOGY, ANIMAL	327	14	311	1	10	2	283	1	1	2	11
PHYSIOLOGY, PLANT	68	11	56		2		49		1		4
ZOOLOGY	197	11	180		3	3	167	1		1	5
GENETICS	157	15	140		5		128			2	5
ENTOMOLOGY	143	26	115	1	9		97		2	1	5
MOLECULAR BIOLOGY	185	7	174		5	3	153	1		2	10
NUTRITION AND/OR DIETETICS	99	14	81	1	4	7	61				8
BIOL SCIENCES, GENERAL	207	13	177		14	5	138			1	19
BIOL SCIENCES, OTHER	154	9	138		4	3	124			1	6
AGRICULTURAL SCIENCES	1150	388	731	2	29	18	635	2	3	11	31
AGRONOMY	177	60	113		3		105	1		2	2
AGRICULTURAL ECONOMICS	168	64	103	1	4	7	84			2	5
ANIMAL HUSBANDRY	19	4	15		1		13				1
FOOD SCIENCE AND TECHNOLOGY	104	49	53		6	1	39			3	4
FISH AND WILDLIFE	66	2	62				58			1	3
FORESTRY	95	21	70		3	2	63	1			1
HORTICULTURE	85	32	48		3	1	40		1	1	2
SOILS AND SOIL SCIENCE	90	39	48		2	3	39			1	3
ANIMAL SCIENCE AND ANIMAL NUTRITION	149	54	89	1	4	2	77		2		3
PHYTOPATHOLOGY	99	27	71		2	1	65			1	2
AGRICULTURE, GENERAL	5	4	1				1				
AGRICULTURE, OTHER	93	32	58		1	1	51				5
MEDICAL SCIENCES	914	88	802	3	47	15	695	2	1	3	36
PUBLIC HEALTH AND EPIDEMIOLOGY	155	13	140		2	4	126	1			7
VETERINARY MEDICINE	41	14	25				24			1	
NURSING	87	4	83		1	3	77	1			1
PARASITOLOGY	18	3	14				12		1		1
ENVIRONMENTAL HEALTH	43	3	38	1	1	3	32				1
PATHOLOGY	106	16	85		4		77				4
PHARMACOLOGY	280	16	259		16	3	226			1	13
PHARMACY	69	6	62		20	2	34			1	5
MEDICAL SCIENCES, GENERAL	24		23	1	1		19				2
MEDICAL SCIENCES, OTHER	91	13	73	1	2		68				2

TABLE 1A. CONTINUED

SUBFIELD OF DOCTORATE	TOTAL COCTORATES	NON-U.S. CITIZENS TEMP. VISAS	U.S. CITIZENS AND NON-U.S. WITH PERMANENT VISAS RACIAL/ETHNIC GROUP 1/								
			TOTAL	AMER. IND.	ASIAN	BLACK	WHITE	PUERTO RICAN	MEX-ICAN	OTHER HIS-PANIC	OTHER & UNK
SOCIAL SCIENCES (INCL PSYCH)	**6505**	**572**	**5662**	**14**	**135**	**223**	**4960**	**16**	**45**	**61**	**208**
ANTHROPOLOGY	369	25	329	1	4	7	283	1	3	5	25
COMMUNICATIONS	221	16	198		5	10	178			1	4
SOCIOLOGY	603	69	520		18	25	444	2	11	2	18
ECONOMICS	807	199	575	2	32	16	477	2	2	8	36
ECONOMETRICS	17	5	12		3		9				
STATISTICS	39	18	20		3		17				
GEOGRAPHY	109	20	85		4	2	71		1	1	6
AREA STUDIES	20	5	13		1	1	10				1
POLITICAL SCIENCE	445	52	373		15	25	305	1		7	20
PUBLIC ADMINISTRATION	147	18	107	1	3	9	88			1	5
INTERNATIONAL RELATIONS	87	16	64		1	4	54		1		4
CRIMINOLOGY	35		34				33	1			
URBAN AND REGIONAL PLANNING	94	26	56		2	4	45		1	2	2
SOCIAL SCIENCES, GENERAL	22	4	16			1	14		1		
SOCIAL SCIENCES, OTHER	133	19	107		3	6	91	1		1	5
PSYCHOLOGY	3357	80	3153	10	41	113	2841	8	25	33	82
CLINICAL	1256	13	1218	5	13	55	1086	6	8	16	29
COUNSELING AND GUIDANCE	351	10	340		6	17	307	1	3	3	3
DEVELOP AND GERONTOL	200	3	197		2	2	187			1	5
EDUCATIONAL	180	4	174	1	2	2	159		2	3	5
SCHOOL PSYCHOLOGY	133	1	130		1	2	120		2	1	4
EXPERIMENTAL	282	9	271	1	4	3	257		2	1	3
COMPARATIVE	11		11				10			1	
PHYSIOLOGICAL	102	3	98		3	1	92		1		1
INDUSTRIAL AND PERSONNEL	87	2	85	1	1	4	75			1	3
PERSONALITY	49	1	48		1	3	43				1
PSYCHOMETRICS	27	3	24				24				
SOCIAL	180	7	170		1	9	153		3	1	3
PSYCHOLOGY, GENERAL	283	10	209		3	9	167	1	3	2	24
PSYCHOLOGY, OTHER	216	14	178	2	4	6	161		1	3	1
HUMANITIES	**3745**	**234**	**3358**	**12**	**56**	**93**	**2954**	**23**	**17**	**64**	**139**
ART, HISTORY AND CRITICISM	157	8	143		2	2	134			1	4
HISTORY, AMERICAN	227	5	222		2	13	193		2	1	11
HISTORY, EUROPEAN	164	3	161	1	2	1	149		1	2	5
HISTORY, OTHER	274	34	219	1	4	8	177	4	2	7	16
HISTORY AND PHILOSOPHY OF SCIENCE	26	4	22				19				3
AMERICAN STUDIES	87	3	82	1	2	5	70				4
THEATRE AND THEATRE CRITICISM	103	3	97			5	90		1		1
MUSIC	368	15	319	1	8	8	294			1	7
SPEECH AS A DRAMATIC ART	37		34	1			30			1	2
ARCHEOLOGY	28		27				26				1
RELIGION	161	8	150	1	5	8	125	1			10
PHILOSOPHY	277	19	252	1	4	5	225	2		1	14
LINGUISTICS	176	47	120		5	2	105	1	1	1	5
COMPARATIVE LITERATURE	132	8	114	1	1	3	99		1	6	3
LANGUAGES AND LITERATURE	1457	74	1329	3	21	31	1159	15	9	43	48
AMERICAN	146	8	138		1	10	122				5
ENGLISH	670	26	620	3	8	10	571	1	1	2	24
GERMAN	89	3	81				80				1
RUSSIAN	27	1	26				25				1
FRENCH	167	6	158		1	9	143				5
SPANISH AND PORTUGUESE	184	13	166		3	1	99	13	8	40	2
ITALIAN	16	1	15				14				1
CLASSICAL	62	3	57			1	54				2
OTHER LANGUAGES	96	13	68		8		51	1		1	7
HUMANITIES, GENERAL	23		23	1			19				3
HUMANITIES, OTHER	48	3	44			2	40				2
PROFESSIONAL FIELDS	**1388**	**164**	**1172**	**3**	**44**	**59**	**984**	**9**	**3**	**9**	**61**
THEOLOGY	201	14	183		3		162			4	14
BUSINESS ADMINISTRATION	622	92	495	1	29	16	420	3		2	24
HOME ECONOMICS	85	6	79			1	74	1			3
JOURNALISM	18	5	13		1		11				1
SPEECH AND HEARING SCIENCES	140		139	2	2	10	120	1			4
LAW, JURISPRUDENCE	28	11	15		1		13				1
SOCIAL WORK	209	15	185		6	25	136	4	3	2	9
LIBRARY AND ARCHIVAL SCIENCE	62	14	48		1	7	35			1	4
PROFESSIONAL FIELDS, OTHER	23	7	15		1		13				1

TABLE 1A. CONTINUED

SUBFIELD OF DOCTORATE	TOTAL DOCTORATES	NON-U.S. CITIZENS TEMP. VISAS	U.S. CITIZENS AND NON-U.S. WITH PERMANENT VISAS RACIAL/ETHNIC GROUP 1/								
			TOTAL	AMER. IND.	ASIAN	BLACK	WHITE	PUERTO RICAN	MEX-ICAN	OTHER HIS-PANIC	OTHER & UNK
EDUCATION	7489	526	6695	42	119	589	5561	38	76	46	224
FOUNDATIONS: SOCIAL, PHILOS	208	29	165	1	6	13	130	1	2	3	9
EDUCATIONAL PSYCHOLOGY	445	23	415	2	13	21	362	4	2	4	7
ELEMENTARY EDUCATION, GENERAL	180	4	164	1	1	9	141		1	2	9
SECONDARY EDUCATION, GENERAL	136	14	109		2	6	96			1	4
HIGHER EDUCATION	671	39	628	4	11	80	494	3	9	5	22
ADULT EDUC AND EXTENSION EDUC	233	21	210	1	2	19	183		1	1	3
EDUCATION MEAS AND STATISTICS	90	11	77	1	4	2	68			1	1
CURRICULUM AND INSTRUCTION	814	69	739	3	11	61	607	6	20	4	27
EDUCATIONAL ADMIN AND SUPERVISION	1653	88	1542	19	17	190	1239	7	17	6	47
GUIDANCE, COUNS, STUDENT PERSONNEL	549	14	524	1	7	35	457	3	4	2	15
SPECIAL ED (GIFTED, HANDICAPPED, ETC)	313	9	301	1	3	9	275	3	1	1	8
AUDIO-VISUAL MEDIA	77	13	64		2	1	60	1			
TEACHING FIELDS	1522	136	1354	5	24	104	1154	8	13	7	39
AGRICULTURE	42	9	32		2	3	25		1		1
ART	63	8	55			3	51			1	
BUSINESS	50	8	42				42				
EARLY CHILDHOOD	90	2	82	1	1	9	66	1	1	1	2
ENGLISH	63	7	55		2	4	49				
FOREIGN LANGUAGE	28	5	21		1	1	15	1	1	1	1
HOME ECONOMICS	25	3	22		1	5	16				
INDUSTRIAL ARTS	27	1	25			2	21				2
MATHEMATICS	62	8	53	1	1	4	47				
MUSIC	76	4	67		1	4	56				6
NURSING	23	1	22		1	1	19				1
PHYS ED, HEALTH, AND REC	367	36	324	1	7	18	275	2	2	4	15
READING	193	6	182			10	163	1	2		6
SCIENCE	107	23	84	2	2	12	67				1
SOCIAL SCIENCE	49	4	45		1	4	39	1			
SPEECH	12		12			1	10	1			
VOCATIONAL	213	10	200		3	20	172	1	1		3
OTHER TEACHING FIELDS	32	1	31		1	3	21		5		1
EDUCATION, GENERAL	407	38	237	2	6	23	176		4	3	23
EDUCATION, OTHER	191	18	166	1	10	16	119	2	2	6	10
OTHER AND UNSPECIFIED	35	8	26	1		2	21				2

SOURCE: NRC, Office of Scientific and Engineering Personnel, Doctorate Records File.

TABLE 2
STATISTICAL PROFILE OF DOCTORATE RECIPIENTS BY FIELD OF DOCTORATE, 1981 1/

TOTAL ALL DOCTORATES

	1981 TOTAL	PHYSICS AND ASTRONOMY	CHEMISTRY	EARTH, ENVIRONMENTAL AND MARINE SCIENCES	PHYSICAL SCIENCES	MATHEMATICS	COMPUTER SCIENCES	ENGINEERING	EMP FIELDS	BIOCHEMISTRY	BASIC MEDICAL SCIENCES	OTHER BIOSCIENCES	BIOSCIENCES	MEDICAL SCIENCES	AGRICULTURAL SCIENCES
NUMBER IN FIELD	31319	1015	1611	582	3208	728	232	2528	6696	644	1336	1417	3397	914	1150
MALE %	68.5	92.8	85.4	90.4	88.7	84.6	88.8	96.1	91.0	70.7	70.6	71.5	71.0	66.1	87.2
FEMALE	31.5	7.2	14.6	9.6	11.3	15.4	11.2	3.9	9.0	29.3	29.4	28.5	29.0	33.9	12.8
U.S. CITIZENSHIP %	79.8	70.4	76.5	80.9	75.4	65.9	72.4	46.2	63.3	85.9	89.2	84.8	86.8	82.6	59.6
FOREIGN CITIZENSHIP	16.6	24.9	20.5	17.2	21.3	31.5	25.9	49.1	33.1	11.5	9.3	11.6	10.7	14.8	37.7
UNKNOWN	3.6	4.6	2.9	1.9	3.3	2.6	1.7	4.7	3.7	2.6	1.5	3.5	2.6	2.6	2.7
MARRIED %	60.1	50.0	52.8	59.5	53.1	49.7	54.3	61.6	56.0	51.9	54.9	55.8	54.7	59.1	73.0
NOT MARRIED	34.7	43.6	42.8	37.5	42.1	46.0	41.4	32.7	38.9	44.6	42.0	38.9	41.2	36.3	23.1
UNKNOWN	5.2	6.4	4.5	3.1	4.8	4.3	4.3	5.8	5.1	3.6	3.1	5.3	4.1	4.6	3.8
MEDIAN AGE AT DOCTORATE	32.4	29.1	28.3	30.9	29.0	29.2	30.1	30.5	29.6	28.5	29.3	30.2	29.5	31.2	31.7
PERCENT WITH BACC IN SAME FIELD AS DOCTORATE	53.3	80.5	84.6	47.8	76.6	80.2	13.8	74.1	73.9	22.0	18.9	66.3	39.3	26.7	55.8
PERCENT WITH MASTERS	80.6	65.8	38.3	75.6	53.8	76.6	80.6	89.4	70.6	29.3	44.2	66.5	50.7	60.6	91.7
MEDIAN TIME LAPSE FROM BACC TO DOCT															
TOTAL TIME YRS	9.4	7.0	6.0	8.3	6.7	6.9	7.7	7.9	7.2	6.4	6.7	7.6	7.0	8.3	8.0
REGISTERED TIME	6.4	6.2	5.2	6.4	5.7	5.9	6.2	5.6	5.7	5.7	5.8	6.3	6.0	6.0	5.6
POSTDOCTORAL STUDY PLANS %	18.3	45.5	38.4	29.2	39.0	15.2	6.5	13.1	25.5	78.3	75.5	47.3	64.3	42.0	13.7
FELLOWSHIP	8.9	16.4	16.1	9.3	14.9	6.7	2.2	3.7	9.3	45.3	46.0	24.6	36.9	24.4	3.9
RESEARCH ASSOC	6.7	28.5	20.4	19.1	22.7	5.8	3.0	7.6	14.5	25.2	18.9	17.9	19.7	8.8	8.9
TRAINEESHIP	1.0	.2	.8	.2	.5	1.4	.9	1.5	1.0	2.2	2.1	1.3	1.8	1.8	.8
OTHER	1.7	.5	1.1	.7	.8	1.4	.4	.4	.7	5.6	8.5	3.5	5.9	7.1	.1
PLANNED EMPLOYMENT AFTER DOCTORATE %	75.4	46.9	55.5	66.3	54.7	78.8	90.1	80.2	68.2	16.5	20.6	45.4	30.2	53.2	80.5
EDUC INSTITUTION	44.3	10.0	7.4	21.5	10.8	53.7	46.6	24.7	21.9	5.4	11.1	28.4	17.2	27.4	42.2
INDUSTRY/BUSINESS	14.2	26.4	42.4	27.7	34.7	18.0	35.3	42.6	35.9	7.9	5.5	7.0	6.6	11.5	15.1
GOVERNMENT	8.8	7.8	3.6	14.9	7.0	5.1	4.7	9.6	7.7	2.0	2.5	6.8	4.2	7.2	16.4
NONPROFIT	4.7	.7	1.1	.2	.8	.8	.4	1.6	1.1	.5	.7	1.6	1.0	4.2	1.9
OTHER & UNKNOWN	3.4	2.1	1.1	2.1	1.6	1.2	3.0	1.7	1.6	.6	.9	1.7	1.2	3.0	4.9
POSTDOCT STATUS UNKN %	6.3	7.6	6.1	4.5	6.3	5.9	3.4	6.7	6.3	5.3	3.9	7.3	5.6	4.8	5.8
DEFINITE POSTDOCTORAL STUDY	13.4	36.1	30.0	21.3	30.4	10.0	4.3	8.1	18.8	65.1	63.0	35.1	51.8	32.1	8.2
SEEKING POSTDOCTORAL STUDY	4.9	9.5	8.4	7.9	8.6	5.2	2.2	5.0	6.7	13.2	12.5	12.2	12.5	10.0	5.5
DEFINITE EMPLOYMENT	56.0	35.4	46.7	54.6	44.5	62.0	72.0	61.9	53.9	11.6	14.3	30.3	20.5	40.2	59.4
SEEKING EMPLOYMENT	19.5	11.5	8.8	11.7	10.2	16.9	18.1	18.3	14.3	4.8	6.3	15.1	9.7	13.0	21.1
EMPLOYMENT ACTIVITY AFTER DOCTORATE															
PRIMARY ACTIVITY															
R & D %	26.2	76.6	82.6	56.0	75.2	42.6	60.5	62.6	65.0	72.0	48.7	43.7	48.1	41.1	57.2
TEACHING	39.7	15.9	9.8	22.6	14.2	49.4	29.3	22.1	22.7	12.0	29.3	37.7	32.6	33.5	23.1
ADMINISTRATION	14.2	1.4	1.6	3.8	2.0	1.1	3.0	2.4	2.1	4.0	4.7	5.6	5.2	9.5	2.6
PROF. SERVICES	12.1	1.7	2.5	6.6	3.2	3.1	2.4	5.4	4.1	8.0	11.5	7.2	8.5	9.5	4.2
OTHER	2.9	1.7	1.1	7.2	2.6	1.6	1.8	2.6	2.4	1.3	2.1	2.3	2.2	2.2	5.6
ACTIVITY UNKNOWN	4.8	2.8	2.4	3.8	2.8	2.2	3.0	4.9	3.7	2.7	3.7	3.5	3.4	4.1	7.2
SECONDARY ACTIVITY															
R & D	25.2	13.9	7.7	25.5	13.2	42.1	29.3	21.4	21.1	13.3	23.0	33.5	28.4	27.8	19.8
TEACHING	11.9	4.2	3.1	8.5	4.5	19.7	20.4	11.3	10.1	14.7	18.8	18.4	18.1	16.3	19.6
ADMINISTRATION	9.7	7.8	14.9	11.0	12.2	3.5	4.2	8.8	9.3	16.0	10.5	6.3	8.5	16.1	10.0
PROF. SERVICES	7.7	4.2	6.1	8.8	6.2	3.3	2.4	6.8	5.9	1.3	4.7	6.7	5.6	7.4	6.6
OTHER	2.0	1.7	1.2	1.6	1.4	.7	.0	1.4	1.2	.0	.5	1.2	.9	.5	1.5
NO SECONDARY ACTIVITY	38.6	65.5	64.6	40.9	59.6	28.4	40.7	45.4	48.6	52.0	38.7	30.5	35.1	27.8	35.4
UNKNOWN	4.8	2.8	2.4	3.8	2.8	2.2	3.0	4.9	3.7	2.7	3.7	3.5	3.4	4.1	7.2
REGION OF EMPLOYMENT AFTER DOCTORATE															
NEW ENGLAND %	6.5	7.8	4.9	4.4	5.5	8.4	10.8	6.3	6.5	6.7	5.8	6.0	6.0	4.4	2.2
MIDDLE ATLANTIC	15.1	20.6	25.3	8.2	20.3	15.7	19.2	16.9	18.2	18.7	14.7	10.9	12.8	16.6	5.7
EAST NO CENTRAL	13.9	8.1	18.0	6.6	12.9	17.1	5.4	11.9	12.7	12.0	17.3	8.4	11.2	16.3	8.6
WEST NO CENTRAL	6.2	2.8	3.5	2.8	3.1	3.8	4.8	3.3	3.4	2.7	7.9	7.0	6.8	6.8	10.0
SOUTH ATLANTIC	15.3	9.2	15.8	12.3	13.4	13.5	12.0	11.6	12.5	20.0	13.6	17.4	16.7	16.1	12.3
EAST SO CENTRAL	4.3	1.9	3.2	2.2	2.7	4.2	1.2	2.9	2.9	5.3	3.1	5.3	4.7	3.3	4.7
WEST SO CENTRAL	8.2	7.8	10.1	20.8	11.9	9.3	10.2	8.4	10.0	5.3	10.5	9.8	9.5	7.9	5.9
MOUNTAIN	4.6	8.6	2.5	13.2	6.4	3.3	4.2	5.2	5.4	2.7	4.7	5.3	4.9	2.7	5.6
PACIFIC & INSULAR	11.3	22.8	9.3	17.3	14.5	10.9	21.6	15.8	14.9	16.0	9.9	13.7	12.9	10.6	9.4
FOREIGN	9.0	7.2	3.7	8.8	5.7	10.4	7.8	13.5	9.8	9.3	9.9	13.5	12.1	9.5	32.1
REGION UNKNOWN	5.5	3.1	3.7	3.5	3.5	3.3	3.0	4.2	3.7	1.3	2.6	2.6	2.4	5.7	3.7

1/Refer to explanatory note on page 24 and the description of doctoral fields inside back cover.

TABLE 2. CONTINUED

TOTAL ALL DOCTORATES

LIFE SCIENCES	PSYCHOLOGY	ECONOMICS	ANTHROPOLOGY AND SOCIOLOGY	POLIT. SCI., PUBLIC ADMIN., INTERN'L REL.	OTHER SOCIAL SCIENCES	SOCIAL SCIENCES INCL. PSYCHOL.	TOTAL SCIENCES	HISTORY	ENG. AND AMER. LANG. AND LIT.	FOREIGN LANG. AND LIT.	OTHER HUMANITIES	HUMANITIES	PROFESSIONAL FIELDS	EDUCATION	TOTAL NON-SCIENCES	OTHER OR UNSPECIFIED 2/
5461	3357	824	972	679	673	6505	18662	691	816	641	1597	3745	1388	7489	12622	35
73.6	56.2	87.7	59.5	80.1	68.4	64.4	76.6	71.9	48.2	46.5	63.2	58.7	69.5	52.8	56.4	77.1
26.4	43.8	12.3	40.5	19.9	31.6	35.6	23.4	28.1	51.8	53.5	36.8	41.3	30.5	47.2	43.6	22.9
80.3	92.5	64.1	83.5	75.6	74.6	84.0	75.5	87.4	90.8	78.6	85.2	85.7	79.6	87.7	86.2	
17.1	3.8	31.9	13.5	17.2	20.1	11.9	21.0	9.6	6.3	16.7	9.9	10.2	16.6	8.8	10.1	
2.6	3.7	4.0	3.0	7.2	5.3	4.2	3.5	3.0	2.9	4.7	4.9	4.1	3.7	3.6	3.7	
59.3	53.8	58.9	59.2	59.4	61.4	56.6	57.2	60.6	57.6	54.9	56.0	57.0	66.1	67.9	64.5	
36.6	41.0	35.0	35.6	31.2	31.9	37.5	37.7	33.4	37.6	37.9	36.8	36.5	27.8	27.3	30.1	
4.1	5.2	6.2	5.2	9.4	6.7	5.9	5.1	5.9	4.8	7.2	7.2	6.4	6.1	4.8	5.4	
30.1	31.4	30.9	33.2	33.4	33.5	32.0	30.5	33.4	33.5	34.1	33.3	33.5	34.2	37.3	35.7	
40.7	66.5	63.0	60.3	49.0	26.3	59.1	59.0	63.5	77.3	59.8	52.1	61.0	34.6	38.9	45.0	
61.0	81.4	77.4	87.3	89.2	90.9	83.6	72.3	89.3	89.1	85.0	86.1	87.2	91.9	95.7	92.8	
7.3	8.4	8.0	10.0	10.4	10.1	9.0	7.8	11.0	10.9	10.9	10.6	10.8	11.1	13.5	12.3	
5.9	6.3	6.1	7.5	7.0	6.2	6.5	6.0	8.3	7.7	7.8	7.4	7.7	6.6	7.0	7.2	
49.9	17.5	4.2	12.9	6.3	4.6	12.6	28.1	7.7	2.8	5.6	5.9	5.5	1.9	3.2	3.8	
27.9	9.6	1.8	6.9	3.2	1.5	6.7	13.9	4.2	1.5	2.2	2.6	2.6	.9	1.0	1.5	
15.6	3.1	1.3	4.1	1.8	1.9	2.8	10.7	1.3	.1	1.2	.9	.9	.6	.9	.9	
1.6	3.1	.5	.1	.4	.3	1.7	1.4	.3	.0	.0	.3	.2	.3	.6	.4	
4.9	1.7	.6	1.7	.9	.9	1.4	2.2	1.9	1.2	2.2	2.1	1.9	.1	.7	1.0	
44.6	76.7	89.7	80.8	83.2	87.2	80.7	65.7	85.7	89.8	86.4	85.5	86.6	91.6	91.1	89.8	
24.2	29.8	55.7	55.8	46.5	54.2	41.2	29.3	59.9	74.8	70.2	65.9	67.5	65.1	66.3	66.5	
9.2	12.7	11.2	6.0	8.5	13.1	11.1	19.4	8.7	7.5	5.9	6.3	6.9	8.9	5.8	6.5	
7.3	14.7	14.9	7.7	18.0	10.8	13.7	9.6	7.5	1.5	2.3	2.8	3.3	5.4	10.2	7.6	
1.7	13.8	4.2	6.2	4.7	4.5	9.5	4.2	4.9	1.1	1.1	6.6	4.2	10.5	5.0	5.3	
2.3	5.7	3.6	5.1	5.4	4.6	5.2	3.1	4.6	5.0	6.9	3.8	4.7	1.7	3.9	3.9	
5.5	5.8	6.1	6.4	10.5	8.2	6.7	6.2	6.7	7.4	8.0	8.6	7.9	6.4	5.7	6.4	
39.3	12.7	2.8	8.1	4.1	1.9	8.8	21.3	3.8	1.0	2.7	2.8	2.5	1.1	1.6	1.8	
10.6	4.7	1.5	4.7	2.2	2.7	3.8	6.8	3.9	1.8	3.0	3.1	3.0	.9	1.6	1.9	
32.0	54.3	77.4	55.8	62.3	64.5	59.3	49.4	56.4	59.6	57.1	56.8	57.4	77.5	67.6	65.6	
12.7	22.4	12.3	25.0	20.9	22.7	21.4	16.3	29.2	30.3	29.3	28.7	29.2	14.1	23.5	24.2	
50.2	16.2	37.1	27.9	16.1	21.4	21.9	44.1	8.2	2.5	3.3	5.6	5.0	11.2	5.9	6.4	
29.1	21.0	44.7	55.4	47.3	56.7	36.6	29.8	64.1	81.3	77.9	73.2	74.2	59.0	39.1	50.8	
5.1	6.8	5.5	5.7	18.4	7.8	7.8	5.1	9.2	5.3	4.9	6.4	6.4	9.6	35.2	24.4	
7.0	50.7	3.6	4.8	5.2	6.7	26.6	14.1	5.9	3.1	3.6	6.5	5.1	12.3	11.5	9.9	
3.5	1.9	4.1	2.4	5.9	3.7	3.0	2.9	8.2	4.7	2.7	5.0	5.1	3.2	1.8	2.8	
5.0	3.3	5.0	3.9	7.1	3.7	4.1	4.1	4.4	3.1	7.7	3.3	4.2	4.8	6.4	5.6	
24.9	24.1	37.6	38.7	30.0	37.3	30.5	25.8	32.6	32.3	40.4	33.2	34.1	38.1	17.6	24.5	
18.3	16.7	16.1	12.2	8.0	10.6	14.4	13.4	5.9	4.5	4.9	7.6	6.1	12.4	11.5	10.2	
10.7	11.6	6.1	7.9	12.5	12.0	10.3	10.0	7.7	9.9	6.0	9.8	8.8	8.1	10.0	9.5	
6.4	9.1	3.4	3.1	4.7	7.6	6.7	6.3	2.1	1.9	2.7	6.8	4.1	8.5	11.6	9.2	
1.0	2.6	.8	1.1	1.7	.9	1.8	1.4	2.8	3.3	2.2	6.1	4.2	1.8	2.3	2.7	
33.7	32.5	30.9	33.0	35.9	27.9	32.2	38.9	44.6	45.1	36.1	33.2	38.4	26.4	40.7	38.2	
5.0	3.3	5.0	3.9	7.1	3.7	4.1	4.1	4.4	3.1	7.7	3.3	4.2	4.8	6.4	5.6	
4.2	7.4	7.7	9.2	8.3	3.5	7.4	6.4	7.2	8.2	12.6	7.7	8.6	4.8	6.0	6.5	
10.8	19.5	16.8	16.6	15.8	12.7	17.5	16.5	14.6	16.5	15.8	15.2	15.5	12.6	13.1	13.6	
11.3	16.3	12.7	13.5	7.8	15.4	14.3	13.1	11.8	15.0	12.6	13.8	13.5	16.4	15.0	14.8	
8.0	6.9	3.9	6.5	3.3	9.2	6.2	5.4	6.2	5.8	6.8	7.8	6.9	7.2	7.2	7.1	
14.8	13.8	23.4	16.1	26.7	12.2	16.9	14.8	17.2	16.3	11.7	14.0	14.7	15.7	16.5	15.9	
4.4	3.3	2.5	4.2	2.6	4.6	3.4	3.4	2.6	4.1	3.0	6.3	4.6	5.0	5.7	5.3	
7.7	7.6	4.2	4.1	5.0	6.5	6.1	7.9	8.5	9.5	6.8	8.2	8.3	11.2	8.0	8.5	
4.7	3.7	4.4	3.1	3.8	6.0	4.0	4.7	4.1	4.1	4.6	3.2	3.8	3.5	5.2	4.6	
11.1	13.4	7.5	10.1	7.3	10.4	11.0	12.5	11.3	8.4	10.7	9.8	9.9	9.9	10.0	10.0	
19.4	2.5	13.5	11.6	13.0	13.4	8.0	10.8	9.7	5.8	7.1	8.7	8.0	9.7	5.9	6.9	
3.6	5.7	3.4	5.0	6.4	6.2	5.4	4.4	6.9	6.4	8.2	5.3	6.3	3.9	7.5	6.7	

2/Statistics are not presented for this group because too few records contained the specified data.

SOURCE: NRC, Office of Scientific and Engineering Personnel, Doctorate Records File.

TABLE 2
STATISTICAL PROFILE OF DOCTORATE RECIPIENTS BY FIELD OF DOCTORATE, 1981 1/

DOCTORATES: MEN

		1981 TOTAL	PHYSICS AND ASTRONOMY	CHEMISTRY	EARTH, ENVIRONMENTAL AND MARINE SCIENCES	PHYSICAL SCIENCES	MATHEMATICS	COMPUTER SCIENCES	ENGINEERING	EMP FIELDS	BIOCHEMISTRY	BASIC MEDICAL SCIENCES	OTHER BIOSCIENCES	BIOSCIENCES	MEDICAL SCIENCES	AGRICULTURAL SCIENCES
TOTAL MALE		21447	942	1376	526	2844	616	206	2429	6095	455	943	1013	2411	604	1003
MALE AS A PERCENT OF TOTAL DOCTORATES	%	68.5	92.8	85.4	90.4	88.7	84.6	88.8	96.1	91.0	70.7	70.6	71.5	71.0	66.1	87.2
U.S. CITIZENSHIP	%	76.1	71.1	76.7	80.6	75.6	64.9	71.8	45.9	62.6	87.3	88.4	84.6	86.6	81.1	58.7
FOREIGN CITIZENSHIP		20.2	24.0	20.4	17.5	21.1	32.3	26.2	49.3	33.6	10.3	10.1	11.5	10.7	16.6	38.8
UNKNOWN		3.7	4.9	2.9	1.9	3.4	2.8	1.9	4.8	3.8	2.4	1.5	3.9	2.7	2.3	2.5
MARRIED	%	63.7	49.0	52.9	61.0	53.1	51.3	52.4	61.8	56.4	54.1	58.6	59.9	58.3	65.1	75.4
NOT MARRIED		30.9	44.4	42.4	36.1	41.9	44.8	42.7	32.4	38.4	42.4	38.3	34.3	37.4	30.6	21.0
UNKNOWN		5.3	6.6	4.7	2.9	5.0	3.9	4.9	5.8	5.2	3.5	3.1	5.8	4.3	4.3	3.6
MEDIAN AGE AT DOCTORATE		31.8	29.1	28.3	31.1	29.0	29.1	30.1	30.6	29.6	28.5	29.3	30.2	29.5	30.3	31.8
PERCENT WITH BACC IN SAME FIELD AS DOCTORATE		54.7	80.6	84.6	48.3	76.5	79.2	14.1	75.1	74.1	23.7	18.6	65.4	39.2	17.9	58.0
PERCENT WITH MASTERS		78.8	65.4	38.2	76.2	54.2	75.3	78.6	89.3	71.2	29.0	44.6	67.9	51.5	54.6	92.2
MEDIAN TIME LAPSE FROM BACC TO DOCT																
TOTAL TIME	YRS	8.8	7.0	6.0	8.4	6.7	6.9	7.7	7.9	7.2	6.3	6.7	7.5	7.0	7.6	8.1
REGISTERED TIME		6.2	6.2	5.2	6.4	5.7	5.9	6.1	5.6	5.7	5.6	5.9	6.3	6.0	6.0	5.5
POSTDOCTORAL STUDY PLANS	%	19.8	45.4	38.7	29.7	39.2	16.6	6.3	13.1	25.4	79.6	75.3	45.3	63.5	47.2	13.2
FELLOWSHIP		9.2	15.8	15.7	8.9	14.5	7.3	2.4	3.7	9.0	45.9	44.0	22.4	35.3	27.8	3.7
RESEARCH ASSOC		7.9	28.9	20.9	19.8	23.3	6.2	2.9	7.6	14.6	24.8	18.8	18.5	19.8	9.4	8.6
TRAINEESHIP		1.0	.2	.8	.2	.5	1.5	.5	1.4	1.0	2.2	2.2	1.3	1.8	1.5	.8
OTHER		1.8	.5	1.3	.8	.9	1.6	.5	.4	.8	6.6	10.3	3.2	6.6	8.4	.1
PLANNED EMPLOYMENT AFTER DOCTORATE	%	74.0	47.0	55.3	66.7	54.7	77.8	89.8	80.1	68.3	15.8	20.8	47.7	31.1	48.0	81.7
EDUC INSTITUTION		41.3	9.7	7.3	22.1	10.8	52.3	46.1	24.5	21.7	5.5	10.8	29.7	17.8	22.4	42.6
INDUSTRY/BUSINESS		16.6	27.1	42.8	27.6	34.8	18.5	35.4	42.7	36.3	8.6	5.9	6.8	6.8	13.9	15.6
GOVERNMENT		9.4	8.0	3.2	14.8	6.9	5.2	4.9	9.7	7.8	1.1	2.7	8.0	4.6	6.5	16.8
NONPROFIT		4.3	.6	1.0	.2	.7	.8	.5	1.6	1.1	.7	.7	1.6	1.1	3.3	1.8
OTHER & UNKNOWN		2.4	1.7	.9	2.1	1.4	1.0	2.9	1.7	1.5	.0	.6	1.6	.9	2.0	4.9
POSTDOCT STATUS UNKN	%	6.2	7.5	6.0	3.6	6.1	5.7	3.9	6.8	6.3	4.6	3.9	7.0	5.4	4.8	5.2
DEFINITE POSTDOCTORAL STUDY		14.8	36.1	29.7	21.7	30.3	11.2	3.9	8.1	18.6	66.4	63.1	33.9	51.4	37.1	7.8
SEEKING POSTDOCTORAL STUDY		5.0	9.3	8.9	8.0	8.9	5.4	2.4	5.0	6.8	13.2	12.2	11.5	12.1	10.1	5.4
DEFINITE EMPLOYMENT		56.9	35.7	46.7	55.1	44.6	61.5	72.8	61.8	54.1	11.6	14.7	32.9	21.8	35.9	61.6
SEEKING EMPLOYMENT		17.2	11.4	8.6	11.6	10.1	16.2	17.0	18.4	14.2	4.2	6.0	14.8	9.4	12.1	20.0
EMPLOYMENT ACTIVITY AFTER DOCTORATE																
PRIMARY ACTIVITY																
R & D	%	31.3	76.2	82.4	55.5	74.6	43.8	62.7	62.7	65.1	69.8	47.5	47.4	49.7	48.4	57.4
TEACHING		36.6	16.1	10.1	23.4	14.7	47.8	26.7	21.7	22.2	11.3	25.9	35.1	30.3	24.9	22.5
ADMINISTRATION		13.4	1.5	1.4	3.4	1.9	1.3	3.3	2.5	2.2	3.8	5.0	5.4	5.1	9.7	2.8
PROF. SERVICES		10.9	1.5	2.6	6.9	3.3	3.2	2.7	5.5	4.2	9.4	14.4	6.6	9.0	9.7	4.4
OTHER		3.0	1.8	.8	7.2	2.5	1.8	2.0	2.7	2.5	1.9	2.2	2.1	2.1	2.8	5.7
ACTIVITY UNKNOWN		4.9	3.0	2.6	3.4	2.9	2.1	2.7	4.9	3.7	3.8	5.0	3.3	3.8	4.6	7.3
SECONDARY ACTIVITY																
R & D		24.5	14.0	7.9	26.6	13.8	40.9	27.3	21.1	20.9	13.2	22.3	33.0	28.2	24.4	18.8
TEACHING		12.1	3.9	3.4	9.0	4.8	20.3	22.0	11.5	10.4	13.2	18.0	19.5	18.5	16.1	20.4
ADMINISTRATION		9.9	8.0	15.9	11.0	12.7	4.2	4.7	9.1	9.7	18.9	10.1	6.3	8.6	15.7	10.0
PROF. SERVICES		7.2	4.2	5.9	8.6	6.1	3.4	2.7	6.9	6.0	1.9	3.6	7.2	5.7	6.0	6.8
OTHER		1.8	1.8	1.4	1.4	1.5	.5	.0	1.5	1.3	.0	.7	1.5	1.1	.5	1.6
NO SECONDARY ACTIVITY		39.6	65.2	62.8	40.0	58.2	28.5	40.7	45.1	48.0	49.1	40.3	29.1	34.1	32.7	35.1
UNKNOWN		4.9	3.0	2.6	3.4	2.9	2.1	2.7	4.9	3.7	3.8	5.0	3.3	3.8	4.6	7.3
REGION OF EMPLOYMENT AFTER DOCTORATE																
NEW ENGLAND	%	6.2	7.4	5.0	4.1	5.4	7.9	11.3	6.1	6.3	5.7	5.0	6.3	5.9	4.6	1.9
MIDDLE ATLANTIC		14.6	19.6	24.6	7.2	19.3	15.6	20.7	16.5	17.7	17.0	15.8	10.5	12.6	13.8	4.9
EAST NO CENTRAL		13.6	8.0	18.4	7.2	13.1	18.2	5.3	12.1	12.9	11.3	17.3	7.5	10.5	18.0	9.5
WEST NO CENTRAL		6.2	3.0	3.3	2.4	3.0	4.0	4.7	3.3	3.3	3.8	7.2	6.3	6.3	6.5	10.2
SOUTH ATLANTIC		14.7	9.5	15.6	12.8	13.3	13.2	11.3	11.7	12.5	17.0	12.2	17.4	16.0	17.1	12.1
EAST SO CENTRAL		4.3	2.1	3.4	2.4	2.8	4.0	1.3	3.0	3.0	5.7	2.9	6.0	5.1	4.1	4.7
WEST SO CENTRAL		8.2	7.7	11.4	20.7	12.5	8.7	7.3	8.5	10.0	5.7	10.1	9.0	9.0	9.2	5.5
MOUNTAIN		4.9	8.6	2.6	14.1	6.9	3.7	4.0	5.4	5.7	1.9	6.5	4.8	5.0	1.4	5.7
PACIFIC & INSULAR		11.3	23.5	7.9	16.9	14.1	10.8	22.7	15.7	14.8	20.8	8.6	14.4	13.5	7.8	9.2
FOREIGN		10.9	7.1	3.9	9.3	6.0	10.0	8.7	13.7	10.1	11.3	11.5	14.7	13.5	12.0	32.2
REGION UNKNOWN		5.1	3.3	3.9	2.8	3.5	4.0	2.7	4.1	3.8	.0	2.9	3.0	2.7	5.5	4.0

1/Refer to explanatory note on page 24 and the description of doctoral fields inside back cover.

TABLE 2. CONTINUED

DOCTORATES: MEN

LIFE SCIENCES	PSYCHOLOGY	ECONOMICS	ANTHROPOLOGY AND SOCIOLOGY	POLIT. SCI., PUBLIC ADMIN., INTERN'L REL.	OTHER SOCIAL SCIENCES	SOCIAL SCIENCES INCL. PSYCHOL.	TOTAL SCIENCES	HISTORY	ENG. AND AMER. LANG. AND LIT.	FOREIGN LANG. AND LIT.	OTHER HUMANITIES	HUMANITIES	PROFESSIONAL FIELDS	EDUCATION	TOTAL NON-SCIENCES	OTHER OR UNSPECIFIED 2/
4018	1885	723	578	544	460	4190	14303	497	393	298	1010	2198	964	3955	7117	27
73.6	56.2	87.7	59.5	80.1	68.4	64.4	76.6	71.9	48.2	46.5	63.2	58.7	69.5	52.8	56.4	77.1
78.8	92.6	63.1	82.2	72.4	68.0	80.7	72.5	86.9	89.3	77.2	85.4	85.4	74.9	84.3	83.4	
18.6	3.7	32.9	14.7	19.7	26.3	14.8	23.9	10.5	7.4	17.1	10.6	10.9	20.9	12.1	12.9	
2.6	3.8	4.0	3.1	7.9	5.7	4.5	3.7	2.6	3.3	5.7	4.0	3.8	4.3	3.5	3.7	
63.6	58.8	59.9	65.1	61.9	67.8	61.2	59.8	63.8	62.1	57.0	59.9	60.8	71.5	77.6	71.6	
32.3	36.0	33.9	29.1	27.6	25.2	32.4	34.9	30.2	33.1	35.2	34.0	33.1	21.4	17.5	22.9	
4.1	5.2	6.2	5.9	10.5	7.0	6.3	5.2	6.0	4.8	7.7	6.1	6.1	7.2	4.9	5.6	
30.0	31.2	31.0	33.0	33.4	33.5	31.9	30.3	33.2	32.6	33.8	33.1	33.1	34.1	36.8	35.2	
40.7	68.5	63.1	61.6	49.1	28.0	59.6	60.5	64.2	79.1	55.4	54.4	61.1	36.3	34.8	43.2	
62.1	81.1	77.5	87.5	90.1	91.1	83.6	72.3	89.3	87.5	83.9	84.5	86.0	90.9	95.3	91.8	
7.3	8.2	8.0	9.9	10.2	10.2	8.8	7.6	10.8	10.0	10.7	10.1	10.4	10.8	13.0	11.9	
5.9	6.2	6.1	7.4	6.9	6.1	6.4	5.9	8.2	7.3	7.5	7.0	7.4	6.7	7.1	7.2	
48.5	17.3	4.6	13.0	6.8	4.6	11.7	27.9	7.2	2.5	6.0	5.9	5.6	1.8	2.9	3.6	
26.3	9.9	2.1	5.7	3.5	1.3	6.2	13.0	3.6	1.5	2.0	2.6	2.5	.8	.9	1.4	
15.4	3.1	1.2	4.8	1.8	2.2	2.7	11.4	1.2	.3	2.3	.6	.9	.5	1.0	.9	
1.5	2.7	.6	.2	.4	.2	1.4	1.2	.4	.0	.0	.3	.2	.3	.5	.4	
5.3	1.7	.7	2.2	1.1	.9	1.4	2.2	2.0	.8	1.7	2.5	2.0	.1	.6	.9	
46.3	76.9	89.3	80.4	81.8	86.7	81.2	65.9	86.7	89.1	86.2	86.5	87.0	91.5	91.7	90.2	
24.6	29.3	55.9	56.9	46.5	52.8	42.5	28.6	61.8	77.1	72.8	67.8	68.8	64.0	66.1	66.6	
10.1	13.7	10.7	6.2	8.3	13.0	11.4	21.6	8.5	6.9	5.4	5.4	6.4	9.1	5.8	6.4	
7.9	16.3	15.8	8.7	18.0	11.7	14.9	9.9	8.2	2.0	3.0	3.1	4.0	5.2	11.7	8.5	
1.6	13.4	3.7	5.0	4.6	5.2	8.5	3.4	4.2	1.0	.7	7.6	4.7	12.2	5.4	6.1	
2.1	4.1	3.3	3.6	4.4	3.9	3.9	2.4	4.0	2.0	4.4	2.6	3.0	.9	2.7	2.6	
5.2	5.8	6.1	6.6	11.4	8.7	7.0	6.2	6.0	8.4	7.7	7.5	7.4	6.7	5.4	6.2	
38.4	12.8	3.2	8.5	4.0	2.6	8.3	21.2	4.0	1.5	3.4	3.0	3.0	1.1	1.5	1.9	
10.1	4.5	1.4	4.5	2.8	2.0	3.4	6.7	3.2	1.0	2.7	3.0	2.6	.6	1.4	1.7	
33.8	56.6	77.2	56.9	61.6	65.7	61.8	50.7	60.0	64.4	64.1	58.5	60.6	80.6	71.2	69.2	
12.4	20.3	12.2	23.5	20.2	21.1	19.4	15.3	26.8	24.7	22.1	28.0	26.3	10.9	20.5	21.0	
53.0	16.8	36.6	28.6	14.3	22.5	22.9	47.8	8.4	2.4	5.8	5.9	5.8	11.8	6.4	7.1	
25.9	21.3	45.2	55.6	47.2	55.0	38.1	28.6	64.4	80.2	75.4	74.5	73.4	58.3	33.9	48.5	
4.8	7.1	5.6	4.6	19.4	7.9	8.1	4.8	8.4	6.3	5.2	5.9	6.5	8.5	40.0	25.9	
7.0	49.8	3.4	5.2	6.0	7.3	23.5	11.6	5.4	2.8	4.2	6.1	5.0	13.1	10.9	9.7	
3.8	1.8	4.3	2.1	6.0	3.0	3.1	3.0	8.7	5.9	2.1	4.6	5.4	3.5	1.7	3.0	
5.5	3.2	5.0	4.0	7.2	4.3	4.3	4.3	4.7	2.4	7.3	3.0	3.9	4.8	7.0	5.8	
23.3	24.7	37.3	38.9	29.6	35.1	31.0	25.0	33.9	34.4	42.9	31.8	34.4	37.5	15.3	23.9	
19.0	17.0	15.9	10.9	8.7	11.6	14.3	13.4	6.0	4.7	5.2	7.6	6.4	14.0	10.9	10.2	
10.4	11.9	6.3	8.2	12.5	12.9	10.4	10.1	8.4	10.7	6.8	11.3	9.9	8.2	10.1	9.7	
6.3	9.6	3.8	3.3	4.8	6.6	6.6	6.2	2.3	1.6	3.1	6.9	4.4	7.7	10.8	8.6	
1.3	1.9	.9	.9	2.1	.7	1.4	1.3	2.3	2.8	2.6	5.9	4.1	1.8	1.8	2.4	
34.3	31.8	30.8	33.7	35.2	28.8	31.9	39.7	42.3	43.5	31.9	33.3	37.1	26.0	44.2	39.4	
5.5	3.2	5.0	4.0	7.2	4.3	4.3	4.3	4.7	2.4	7.3	3.0	3.9	4.8	7.0	5.8	
3.9	7.0	7.2	7.9	7.5	3.0	6.8	6.0	7.0	7.1	15.7	7.6	8.6	4.5	6.0	6.5	
9.3	18.9	16.5	14.9	15.2	12.6	16.7	15.7	12.1	16.2	13.1	13.9	13.8	12.2	12.9	13.0	
11.3	16.7	12.4	11.9	9.0	14.6	13.9	12.9	10.7	14.2	13.6	13.4	13.0	16.0	14.8	14.5	
8.1	7.4	3.8	6.7	3.6	9.3	6.3	5.3	6.4	6.7	7.9	8.5	7.6	6.8	7.7	7.6	
14.4	12.9	24.0	17.3	26.0	11.6	17.4	14.6	16.4	14.2	11.0	13.2	13.8	15.7	15.3	15.0	
4.8	3.9	2.5	4.6	3.3	4.6	3.7	3.6	2.3	4.7	3.7	6.9	5.0	5.4	5.6	5.4	
7.4	8.4	3.9	3.6	5.1	6.6	6.2	8.2	8.7	7.9	4.7	8.3	7.8	12.2	7.1	8.1	
4.7	4.4	4.3	3.6	3.6	5.3	4.3	5.0	4.4	4.7	3.7	2.7	3.6	3.3	5.8	4.8	
10.7	12.1	7.7	12.2	6.0	9.3	10.0	12.3	12.1	10.7	10.5	9.5	10.4	9.1	9.6	9.7	
21.8	2.7	14.2	12.8	14.9	16.6	9.7	12.1	11.4	7.9	8.9	11.0	10.2	10.7	8.2	9.2	
3.8	5.4	3.6	4.6	6.0	6.6	5.1	4.3	8.4	5.5	7.3	5.1	6.2	4.0	7.0	6.3	

2/Statistics are not presented for this group because too few records contained the specified data.

SOURCE: NRC, Office of Scientific and Engineering Personnel, Doctorate Records File.

TABLE 2
STATISTICAL PROFILE OF DOCTORATE RECIPIENTS BY FIELD OF DOCTORATE, 1981[1/]

DOCTORATES: WOMEN

	1981 TOTAL	PHYSICS AND ASTRONOMY	CHEMISTRY	EARTH, ENVIRONMENTAL AND MARINE SCIENCES	PHYSICAL SCIENCES	MATHEMATICS	COMPUTER SCIENCES	ENGINEERING	EMP FIELDS	BIOCHEMISTRY	BASIC MEDICAL SCIENCES	OTHER BIOSCIENCES	BIOSCIENCES	MEDICAL SCIENCES	AGRICULTURAL SCIENCES
TOTAL FEMALE	9872	73	235	56	364	112	26	99	601	189	393	404	986	310	147
FEMALE AS A PERCENT															
OF TOTAL DOCTORATES %	31.5	7.2	14.6	9.6	11.3	15.4	11.2	3.9	9.0	29.3	29.4	28.5	29.0	33.9	12.8
U.S. CITIZENSHIP %	87.9	61.6	75.7	83.9	74.2	71.4	76.9	53.5	70.4	82.5	91.1	85.4	87.1	85.5	65.3
FOREIGN CITIZENSHIP	8.7	37.0	21.3	14.3	23.4	26.8	23.1	44.4	27.5	14.3	7.4	12.1	10.6	11.3	30.6
UNKNOWN	3.5	1.4	3.0	1.8	2.5	1.8	.0	2.0	2.2	3.2	1.5	2.5	2.2	3.2	4.1
MARRIED %	52.2	61.6	51.9	44.6	52.7	41.1	69.2	55.6	51.7	46.6	46.1	45.5	45.9	47.4	57.1
NOT MARRIED	42.8	34.2	44.7	50.0	43.4	52.7	30.8	40.4	44.1	49.7	50.9	50.5	50.5	47.4	37.4
UNKNOWN	5.0	4.1	3.4	5.4	3.8	6.3	.0	4.0	4.2	3.7	3.1	4.0	3.5	5.2	5.4
MEDIAN AGE AT DOCTORATE	33.8	29.6	28.4	29.9	28.8	29.5	30.2	29.0	29.0	28.8	29.3	30.0	29.5	33.7	30.5
PERCENT WITH BACC IN															
SAME FIELD AS DOCTORATE	50.3	79.5	84.7	42.9	77.2	85.7	11.5	51.5	71.7	18.0	19.6	68.8	39.5	43.9	40.8
PERCENT WITH MASTERS	84.5	71.2	39.1	69.6	50.3	83.9	96.2	90.9	65.2	30.2	43.0	62.9	48.7	72.3	88.4
MEDIAN TIME LAPSE															
FROM BACC TO DOCT															
TOTAL TIME YRS	10.8	7.6	6.1	7.6	6.6	7.3	7.8	7.1	6.9	6.9	6.8	7.7	7.2	10.9	7.6
REGISTERED TIME	6.7	6.7	5.2	5.8	5.6	5.9	6.6	6.0	5.8	5.9	5.8	6.4	6.0	6.1	5.6
POSTDOCTORAL STUDY PLANS %	15.0	46.6	37.0	25.0	37.1	8.0	7.7	13.1	26.5	75.1	76.1	52.2	66.1	31.9	17.0
FELLOWSHIP	8.2	23.3	18.3	12.5	18.4	3.6	.0	4.0	12.5	43.9	50.9	30.0	41.0	17.7	5.4
RESEARCH ASSOC	4.3	23.3	17.9	12.5	18.1	3.6	3.8	7.1	13.0	25.9	19.1	16.6	19.4	7.4	10.9
TRAINEESHIP	1.1	.0	.9	.0	.5	.9	3.8	2.0	1.0	2.1	1.8	1.5	1.7	2.3	.7
OTHER	1.4	.0	.0	.0	.0	.0	.0	.0	.0	3.2	4.3	4.2	4.1	4.5	.0
PLANNED EMPLOYMENT															
AFTER DOCTORATE %	78.5	45.2	56.6	62.5	55.2	84.8	92.3	82.8	66.9	18.0	20.1	39.9	27.8	63.2	72.8
EDUC INSTITUTION	51.0	13.7	7.7	16.1	10.2	61.6	50.0	29.3	24.6	5.3	11.7	25.0	15.9	37.1	39.5
INDUSTRY/BUSINESS	9.0	17.8	40.0	28.6	33.8	15.2	34.6	42.4	31.8	6.3	4.3	7.4	6.0	6.8	12.2
GOVERNMENT	7.5	5.5	6.0	16.1	7.4	4.5	3.8	7.1	6.7	4.2	2.0	4.0	3.2	8.7	13.6
NONPROFIT	5.4	1.4	1.3	.0	1.1	.9	.0	1.0	1.0	.0	.5	1.5	.8	5.8	2.7
OTHER & UNKNOWN	5.5	6.8	1.7	1.8	2.7	2.7	3.8	3.0	2.8	2.1	1.5	2.0	1.8	4.8	4.8
POSTDOCT STATUS UNKN %	6.5	8.2	6.4	12.5	7.7	7.1	.0	4.0	6.7	6.9	3.8	7.9	6.1	4.8	10.2
DEFINITE POSTDOCTORAL STUDY	10.5	35.6	31.9	17.9	30.5	3.6	7.7	8.1	20.8	61.9	62.8	38.1	52.5	22.3	10.9
SEEKING POSTDOCTORAL STUDY	4.5	11.0	5.1	7.1	6.6	4.5	.0	5.1	5.7	13.2	13.2	14.1	13.6	9.7	6.1
DEFINITE EMPLOYMENT	54.1	31.5	46.8	50.0	44.2	64.3	65.4	65.7	52.4	11.6	13.2	24.0	17.3	48.4	44.2
SEEKING EMPLOYMENT	24.4	13.7	9.8	12.5	11.0	20.5	26.9	17.2	14.5	6.3	6.9	15.8	10.4	14.8	28.6
EMPLOYMENT ACTIVITY															
AFTER DOCTORATE															
PRIMARY ACTIVITY															
R & D %	14.7	82.6	83.6	60.7	79.5	36.1	41.2	58.5	63.2	77.3	51.9	30.9	43.3	30.7	55.4
TEACHING	46.8	13.0	8.2	14.3	9.9	58.3	52.9	32.3	27.9	13.6	38.5	46.4	39.8	46.0	29.2
ADMINISTRATION	16.2	.0	2.7	7.1	3.1	.0	.0	.0	1.6	4.5	3.8	6.2	5.3	9.3	1.5
PROF. SERVICES	15.0	4.3	1.8	3.6	2.5	2.8	.0	4.6	2.9	4.5	3.8	9.3	7.0	9.3	3.1
OTHER	2.6	.0	2.7	7.1	3.1	.0	.0	.0	1.6	.0	1.9	3.1	2.3	1.3	4.6
ACTIVITY UNKNOWN	4.7	.0	.9	7.1	1.9	2.8	5.9	4.6	2.9	.0	.0	4.1	2.3	3.3	6.2
SECONDARY ACTIVITY															
R & D	26.7	13.0	6.4	14.3	8.7	48.6	47.1	27.7	23.8	13.6	25.0	35.1	29.2	32.7	29.2
TEACHING	11.5	8.7	.9	3.6	2.5	16.7	5.9	7.7	7.0	18.2	21.2	14.4	17.0	16.7	12.3
ADMINISTRATION	9.3	4.3	9.1	10.7	8.7	.0	.0	3.1	5.1	9.1	11.5	6.2	8.2	16.7	9.2
PROF. SERVICES	8.9	4.3	7.3	10.7	7.5	2.8	.0	4.6	5.4	.0	7.7	5.2	5.3	9.3	4.6
OTHER	2.6	.0	.0	3.6	.6	1.4	.0	.0	.6	.0	.0	.0	.0	.7	.0
NO SECONDARY ACTIVITY	36.3	69.6	75.5	50.0	70.2	27.8	41.2	52.3	55.2	59.1	34.6	35.1	38.0	20.7	38.5
UNKNOWN	4.7	.0	.9	7.1	1.9	2.8	5.9	4.6	2.9	.0	.0	4.1	2.3	3.3	6.2
REGION OF EMPLOYMENT															
AFTER DOCTORATE															
NEW ENGLAND %	7.1	13.0	4.5	7.1	6.2	11.1	5.9	12.3	8.6	9.1	7.7	5.2	6.4	4.0	4.6
MIDDLE ATLANTIC	16.3	34.8	29.1	17.9	28.0	16.7	5.9	26.2	23.8	22.7	11.5	12.4	13.5	20.7	13.8
EAST NO CENTRAL	14.6	8.7	15.5	.0	11.8	11.1	5.9	7.7	10.5	13.6	17.3	11.3	13.5	14.0	.0
WEST NO CENTRAL	6.3	.0	4.5	7.1	4.3	2.8	5.9	3.1	3.8	.0	9.6	9.3	8.2	7.3	7.7
SOUTH ATLANTIC	16.7	4.3	17.3	7.1	13.7	15.3	17.6	9.2	13.3	27.3	17.3	17.5	18.7	14.7	13.8
EAST SO CENTRAL	4.2	.0	1.8	.0	1.2	5.6	.0	.0	1.9	4.5	3.8	3.1	3.5	2.0	4.6
WEST SO CENTRAL	8.4	8.7	2.7	21.4	6.8	12.5	35.3	7.7	9.8	4.5	11.5	12.4	11.1	6.0	9.2
MOUNTAIN	4.0	8.7	1.8	3.6	3.1	1.4	5.9	.0	2.2	4.5	.0	7.2	4.7	4.7	4.6
PACIFIC & INSULAR	11.4	13.0	17.3	21.4	17.4	11.1	11.8	18.5	15.9	4.5	13.5	11.3	11.1	14.7	10.8
FOREIGN	4.6	8.7	2.7	3.6	3.7	12.5	.0	10.8	7.0	4.5	5.8	9.3	7.6	6.0	30.8
REGION UNKNOWN	6.5	.0	2.7	10.7	3.7	.0	5.9	4.6	3.2	4.5	1.9	1.0	1.8	6.0	.0

1/Refer to explanatory note on page 24 and the description of doctoral fields inside back cover.

TABLE 2. CONTINUED

DOCTORATES: WOMEN

LIFE SCIENCES	PSYCHOLOGY	ECONOMICS	ANTHROPOLOGY AND SOCIOLOGY	POLIT. SCI., PUBLIC ADMIN., INTERN'L REL.	OTHER SOCIAL SCIENCES	SOCIAL SCIENCES INCL. PSYCHOL.	TOTAL SCIENCES	HISTORY	ENG. AND AMER. LANG. AND LIT.	FOREIGN LANG. AND LIT.	OTHER HUMANITIES	HUMANITIES	PROFESSIONAL FIELDS	EDUCATION	TOTAL NON-SCIENCES	OTHER OR UNSPECIFIED 2/
1443	1472	101	394	135	213	2315	4359	194	423	343	587	1547	424	3534	5505	8
26.4	43.8	12.3	40.5	19.9	31.6	35.6	23.4	28.1	51.8	53.5	36.8	41.3	30.5	47.2	43.6	22.9
84.5	92.5	71.3	85.5	88.1	88.7	89.8	85.4	88.7	92.2	79.9	84.8	86.2	90.3	91.4	89.8	
12.8	3.9	24.8	11.7	7.4	6.6	6.6	11.5	7.2	5.2	16.3	8.7	9.2	7.1	5.0	6.4	
2.6	3.6	4.0	2.8	4.4	4.7	3.6	3.1	4.1	2.6	3.8	6.5	4.5	2.6	3.6	3.8	
47.4	47.4	51.5	50.5	48.9	47.4	48.2	48.4	52.6	53.4	53.1	49.4	51.7	53.8	57.0	55.3	
48.5	47.4	42.6	45.2	45.9	46.5	46.6	46.9	41.8	41.8	40.2	41.6	41.4	42.5	38.3	39.5	
4.1	5.3	5.9	4.3	5.2	6.1	5.2	4.7	5.7	4.7	6.7	9.0	6.9	3.8	4.6	5.2	
30.2	31.7	30.1	33.5	33.4	33.6	32.2	31.0	34.2	34.4	34.4	33.8	34.1	34.4	38.0	36.6	
40.5	63.9	62.4	58.4	48.9	22.5	58.2	54.2	61.9	75.7	63.6	48.2	60.8	30.7	43.4	47.3	
57.8	81.8	77.2	87.1	85.9	90.6	83.5	72.5	89.2	90.5	86.0	88.9	88.8	94.1	96.2	94.0	
7.6	8.6	8.1	10.2	10.9	10.0	9.2	8.3	11.8	11.6	11.1	11.2	11.4	11.9	14.2	13.0	
6.0	6.3	6.0	7.6	7.5	6.3	6.5	6.2	8.6	8.2	8.0	8.0	8.1	6.6	6.9	7.2	
53.8	17.7	2.0	12.7	4.4	4.7	14.2	29.0	8.8	3.1	5.2	5.8	5.3	2.4	3.6	4.0	
32.4	9.3	.0	8.6	2.2	1.9	7.7	16.5	5.7	1.4	2.3	2.7	2.7	1.2	1.1	1.6	
15.9	3.1	2.0	3.0	1.5	1.4	2.8	8.6	1.5	.0	.3	1.5	.8	.7	.9	.9	
1.7	3.6	.0	.0	.7	.5	2.4	2.0	.0	.0	.0	.2	.1	.2	.7	.5	
3.7	1.6	.0	1.0	.0	.9	1.3	1.9	1.5	1.7	2.6	1.4	1.7	.2	.8	1.0	
40.0	76.6	92.1	81.2	88.9	88.3	79.8	64.9	83.0	90.5	86.6	83.6	86.1	92.0	90.4	89.3	
22.9	30.3	54.5	54.1	46.7	57.3	38.8	31.6	55.2	72.6	67.9	62.7	65.6	67.7	66.5	66.3	
6.8	11.4	14.9	5.6	9.6	13.1	10.6	12.3	9.3	8.0	6.4	7.8	7.8	8.3	5.7	6.5	
5.5	12.7	8.9	6.3	17.8	8.9	11.4	8.8	5.7	.9	1.7	2.4	2.3	5.9	8.4	6.5	
2.1	14.3	7.9	7.9	5.2	2.8	11.3	6.8	6.7	1.2	1.5	4.9	3.4	6.6	4.5	4.3	
2.8	7.9	5.9	7.4	9.6	6.1	7.6	5.4	6.2	7.8	9.0	5.8	7.1	3.5	5.2	5.6	
6.2	5.8	5.9	6.1	6.7	7.0	6.0	6.2	8.2	6.4	8.2	10.6	8.6	5.7	6.1	6.7	
41.8	12.6	.0	7.6	4.4	.5	9.6	21.8	3.1	.5	2.0	2.4	1.9	.9	1.6	1.7	
12.0	5.1	2.0	5.1	.0	4.2	4.6	7.2	5.7	2.6	3.2	3.4	3.4	1.4	1.9	2.3	
26.7	51.4	79.2	54.1	65.2	62.0	54.9	45.2	47.4	55.1	51.0	53.8	52.7	70.5	63.6	61.1	
13.2	25.1	12.9	27.2	23.7	26.3	25.0	19.6	35.6	35.5	35.6	29.8	33.4	21.5	26.8	28.2	
40.4	15.5	41.3	26.8	22.7	18.9	19.8	30.8	7.6	2.6	.6	5.1	3.7	9.4	5.3	5.3	
40.4	20.6	41.3	54.9	47.7	60.6	33.7	34.1	63.0	82.4	80.6	70.9	75.4	60.9	45.6	54.2	
6.2	6.3	5.0	7.5	14.8	7.6	7.2	6.1	12.0	4.3	4.6	7.3	6.4	12.4	29.3	22.2	
7.3	52.0	5.0	4.2	2.3	5.3	32.8	23.0	7.6	3.4	2.9	7.3	5.3	10.0	12.2	10.3	
2.3	2.1	2.5	2.8	5.7	5.3	2.8	2.5	6.5	3.4	3.4	5.7	4.7	2.3	1.9	2.6	
3.4	3.4	5.0	3.8	6.8	2.3	3.7	3.5	3.3	3.9	8.0	3.8	4.7	5.0	5.7	5.4	
30.6	23.4	40.0	38.5	31.8	42.4	29.5	28.8	28.3	30.0	37.7	35.8	33.7	39.8	20.4	25.4	
16.1	16.4	17.5	14.1	5.7	8.3	14.5	13.6	5.4	4.3	4.6	7.6	5.8	8.0	12.2	10.3	
11.7	11.2	5.0	7.5	12.5	9.8	10.2	9.6	5.4	9.0	5.1	7.0	7.0	7.7	10.0	9.0	
6.7	8.5	1.3	2.8	4.5	9.8	6.9	6.6	1.1	2.1	2.3	6.6	3.8	10.4	12.5	10.2	
.3	3.6	.0	1.4	.0	1.5	2.5	1.8	4.3	3.9	1.7	6.3	4.4	1.7	2.8	3.1	
31.3	33.6	31.3	31.9	38.6	25.8	32.7	36.0	52.2	46.8	40.6	32.9	40.7	27.4	36.3	36.6	
3.4	3.4	5.0	3.8	6.8	2.3	3.7	3.5	3.3	3.9	8.0	3.8	4.7	5.0	5.7	5.4	
5.2	7.9	11.3	11.3	11.4	4.5	8.6	7.9	7.6	9.4	9.1	7.9	8.6	5.7	6.1	6.7	
16.3	20.2	18.8	19.2	18.2	12.9	19.1	19.3	22.8	16.7	18.9	17.7	18.3	13.7	13.4	14.6	
11.4	15.7	15.0	16.0	3.4	17.4	15.0	13.6	15.2	15.9	11.4	14.6	14.3	17.4	15.1	15.1	
7.8	6.2	5.0	6.1	2.3	9.1	6.1	6.1	5.4	4.7	5.7	6.6	5.8	8.4	6.5	6.5	
16.3	15.1	18.8	14.1	29.5	13.6	16.0	15.6	19.6	18.5	12.6	15.5	16.2	15.7	18.0	17.3	
3.1	2.4	2.5	3.8	.0	4.5	2.7	2.6	3.3	3.4	2.3	5.1	3.8	4.0	5.7	5.1	
8.8	6.3	6.3	4.7	4.5	6.1	5.9	7.1	7.6	11.2	9.1	7.9	9.1	8.4	9.2	9.1	
4.7	2.6	5.0	2.3	4.5	7.6	3.4	3.5	3.3	3.4	5.7	4.1	4.2	4.0	4.4	4.3	
12.4	15.3	6.3	7.0	12.5	12.9	12.9	13.3	8.7	6.0	10.9	10.4	9.1	12.0	10.5	10.3	
10.9	2.1	8.8	9.9	5.7	6.1	4.5	6.1	4.3	3.4	5.1	4.4	4.3	7.0	2.9	3.6	
3.1	6.1	2.5	5.6	8.0	5.3	5.8	4.9	2.2	7.3	9.1	5.7	6.5	3.7	8.2	7.4	

2/Statistics are not presented for this group because too few records contained the specified data.

SOURCE: NRC, Office of Scientific and Engineering Personnel, Doctorate Records File.

TABLE 3

PERCENTAGE OF 1981 DOCTORATE RECIPIENTS BY SOURCES OF SUPPORT IN GRADUATE SCHOOL, BY SEX AND SUMMARY FIELD[1]

SOURCES OF SUPPORT IN GRADUATE SCHOOL		DOCTORATE RECIPIENTS BY FIELD							
		PHYSICAL SCIENCES[2]	ENGINEERING	LIFE SCIENCES	SOCIAL SCIENCES	HUMANITIES	PROF. FIELDS	EDUCATION	TOTAL
		MEN/WOMEN	MEN/WOMEN	MEN/WOMEN	MEN/WOMEN	MEN/WOMEN	MEN/WOMEN	MEN/WOMEN	MEN/WOMEN
NSF FELLOWSHIP	N	208/ 25	85/ 2	95/ 53	95/ 43	10/ 7	3/ 1	22/ 8	518/ 139
	V%	6.0/ 5.2	3.7/ 2.1	2.5/ 3.9	2.4/ 2.0	.5/ .5	.3/ .2	.6/ .2	2.6/ 1.5
	H%	40.2/ 18.0	16.4/ 1.4	18.3/ 38.1	18.3/ 30.9	1.9/ 5.0	.6/ .7	4.2/ 5.8	100.0/100.0
NSF TRAINEESHIP	N	54/ 4	34/ 3	33/ 15	27/ 22	1/ 4	1/ 2	1/ 3	151/ 53
	V%	1.6/ .8	1.5/ 3.2	.9/ 1.1	.7/ 1.0	.0/ .3	.1/ .5	.0/ .1	.7/ .6
	H%	35.8/ 7.5	22.5/ 5.7	21.9/ 28.3	17.9/ 41.5	.7/ 7.5	.7/ 3.8	.7/ 5.7	100.0/100.0
NIH FELLOWSHIP[3]	N	37/ 4	14/ 0	176/ 72	109/ 105	1/ 2	5/ 10	7/ 9	349/ 202
	V%	1.1/ .8	.6/ .0	4.6/ 5.3	2.8/ 4.8	.0/ .1	.6/ 2.5	.2/ .3	1.7/ 2.2
	H%	10.6/ 2.0	4.0/ .0	50.4/ 35.6	31.2/ 52.0	.3/ 1.0	1.4/ 5.0	2.0/ 4.5	100.0/100.0
NIH TRAINEESHIP[3]	N	50/ 12	35/ 2	669/ 313	209/ 160	2/ 1	7/ 11	5/ 18	977/ 517
	V%	1.4/ 2.5	1.5/ 2.1	17.5/ 22.9	5.3/ 7.3	.1/ .1	.8/ 2.7	.1/ .5	4.8/ 5.6
	H%	5.1/ 2.3	3.6/ .4	68.5/ 60.5	21.4/ 30.9	.2/ .2	.7/ 2.1	.5/ 3.5	100.0/100.0
NDEA FELLOWSHIP	N	13/ 4	8/ 0	13/ 9	70/ 38	128/ 81	4/ 3	31/ 13	267/ 148
	V%	.4/ .8	.3/ .0	.3/ .7	1.8/ 1.7	6.2/ 5.6	.5/ .7	.8/ .4	1.3/ 1.6
	H%	4.9/ 2.7	3.0/ .0	4.9/ 6.1	26.2/ 25.7	47.9/ 54.7	1.5/ 2.0	11.6/ 8.8	100.0/100.0
GRADUATE & PROF. OPPORTUNITIES PROGRAM	N	8/ 3	4/ 0	5/ 6	12/ 0	6/ 3	4/ 0	12/ 20	51/ 32
	V%	.2/ .6	.2/ .0	.1/ .4	.3/ .0	.3/ .2	.5/ .0	.3/ .6	.3/ .3
	H%	15.7/ 9.4	7.8/ .0	9.8/ 18.8	23.5/ .0	11.8/ 9.4	7.8/ .0	23.5/ 62.5	100.0/100.0
NATIONAL DIRECT STUDENT LOANS	N	160/ 18	103/ 5	299/ 111	678/ 412	353/ 216	98/ 57	463/ 351	2154/ 1170
	V%	4.6/ 3.8	4.5/ 5.3	7.8/ 8.1	17.3/ 18.8	17.1/ 15.0	11.0/ 14.0	12.4/ 10.6	10.7/ 12.6
	H%	7.4/ 1.5	4.8/ .4	13.9/ 9.5	31.5/ 35.2	16.4/ 18.5	4.5/ 4.9	21.5/ 30.0	100.0/100.0
OTHER HEW	N	30/ 6	29/ 1	111/ 88	206/ 234	12/ 13	44/ 63	121/ 146	553/ 551
	V%	.9/ 1.3	1.3/ 1.1	2.9/ 6.4	5.3/ 10.7	.6/ .9	5.0/ 15.5	3.2/ 4.4	2.7/ 5.9
	H%	5.4/ 1.1	5.2/ .2	20.1/ 16.0	37.3/ 42.5	2.2/ 2.4	8.0/ 11.4	21.9/ 26.5	100.0/100.0
GI BILL	N	170/ 0	94/ 0	213/ 5	364/ 12	206/ 9	130/ 2	486/ 25	1663/ 53
	V%	4.9/ .0	4.1/ .0	5.6/ .4	9.3/ .5	10.0/ .6	14.6/ .5	13.0/ .8	8.2/ .6
	H%	10.2/ .0	5.7/ .0	12.8/ 9.4	21.9/ 22.6	12.4/ 17.0	7.8/ 3.8	29.2/ 47.2	100.0/100.0
OTHER FEDERAL[4] SUPPORT	N	215/ 13	216/ 7	214/ 62	298/ 147	94/ 43	27/ 19	101/ 76	1165/ 367
	V%	6.2/ 2.7	9.4/ 7.4	5.6/ 4.5	7.6/ 6.7	4.6/ 3.0	3.0/ 4.7	2.7/ 2.3	5.8/ 3.9
	H%	18.5/ 3.5	18.5/ 1.9	18.4/ 16.9	25.6/ 40.1	8.1/ 11.7	2.3/ 5.2	8.7/ 20.7	100.0/100.0
OTHER NATIONAL[5] FELLOWSHIP	N	70/ 17	31/ 7	88/ 45	144/ 81	125/ 124	13/ 13	42/ 69	513/ 356
	V%	2.0/ 3.5	1.4/ 7.4	2.3/ 3.3	3.7/ 3.7	6.1/ 8.6	1.5/ 3.2	1.1/ 2.1	2.5/ 3.8
	H%	13.6/ 4.8	6.0/ 2.0	17.2/ 12.6	28.1/ 22.8	24.4/ 34.8	2.5/ 3.7	8.2/ 19.4	100.0/100.0
UNIVERSITY FELLOWSHIP	N	738/ 111	383/ 18	591/ 241	845/ 448	748/ 516	174/ 83	307/ 334	3786/ 1751
	V%	21.2/ 23.1	16.7/ 18.9	15.5/ 17.6	21.6/ 20.5	36.2/ 35.9	19.6/ 20.4	8.2/ 10.1	18.8/ 18.8
	H%	19.5/ 6.3	10.1/ 1.0	15.6/ 13.8	22.3/ 25.6	19.8/ 29.5	4.6/ 4.7	8.1/ 19.1	100.0/100.0
TEACHING ASSISTANTSHIP	N	2455/ 356	893/ 43	1594/ 555	2042/ 1099	1375/ 940	398/ 165	810/ 782	9567/ 3940
	V%	70.6/ 74.2	39.0/ 45.3	41.7/ 40.6	52.2/ 50.3	66.6/ 65.5	44.8/ 40.6	21.7/ 23.5	47.4/ 42.4
	H%	25.7/ 9.0	9.3/ 1.1	16.7/ 14.1	21.3/ 27.9	14.4/ 23.9	4.2/ 4.2	8.5/ 19.8	100.0/100.0
RESEARCH ASSISTANTSHIP	N	2384/ 306	1570/ 69	1984/ 607	1402/ 696	275/ 159	216/ 106	599/ 491	8430/ 2434
	V%	68.6/ 63.8	68.6/ 72.6	51.9/ 44.4	35.8/ 31.8	13.3/ 11.1	24.3/ 26.1	16.0/ 14.8	41.8/ 26.2
	H%	28.3/ 12.6	18.6/ 2.8	23.5/ 24.9	16.6/ 28.6	3.3/ 6.5	2.6/ 4.4	7.1/ 20.2	100.0/100.0
EDUC. FUNDS OF INDUSTRY	N	197/ 31	166/ 13	85/ 52	78/ 31	29/ 23	51/ 10	85/ 60	691/ 220
	V%	5.7/ 6.5	7.3/ 13.7	2.2/ 3.8	2.0/ 1.4	1.4/ 1.6	5.7/ 2.5	2.3/ 1.8	3.4/ 2.4
	H%	28.5/ 14.1	24.0/ 5.9	12.3/ 23.6	11.3/ 14.1	4.2/ 10.5	7.4/ 4.5	12.3/ 27.3	100.0/100.0
OTHER INSTITUTION FUNDS	N	155/ 26	87/ 4	292/ 133	327/ 244	229/ 151	78/ 52	252/ 263	1420/ 873
	V%	4.5/ 5.4	3.8/ 4.2	7.6/ 9.7	8.4/ 11.2	11.1/ 10.5	8.8/ 12.8	6.7/ 7.9	7.0/ 9.4
	H%	10.9/ 3.0	6.1/ .5	20.6/ 15.2	23.0/ 27.9	16.1/ 17.3	5.5/ 6.0	17.7/ 30.1	100.0/100.0
OWN EARNINGS	N	954/ 105	751/ 31	1246/ 496	2314/ 1349	1346/ 886	566/ 262	2930/ 2570	10107/ 5699
	V%	27.4/ 21.9	32.8/ 32.6	32.6/ 36.3	59.2/ 61.7	65.2/ 61.7	63.7/ 64.5	78.4/ 77.4	50.1/ 61.3
	H%	9.4/ 1.8	7.4/ .5	12.3/ 8.7	22.9/ 23.7	13.3/ 15.5	5.6/ 4.6	29.0/ 45.1	100.0/100.0
SPOUSE'S EARNINGS	N	726/ 95	392/ 21	1085/ 341	1279/ 714	745/ 536	298/ 149	1263/ 1298	5788/ 3154
	V%	20.9/ 19.8	17.1/ 22.1	28.4/ 24.9	32.7/ 32.6	36.1/ 37.3	33.6/ 36.7	33.8/ 39.1	28.7/ 33.9
	H%	12.5/ 3.0	6.8/ .7	18.7/ 10.8	22.1/ 22.6	12.9/ 17.0	5.1/ 4.7	21.8/ 41.2	100.0/100.0
FAMILY CONTRIBUTIONS	N	462/ 54	379/ 18	592/ 249	825/ 466	514/ 336	141/ 53	468/ 434	3381/ 1610
	V%	13.3/ 11.3	16.6/ 18.9	15.5/ 18.2	21.1/ 21.3	24.9/ 23.4	15.9/ 13.1	12.5/ 13.1	16.7/ 17.3
	H%	13.7/ 3.4	11.2/ 1.1	17.5/ 15.5	24.4/ 28.9	15.2/ 20.9	4.2/ 3.3	13.8/ 27.0	100.0/100.0
OTHER LOANS	N	197/ 20	133/ 7	343/ 122	607/ 353	257/ 171	108/ 57	514/ 416	2159/ 1146
	V%	5.7/ 4.2	5.8/ 7.4	9.0/ 8.9	15.5/ 16.1	12.4/ 11.9	12.2/ 14.0	13.8/ 12.5	10.7/ 12.3
	H%	9.1/ 1.7	6.2/ .6	15.9/ 10.6	28.1/ 30.8	11.9/ 14.9	5.0/ 5.0	23.8/ 36.3	100.0/100.0
OTHER	N	185/ 23	215/ 10	371/ 108	301/ 142	160/ 108	98/ 37	285/ 213	1615/ 641
	V%	5.3/ 4.8	9.4/ 10.5	9.7/ 7.9	7.7/ 6.5	7.7/ 7.5	11.0/ 9.1	7.6/ 6.4	8.0/ 6.9
	H%	11.5/ 3.6	13.3/ 1.6	23.0/ 16.8	18.6/ 22.2	9.9/ 16.8	6.1/ 5.8	17.6/ 33.2	100.0/100.0
UNDUPLICATED TOTAL	N	3477/ 480	2287/ 95	3821/ 1367	3912/ 2187	2065/ 1436	888/ 406	3737/ 3322	20187/ 9293[6]

1/Data are not compatible with data prior to 1977 because of a change in the survey question on source of support. Frequencies as reported are not reliable but relative frequencies should serve as useful approximations.
2/Includes mathematics and computer sciences.
3/The sources NIH Fellowship and NIH Traineeship refer to support provided under the National Research Awards Act of 1974.
4/Includes AEC/ERDA Fellowship and NASA Traineeship which were formerly shown seperately.
5/Includes Woodrow Wilson Fellowship which was formerly shown separately.
6/The 35 individuals shown in Table 1 as having subfield "Other and Unspecified" and the Ph.D.'s who did not report source of support are omitted from this table.

SOURCE: NRC, Office of Scientific and Engineering Personnel, Doctorate Records File.

TABLE 4
NUMBER OF DOCTORATE RECIPIENTS BY SEX, STATE OF DOCTORAL INSTITUTION, AND SUMMARY FIELD, 1981[1/]

STATE OF DOCTORAL INSTITUTION	NUMBER OF DOCTORATE RECIPIENTS BY FIELD: PHYSICAL SCIENCES[2/]		ENGINEERING		LIFE SCIENCES		SOCIAL SCIENCES		HUMANITIES		PROF. FIELDS		EDUCATION		OTHER & UNSPEC.		TOTAL	
	MEN	WOMEN	MEN	WOMEN	MEN	WOMEN	MEN	WOMEN	MEN	WOMEN	MEN	WOMEN	MEN	WOMEN	MEN	WOMEN	MEN	WOMEN
U.S. TOTAL	3666	502	2429	99	4018	1443	4190	2315	2198	1547	964	424	3955	3534	27	8	21447	9872
ALABAMA	16	4	10	1	30	15	24	8	6	4	5	4	74	52	0	0	165	88
ALASKA	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0
ARIZONA	60	3	24	0	43	12	39	19	18	18	14	1	74	65	0	0	272	118
ARKANSAS	13	0	4	1	24	6	5	2	6	0	17	1	13	13	0	0	82	23
CALIFORNIA	599	86	417	18	442	176	613	351	265	168	98	32	263	256	12	4	2709	1091
COLORADO	90	5	55	0	75	10	83	55	28	21	11	7	134	91	0	0	476	189
CONNECTICUT	51	9	24	1	63	34	77	41	65	48	3	1	24	32	0	0	307	166
DELAWARE	6	2	11	0	4	5	8	3	6	6	0	0	1	5	0	0	36	21
D. C.	37	6	18	1	50	42	75	57	46	39	18	6	60	63	0	0	304	214
FLORIDA	69	10	34	0	83	21	160	65	35	36	33	20	336	259	0	0	750	411
GEORGIA	43	10	29	0	80	21	89	44	30	27	24	9	68	67	0	0	363	178
HAWAII	15	2	4	0	34	11	16	8	14	3	0	0	2	5	0	0	85	29
IDAHO	10	0	6	0	19	3	3	0	2	1	0	0	9	7	0	0	49	11
ILLINOIS	243	33	194	7	181	67	273	147	148	101	54	24	228	187	0	1	1321	567
INDIANA	114	11	109	1	123	36	131	51	102	58	42	14	118	111	1	0	740	282
IOWA	64	11	41	1	114	18	53	22	48	19	12	5	66	66	1	0	399	142
KANSAS	33	3	28	0	65	17	44	19	26	17	9	9	54	46	0	0	259	111
KENTUCKY	12	1	8	2	49	9	23	6	19	8	23	3	10	12	0	0	144	41
LOUISIANA	23	5	10	0	49	8	20	18	28	16	32	5	26	28	0	0	188	80
MAINE	4	0	0	0	5	1	3	1	2	1	0	0	8	1	0	0	22	4
MARYLAND	72	16	27	1	78	43	69	42	41	35	13	10	54	78	0	0	354	225
MASSACHUSETTS	265	37	173	15	149	80	255	121	140	101	46	17	233	213	0	0	1261	584
MICHIGAN	103	12	99	2	183	50	176	115	68	54	24	15	222	155	0	0	875	403
MINNESOTA	41	9	44	2	109	41	63	40	40	20	9	15	47	38	0	0	353	165
MISSISSIPPI	3	0	10	0	47	12	33	7	5	5	6	0	60	50	0	0	164	74
MISSOURI	45	8	51	3	72	17	78	40	27	21	22	9	92	65	0	0	387	163
MONTANA	5	1	0	0	11	1	7	6	1	0	0	0	5	1	0	0	29	9
NEBRASKA	21	2	7	1	55	11	37	8	14	10	7	4	33	26	0	0	174	62
NEVADA	1	1	0	0	5	1	2	5	1	0	0	0	8	6	0	0	17	13
NEW HAMPSHIRE	13	3	7	1	17	7	10	2	4	1	0	0	0	1	0	0	51	15
NEW JERSEY	104	23	58	3	73	26	69	46	64	46	16	4	75	62	0	0	459	210
NEW MEXICO	28	4	9	0	19	6	15	10	15	10	0	0	18	31	0	0	104	61
NEW YORK	393	39	207	12	345	184	489	342	261	230	75	58	266	307	1	2	2037	1174
NORTH CAROLINA	74	10	31	4	138	56	110	56	47	39	15	8	54	64	0	0	469	237
NORTH DAKOTA	9	0	0	0	23	0	11	5	4	1	0	0	7	9	0	0	54	15
OHIO	141	22	106	2	137	49	142	107	88	50	51	35	196	180	3	0	864	445
OKLAHOMA	24	4	35	2	54	13	45	19	20	9	12	1	69	45	0	0	259	93
OREGON	41	13	18	1	80	23	41	26	9	15	16	5	64	41	0	1	269	125
PENNSYLVANIA	191	25	137	7	138	63	200	119	118	91	56	27	250	191	3	0	1093	523
RHODE ISLAND	50	8	12	1	14	6	28	7	29	20	0	0	0	0	0	0	133	42
SOUTH CAROLINA	23	4	8	0	29	9	18	12	11	8	8	1	31	35	1	0	129	69
SOUTH DAKOTA	2	0	C	0	4	0	7	4	0	0	0	0	11	3	0	0	24	7
TENNESSEE	35	10	31	0	55	27	81	43	26	15	19	9	109	118	0	0	356	222
TEXAS	197	18	128	5	230	93	174	82	115	78	106	30	218	212	3	0	1171	518
UTAH	36	1	32	2	48	11	60	15	16	7	18	8	69	43	1	0	280	87
VERMONT	5	0	0	0	13	1	8	2	3	4	0	0	0	0	0	0	29	7
VIRGINIA	53	8	65	0	88	29	47	19	29	15	20	11	69	78	0	0	371	160
WASHINGTON	83	6	31	0	107	28	55	37	37	26	7	4	38	36	0	0	358	137
WEST VIRGINIA	6	0	7	0	20	5	12	3	6	2	0	0	24	22	0	0	75	32
WISCONSIN	80	14	66	2	130	36	99	51	63	39	23	12	56	51	1	0	518	205
WYOMING	17	1	4	0	13	3	10	7	0	0	0	0	9	7	0	0	53	18
PUERTO RICO	2	2	0	0	0	0	0	0	2	4	0	0	0	0	0	0	4	6

1/Refer to explanatory note on page 25.
2/Includes mathematics and computer sciences.

SOURCE: NRC, Office of Scientific and Engineering Personnel, Doctorate Records File.

TABLE 5
STATISTICAL PROFILE OF DOCTORATE RECIPIENTS BY RACIAL OR ETHNIC GROUP AND U.S. CITIZENSHIP STATUS, 1981[1/]

		TOTAL				AMERICAN INDIAN	ASIAN				BLACK			
		U.S.	NON-U.S. PERM.	NON-U.S. TEMP.	TOTAL	TOTAL	U.S.	NON-U.S. PERM.	NON-U.S. TEMP.	TOTAL	U.S.	NON-U.S. PERM.	NON-U.S. TEMP.	TOTAL
TOTAL NUMBER		24990	1272	3924	31319[2/]	89	460	602	1559	2704[2/]	1007	97	370	1483[2/]
MALE	%	65.3	75.9	86.0	68.5	65.2	67.6	82.1	85.8	82.0	49.2	82.5	91.4	62.0
FEMALE		34.7	24.1	14.0	31.5	34.8	32.4	17.9	14.2	18.0	50.8	17.5	8.6	38.0
DOCTORAL FIELD														
PHYSICAL SCIENCES[4/]	%	12.3	17.6	19.1	13.3	2.2	15.4	23.8	24.8	23.3	3.1	8.2	8.1	4.7
ENGINEERING		4.7	23.4	24.0	8.1	4.5	16.7	34.1	31.8	29.7	1.6	3.1	10.5	4.0
LIFE SCIENCES		17.6	16.0	18.6	17.4	12.4	23.3	17.4	16.8	17.9	6.3	17.5	25.1	11.9
SOCIAL SCIENCES		21.9	15.8	14.6	20.8	15.7	17.0	9.5	11.1	11.6	19.6	26.8	17.6	19.6
ARTS & HUMANITIES		12.8	11.6	6.0	12.0	13.5	7.2	3.8	4.4	4.8	8.3	9.3	4.6	7.4
EDUCATION		26.3	10.2	13.4	23.9	47.2	17.2	6.6	8.2	9.4	55.6	29.9	28.1	46.8
PROFESSIONS & OTHER		4.5	5.3	4.4	4.5	4.5	3.3	4.8	2.9	3.3	5.6	5.2	5.9	5.6
MEDIAN AGE AT DOCTORATE		32.4	32.6	32.1	32.4	36.3	32.7	31.8	31.1	31.4	37.3	34.0	34.3	35.8
MEDIAN TIME LAPSE BA-PHD														
TOTAL TIME	YRS	9.6	9.2	8.6	9.4	11.6	9.8	9.4	8.6	8.9	13.0	8.1	7.6	10.8
REGISTERED TIME		6.5	6.3	5.6	6.4	7.1	7.0	6.5	5.9	6.2	7.1	6.2	5.1	6.3
GRADUATE SCHOOL SUPPORT														
FEDERAL FELLOW/TRAINEE	%	20.7	10.1	7.0	17.8	25.8	24.3	11.6	8.1	11.5	17.8	3.1	7.3	14.1
GI BILL		6.9	.2	.0	5.5	7.9	2.6	.0	.0	.4	7.9	1.0	.0	5.5
OTHER FELLOWSHIP		20.4	22.6	19.2	19.7	15.7	19.1	22.9	19.8	19.9	22.3	23.7	18.1	21.2
TEACHING ASSISTANTSHIP		45.6	50.4	37.1	43.2	31.5	42.0	52.3	45.0	45.1	25.7	39.2	25.9	26.5
RESEARCH ASSISTANTSHIP		33.8	49.5	45.1	34.7	13.5	43.3	62.3	59.5	55.8	15.4	25.8	31.9	20.2
EDUC./INST. FUNDS		10.7	8.9	9.1	10.1	5.6	14.1	8.1	8.9	9.4	11.7	6.2	9.5	10.7
OWN/SPOUSE EARNINGS		69.1	52.7	28.0	60.9	77.5	53.7	43.9	20.7	31.0	73.3	61.9	41.1	64.2
FAMILY CONTRIBUTIONS		15.9	19.2	19.6	16.0	6.7	16.5	19.8	21.0	19.3	10.8	19.6	17.3	12.9
NATL DIRECT STDNT LOAN		12.8	7.1	.8	10.6	14.6	10.9	5.3	.3	3.2	17.6	16.5	1.1	13.3
OTHER LOANS		12.1	8.5	4.7	10.6	14.6	9.1	5.5	2.9	4.5	17.7	20.6	8.1	15.4
OTHER		4.3	5.0	28.4	7.2	3.4	3.5	2.5	12.4	8.3	5.3	9.3	41.9	14.7
UNKNOWN		2.3	1.6	3.6	5.8	.0	1.7	1.8	2.3	4.6	1.6	2.1	3.0	2.4
POSTDOCTORAL STUDY PLANS	%	18.3	17.8	23.5	18.3	9.0	26.5	20.3	29.6	26.1	7.1	11.3	13.8	9.0
PLANNED EMPLOYMENT AFTER DOCTORATE		79.0	78.1	72.3	75.4	91.0	70.4	75.9	66.7	67.8	90.5	83.5	83.5	87.9
EDUC. INSTITUTION		47.1	35.1	41.6	44.3	56.2	30.4	22.8	33.5	29.8	61.7	48.5	52.2	58.2
INDUSTRY/BUSINESS		14.0	32.2	13.8	14.2	12.4	25.4	44.7	20.0	25.9	7.8	11.3	6.8	7.8
GOVERNMENT		9.2	3.7	10.4	8.8	10.1	8.7	2.3	7.6	6.4	11.6	13.4	15.1	12.5
NON-PROFIT		5.3	3.4	2.4	4.7	9.0	2.4	3.3	2.2	2.5	4.9	1.0	3.5	4.2
OTHER & UNKNOWN		3.4	3.8	4.1	3.4	3.4	3.5	2.8	3.3	3.2	4.5	9.3	5.9	5.1
POSTDOCT STATUS UNKNOWN	%	2.7	4.0	4.2	6.3	.0	3.0	3.8	3.7	6.0	2.4	5.2	2.7	3.1
DEFINITE POSTDOCT STUDY	%	14.1	10.7	13.9	13.4	6.7	18.3	12.0	17.8	16.1	4.3	3.1	5.1	4.4
SEEKING POSTDOCT STUDY		4.2	7.2	9.6	4.9	2.2	8.3	8.3	11.8	10.1	2.9	8.2	8.6	4.7
DEFINITE EMPLOYMENT		59.3	50.5	51.8	56.0	66.3	49.6	51.0	47.7	47.6	66.0	46.4	52.7	61.1
SEEKING EMPLOYMENT		19.7	27.7	20.6	19.5	24.7	20.9	24.9	19.1	20.2	24.4	37.1	30.8	26.8
EMPLOYMENT LOCATION AFTER DOCTORATE														
U.S.	%[5/]	93.2	86.1	29.3	85.5	93.2	89.5	89.3	46.2	63.9	88.7	66.7	12.8	71.2
FOREIGN		1.4	7.8	64.9	9.0	.0	2.6	6.2	46.7	29.1	.2	15.6	78.5	17.9
UNKNOWN		5.4	6.1	5.8	5.5	6.8	7.9	4.6	7.1	7.0	11.1	17.8	8.7	10.9

1/Data not comparable with data for earlier years because of changes in the survey question on racial/ethnic group. See discussion on page 25.
2/Includes individuals who did not report their citizenship at time of doctorate.
3/Includes those who provided no usable response to the item on racial/ethnic group.
4/Includes mathematics and computer sciences.
5/The base for this percentage is the number of doctorates in the column caption group who have found definite employment.

TABLE 5. CONTINUED

WHITE				PUERTO RICAN	MEXICAN-AMERICAN				OTHER HISPANIC[2/]				OTHER & UNKNOWN		
U.S.	NON-U.S. PERM.	NON-U.S. TEMP.	TOTAL	TOTAL	U.S.	NON-U.S. PERM.	NON-U.S. TEMP.	TOTAL	U.S.	NON-U.S. PERM.	NON-U.S. TEMP.	TOTAL	U.S.	NON-U.S.	TOTAL
21911	489	1425	23849[2/]	115	154	7	56	219[2/]	195	54	331	594[2/]	1059	206	2266[2/3/]
65.8	67.7	85.6	67.1	49.6	66.2	71.4	87.5	72.1	59.5	75.9	81.9	74.1	71.5	85.0	70.8
34.2	32.3	14.4	32.9	50.4	33.8	28.6	12.5	27.9	40.5	24.1	18.1	25.9	28.5	15.0	29.2
12.5	13.3	16.6	12.8	12.2	1.9	.0	19.6	6.4	9.7	9.3	13.9	12.1	17.5	19.9	14.2
4.6	17.2	21.3	5.9	4.3	1.3	.0	26.8	8.2	2.6	7.4	18.1	12.1	4.9	15.5	7.4
18.1	13.3	14.2	17.7	8.7	8.4	28.6	33.9	15.5	12.3	22.2	36.9	27.1	19.2	15.5	15.9
22.2	19.6	17.8	21.9	13.9	27.3	42.9	12.5	23.7	24.1	25.9	12.7	17.8	19.2	18.0	21.9
13.0	20.4	8.1	12.9	20.0	10.4	14.3	.0	7.8	27.2	20.4	6.3	14.6	12.7	7.8	13.0
25.2	10.2	15.4	24.3	33.0	48.7	14.3	7.1	37.0	20.5	11.1	10.6	13.6	20.8	18.9	22.4
4.5	5.9	6.5	4.6	7.8	1.9	.0	.0	1.4	3.6	3.7	1.5	2.5	5.8	4.4	5.3
32.2	33.4	32.1	32.2	33.9	35.0	34.0	32.3	34.3	32.9	33.9	34.3	33.8	31.9	33.0	32.2
9.4	9.3	8.6	9.4	11.4	10.9	7.5	9.1	10.4	9.9	9.5	10.0	9.9	9.3	9.0	9.3
6.4	6.2	5.6	6.4	6.7	6.4	5.2	5.7	6.1	6.8	6.1	5.3	5.8	6.4	5.4	6.2
21.0	8.8	5.9	19.8	19.1	29.9	.0	1.8	21.9	22.6	14.8	7.9	13.1	13.8	6.8	7.2
7.0	.0	.0	6.4	5.2	11.0	14.3	.0	8.2	3.6	.0	.3	1.3	5.3	.0	2.5
20.4	23.1	19.5	20.4	37.4	27.9	28.6	21.4	26.5	27.2	16.7	18.1	20.7	15.6	14.1	8.7
47.4	51.7	36.7	46.9	27.8	36.4	28.6	21.4	32.0	48.7	42.6	21.5	32.2	32.4	29.1	18.1
35.1	39.5	39.6	35.5	23.5	22.1	14.3	33.9	25.1	21.0	42.6	27.5	26.3	26.9	30.6	15.6
10.7	9.4	9.3	10.6	21.7	15.6	.0	1.8	11.9	9.2	11.1	10.9	10.1	7.3	10.2	4.5
70.4	61.8	34.2	68.1	57.4	71.4	57.1	10.7	55.7	63.1	46.3	26.6	39.9	46.0	28.6	24.5
16.6	18.4	21.8	16.9	10.4	7.8	14.3	7.1	7.8	15.9	14.8	12.4	13.5	10.0	14.6	6.0
12.8	7.0	1.3	12.0	27.8	14.9	14.3	.0	11.0	12.3	7.4	.3	4.9	8.2	2.4	4.1
12.0	9.0	5.1	11.5	21.7	10.4	.0	10.7	10.0	12.8	16.7	6.3	9.3	7.9	5.3	4.2
4.3	7.0	34.4	6.2	7.8	4.5	.0	55.4	17.4	6.2	5.6	53.8	32.5	2.5	34.0	4.4
1.0	.4	3.2	1.2	4.3	1.3	14.3	1.8	1.8	2.1	7.4	5.1	5.9	28.8	14.1	58.3
18.8	15.7	22.2	18.9	11.3	13.6	42.9	23.2	16.9	16.4	14.8	13.0	14.1	16.8	20.4	10.0
79.6	80.6	73.5	79.2	84.3	85.1	57.1	76.8	81.7	81.0	77.8	83.4	80.8	57.6	67.0	33.5
47.3	46.4	45.0	47.1	69.6	58.4	28.6	39.3	52.5	49.2	44.4	54.4	51.0	31.7	39.8	18.6
14.2	23.1	10.9	14.2	3.5	7.8	14.3	16.1	10.0	10.8	20.4	7.3	9.6	12.7	9.2	7.1
9.3	3.5	10.9	9.3	6.1	11.0	14.3	17.9	12.8	12.3	3.7	14.8	12.6	5.2	9.7	3.3
5.4	3.9	2.5	5.2	2.6	3.9	.0	1.8	3.2	3.1	3.7	2.1	2.5	4.6	1.9	2.3
3.3	3.7	4.1	3.4	2.6	3.9	.0	1.8	3.2	5.6	5.6	4.8	5.1	3.3	6.3	2.3
1.6	3.7	4.2	1.8	4.3	1.3	.0	.0	1.4	2.6	7.4	3.6	5.1	25.6	12.6	56.4
14.6	10.2	13.7	14.5	9.6	9.1	28.6	14.3	11.0	10.8	11.1	6.6	8.2	12.7	13.1	7.3
4.2	5.5	8.6	4.5	1.7	4.5	14.3	8.9	5.9	5.6	3.7	6.3	5.9	4.2	7.3	2.7
59.9	51.7	53.6	59.4	70.4	61.0	57.1	51.8	58.0	56.9	48.1	65.3	59.8	43.4	44.2	24.5
19.6	28.8	19.9	19.8	13.9	24.0	.0	25.0	23.7	24.1	29.6	18.1	21.0	14.2	22.8	9.0
93.7	86.2	25.4	89.8	96.3	89.4	50.0	3.4	68.5	94.6	84.6	8.8	41.1	88.9	22.0	77.9
1.4	7.5	70.2	5.2	.0	1.1	25.0	96.6	23.6	.0	15.4	87.5	54.6	1.5	71.4	12.9
4.9	6.3	4.5	4.9	3.7	9.6	25.0	.0	7.9	5.4	.0	3.7	4.2	9.6	6.6	9.2

SOURCE: NRC, Office of Scientific and Engineering Personnel, Doctorate Records File.

NSF Form 558 1979
OMB No. 99-R0290
Approval Expires June 30, 1981

SURVEY OF EARNED DOCTORATES

This form is to be returned to the GRADUATE DEAN, for forwarding to .... Commission on Human Resources
National Research Council
2101 Constitution Avenue, Washington, D. C. 20418

Please print or type.

1. Name in full: .... (9-30)
(Last Name) (First Name) (Middle Name)

Cross Reference: Maiden name or former name legally changed ....

2. Permanent address through which you could always be reached: (Care of, if applicable) ....
....
(Number) (Street) (City)
....
(State) (Zip Code) (Or Country if not U.S.)

3. U.S. Social Security Number: __ __ __ - __ __ - __ __ __ __ (31-39)

4. Date of birth: .... Place of birth: ....
(10-14) (Month) (Day) (Year) (15-16) (State) (Or Country if not U.S.)

5. Sex: 1 ☐ Male 2 ☐ Female (17)

6. Marital status: 1 ☐ Married 2 ☐ Not married (including widowed, divorced) (18)

7. Citizenship: 0 ☐ U.S. native 2 ☐ Non U.S., Immigrant (Permanent Resident)
1 ☐ U.S. naturalized 3 ☐ Non-U.S., Non-Immigrant (Temporary Resident) (19)
If Non-U.S., indicate country of present citizenship .... (20-21)

8. Racial or ethnic group: (Check only one.) <u>*A person having origins in —*</u>
0 ☐ American Indian or Alaskan Native .... any of the original peoples of North America, and who maintain cultural identification through tribal affiliation or community recognition.
1 ☐ Asian or Pacific Islander .... any of the original peoples of the Far East, Southeast Asia,, the Indian Subcontinent, or the Pacific Islands. This area includes, for example, China, India, Japan, Korea, the Philippine Islands, and Samoa.
2 ☐ Black, not of Hispanic Origin .... any of the black racial groups of Africa.
3 ☐ White, not of Hispanic Origin .... any of the original peoples of Europe, North Africa, or the Middle East.
4 ☐ Puerto Rican .... Puerto Rico, regardless of race.
5 ☐ Mexican-American .... Mexico, regardless of race.
6 ☐ Other Hispanic .... Central or South America, Cuba, or other Spanish culture, regardless of race. (22-24)

9. Number of dependents: Do not include yourself. (Dependent = someone receiving at least one half of his or her support from you) .... (25)

EDUCATION

10. High school last attended: .... (26-27)
(School Name) (City) (State)

Year of graduation from high school: .... (28-29)

11. List in the table below all collegiate and graduate institutions you have attended including 2-year colleges. List chronologically, and include your doctoral institution as the last entry.

Institution Name	Location	Years Attended		Major Field (Use Specialties List)		Minor Field	Degree (if any)		
		From	To	Name	Number	Number	Title of Degree	Granted Mo.	Granted Yr.

12. Enter below the title of your doctoral dissertation and the most appropriate classification number and field. If a project report or a musical or literary composition (not a dissertation) is a degree requirement, please check box. ☐ (12)

Title .... Classify using Specialties List
.... Number Name of field
....

13. Name the department (or interdisciplinary committee, center, institute, etc.) and school or college of the university which supervised your doctoral program: ....
(Department/Institute/Committee/Program) (School)

14. Name of your adviser for dissertation, project report or music/literary composition: ....
(Last Name) (First Name) (Middle Initial)

SURVEY OF EARNED DOCTORATES, Cont.

15. Please enter a "1" beside your primary source of support during graduate study. Enter a "2" beside your secondary source of support during graduate study. Check (√) all other sources from which support was received.

a — NSF Fellowship
b — NSF Traineeship
c — NIH Fellowship
d — NIH Traineeship
e — NDEA Fellowship
f — Title IX Graduate & Professional Opportunities Pgm. Fellowship
g — Other HEW
h — AEC/ERDA/DOE Fellowship
i — NASA Traineeship
j — GI Bill
k — Other Federal support (specify) ....
l — Woodrow Wilson Fellowship
m — Other U.S. national fellowship (specify) ....
n — University Fellowship
o — Teaching Assistantship
p — Research Assistantship
q — Educational fund of industrial or business firm
r — Other institutional funds (specify) ....
s — Own earnings
t — Spouse's earnings
u — Family contributions
v — Loans (NDSL direct)
w — Other loans
x — Other (specify) ....

(26-49)

16. Please check the space which most fully describes your status during the year immediately preceding the doctorate.

0 ☐ Held fellowship
1 ☐ Held assistantship
2 ☐ Held own research grant
3 ☐ Not employed
4 ☐ Part-time employed

Full-time Employed in: (Other than 0, 1, 2)
5 ☐ College or university, teaching
6 ☐ College or university, non-teaching
7 ☐ Elem. or sec. school, teaching
8 ☐ Elem. or sec. school, non-teaching
9 ☐ Industry or business
(11) ☐ Other (specify) ....

(12) ☐ Any other (specify) .... (50)

POSTGRADUATION PLANS

17. How well defined are your postgraduation plans?
0 ☐ Am returning to, or continuing in, predoctoral employment
1 ☐ Have signed contract or made definite commitment
2 ☐ Am negotiating with one or more specific organizations
3 ☐ Am seeking appointment but have no specific prospects
4 ☐ Other (specify) .... (51)

18. What are your immediate postgraduation plans?
0 ☐ Postdoctoral fellowship
1 ☐ Postdoctoral research associateship
2 ☐ Traineeship
3 ☐ Other study (specify) ....
} Go to Item "19"
4 ☐ Employment (other than 0, 1, 2, 3)
5 ☐ Military service
6 ☐ Other (specify)......................... (52)
} Go to Item "20"

19. If you plan to be on a postdoctoral fellowship, associateship, traineeship or other study

a. What was the most important reason for taking a postdoctoral appointment? (Check only one.)
0 ☐ To obtain additional research experience in my doctoral field
1 ☐ To work with a particular scientist or research group
2 ☐ To switch into a different field of research
3 ☐ Could not obtain the desired type of employment position
4 ☐ Other reason (specify) .... (53)

b. What will be the field of your postdoctoral study? Please enter number from Specialties List .... (54-56)

c. What will be the primary source of research support?
0 ☐ U.S. Government
1 ☐ College or university
2 ☐ Private foundation
3 ☐ Nonprofit, other than private foundation
4 ☐ Other (specify)
....
6 ☐ Unknown (57)

Go to Item "21"

20. If you plan to be employed, enter military service, or other —

a. What will be the type of employer?
0 ☐ 4-year college or university other than medical school
1 ☐ Medical school
2 ☐ Jr. or community college
3 ☐ Elem. or sec. school
4 ☐ Foreign government
5 ☐ U.S. Federal government
6 ☐ U.S. state government
7 ☐ U.S. local government
8 ☐ Nonprofit organization
9 ☐ Industry or business
(11) ☐ Self-employed
(12) ☐ Other (specify).............................. (58)

b. Indicate what your *primary* work activity will be with "1" in appropriate box; *secondary* work activity (if any) with "2" in appropriate box.
0 ☐ Research and development
1 ☐ Teaching
2 ☐ Administration
3 ☐ Professional services to individuals
5 ☐ Other (specify)........................... (59-60)

c. In what field will you be working? Please enter number from Specialties List .... (61-63)

d. Did you consider taking a postdoctoral appointment? Yes — No — (64)

If yes, why did you decide against the postdoctoral?
0 ☐ No postdoctoral appointment available
1 ☐ Felt that I would derive little or no benefit from a postdoctoral appointment
2 ☐ Had more attractive employment opportunity
3 ☐ Other (specify) .... (65)

Go to Item "21"

21. What is the name and address of the organization with which you will be associated?

....
(Name of Organization)

....
(Street) (City, State) (Or Country if not U.S.) (66-71)

BACKGROUND INFORMATION

22. Please indicate, by circling the highest grade attained, the education of

		Elementary school	High school	College	Graduate		
your father:	none	1 2 3 4 5 6 7 8	9 10 11 12	1 2 3 4	MA, MD PhD	Postdoctoral	(72)
your mother	none	1 2 3 4 5 6 7 8	9 10 11 12	1 2 3 4	MA, MD PhD	Postdoctoral	(73)
	0	1 2 3	4 5	6 7	8 9	(11)	

Signature .... Date .... (74-76)

If you would like to receive a summary of the results of this survey, please check box. ☐ (79)

SPECIALTIES LIST

MATHEMATICS

000 Algebra
010 Analysis & Functional Analysis
020 Geometry
030 Logic
040 Number Theory
050 Probability & Math. Statistics (see also 544, 670, 725, 727, 920)
060 Topology
080 Computing Theory & Practice
082 Operations Research (see also 478)
085 Applied Mathematics
098 Mathematics, General
099 Mathematics, Other*

COMPUTER SCIENCES

079 Computer Sciences* (see also 437)

ASTRONOMY

101 Astonomy
102 Astrophysics

PHYSICS

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

CHEMISTRY

200 Analytical
210 Inorganic
220 Organic
230 Nuclear
240 Physical
250 Theoretical
270 Pharmaceutical
275 Polymer
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.
360 Hydrology & Water Resources
370 Oceanography
397 Marine Sciences, Other*
381 Atmospheric Physics and 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
437 Computer
440 Electrical
445 Electronics
450 Industrial
455 Nuclear
460 Engineering Mechanics
465 Engineering Physics
470 Mechanical
475 Metallurgy & Phys. Met. Engr.
476 Systems Design & Systems Science
478 Operations Research (see also 082)
479 Fuel Tech. & Petrol. Engr.
480 Sanitary & Environmental
486 Mining
497 Materials Science
498 Engineering, General
499 Engineering, Other*

AGRICULTURAL SCIENCES

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

MEDICAL SCIENCES

522 Public Health & Epidemiology
523 Veterinary Medicine
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
542 Biophysics
544 Biometrics & Biostatistics (see also 050, 670, 725, 727, 920)
545 Anatomy
546 Cytology
547 Embryology
548 Immunology
550 Botany
560 Ecology
564 Microbiology & Bacteriology
566 Physiology, Animal
567 Physiology, Plant
569 Zoology
570 Genetics
571 Entomology
572 Molecular Biology
576 Nutrition and/or Dietetics
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 050, 544, 725, 727, 920)
680 Social
698 Psychology, General
699 Psychology, Other*

SOCIAL SCIENCES

700 Anthropology
708 Communications*
710 Sociology
720 Economics (see also 501)
725 Econometrics (see also 050, 544, 670, 727, 920)
727 Statistics (see also 050, 544, 670, 725, 920)
740 Geography
745 Area Studies*
751 Political Science
752 Public Administration
755 International Relations
760 Criminology & Criminal Justice
770 Urban & Reg. Planning
798 Social Sciences, General
799 Social Sciences, Other*

HUMANITIES

802 History & Criticism of Art
804 History, American
805 History, European
806 History, Other*
807 History & Philosophy of Science
808 American Studies
809 Theatre and Theatre Criticism
830 Music
831 Speech as a Dramatic Art (see also 885)
832 Archeology
833 Religion (see also 881)
834 Philosophy
835 Linguistics
836 Comparative Literature
878 Humanities, General
879 Humanities, Other*

LANGUAGES & LITERATURE

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

EDUCATION

900 Foundations: Social & Philosoph.
910 Educational Psychology
908 Elementary Educ., General
909 Secondary Educ., General
918 Higher Education
919 Adult Educ. & Extension Educ.
920 Educ. Meas. & Stat.
929 Curriculum & Instruction
930 Educ. Admin. & Superv.
940 Guid., Couns., & Student Pers.
950 Special Education (Gifted, Handicapped, etc.)
960 Audio-Visual Media

TEACHING FIELDS

970 Agriculture Educ.
972 Art Educ.
974 Business Educ.
975 Early Childhood Educ.
976 English Educ.
978 Foreign Languages Educ.
980 Home Economics Educ.
982 Industrial Arts Educ.
984 Mathematics Educ.
986 Music Educ.
987 Nursing Educ.
988 Phys. Ed., Health, & Recreation
989 Reading Education
990 Science Educ.
992 Social Science Educ.
993 Speech Education
994 Vocational Educ.
996 Other Teaching Fields*
998 Education, General
999 Education, Other*

OTHER PROFESSIONAL FIELDS

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
891 Library & Archival Science
897 Professional Field, Other*

899 OTHER FIELDS*

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

CODE NUMBERS FOR FIELDS DISPLAYED IN TABLE 2

Physics & Astronomy (101-199)
Chemistry (200-299)
Earth, Environmental, and Marine Sciences (301-399)

Physical Sciences Subtotal (101-399)
Mathematics (000-060, 080-099)
Computer Sciences (079)
Engineering (400-499)

EMP Total (000-499)

Biochemistry (540)
Basic Medical Sciences (542, 545-548, 564-566, 572)
Other Biosciences (544, 550-562 567-571, 576-579)

Biosciences Subtotal (540-579)
Medical Sciences (520-539)
Agricultural Sciences (500-519)

Life Sciences Total (500-579)

Psychology (600-699)
Economics and Econometrics (720,725)
Anthropology and Sociology (700, 710)
Political Science, Public Administration, International Relations (751-755)
Other Social Sciences (708, 727-745, 760-799)

Social Sciences Total (600-799)

Total Sciences (000-799)

History (804-807)
English and American Language and Literature (811-812)
Foreign Languages and Literature (821-829)
Other Humanities (802, 808-809, 830-879)

Humanities Total (802-879)

Professional Fields (881-897)

Education (900-999)

Total Non-Sciences (802-897, 900-999)

Other or Unspecified (899)

TITLES OF DEGREES INCLUDED IN THE SURVEY OF EARNED DOCTORATES

DAS	Doctor of Applied Science
DArch	Doctor of Architecture
DA	Doctor of Arts
DBA	Doctor of Business Administration
JCD	Doctor of Canon Law
DCJ	Doctor of Criminal Justice
DCrim	Doctor of Criminology
EdD	Doctor of Education
DEng	Doctor of Engineering
DESc	Doctor of Engineering Science
ScDE	Doctor of Engineering Science
DEnv	Doctor of Environment
DED	Doctor of Environmental Design
DFA	Doctor of Fine Arts
DF	Doctor of Forestry
DGS	Doctor of Geological Science
DHS	Doctor of Health and Safety
DHL	Doctor of Hebrew Literature
DHS	Doctor of Hebrew Studies
DIT	Doctor of Industrial Technology
SDJ	Doctor of Juridical Science
JSD	Doctor of Juristic Science
DLS	Doctor of Library Science
DMin or DM	Doctor of Minstry (except professional)
DM	Doctor of Music
DMA	Doctor of Musical Arts
DME	Doctor of Music Education
DML	Doctor of Modern Languages
DNSc	Doctor of Nursing Science
PhD	Doctor of Philosophy
DPE	Doctor of Physical Education
DPA	Doctor of Public Administration
DPH	Doctor of Public Health
DRec or DR	Doctor of Recreation
DRE	Doctor of Religious Education
DSM	Doctor of Sacred Music
STD	Doctor of Sacred Theology
DSc	Doctor of Science
DScH	Doctor of Science and Hygiene
DScD	Doctor of Science in Dentistry
LScD	Doctor of Science and Law
DSSc	Doctor of Social Science
DSW	Doctor of Social Work
ThD	Doctor of Theology

NAS NAE IOM NRC National Academy Press

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Declassified and Approved For Release 2012/10/22 : CIA-RDP90-00530R000300610001-6

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Blacks Earn Few Science Doctorates, Study Says

Other Minorities Steadily Earning More Advanced Degrees in Technological Fields

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Black students earned only 222, or 1.8 percent, of the 12,480 doctorates awarded to U.S. citizens in graduate science and engineering programs last year, according to figures released by the National Science Foundation.

Of 290 doctorates awarded in electrical engineering, none went to black students, and of 243 doctorates in computer and information science, just two went to blacks. Blacks received three of 281 doctorates in chemical engineering, two of 240 doctorates in mechanical engineering and five of 698 doctorates in physics and astronomy. In biology the proportion was slightly better—45 of 2,971.

The statistics, in an annual study sponsored by the NSF and other federal agencies, are the most recent evidence that minority participation in the hard sciences, which was increasing during the 1970s, has leveled off and may be declining.

Academics and federal officials point to several contributing factors, including declining federal student-aid grants, the absence of black faculty who might act as role models and a lack of preparation in elementary and secondary schools.

Black students earning bachelor's degrees in the sciences are heavily recruited by industry, where they can earn salaries comparable to or only slightly less than what they would earn after four to six years in graduate school.

Also, there is a widespread belief that teachers and faculty may be unintentionally steering black students and women away from the hard sciences.

"This is something that is deeply imbedded in our education system," said Daryl E. Chubin, who directed a recent study by the congressional Office of Technology Assessment on science and engineering education. "You can't scapegoat teachers. It's part of a much more complex system."

The extraordinarily low numbers are seen as cause for alarm on several counts. As minorities make up a growing proportion of a shrinking college-age population, they become an increasingly vital pool of future scientists. The tendency of black students to choose programs other than science and engineering could exacerbate what many believe will be a serious shortage of scientists in the future. And this is happening in an era when the nation's competitive position is seen as heavily dependent on its technological prowess.

"It is a serious problem for the country," said Joseph Danek, director of research initiation and improvement at the NSF. "The country must look at the issue not just as an equity issue but as an important personnel issue."

Blacks—who make up about 12 percent of the population and 9 percent of college freshmen—receive 2.6 percent of bachelor's degrees in science and engineering, according to the OTA. In non-scientific fields, blacks do slightly better, receiving about 5 percent of the doctorates.

While the number of blacks earning science doctorates increased from 1975 to 1978, the number has declined since then. There were 278 black science and engineering doctorates, or 2.1 percent of the total, in 1978.

By comparison, Hispanics, Native Americans and Asians have earned steadily higher numbers of science doctorates since 1978, although the numbers remain low for Hispanics and Native Americans. Hispanics earned 292 science doctorates last year, compared to 160 nine years earlier.

"Blacks are the only racial and ethnic group in which this is occurring," said Susan Hill, a senior analyst at the NSF. She said that while the number of black women earning science doctorates had been up until 1984, it has declined since. The number for black men has been declining throughout the decade.

The NSF figures reflect doctorates awarded from July 1986 to June 1987. They do not include foreign students; there were 67 blacks among non-citizens holding permanent visas who earned science doctorates last year.

W. Ann Reynolds, chancellor of the California State University system and chair of a federal task force on women and minorities in science, recommends more funding for graduate scholarships, cooperation between historically black colleges and graduate schools and programs that encourage junior and senior high students to enter science fields.

"By the time students walk onto our campuses, they're already cut off from science careers," she said. "The real preparation has to occur in junior and senior high school."

The statistics on doctoral degrees underscore another trend—the dramatic increase in the number of foreign students attending graduate school in this country. Foreign students earned more than half of the mathematics doctorates granted last year, more than doubling the 1978 percentage. In computer and information science, foreign students earned about 42 percent of the doctorates.

Most of these students hold temporary, rather than permanent, visas, and so are considered less likely to remain in the country.

This phenomenon, coupled with the diminished numbers of blacks earning doctorates, complicates what were already serious questions about the future supply of scientists.

A study undertaken by the NSF and released recently concludes that there will be a "substantial shortfall" of scientists and engineers in the years ahead. The problem will be particularly acute in academia, where large numbers of faculty are expected to retire a decade from now.

"There is going to be a hole there that is a very, very large hole," said Peter House, director of the NSF's policy, research and analysis division.