Association of Neuroscience Departments and Programs

The 2000 ANDP Survey of Neuroscience Graduate, Postdoctoral, & Undergraduate Programs

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Introduction

Neuroscience Departments and Programs are relatively new entities, being virtually unknown 35 years ago. By now they are plentiful, diverse in organization and goals, and still evolving. For years the ANDP has attempted to monitor that evolution by characterizing the departments and programs along several important dimensions so that we can know ourselves better (i.e., bench-marking) and present ourselves better to our colleagues, our deans, and our students.

Previous ANDP surveys of graduate and postdoctoral training in North America were conducted in 1986 by Michael Zigmond, in 1991 by Linda Spear, and in 1998 (see 1998 ANDP Survey) by Lesly Huffman, Robert Fellows, and Ronald Schoenfeld.1,2 In 2000, we wanted to initiate an annual survey that focused on the most critical issues and allowed current information about the academic discipline to be readily available. Thus, in August 2000 we asked directors of member programs to complete a survey so promptly that its results could be analyzed in time for presentation in a Forum at the annual meeting of the Society for Neuroscience on 4 November 2000, in New Orleans. To facilitate this response, we eliminated several questions from the past survey, and also conducted the survey electronically.

There were two versions of the survey, one intended for graduate and postdoctoral programs, as in previous years, and one intended for undergraduate programs, for the first time. The present report provides the results of both surveys. The two survey questionnaires were posted on the ANDP web site between mid-August 2000 and December 2000, and program members in the ANDP were asked to complete and submit data electronically to the University Center for Social and Urban Research (UCSUR) at the University of Pittsburgh, which helped in designing the surveys and was responsible for compiling the obtained responses. Completed questionnaires were received from 81 graduate neuroscience departments and programs, and from 24 undergraduate neuroscience departments and programs. It is difficult to be certain what percentage of North American programs in Neuroscience are represented by these responses because there has never been an accurate count of all programs. Be that as it may, 50% (81/163) of graduate programs in Neuroscience that are active members of the ANDP submitted responses to the survey. Of those 81 graduate programs, 51 (63%) also participated in the 1998 survey, and many of them no doubt participated as well in the previous two surveys, enabling the results of these surveys to be compared meaningfully. Similarly, 49% (24/49) of undergraduate programs in Neuroscience that are active members of ANDP responded to the first survey of undergraduate programs. Many programs communicated their regrets about not participating because they were still too new or had not yet begun to track the information we had requested. The results of the two surveys were entered into a database at UCSUR for subsequent analysis.

Complete lists of the programs that participated in the two surveys are given below. The institutions with graduate programs represented a broad cross-section of Neuroscience departments and programs. That is, responses were obtained from large institutions and small institutions, from older programs and newer programs, from programs with many students and programs with relatively few students, from programs located in medical schools and from programs located in schools of arts and sciences (or both). Almost all of the programs were located in the United States, in 29 states plus the District of Columbia, but a few responses also were obtained from institutions in three Canadian provinces. The results reported below represent all the responses obtained from all the institutions excepting responses from the Canadian institutions to questions regarding faculty citizenship and U.S. racial and ethnic minority groups, which were excluded. The institutions with undergraduate programs in the neural sciences were similarly diverse, and were located in13 states and two Canadian provinces.

The results have been organized for presentation in the following nine categories. The first six categories summarize the results regarding graduate and postdoctoral training. Whenever possible, current results are compared with those obtained from the previous ANDP surveys. The seventh category summarizes the responses regarding undergraduate training. The final two categories provide a summary of the major findings of the two surveys and the conclusions drawn. A specific index of these nine categories is as follows:

Results

1. Program Characteristics
2. Faculty
3. Graduate Education
4. Postdoctoral Training
5. Diversity
6. Financial Support
7. Undergraduate Education
8. Summary
9. Conclusions

(1) Zigmond, M.J. and Spear, L.P. Neuroscience training in the USA and Canada: observations and suggestions, Trends in Neuroscience 15:379-383, 1992.
(2) Huffman, L., Fellows, R.E., and Schoenfeld, R.I. The 1998 ANDP survey of neuroscience graduate & postdoctoral programs.

Participating Institutions

Participating Institutions (Graduate and Postdoctoral Training) (n = 81)
Note that some institutions have multiple Neuroscience programs, and different programs responded to the survey.

State	Institution
AL	Auburn University
AL	University of Alabama, Birmingham
AZ	University of Arizona
CA	Scripps Research Institute
CA	University of California, Berkeley
CA	University of California, Los Angeles
CA	University of California, San Diego
CO	Colorado State University
CO	University of Colorado Health Science Center
CT	University of Connecticut
CT	Wesleyan University
DC	George Washington University
DE	University of Delaware
FL	Florida Atlantic University
FL	University of Florida
FL	University of South Florida
IA	Iowa State University
IA	University of Iowa
IL	Northwestern University
IL	Southern Illinois University School of Medicine
IL	University of Illinois College of Medicine
IN	Indiana University
LA	Tulane University
MA	Amherst College
MA	Boston University
MA	Brandeis University
MA	Harvard University Medical School
MA	Tufts University School of Medicine
MA	University of Massachusetts
MD	Johns Hopkins University
MD	Uniformed Services University of Health Sciences.
MD	University of Maryland, Baltimore
MD	University of Maryland, College Park
MI	Michigan State University
MN	University of Minnesota
MO	Saint Louis University
NC	Duke University
NC	University of North Carolina

NJ Rutgers University
NM University of New Mexico
NY Albany Medical College
NY Albert Einstein College of Medicine
NY Columbia University
NY Cornell University Medical College
NY Cornell University
NY Mt. Sinai School of Medicine
NY New York University
NY SUNY Downstate Medical College
NY SUNY, Stony Brook
NY SUNY Upstate Medical College
OH Ohio State University
OH Medical College of Ohio
OR Oregon Health Sciences University
PA Lehigh University
PA Temple University
PA University of Pennsylvania
PA University of Pittsburgh
SD University of South Dakota
TX Baylor College of Medicine
TX University of Houston College of Optometry
TX University of Texas Health Science Center
TX University of Texas Medical Branch
TX University of Texas, Austin
TX University of Texas, Dallas
TX University of Texas, San Antonio
UT University of Utah
VA University of Virginia
VT University of Vermont
WA University of Washington
WA Washington State University
WI Medical College of Wisconsin
WI University of Wisconsin, Madison
WI University of Wisconsin, Milwaukee

CANADA
AL University of Alberta
ON University of Toronto
QU McGill University

Participating Institutions (Undergraduate Training) (n = 24)

State	Institution
CA	Pomona College
CA	Westmount College
CT	Fairfield University
CT	Wesleyan College
FL	University of Miami, Coral Gables
GA	Emory University
GA	Georgia College and State University
IL	Loyola University, Chicago
MD	Washington College
MN	University of Minnesota
NC	Davidson College
NY	Hamilton College
NY	Ithaca College
NY	University of Rochester
OH	Baldwin-Wallace College
OH	Oberlin College
PA	Cedar Crest College
PA	Franklin and Marshall College
PA	University of Pittsburgh
PA	Westminster College
UT	Brigham Young University
WA	Washington State University

CANADA

AL	University of Alberta
NS	Dalhousie University

1. Program Characteristics

Table 1a - School Affiliation

The locus of graduate education in the neural sciences continues to evolve. In the 1991 survey, graduate programs located in Schools of Medicine were most numerous, and relatively few programs were University-wide and integrated across both Schools of Medicine and Schools of Arts & Sciences (or the equivalent). In the 2000 survey, in contrast, an increased percentage of programs were found in Schools of Arts & Sciences or were university-wide and included both Schools of Medicine and Schools of Arts & Sciences. (Data not obtained in 1986 survey.)

Survey Year	91	98	00*
	Percent of Total		
School of Medicine	38	43	32
Arts & Sciences	30	30	41
Both SOM and A&S	17	21	23
Other	15	7	5

* Survey question #4

Table 1b - Administrative Structure and Degree Granted

The administrative structure of graduate programs in the neural sciences is quite varied. Only 15% of current programs are found exclusively in Departments of Neuroscience or Neurobiology (or in departments that had those words in their name, such as "Behavioral Neuroscience" and "Anatomy and Neurobiology"). In contrast, 69% of the programs link neuroscientists in multiple departments (or in a "Division" or "Institute" of Neuroscience) in a unified, degree-granting program, and only 15% are in departments that did not have Neuroscience or Neurobiology in their names. [Survey question #5, not asked in previous ANDP surveys.]

One implication of this administrative structure is that, unlike departments, only 54% of graduate training programs in the neural sciences hire their own faculty. [Survey question #10, not asked in previous ANDP surveys.] Another implication is that the degree awarded to graduate students trained in the neural sciences is much more likely to be a Ph.D. in Neuroscience or Neurobiology (or in disciplines that had those words in their name) than a Ph.D. in another discipline. This feature, first seen in the 1998 survey, represents a striking reversal from the situation 15 years ago, when the majority of degrees were awarded in other disciplines. (The "Other" category represents the relatively few graduate training programs in Neuroscience that do not offer a Ph.D. degree.) Note that throughout this report, "Neuroscience" and "Neurobiology" are used interchangeably.

Survey Year	86	91	98	00*
		Percent of Total		
Ph.D. in Neuroscience	24	28	66	67
Ph.D. in another discipline	74	54	30	29
Other	2	18	4	4

* Survey question #6

Table 1c - Undergraduate Activities

Graduate programs in the neural sciences now play a very substantial role in the education of undergraduate students. Although only 22% of the graduate programs additionally administer an undergraduate program in Neuroscience, faculty in most graduate programs teach undergraduate courses (72%) and provide opportunities for undergraduate students to be involved in research projects (94%). These important contributions are much greater than those observed 10 years ago.

Survey Year	86	91	98	00*
		Percent of Total		
Formal Program	-	23	24	22
Teaching	9	48	39	72
Research	-	68	62	94

* Survey questions #7-9

2. Faculty

Of 2131 total faculty in the 81 graduate training programs in the neural sciences that were surveyed, 88% have tenure-stream positions. This number is within the range (86-90%) observed in the three previous surveys. Of ~26 total faculty per program, ~23 have tenure-stream positions on average whereas only ~3 have non-tenure-stream positions. The total number of tenure-stream faculty in these 81 programs in academic year (AY) 1999-2000 was 38% more than the number present in AY1997-98, whereas the increase in nontenure-stream faculty during this time was 80%.

There was considerable stability in the training faculty; in AY1999-2000, only 3% of the tenure-stream faculty left their positions, and only 8% arrived as new appointments. A similarly low turnover was observed in the two previous years. The turnover of nontenure-stream faculty was somewhat greater (10% leaving, 11% arriving, in AY1999-2000, similar to that in the two previous years). [Survey question #13, not asked in previous ANDP surveys.]

Table 2a - Number of Faculty per Program

The number of tenure-stream faculty per graduate program varied widely, from less than 10 to more than 100 per program; however, 65% of the programs had 30 or fewer faculty members.

Number	
0-10	23%
11-20	22%
21-30	20%
31-40	8%
41-50	6%
51-60	6%
61-70	8%
70-90	5%
>90	2%

Table 2b - Distribution of Faculty by Rank

The distribution of tenure-stream faculty across the three ranks resembles that reported in the previous surveys; approximately half the faculty are full professors, and one-fourth each are at the assistant and associate levels.

Survey Year	86	91	98	00*
	Percent of Total			
Assistant Professor	23	26	24	25
Associate Professor	28	28	25	23
Full Professor	49	46	51	51

* Survey question #14

The great majority of faculty members that have tenure-stream positions at U.S. institutions are U.S. citizens (97%). This number is similar to that seen in the 1991 and 1998 surveys (93%, 97%, respectively). However, the distribution of non-U.S. citizens by rank is not similar to that of U.S. citizens: 52% assistant

professors, 15% associate professors, and 33% full professors. Most of these tenure-stream faculty members are Europeans (42%), Asians (24%), Canadians (14%), and Latin Americans (14%). Similarly, most faculty holding nontenure-stream positions at U.S. institutions are U.S. citizens (94%). [Survey question #14, not asked in previous surveys.]

Table 2c - Percentage of Women by Rank

Women represented only 21% of TS faculty in the 2000 survey. Their distribution was similar across the three ranks (37% assistant professor, 29% associate professor, 34% full professor), unlike men (23%, 22%, 56%, respectively). Thus, there were a higher percentage of women faculty members at the assistant and associate professor levels than at the full professor level. That distribution has not changed appreciably in the past 10 years.

Survey Year	86	91	98	00*
		Percent of Total		
Assistant Professor	23	27	32	30
Associate Professor	20	22	27	26
Full Professor	9	13	19	14

* Survey question #14

In contrast, women represented 43% of nontenure-stream faculty members in AY1999-2000. [Survey question #14.] This information was not solicited in previous ANDP surveys, although it resembles the previous question asking about women occupying "research staff" positions: 26% in the 1986 survey, and 37% in both the 1991 and 1998 surveys.

3. Graduate Education

Table 3a - Recruitment

The total number of applications to the 81 graduate training programs in the neural sciences in the 2000 survey was 4853, or 71.4 per program. That number is three times the number per program reported in the 1986 survey. Offers of admission doubled during the same time period, as did the number of students matriculating per program, which were 7.0 per program in 2000.

Women represented 41% of the applicants, 50% of the students admitted, and 48% of those who began graduate training in the neural sciences in AY2000-2001. Students who are U.S. racial and ethnic minorities represented only 4% of the applicants, but they were 9% of the students admitted and 13% of those who matriculated. In contrast, students who are not U.S. citizens represented 46% of the applicants, but only 23% of the students admitted and 25% of those who began graduate training in U.S. institutions. On average, 68% of women applicants and 74% of applicants who were non-U.S. citizens accepted the offer of admission, whereas U.S. racial and ethnic minorities were much more likely to accept the offer (92%).

Survey Year	86	91	98	00*
	Mean per program			
Number of students applied	24	42	61	71
Number of students admitted	6	10	12	13
Number of students entered	4	5	5	7

* Survey question #15

Table 3b - Academic Credentials of Entering Students

The academic credentials of students entering graduate programs in the neural sciences in AY2000-20001 were similar to those of students characterized in previous surveys. Average GRE scores in the quantitative and analytical sections of the exam have increased progressively, whereas scores on the verbal section decreased slightly. The average scores in the 2000 survey place incoming graduate students in approximately the 76th, 79th, and 78th percentiles, respectively, of all students who took the GRE exams. Ninety-one percent of the students had research experience before they began graduate training, which is a higher percentage than in the 1991 and 1998 surveys (81%, 78%, respectively).

The incoming graduate students had an average GPA in their college courses of 3.5 (i.e., midway between B+ and A-), as was seen in the previous surveys. Only 18% of the incoming students had an undergraduate major in Neuroscience or Behavioral Neuroscience. [Survey question #16, not asked in previous ANDP surveys.] Other common undergraduate majors were Biology (29%), Psychology (12%), and Chemistry (10%), and an additional 11% had dual majors including one or more of these disciplines.

Survey Year	86	91	98	00*
	Average GRE Scores			
Quantitative	624	630	658	679
Analytical	624	635	650	664
Verbal	590	600	577	570

* Survey question #16

Table 3c - Total Predoctoral Students, and PhD Degrees Awarded, per Program
The number of graduate students per program varied widely, from less than 10 to more than 80 per program; however, 87% of the programs had 40 or fewer students. The number of graduate students in a program was closely correlated with the number of tenure-stream faculty members in that program ($r = 0.62$, $p < 0.001$).

Number	Faculty	Students
0-10	23%	16%
11-20	22%	30%
21-30	20%	20%
31-40	8%	21%
41-50	6%	2%
51-60	6%	2%
61-70	8%	2%
71-80	3%	5%
81-90	2%	2%
>90	2%	0%

The mean number of graduate students per program has increased steadily since 1986, and is now 24. Women represented 47% of this population in AY1999-2000. Students who were not U.S. citizens represented only 19% of predoctoral trainees in U.S. institutions, a number similar to that observed in the 1991 and 1998 surveys; among that population, the largest number were from Asia (64%) and Europe (16%).

The large increase in graduate students per program was not accompanied by a similar increase in Ph.D. degrees awarded by those programs, which rose from 2.6 per program in 1986 to 3.5 per program in 2000. Instead, part of this difference can be attributed to the students who left the graduate program without obtaining a Ph.D. degree, and part can be attributed to an increase in time to Ph.D. degree (Table 3d).

Survey Year	86	91	98	00*
	Average per Program			
Total predoctoral trainees	12	16	20	24
Non-U.S. citizens (%)	---	20	19	19
Ph.D. degree awarded	2.6	2.8	3.2	3.5
Ph.D. degree not awarded	---	---	---	1.8

*Survey questions #18, 19, 21

Table 3d - Years in Program
The number of years in graduate training required to obtain a Ph.D. degree increased substantially between the 1986 and 1991 surveys, but it has changed little since then. In 2000, it took students 5.4 years on average to complete training, with 90% of the students doing so between 4 and 7 years. These numbers were virtually identical for U.S. and non-U.S. citizens.

Fewer than 10% of predoctoral trainees left their graduate programs without obtaining a Ph.D. degree. Among them, 49% were women, a number comparable to their representation in the total population of

predoctoral trainees. Similarly, 25% of those who left were U.S. racial and ethnic minorities, and another 25% were non-U.S. citizens, numbers only slightly higher than their representations in the total population of predoctoral trainees. In all cases, these students left after 2.1 years of training, on average, with 93% doing so between 0.5 and 4 years. Many students (39%) left with a M.S. degree. A surprisingly high number (23%) of the domestic students (but only 5% of non-U.S. citizens) who left were in an M.D./Ph.D. program, and they either returned to medical school or began their medical internship or residency. [Survey question #21, not asked in previous surveys.]

Survey Year	86	91	98	00*
	Average Years			
Ph.D. awarded	4.3	5.2	5.5	5.4
Ph.D. not awarded	---	---	---	2.1

* Survey questions #20, 21

Table 3e - Placement of New Graduates with a Ph.D. Degree

Upon receiving their Ph.D. degree in Neuroscience, most graduates pursued further research training and accepted postdoctoral positions (61%), as was observed in the previous two surveys. Many went to medical school or began a medical internship or residency (14%). As in previous years, few graduates were employed outside of Neuroscience (4%) or were not yet employed (3%). (Data not obtained in 1986 survey.)

Survey Year	91	98	00*
	Percent of Total		
Postdoctoral position	60	70	61
Medical School	13	15	14
Faculty position	6	5	8
Industry	12	1	6
Other	6	5	3
Employed outside the field	2	3	4
Currently unemployed	1	1	3

* Survey question #20

4. Postdoctoral Training

Table 4a - Profile of Postdoctoral Trainees

The average number of postdoctoral trainees (~8) per Neuroscience program in the 2000 survey is within the range (8-12) seen in each of the previous surveys. [Survey question #23.] Most of the trainees (78%) have only a Ph.D. degree, as has been observed since 1986. In contrast, relatively few trainees have an M.D. degree, whether as their sole degree or in addition to a Ph.D. degree (~10% each); note that the number of trainees with only a M.D. degree is now much less than was observed in the 1986 and 1991 surveys.

Survey Year	86	91	98	00*
	Percent of Total			
Ph.D.	78	63	88	78
M.D.	18	25	5	8
M.D./Ph.D.	4	12	6	12
Other	0	0	1	3

* Survey question #22

Women constituted only 40% of this population in AY1999-2000, somewhat less than their representation in graduate programs in Neuroscience. In contrast, more than half (55%) of the postdoctoral trainees were not U.S. citizens, almost three-times their representation as predoctoral trainees and progressively more than were observed in the 1991 and 1998 surveys (40%, 49%, respectively). Among that population, the largest portions are from Asia (50%) and Europe (37%). [Survey question #23.]

Table 4b - Placement from Postdoctoral Position

When postdoctoral trainees leave, most likely they either take a faculty position (38%) or pursue additional training in another postdoctoral position (35%). This outcome, seen also in the 1998 survey, may be contrasted with the results of the 1991 survey, which indicated that postdoctoral trainees typically left to accept faculty positions. As in previous years, very few postdoctoral trainees left to take employment outside of Neuroscience (2%) or were not employed (1%). This pattern of placements was similar for U.S. citizens and non-US citizens. (Data not obtained in 1986 survey.)

Survey Year	91	98	00*
	Percent of Total		
Another postdoctoral position	21	30	35
Medical School	3	1	5
Faculty position	45	28	38
Industry	14	4	11
Other	14	29	8
Employed outside the field	2	1	2
Currently unemployed	1	6	1

* Survey question #24

5. Diversity

Table 5a - Minority Representation

The representation of U.S. racial and ethnic minorities as a percentage of all predoctoral trainees has almost doubled since the 1986 and 1991 surveys. However, a comparable increase in their representation among postdoctoral trainees has not yet occurred. Similarly, while minority representation at the faculty level appears to have increased gradually over the years, it still remains relatively low.

Survey Year	86	91	98	00*
	Percent of Total			
Predoctoral	10	9	18	16
Postdoctoral	22	6	21	7
Tenure-stream Faculty	5	6	7	8

* Survey questions #14, 18, 23

Table 5b - Minority Distribution

Among the U.S. racial and ethnic minority population, Asian-Americans represented the largest group of predoctoral and postdoctoral trainees, and tenure-stream faculty, in the neural sciences. Hispanic-Americans were less numerous in all three categories, while African-Americans were even fewer in number, and Native Americans were still fewer (data not obtained in 1986 survey).

Survey Years	91	98	00*	91	98	00*	91	98	00*
	Percent of Total Minority								
	Predoc			Postdoc			Faculty		
Asian-Amer.	38	42	42	53	50	51	64	61	51
Hispanic-Amer.	32	25	27	25	10	21	22	20	25
African-Amer.	22	20	16	12	32	5	11	7	10
Native-Amer.	-	8	7	-	4	2	-	5	0
Other	8	5	8	10	4	21	3	7	14

* Survey questions #14, 18, 23

6. Financial Support

Table 6a - Stipend Sources - First Year Graduate Students
Almost all predoctoral trainees in the neural sciences receive stipend support. First-year graduate students receive two-thirds of this support from University funds, often in the form of teaching assistantships. The balance of their stipend is derived from a combination of training grants, research grants, and fellowships, in roughly equal amounts. These numbers have changed little during the past 15 years.

Survey Year	86	91	98	00*
	Percent of Total			
Teaching assistantship	34	29	29	31
Other university funds	30	38	41	38
Training grants	9	10	10	12
Research grants	16	14	9	12
Fellowships	10	8	11	7

* Survey question #17

Table 6b - Stipend Sources - Advanced Graduate Students
Predoctoral trainees advanced beyond their first year receive only 30% of their support from the university, an amount much lower than was reported in the 1986 survey and less than half of the university's support of first-year students. To compensate for this change, research grants have provided increasing support of these advanced graduate students; indeed, in the 2000 survey this source amounted to the single largest portion (39%) of the pool of funds.

Survey Year	86	91	98	00*
	Percent of Total			
Teaching assistantship	31	27	29	19
Other university funds	21	21	12	11
Training grants	12	9	6	13
Research grants	24	33	37	39
Fellowships	13	10	6	15

* Survey question #17

Table 6c - Stipend Sources - Postdoctoral Trainees

Research grants have been the major source of support for postdoctoral trainees during the past 15 years, amounting to 65% in the 1998 survey. In previous surveys, the support of all postdoctoral trainees was considered collectively. In the 2000 survey, however, U.S. and non-U.S. citizens were considered separately. The recent results indicate an even greater dependence than in previous years on research grants to support postdoctoral trainees, especially those who are not U.S. citizens (86% of the support). Training grants and fellowships, once the source of ~50% of the total support, now provide less than 25% of the funds (much less for trainees who are not U.S. citizens), and universities now provide little support at all.

Survey Year	86	91	98	00*(U.S.)	00*(Non-U.S.)+
			Percent of Total		
University funds	8	12	9	0	1
Training grants	22	16	12	19	3
Research grants	38	50	65	68	86
Fellowships	30	22	12	13	10

* Survey question #25

7. Undergraduate Programs

Based on information available from 51 member programs, 8 (16%) founded their programs before 1980, 13 (25%) founded them between 1980 and 1989, and 30 (59%) founded them after 1989. Roughly the same distribution was seen among the 24 programs that participated in the survey. Thus, the existence of undergraduate programs in Neuroscience is a relatively recent phenomenon, and a representative mix of older and newer programs participated in the 2000 survey. Nonetheless, these results must be considered preliminary because of the relatively small size of the obtained sample, and the absence of previous information to which the new data could be compared.

The responses are organized in the sequence of the first six questions in the survey.

i. Institutional Affiliation. Half (12) of the 24 programs were located in undergraduate colleges that did not have a Ph.D. program in Neuroscience, whereas the other 12 programs were at universities that did have at least one graduate program in Neuroscience.

ii. Administrative Structure. Two-thirds (16) of the 24 programs were interdisciplinary in nature, and offered a B.S. or B.A. degree in Neuroscience. Four programs offered a B.S. or B.A. degree either in Biology or Psychology, with a specialization in Neuroscience. Only four programs were located in Departments of Neuroscience or Behavioral Neuroscience.

iii. Faculty Hiring. Ten of the 24 programs did not hire faculty for their program, whereas 14 did. The latter response (57%) is comparable to that in graduate training programs (54%).

iv. Faculty Appointments. The total number of faculty members with tenure-stream positions in the 24 programs increased by 3% from 1997-98 to 1998-99, and by 13% from 1997-98 to 1999-2000. In each of the 3 years there was 5-10% turnover of tenure-stream positions (i.e., faculty leaving and arriving as a percent of the total number of faculty affiliated with a program).

Many fewer faculty positions were nontenure-stream than were tenure-stream: 11% as many in 1997-98, 15% as many in 1998-99, and 20% as many in 1999-2000. Although the absolute numbers of nontenure-stream positions in these 24 programs are still relatively low, they increased by 44% from 1997-98 to 1998-99, and by 111% from 1997-98 to 1999-2000. Note that the turnover of faculty with nontenure-stream positions was much higher (30-50%) than those of faculty with tenure-stream positions, as might be expected.

v. Faculty. In 1999-2000, the distribution of faculty with tenure-stream positions according to rank was 20% assistant professors, 20% associate professors, and 60% full professors. At each faculty rank, women occupied 20-30% of the tenure-stream positions. They also held 53% of the nontenure-stream faculty positions. All of these numbers are similar to those of faculty in graduate Neuroscience programs. The total number of faculty in these programs, on average, were ~8 tenure-stream and ~1.5 nontenure-stream faculty members per program.

Among faculty with tenure-stream positions, 95% were Caucasian and only 5% were U.S. racial and ethnic minorities; less than 1% were not U.S. citizens. (Note that data from the two Canadian institutions were not included here.)

vi. Undergraduate Students. The number of undergraduate students with Neuroscience majors in these 24 programs increased substantially during the past three years, by 36% from 1997-98 to 1998-99, and by 88% from 1997-98 to 1999-2000. On average, there were now 54 Neuroscience majors per program, although the number per program varied widely (range = 4 to 272), and 45% of the programs still had 20 or fewer students. There were approximately equal numbers of males and females among the undergraduate students with majors in Neuroscience during each of the past three years (48-52% each). These numbers are consistent with a similar representation of males and females among predoctoral trainees.

8. Summary

Most graduate training programs in the neural sciences continue to be located in Schools of Medicine or in Schools of Arts & Sciences. However, there is a recent trend to link neuroscientists in multiple departments in a university-wide program that spans both Schools of Medicine and Schools of Arts & Sciences.

The administrative structure of graduate programs in the neural sciences is quite varied. Most training is now conducted in interdisciplinary programs rather than in departments offering degrees in neuroscience or in other disciplines. Graduate students are now much more likely to be awarded a Ph.D. degree in Neuroscience than in another discipline.

Graduate faculty in the neural sciences now play a very substantial role in undergraduate education, both by teaching undergraduate courses and by providing opportunities for undergraduate students to become involved in research projects.

There are ~26 faculty per program, on average, in the graduate programs surveyed. Almost 90% of the faculty members have tenure-stream positions. The annual turnover in these positions is only ~10%, whereas it is ~20% in nontenure-stream positions. Approximately half the tenure-stream faculty members are full professors, while one-fourth each are assistant or associate professors.

The annual number of applications for graduate training in the neural sciences has tripled during the past 15 years, and is now ~71 per program, while the number of matriculants has doubled and is now ~7 students per program. Nonetheless, the academic quality of incoming graduate students has remained high, as suggested by their undergraduate GPA (average = 3.5), their scores on the GRE (average = ~78th percentile), and their research experience.

Only 18% of the incoming students had an undergraduate major in Neuroscience or Behavioral Neuroscience. Other common majors were Biology (29%), Psychology (12%), and Chemistry (10%), and an additional 11% had dual majors including one or more of these disciplines.

The number of Ph.D. degrees in Neuroscience awarded annually per program has increased little in recent years and is now 3.5, while the time to degree has stabilized at ~5.5 years. Most new graduates pursue further research training in postdoctoral positions (61%), while many go to medical school (14%). Fewer than 10% of predoctoral trainees leave the program without obtaining a Ph.D. degree; they do so on average after 2.1 years of graduate study, often (39%) obtaining a terminal M.S. degree. Predoctoral students who are women, U.S. racial and ethnic minorities, or non-U.S. citizens are equally likely to obtain their Ph.D. degree, and in the same time frame, as one another and as the Caucasian male American majority.

Approximately 80% of postdoctoral trainees in the neural sciences have only a Ph.D. degree. Postdoctoral trainees usually leave their position either to pursue further training or to accept a faculty position. Almost all graduates with a Ph.D. degree in Neuroscience are employed in scientific positions, and very few are employed outside the field or are not employed at all.

Women represent 47% of predoctoral trainees and 40% of postdoctoral trainees, but they are very under-represented as tenure-stream faculty members (21%), especially at the full professor level (14%). However, they constitute 43% of the nontenure-stream faculty.

U.S. racial and ethnic minorities represent almost 20% of predoctoral trainees, but less than 10% each of postdoctoral trainees and tenure-stream faculty members. Most of them are Asian-American or Hispanic-American.

Predoctoral trainees who are not U.S. citizens come predominantly from Asia and Europe. They also represent almost 20% of predoctoral trainees, as they have during the past 10 years. In contrast, their presence as postdoctoral trainees has increased progressively, and they now represent more than 50% of that population. Nonetheless, they occupy less than 5% of all tenure-stream graduate faculty positions.

Almost all predoctoral students receive stipend support, primarily from university funds (first-year students) and from research grant funds (advanced students). Research grant funds also are the major source of support for postdoctoral trainees, almost exclusively so for non-U.S. citizens.

Much less information was available from undergraduate programs in the neural sciences, but available evidence indicates that most programs are interdepartmental in administrative structure, and most tenure-stream faculty are Caucasian, American, male, full professors (95%, 99%, 75%, 60%, respectively). Although the number of tenure-stream faculty positions is relatively small (~8 per program) and has increased by only 13% during the past two years, the number of undergraduate students with majors in Neuroscience has almost doubled during that same time period (to 54 per program, on average).

9. Conclusions

Neuroscience is a very attractive discipline. Increased recognition and appreciation of Neuroscience certainly has been promoted by such recent developments as the "decade of the brain", the award of Nobel prizes to several neuroscientists, and conspicuous progress in the diagnosis and treatment of Parkinson's disease, Alzheimer's disease, and spinal injury. These and other developments have attracted a steady increase in the number of graduate students being trained in the neural sciences, and an even greater rate of increase in the number of undergraduate students who major in Neuroscience. Increased recognition and appreciation of the discipline also is reflected in the likelihood that students trained in the neural sciences will receive their degrees in Neuroscience rather than in some other discipline, as was true 15 years ago.

The finding that graduate training in the neural sciences is not confined to departments of neuroscience is in keeping with a similar trend in other biomedical sciences (e.g., Cell Biology, Pharmacology), but is in striking contrast to graduate training in the physical sciences (e.g., Chemistry, Physics). In explanation, not all schools with neuroscientists as faculty members have departments of neuroscience. Even in schools with such departments, neuroscientists may be found in many other departments, both clinical (e.g., Neurology, Psychiatry) and preclinical (e.g., Biology, Pharmacology). Neuroscientists in these other departments understandably want to interact with their colleagues elsewhere on campus, both in research programs and in graduate training programs. The resultant integration of neuroscientists across departments and across schools likely enhances the quality of those programs while making the community more collegial, more visible and attractive to students and faculty, and more influential on campus.

The integration of faculty in Schools of Medicine and Schools of Arts & Sciences into a university-wide graduate training program likely promotes their increased contribution to undergraduate education. Nonetheless, half of the undergraduate programs in Neuroscience surveyed are at institutions not affiliated with graduate training programs in Neuroscience. It is a challenge to such programs to provide opportunities for research training in Neuroscience to their undergraduate student majors.

The finding that students in the neural sciences continue to have very good credentials upon entering graduate programs suggests that the increasing size of graduate programs does not reflect a lowering of admissions standards. The remarkable heterogeneity in background of students entering graduate programs in the neural sciences suggests that prior expertise in Neuroscience is generally not a significant variable in the admission process. That heterogeneity also presents a challenge to the design of a suitable graduate curriculum of courses.

The finding that the portion of predoctoral trainees who are not U.S. citizens has remained stable during the past 15 years indicates that their presence is not responsible for the net increase in the size of graduate programs in the neural sciences. In contrast, the number of non-U.S. citizens who come to the U.S. as postdoctoral trainees has increased steadily during the past 15 years, and they now outnumber domestic postdoctoral trainees. Thus, their increased presence does appear to be responsible for the stable number of postdoctoral trainees per program.

The financial support of advanced graduate students and postdoctoral trainees has become increasingly dependent on faculty research grants. This trend is especially pronounced among trainees who are not U.S. citizens, since they are not eligible for federal fellowships or support on federal training grants. Whether the National Institutes of Health will continue to allow research grants to support so many trainees is a

controversial matter now under discussion.3,4 If NIH decides to change their policy and limit the use of research funds to support trainees, then the funds derived from fellowships and training grants likely will have to increase for the size of training and research programs in the neural sciences to remain stable.

The finding that the relatively low number of women in tenure-stream faculty positions has not changed appreciably in the past 10 years may be contrasted with their good representation as predoctoral and postdoctoral trainees, and as undergraduate Neuroscience majors. Their increasing number in nontenure-stream faculty positions provides part of the answer to the question of where the women trainees in the neural sciences find employment.

Because little more than half the graduate and undergraduate programs in the neural sciences can hire their own faculty, it seems likely that such programs have difficulty in maintaining a stable curriculum of courses and research specialties. For example, when a contributing faculty member leaves, the program has to hope (rather than determines) that someone else will be hired to maintain a core course or a collaborative research program. Indeed, when a neuroscientist leaves a department in another discipline, there is no assurance that a neuroscientist will be hired as a replacement, much less a neuroscientist with interests and expertise that best suit the training program.

The finding that undergraduate education in Neuroscience usually is not provided in a single departmental setting (unlike scientific disciplines such as Chemistry, Physics, and Biology) suggests that often the departmental community of neuroscientists on campus is relatively small, and that neuroscientists find colleagues in their discipline in other departments. One disadvantage in this arrangement is that neuroscientists may have little clout in influencing administrative decisions that affect their educational program.

The finding that tenure-stream faculty positions in undergraduate programs in the neural sciences increased less rapidly than undergraduate students with Neuroscience majors suggests that existing faculty are doing more teaching (i.e., larger classes, more classes). In addition, the finding that nontenure-stream faculty positions increased more rapidly than tenure-stream faculty positions indicates another likely way in which the new instructional responsibilities are being discharged.

The finding that most tenure-stream faculty positions in undergraduate Neuroscience programs are at the associate or full professor levels suggests that Neuroscience is not being taught primarily by faculty who received graduate and postdoctoral training in recent years.

The finding that faculty positions in the neural sciences are being filled more slowly than the rate at which Ph.D. degrees in Neuroscience are being awarded has had two striking effects on postdoctoral trainees. First, an increasing number of them are choosing professional careers in industry rather than academia. That development provides a challenge to graduate programs to prepare predoctoral and postdoctoral trainees appropriately for such nonacademic positions. Second, an increasing percentage of postdoctoral trainees, when they leave one postdoctoral position, are moving to another. One could argue that long-term postdoctoral training in an academic setting is beneficial because it allows the trainees the time and facilities with which to do research, and improve their credentials, without the intrusion of traditional faculty responsibilities such as teaching and committee work. One could also argue that increased competition for faculty positions among postdoctoral trainees is beneficial because it improves their performance and their contribution to the field. However, this survey did not solicit information about whether postdoctoral

trainees are content while they remain in such positions. With time, whatever the benefits of their positions, many of these well-trained young people no doubt become increasingly disappointed that they have less security, less respect, and less income than they had anticipated. On the other hand, it seems inappropriate to deal with this complex problem by limiting graduate training, as has been suggested,5 and thereby prevent students from ever competing for the jobs they want6, because there always have been numerous opportunities available for employment besides faculty positions, and postdoctoral trainees usually find employment in science ultimately. More generally, it also seems unwise to reduce education in science at a time when life has become increasingly more complex and science-based, and unfair to place limits on opportunities when some groups have not yet had a chance to take advantage of them.

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