The 2000/2001 ANDP Survey of Neuroscience Graduate, Postdoctoral, and 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, our students, and to the federal agencies that support our predoctoral and postdoctoral training programs.

Previous ANDP surveys of graduate and postdoctoral training in the U.S and Canada were conducted in 1986 by Michael Zigmond, in 1991 by Linda Spear, and in 1998 by Lesly Huffman, Robert Fellows, and Ronald Schoenfeld.[1,2] In 2000, we wanted to initiate a series of annual surveys that focused on the most critical issues and allowed current information about the academic discipline to be readily available. To facilitate responses, we eliminated several questions from past surveys, 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 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 to design the surveys and was responsible for compiling the obtained responses. Completed questionnaires were received from 81 graduate programs and from 24 undergraduate programs. A report based on the data from this survey, which focused on academic year 1999-2000 (AY2000), was posted on the ANDP web page in spring 2001.[3]

In winter 2002, a second survey was conducted, almost identical to the first, which focused on AY2001. This time, completed questionnaires were received from 63 graduate programs and from 23 undergraduate programs. Because the total response was smaller and overlapped considerably with the responses from the previous year,[4] we believed that it would be more useful to add the new data to the pool of responses from the previous year than to present it alone. Thus, the data from the 41 programs responding only to the 2000 survey were added to the data from all 63 programs responding to the 2001 survey (40 of which had responded to both) to create a merged file of information spanning two consecutive years.[5] Thus, the present report is based on the responses of 104 separate programs. This report is essentially an updated version of the report based on the 2000 survey, modified as necessary by the enlarged data base now available. Although it contains more responses than the earlier report (indeed, it is a larger pool of such information than in any previous survey), it is still a survey

rather than a census, representing ~65% of the program membership of the ANDP. Thus, its value is not in the absolute numbers it provides but in its relative numbers and trends in comparison to the results of previous surveys.

Complete lists of the 104 graduate programs that participated in one or both surveys are given below. A broad cross-section of Neuroscience departments and programs were represented. That is, responses were obtained from older programs and relatively new programs, from programs with many students and programs with relatively few students, and from programs located in medical colleges and programs located in colleges of arts and sciences (or both, or neither). Almost all of the programs were located in the United States, in 37 states plus the District of Columbia, but responses also were obtained from programs in four Canadian provinces. The 31 institutions with undergraduate programs in the neural sciences were similarly diverse; they were located in 15 states and 2 Canadian provinces. The results reported below represent the full responses from these programs but for the responses from the Canadian institutions to questions regarding faculty citizenship and U.S. racial and ethnic minority groups, which were excluded.

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, the results based on the 2000 and 2001 surveys were compared with those obtained from the ANDP surveys in 1986, 1991, and 1998. The seventh category summarizes the responses regarding undergraduate training. The final two categories provide a summary of the major findings of the 2000 and 2001 surveys and the conclusions drawn. A specific index of these nine categories is as follows:

Results

[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.

[3]Stricker, E.M. The 2000 ANDP survey of neuroscience graduate, postdoctoral, & undergraduate programs.

[4]The feedback we received in response to the 2001 survey provided two general insights independent of the specific data. First, it is not easy to obtain this sort of information annually. Second, the winter is

not an optimal time of the academic year for conducting a survey. Consequently, future surveys will be conducted every other year or so, in the late summer or early fall. The next one is scheduled for fall 2003.

[5]The expert advice and technical assistance of Dr. Michael W. Bridges of the UCSUR is gratefully acknowledged.

Participating Institutions

Graduate and Postdoctoral Programs (n = 104)

Note that some institutions have multiple Neuroscience training programs (the number of which is indicated in parentheses), which responded separately to the surveys. Symbols indicate the 41 programs that participated only in the 2000 survey (+) and the 23 programs that participated only in the 2001 survey (*). The 40 other programs participated in both surveys.

State	Institution
AL	Auburn University +
AL	University of Alabama, Birmingham
AR	University of Arkansas *
AZ	University of Arizona
CA	Scripps Research Institute +
CA	University of California, Berkeley (2)
CA	University of California, Los Angeles (2) +
CA	University of California, San Diego (2) +
CO	Colorado State University +
CO	University of Colorado Health Science Center +
CT	University of Connecticut
CT	Wesleyan University
DC	Georgetown University *
DC	George Washington University
DE	University of Delaware +
FL	Florida Atlantic University
FL	University of Florida (2)
FL	University of South Florida +
GA	Georgia State University *
IA	Iowa State University
IA	University of Iowa (2) +
IL	Loyola University, Chicago *
IL	Northwestern University
IL	Southern Illinois Univ. School of Medicine +
IL	University of Chicago *
IL	University of Illinois College of Medicine +
IN	Indiana University +
LA	Tulane University +
MA	Amherst College +
MA	Boston University (3) + +
MA	Brandeis University
MA	Harvard University Medical School +
MA	Massachusetts Institute of Technology *

MA	Tufts University School of Medicine
MA	University of Massachusetts +
MD	Johns Hopkins University
MD	Uniformed Services Univ. of Health Sciences +
MD	University of Maryland +
MD	University of Maryland, Baltimore (2) + *
MI	Michigan State University
MN	University of Minnesota +
MO	Saint Louis University +
MT	Montana State University *
NC	Duke University
NC	University of North Carolina
NC	Wake Forest University (2) * *
NJ	UMDNJ – Robert Wood Johnson Medical School *
NJ	Rutgers University +
NM	University of New Mexico +
NY	Albany Medical College +
NY	Albert Einstein College of Medicine +
NY	Columbia University College of Physicians and Surgeons
NY	Cornell University
NY	Cornell University Medical College
NY	CUNY, Hunter College *
NY	Mt. Sinai School of Medicine +
NY	New York University +
NY	SUNY, Binghamton *
NY	SUNY Downstate Medical College +
NY	SUNY, Stony Brook (2) +
NY	SUNY Upstate Medical College
NY	University of Rochester *
OH	Case Western Reserve University *
OH	Medical College of Ohio
OH	Northeastern Ohio University *
OK	University of Oklahoma *
OR	Oregon Health Sciences University
PA	Lehigh University +
PA	Temple University +
PA	University of Pennsylvania +
PA	University of Pittsburgh
RI	Brown University *
SC	Medical University of South Carolina *
SD	University of South Dakota +
TX	Baylor College of Medicine
TX	University of Houston - College of Optometry +

TX University of Texas Health Science Center, San Antonio (2) + *
TX University of Texas Health Science Center, Houston
TX University of Texas Medical Branch, Galveston
TX University of Texas, Austin
TX University of Texas, Dallas +
UT University of Utah
VA University of Virginia
VT University of Vermont
WA University of Washington
WA Washington State University
WI University of Wisconsin, Madison
WI University of Wisconsin, Milwaukee +
WY University of Wyoming *

CANADA
AL University of Alberta +
NS Dalhousie University *
ON University of Toronto
QU McGill University +

Undergraduate Programs (n = 31)

Symbols indicate the 8 programs that participated only in the 2000 survey (+) and the 7 programs that participated only in the 2001 survey (*). The 16 other programs participated in both surveys.

State Institution

CA Pomona College
CA Westmount College
CT Amherst College *
CT Fairfield University +
CT Wesleyan University
FL University of Miami
GA Emory University
GA Georgia College and State University
GA Wesleyan College *
IL Loyola University, Chicago +
LA Tulane University *
MA Brandeis University *
MA Massachusetts Institute of Technology *
MD Washington College
MN University of Minnesota
NC Davidson College +
NC East Carolina University *

NY Hamilton College
NY Ithaca College
NY University of Rochester
OH Baldwin-Wallace College
OH Bowling Green State University *
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, followed closely by programs located in Schools of Arts and Sciences. Relatively few programs were campus-wide or involved multiple schools at the university. In the 2000 and 2001 surveys, in contrast, the percentage of such broadly based programs had increased considerably, and now is comparable to that of programs located only in Schools of Medicine or Schools of Arts and Sciences.

Survey Year	91	98	00/01
	Percent of Total		
School of Medicine	38	43	33
Arts & Sciences	30	30	29
Multiple Schools	17	21	34
Other	15	7	4

Table 1b - Administrative Structure and Degree Granted

The administrative structure of graduate programs in the neural sciences is quite varied. Only 24% 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, 63% of the programs link neuroscientists in multiple departments (or in a “Division” or “Institute” of Neuroscience) in a unified, degree-granting program, and only 13% are in departments that do not have Neuroscience or Neurobiology in their names. [Not asked in previous ANDP surveys.]

One of the implications of this administrative structure is that, unlike departments, only 60% of graduate training programs in the neural sciences hire their own faculty. [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 in Neurobiology (or in a discipline 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 the neural sciences that do not offer a Ph.D. degree.)

Survey Year	86	91	98	00/01
	Percent of Total			

Ph.D. in Neuroscience	24	28	66	63
Ph.D. in another discipline	74	54	30	33
Other	2	18	4	4

Table 1c - Undergraduate Activities

Graduate programs in the neural sciences now play a very substantial role in the education of undergraduate students. Although only 26% of the graduate programs additionally administer an undergraduate program in Neuroscience, faculty in most of the graduate programs teach undergraduate courses (69%) and provide opportunities for undergraduate students to be involved in research projects (91%). These important contributions are much greater than those reported 10 years ago.

Survey Year	**86**	**91**	**98**	**00/01**
	Percent of Total			
Formal Program	-	23	24	26
Teaching	9	48	39	69
Research	-	68	62	91

2. Faculty

There are 3228 faculty members in the 89 graduate training programs in the neural sciences that responded to these questions in the 2000 and 2001 surveys, which compute to ~36 faculty members per program. Eight-seven percent of them have tenure-stream positions; that is, ~31 faculty members per program have tenure-stream positions whereas ~5 have nontenure-stream positions. These numbers are similar to those observed in the 1998 survey.

There was considerable stability in the training faculty. In AY2000 and AY2001, only 2% of the tenure-stream faculty left their positions, and only 9% arrived as new appointments. A similarly low turnover was observed in the two previous years. The turnover of nontenure-stream faculty was comparable (5% leaving, 8% arriving, in AY2000 and AY2001, somewhat less than in previous years). [Not asked in previous ANDP surveys.]

Table 2a - Number of Faculty per Program

The number of tenure-stream faculty per graduate program varies widely, from less than 10 to more than 100 per program. However, 62% of the programs have 30 or fewer faculty members.

Number	

0-10	20%
11-20	24%
21-30	18%
31-40	9%
41-50	8%
51-60	7%
61-70	6%
70-90	4%
>90	4%

Table 2b - Distribution of Faculty by Academic Rank

The distribution of tenure-stream faculty across the three ranks resembles that reported in 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**	**00/01**
	Percent of Total			
Assistant Professor	23	26	24	23
Associate Professor	28	28	25	26
Full Professor	49	46	51	51

The great majority of faculty members who have tenure-stream positions at U.S. institutions are U.S. citizens (95%). These numbers are similar to those seen in the 1991 and 1998 surveys (93%, 97%, respectively). Similarly, most faculty holding
nontenure-stream positions at U.S. institutions are U.S. citizens (91%).

The distribution by academic rank of faculty members who are not U.S. citizens is quite different from that of U.S. citizens: 62% assistant professors, 22% associate professors, and 16% full professors. Most of these tenure-stream faculty members are Europeans (36%), Asians (22%), Canadians (20%), and Latin Americans (13%).

[Not asked in previous surveys.]

Table 2c - Percentage of Women by Academic Rank

Fifteen years ago women represented only 15% of all tenure-stream faculty members in the neural sciences. In the 2000 and 2001 surveys, this number had increased by similar amounts at each level of appointment, but collectively it still was only 23% of the total. The percentage of women faculty members at the assistant and associate professor levels, which rose to 30% each, remained higher than the percentage of women faculty members at the full professor level, which was only 17%. Note that the women were distributed in roughly equal numbers across the three academic ranks (30% assistant professor, 33% associate professor, 37% full professor), unlike men (21%, 24%, 55%, respectively).

Survey Year	86	91	98	00/01
	Percent of Total			
Assistant Professor	23	27	32	30
Associate Professor	20	22	27	30
Full Professor	9	13	19	17

In contrast, women represented 38% of nontenure-stream faculty members in AY2000 and AY2001. 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 number of applications to graduate training programs in the neural sciences continues to increase, and in the 2000 and 2001 surveys it was almost three times the number per program than it was in the 1986 survey. Offers of admission doubled during the same time period, as did the number of students matriculating per program, which were 8.6 per program in AY2000 and AY2001. Much of this increase appears to have come in the past few years.

Women represent 38% of the applicants, 44% of the students admitted, and 47% of those who began graduate training in the neural sciences in AY2000 or AY2001. Students who are not U.S. citizens represent 42% of the applicants, but only 19% of the students admitted and 23% of those who began graduate training. Although students who are members of U.S. racial and ethnic minorities represent only 5% of the applicants, they were 9%

of the students admitted and 12% of those who began graduate training. (Similar information about predoctoral trainees who graduate is presented below.)

Survey Year	86	91	98	00/01
	Mean per program			
Number of students applied	24	42	61	66
Number of students admitted	6	10	12	14
Number of students entered	4	5	5	9

Table 3b - Academic Credentials of Entering Students

The academic credentials of students entering graduate programs in the neural sciences are similar to those of students characterized in previous surveys. Mean GRE scores in the quantitative and analytical sections of the exam have increased slightly over the years, whereas scores on the verbal section have decreased. The scores in the 2000 and 2001 surveys place incoming graduate students in approximately the 78th, 80th, and 77th percentiles, respectively, of all students who took the GRE exams. Eighty percent of the students had research experience before they began graduate training, as in previous years.

Survey Year	86	91	98	00/01
	Average GRE Scores			
Quantitative	624	630	658	689
Analytical	624	635	650	670
Verbal	590	600	577	567

The incoming graduate students have an average GPA in their college courses of 3.44 (i.e., between B+ and A-), as was seen in the previous surveys. Only 17% of the incoming students had an undergraduate major in Neuroscience, Behavioral Neuroscience, or Psychobiology. [Not asked in previous ANDP surveys.] Other common undergraduate majors were Biology (29%), Psychology (13%), and Chemistry (9%), and an additional 9% had dual majors including one or more of these disciplines.

Table 3c - Total Predoctoral Students, and Ph.D. Degrees Awarded, per Program

The number of graduate students per program varies widely, from less than 10 to more than 80 per program; however, 88% of the programs have 40 or fewer students. The number of faculty in a program, shown earlier in Table 2a, is shown again for purposes of comparison. Note that the first row in this table indicates that 20% of the programs have 0-10 faculty, while 17% of the programs have 0-10 students. The number of graduate students in a program is closely correlated with the number of

tenure-stream faculty members in that program ($r = 0.49$, $P < 0.001$).

Number	Faculty	Students
0-10	20%	17%
11-20	24%	27%
21-30	18%	28%
31-40	9%	16%
41-50	8%	4%
51-60	7%	1%
61-70	6%	2%
71-80	4%	2%
81-90	2%	2%
>90	2%	0%

The mean number of graduate students per program has increased steadily since 1986, and is now 25. This increase undoubtedly reflects the increase in admission of new students that has occurred during the past 15 years, as well as the parallel increase in time required for them to obtain a Ph.D. degree (Table 3d, below).

Women represented 47% of this population of graduate students in AY2000 and AY2001. Students who are not U.S. citizens represented 20% of predoctoral trainees in U.S. institutions, a number similar to that observed in the 1991 and 1998 surveys. Among that population, the largest numbers were from Asia (65%) 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 the 1986 surveys to 3.6 per program in the 2000 and 2001 surveys. This difference can be attributed in part to the students who left the graduate program without obtaining a Ph.D. degree, and in part to an increase in time to Ph.D. degree (Table 3d, below). Among the graduates, 41% were women, 24% were non-U.S. citizens, and 17% were members of U.S. racial and ethnic minorities, numbers similar to their representation in the total population of predoctoral trainees.

Survey Year	86	91	98	00/01
	Average per Program			
Total predoctoral trainees	12	16	20	25
Non-U.S. citizens (%)	---	20	19	20

Ph.D. degree awarded	2.6	2.8	3.2	3.6
Ph.D. degree not awarded	---	---	---	1.3

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. For students graduating in AY2000 or AY2001, it took 5.5 years on average to complete training, with 89% of the students doing so between 4 and 7 years. These numbers were virtually identical for U.S. and non-U.S. citizens.

Only 6% of predoctoral trainees left their graduate programs without obtaining a Ph.D. degree, ~1.5 per program each year. Among them, the numbers of women (51%), U.S. racial and ethnic minorities (21%), and non-U.S. citizens (22%) were similar to their representations in the total population of predoctoral trainees. Students who left did so after 2.5 years of training, on average (91% within 4 years). Many students (42%) left with a M.S. degree. A surprisingly high number of the domestic students (24%, but only 13% 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. [Not asked in previous surveys.]

Survey Year	**86**	**91**	**98**	**00/01**
	Average Years			
Ph.D. awarded	4.3	5.2	5.5	5.5
Ph.D. not awarded	---	---	2.2	2.5

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

Upon receiving their Ph.D. degree, most graduates pursued further research training and accepted postdoctoral positions (62%), as was observed in the previous two surveys. Many went to medical school or began a medical internship or residency (11%). As in previous years, few graduates were employed outside of Neuroscience (2%) or were not yet employed (2%).

Survey Year	**91**	**98**	**00/01**
	Percent of Total		
Postdoctoral position	60	70	62
Medical School	13	15	11

Faculty position	6	5	7
Industry	12	1	8
Other	6	5	8
Employed outside the field	2	3	2
Currently unemployed	1	1	2

4. Postdoctoral Training

Table 4a - Profile of Postdoctoral Trainees

The number of postdoctoral trainees per program in the 2000 and 2001 surveys (7) is slightly below the numbers (8-12) seen in the previous surveys. Most of the trainees (83%) have only a Ph.D. degree, as has been observed since 1986.

Survey Year	**86**	**91**	**98**	**00/01**
	Percent of Total			
Ph.D.	78	63	88	83
M.D.	18	25	5	9
M.D./Ph.D.	4	12	6	6
Other	0	0	1	2

Sixty percent of the postdoctoral trainees were not U.S. citizens, three-times their representation as predoctoral trainees in AY2000 and AY2001 and progressively more than were observed in the 1991 and 1998 surveys (40%, 49%, respectively). Among that population, the largest portions were from Asia (44%) and Europe (38%). Women constituted 36% of the foreign postdoctoral trainees, 43% of the domestic trainees, and 39% of the overall population.

Table 4b - Placement from Postdoctoral Position

When postdoctoral trainees leave, they typically either take a faculty position (41%) or pursue additional training in another postdoctoral position (34%). This general outcome also was seen in the previous surveys, but there has been a progressive increase in the numbers who take another postdoctoral position. As in previous years, very few postdoctoral trainees leave to take employment outside of Neuroscience or are not employed. This pattern of placements was similar for U.S. citizens and non-US citizens.

Survey Year	**91**	**98**	**00/01**
	Percent of Total		

Another postdoctoral position	21	30	34
Medical School	3	1	6
Faculty position	45	28	41
Industry	14	4	5
Other	14	29	9
Employed outside the field	2	1	3
Currently unemployed	1	6	1

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. Although a comparable increase in their representation among postdoctoral trainees does not appear to have occurred, it should be noted that the figures on the left side of Table 5a are confounded by the substantial increase that has occurred during the past decade in the number of postdoctoral trainees at U.S. institutions who are not U.S. citizens. When the figures are expressed as a percentage of only the postdoctoral trainees who are U.S. citizens (right side of the table), it becomes clear that the training of members of U.S. racial and ethnic minorities actually have followed similar trends at the pre- and post-doctoral levels.[6] On the other hand, while minority representation in tenure-stream faculty positions also appears to have increased gradually over the years, it still remains quite low. As was true of women faculty members, it is distributed in roughly equal numbers across the three academic ranks (36% assistant professor, 27% associate professor, 37% full professor). However, unlike women, minority representation in nontenure-stream positions is even lower than in tenure-stream positions (6% of all such positions, 6% of U.S. citizens).

Survey Year	**86**	**91**	**98**	**00/01**		**91**	**98**	**00/01**
	Percent of Total					**Percent of Total U.S.**		
Predoctoral	10	9	18	18		11	22	23
Postdoctoral	22	6	11	6		10	21	16
Tenure-stream Faculty	5	6	7	8		6	7	8

[6]Note that the representation of U.S. racial and ethnic minorities was 11% of all postdoctoral trainees in 1998, not 21% (as was indicated erroneously in the 1998 survey report and repeated in the 2000 survey report). The higher figure actually was the minority representation among postdoctoral trainees who were U.S. citizens.

Table 5b - Minority Distribution

Among the U.S. racial and ethnic minority population, Asian-Americans represent the largest group of predoctoral and postdoctoral trainees, and tenure-stream faculty, in the neural sciences. Hispanic-Americans are less numerous in all three categories, while African-Americans are even fewer in number, and Native Americans are still fewer.

Survey Years	91	98	00/01		91	98	00/01		91	98	00/01
	Percent of Total Minority										
	Predoc				Postdoc				Faculty		
Asian Amer.	38	42	41		53	50	69		64	61	57
Hispanic Amer.	32	25	30		25	10	19		22	20	24
African Amer.	22	20	17		12	32	12		11	7	9
Native Amer.	0	8	2		0	4	0		0	5	1
Other	8	5	10		10	4	0		3	7	9

The U.S. federal government places special emphasis on African-Americans, Hispanic-Americans, Native Americans, and Pacific Islanders when funding trainees from under-represented U.S. racial and ethnic minorities. Thus, it should be noted that excluding Asian-Americans from that group in the 2000/2001 surveys reduces the representation of U.S. racial and ethnic minorities to 14% of predoctoral trainees who were U.S. citizens (11% of all predoctoral trainees) and only 5% of postdoctoral trainees who were U.S. citizens (2% of all postdoctoral trainees).

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, on average, 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	00/01
	Percent of Total			
Teaching assistantship	34	29	29	27

Other university funds	30	38	41	39
Training grants	9	10	10	15
Research grants	16	14	9	14
Fellowships	10	8	11	5

Table 6b - Stipend Sources - Advanced Graduate Students

Predoctoral trainees advanced beyond their first year, collectively, receive only 34% of their support from the university. This amount has steadily decreased since the 1986 survey. To compensate for this change, research grants have provided progressively increasing support of these advanced graduate students; indeed, in the 2000 and 2001 surveys this source was twice as large as any other contribution to the pool of funds.

Survey Year	**86**	**91**	**98**	**00/01**
	Percent of Total			
Teaching assistantship	31	27	29	22
Other university funds	21	21	12	12
Training grants	12	9	6	12
Research grants	24	33	37	43
Fellowships	13	10	6	11

Table 6c - Stipend Sources - Postdoctoral Trainees

Research grants have been the major source of support for postdoctoral trainees during the past 15 years. Previous surveys considered the support of all postdoctoral trainees collectively, whereas the 2000 and 2001 surveys considered U.S. and non-U.S. citizens 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. Training grants and fellowships, once the source of 52% of the total support, now provide only 21% 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**	**00/01 (U.S.)**	**00/01 (Non-U.S.)**
	Percent of Total				
University funds	8	12	9	4	4
Training grants	22	16	12	11	1

Research grants	38	50	65	74	90
Fellowships	30	22	12	10	5

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 31 programs that participated in the 2000 and 2001 surveys. 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 two surveys. 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 surveys.

i. Institutional Affiliation. Nineteen (61%) of the 31 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. Twenty-three (74%) of the 31 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. Thirteen (42%) of the 31 programs did not hire faculty for their program, whereas 18 did. The latter response (58%) is comparable to that in graduate training programs (60%).

iv. Faculty Appointments. The average number of faculty members with tenure-stream positions in AY2000 and AY2001 was 11 per program. That number has changed little during the previous few years, and there was 5-10% turnover of positions (i.e., faculty leaving and arriving as a percent of the total number of faculty affiliated with a program). Only 1-2 faculty positions were outside the tenure-stream during this time period, and the turnover of faculty with such positions was much higher (30-50%) than those of faculty with tenure-stream positions, as might be expected.

v. Faculty. In AY2000 and AY2001, the distribution of faculty with tenure-stream positions according to academic rank was 27% assistant professors, 22% associate professors, and 51% full professors. Women occupied 29%, 31%, and 17% of these positions, respectively, for a total of 24% of all tenure-stream positions. They also held 39% of the nontenure-stream faculty positions. All of these numbers are similar to those of faculty in graduate programs in the neural sciences.

Among faculty with tenure-stream positions, 9% were members of U.S. racial and ethnic minorities, and

fewer than 2% were not U.S. citizens. Among faculty with nontenure-stream positions, 18% were members of U.S. racial and ethnic minorities, and 16% 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 AY1998 to AY1999, and by 88% from AY1998 to AY2000 and AY2001. On average, there were now 55 Neuroscience majors per program, although the number per program varied widely (range = 3 to 308), and half of the programs still had 22 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 four years (48-52% each). These numbers are consistent with a similar representation of males and females among predoctoral trainees.

8. Summary

Graduate training programs in the neural sciences used to be located predominantly in Schools of Medicine or in Schools of Arts & Sciences. However, the recent trend has been to link neuroscientists in multiple schools and in university-wide programs that span both Schools of Medicine and Schools of Arts & Sciences.

Although 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 or Neurobiology 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 ~36 faculty members 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 less than 10%. Approximately half of the tenure-stream faculty members are full professors while one-fourth are assistant professors and one-fourth are associate professors.

The annual number of applications for graduate training in the neural sciences has almost tripled during the past 15 years, and is now ~66 per program, while the number of matriculants has doubled and is now ~9 students per program. Nonetheless, the academic quality of incoming graduate students has remained high, as suggested by their undergraduate GPA (average = 3.44), their scores on the GRE (average = ~78th percentile), and their research experience.

Only 17% of the incoming students had an undergraduate major in Neuroscience or Behavioral Neuroscience. Other common majors were Biology (29%), Psychology (13%), and Chemistry (9%),

and an additional 9% had dual majors including one or more of these disciplines. This heterogeneity in background suggests that extensive expertise in Neuroscience is generally not a significant variable when applicants are considered for admission to graduate training programs.

The number of Ph.D. degrees in Neuroscience awarded annually per program has increased little in recent years and is now 3.6, while the time to degree has stabilized at ~5.5 years. 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. Most new graduates pursue further research training in postdoctoral positions (62%), while many go to medical school (11%).

Fewer than 10% of predoctoral trainees leave the program without obtaining a Ph.D. degree. They do so on average after 2.5 years of graduate study, often (42%) obtaining a terminal M.S. degree.

Almost 90% of postdoctoral trainees in the neural sciences have a Ph.D. degree. Postdoctoral trainees usually leave their position either to accept a faculty appointment or to pursue further training. 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 52% of undergraduate Neuroscience majors, 47% of predoctoral trainees, and 39% of postdoctoral trainees, but only 23% of tenure-stream faculty members in graduate programs and 17% of full professors. Their significant presence in nontenure-stream faculty positions provides part of the answer to the question of where the women trainees in the neural sciences find employment.

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

Predoctoral trainees who are not U.S. citizens come predominantly from Asia and Europe. They represent 20% of predoctoral trainees, as they have during the past 15 years, which indicates that their presence is not responsible for the net increase in the size of graduate programs in the neural sciences.

The number of postdoctoral trainees who are not U.S. citizens has increased progressively, and they now represent 60% of that population. Nonetheless, they occupy only 5% of all tenure-stream graduate faculty positions in the neural sciences at U.S. institutions.

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 (91%, 98%, 76%, 51%,

respectively). Although the number of tenure-stream faculty positions is relatively small (~11 per program) and has increased by only 1-2 per program during the past three years, the number of undergraduate students with majors in Neuroscience has almost doubled during that same time period (to 55 per program, on average).

9. Conclusions

Neuroscience is a very attractive discipline. It is an unusually multidisciplinary in nature, and has drawn significantly from fields as diverse as molecular biology, cognitive psychology, computer science, and clinical medicine. 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 or Neurobiology 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 undoubtedly 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. In addition, it makes it more likely that faculty appointed in graduate and professional programs will participate in undergraduate education.

Despite these clear indications that Neuroscience is a thriving discipline, its research and training programs face several significant challenges. Some are not unique to Neuroscience. For example, despite modest increases during the past 15 years, women and members of U.S. racial and ethnic minorities still are very under-represented as tenure-stream faculty members, especially at the full professor level, in comparison to the diversity of predoctoral trainees. Other issues may be more specific to training in the neural sciences at the undergraduate, predoctoral, and/or postdoctoral levels. Here are some that were addressed in this survey.

Undergraduate. 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. This situation likely provides a challenge for faculty to provide contemporary research experiences to their students, especially in undergraduate programs located at institutions that do not have graduate programs in Neuroscience and do not expect their faculty to have active research programs.

Predoctoral. The remarkable heterogeneity in background of students entering graduate programs in the neural sciences presents a challenge to design a suitable curriculum of courses. Moreover, because little more than half the graduate 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 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. This situation likely occurs in many undergraduate programs, as well.

Postdoctoral. 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. The financial support of postdoctoral trainees (and advanced graduate students) has become increasingly dependent on faculty research grants, especially trainees who are not U.S. citizens and therefore 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.[7,8] If the NIH decides to change their policy and limit the use of research funds to support trainees, then alternative funds will have to increase or else the size of training and research programs in the neural sciences will diminish.

Finally, a problem that cuts across all levels of training results from the finding that faculty positions in the neural sciences are increasing more slowly than the rate at which Ph.D. degrees in Neuroscience are being awarded. Perhaps in consequence, an increasing percentage of trainees are moving from one postdoctoral position to another rather than taking a job in industry or elsewhere outside of academia. It has been a challenge to training programs located in academia to prepare postdoctoral trainees (and predoctoral trainees) appropriately for professional careers in nonacademic positions. It has been an even bigger challenge to develop a sound national policy regarding how many predoctoral and postdoctoral trainees there should be. One suggestion has been to limit graduate training and thereby reduce the number of postdoctoral trainees seeking employment in academia.[9] However, the ANDP leadership has opposed that view, pointing out that there always have been numerous opportunities available for employment besides faculty positions, and postdoctoral trainees usually find employment in science ultimately.[10] More generally, it seems inappropriate to prevent students from competing for the jobs they want, it seems unwise to reduce education in science at a time when life has become increasingly more complex and science-based, and it seems unfair to place limits on opportunities when some groups have not yet had a chance to take advantage of them.

[7]Addressing the nation's changing needs for biomedical and behavioral scientists. Washington, D.C.: National Academy Press, 2000. [http://grants.nih.gov/training/outcomes.htm.]

[8]NIH statement in response to addressing the nation's changing needs for biomedical and behavioral scientists. [http://grants.nih.gov/training/nas_report/NIHResponse.htm]

[9]Trends in the Early Careers of Life Scientists. National Research Council, National Academy Press, 1998. [http://www.nap.edu/catalog/6244.html?onpi_newsdoc091098]

[10]Mize, R.R., Talamo, B.R., Schoenfeld, R.I., Huffman, L.K., and Fellows, R.E. Neuroscience training at the turn of the century: a summary report of the third annual ANDP survey. Nature neuroscience 3: 433-435, 2000.