

Hiring Patterns Experienced by Students Enrolled in Bioinformatics/Computational Biology Programs

Report
to the
Alfred P. Sloan Foundation

May 1999

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I. Introduction

This report presents findings from a survey of recent hiring patterns for students enrolled in bioinformatics/computational biology training programs in the United States. Beginning in late March 1999, a survey was sent to 21 academic institutions that have either a formal or informal program in bioinformatics/computational biology at the undergraduate, graduate, or postdoctorate level. A list of the twenty-one institutions targeted for the survey is attached in Appendix A. Eight institutions filled out the questionnaire, and an additional five institutions and a joint program provided some information. Information concerning one additional program was obtained from the institution's web page. In total, information has been collected for sixteen institutions (76 percent of the targeted institutions). One other institution agreed to respond to the questionnaire but has yet to provide information.

The first wave of the survey targeted institutions with a formal training program established by 1996. The second and third waves included institutions with formal programs established after 1996 and institutions with informal training programs operating at any period. The survey questionnaire was distributed as a pdf document via e-mail. To increase the response rate, follow-up contact by e-mail and/or telephone was made. Appendix B includes a copy of the survey instrument and accompanying cover letter.

II. Training Programs

A summary of the programs offered by the responding institutions is given in Table 1. Twelve of the institutions provide or have plans to provide by Fall 1999 training as part of a formal degree program.¹ Four other institutions offer no formal program but provide some training to students interested in bioinformatics/computational biology at various degree levels depending upon the institution. Nine of the twelve formal programs offer the Ph.D.; six offer a post doc program. Seven of the formal programs offer a masters degree, and five of the programs offer a bachelors degree. Three of the six masters programs will be offered in the fall of 1999 for the first time.

Funding sources for the formal programs providing information are outlined in Table 2. For purposes of clarity, the W.M. Keck Center institutions are grouped together, although separate information is presented for a Baylor College of Medicine Ph.D. program which provided detailed information concerning students enrolled in its

¹In the case of Rice University and the University of Houston the degree is offered in conjunction with the W.M. Keck Center for Computational Biology.

own specific Ph.D. program. With but one exception, every program has received funding, either internally and/or externally. External sources of funds are least prevalent for undergraduate and masters programs. They are most prevalent for Ph.D. and post doc programs. Eight of the nine Ph.D. programs have received support; all of the formal post doc programs receive support.² Table 3 lists the sources of external funds cited for the institutions reporting external support. Out of the nine institutions reporting external funding, six name the National Science Foundation (NSF) as a source. Four institutions report receiving support from the National Institutes of Health (NIH); one additional institution reports support from the NIH affiliate, the National Library of Medicine (NLM).³ Only one institution reports industrial sponsorship of training programs.

III. Enrollment

Table 2 also summarizes student enrollment in training programs by degree level as of March 1999. Doctorate programs dominate enrollment in terms of the number of training programs and the number of students (86). The largest program is at Stanford, followed by Rutgers, the W. M. Keck Center program and Baylor College of Medicine. The smallest enrollment is at the bachelors level, with the University of Pennsylvania having by far the largest program. There are currently 35 students enrolled in the various masters programs and approximately 25 in formal post doc programs. Enrollment in masters programs should more than double by the fall of 1999 when new programs at George Mason University, the Georgia Institute of Technology, and Boston University come on line.

IV. Hiring Patterns

Placement

Table 2 explores by degree level the placement of program graduates during the period January 1998 to March 1999.⁴ Of the eight institutions/programs reporting students taking jobs over this period, all but one indicate

²Counting two Keck institutions (Rice University and University of Houston), which do not have a distinct Ph.D. program, as two.

³Two institutions report both NIH and NLM support.

⁴The W.M. Keck Center placements are for a slightly earlier period starting in 1997, and the UC-Santa Cruz doctorate and postdoctorate placements are for a broader period, from approximately 1995 to May 1999.

that students completed their degrees prior to employment at these new jobs.⁵ The institution reporting early exit of students noted that only “two or three students have left before finishing in the past two to three years.” This suggests that earlier media reports that students are commonly recruited before completing programs do not hold for most trainees in the field.⁶ Fifty-three jobs in total were acquired by graduating students/post docs. Of these, around 43 percent were for masters students. Doctoral students accounted for about one fourth; post docs just over another fourth. Only three individuals with B.A.s in the field were reported to have taken jobs.

Nine students who graduated during the period 1998 to March 1999 chose to continue their education and training.⁷ Five of these went to a post doc position either from a Ph.D. program or from a previous post doc appointment. Three moved on to graduate programs, and one went to medical school.

Specific placement information was ascertained for at least 42 of the 53 hires. Among these 42 placements, there is little overlap across programs. Only two institutions placed graduates at common entities. A list of companies and institutions identified as hiring students enrolled in training programs is given in Table 4. Seven of the fifty-three placements are at an academic institution, and only one position is at a government-sponsored institution (German Cancer Center). The remaining identified placements are in the private sector. Three (Stanford) Ph.D. graduates acquired venture capital and jointly established their own start-up firm; another student from the W. M. Keck Center established a start-up.

The majority of recent hires are at biotechnology or pharmaceutical related firms and, for the most part, placements are evenly dispersed across hiring institutions at the undergraduate and doctorate levels. This is not the case at the masters and postdoctorate levels. Over half the masters-level hires are concentrated among three firms: Astra Pharmaceuticals, Genetics Institute, and Motorola. Four of the fourteen hires at the postdoctorate trainees level took place at a single company, SmithKline Beecham.

Salaries

Some indication of salaries for recently hired graduates was provided by most of the institutions. Four of the

⁵Two institutions did not report whether students completed degrees before accepting positions.

⁶See Jocelyn Kaiser, “Hopkins Genetic Database to Close,” *Science*, vol. 279, January 30, 1998, p. 645.

⁷Once again the Keck and UC-Santa Cruz placements are for slightly different periods.

institutions with student hires, however, reported that salary data are unknown for at least a portion of their graduates. Table 5 outlines the frequency of reported salary ranges by program level for the period of January 1998 to March 1999. Salary ranges are reported for 34 (71 percent) of 48 hires during this period.⁸ The greatest lack of information on salaries is at the postdoctorate (56 percent) and doctorate (38 percent) levels. At the masters level, on the other hand, programs report only 17 percent of hires as having unknown salary information.

As expected, salaries for the most part climb as the level of training rises, starting in the \$40,000-\$50,000 range for BAs and reaching over \$100,000 for one post doc. But there are exceptions. For example, two of the three undergraduates who were placed received salaries between \$50,000 to \$60,000. This is higher than that earned by seven of the masters students, although ten of the nineteen masters students for whom we have salary information earn more than \$60,000. One masters student received a starting salary of over \$100,000. Reported salaries for five hires at the doctorate level are over \$70,000. One is between \$80,000 to \$90,000; another is over \$100,000; yet another is between \$60,000 to \$70,000. Three post docs received placements with a salary between \$80,000 to \$90,000. One post doc was placed at a salary of over \$100,000. One institution reported that one or more masters student(s) received a signing bonus.

Job Search

Six institutions provided some information concerning methods used to place students in jobs. Consistently institutions reported that they relied on ads. The next most frequently reported method was faculty contacts, initiated either by a faculty member or by companies, recruiters or headhunters. Networking by faculty with alumni was also reported as a way of placing students.

V. Conclusion

In previous research we examined position advertisement in *Science* to study demand in the field of computational biology/bioinformatics.⁹ In 1996, 209 positions were advertised; in 1997 this had increased by 96

⁸No salary information is provided for the placements of 1997 trainees listed in the W. M. Keck Center's 1997 *Annual Report*. The 48 excludes these Keck placements.

⁹Stephan and Black, "Bioinformatics: Does the U.S. System Lead to Missed Opportunities in Emerging Fields? A Case Study," November 1998. An earlier version of this paper was prepared and presented at a workshop on the Role of Human Capital in Capitalizing on Research, National Research Council's Committee on Science, Engineering, and Public Policy, The Beckman Center, January 20-21, 1998, Irvine, California. *Science* and *Nature* are the two scientific

percent to 354. These counts include two special advertising supplements focused on biotechnology, one in June of 1996, the other in July of 1997. Both supplements were dominated by ads from SmithKline.¹⁰

Table 6 organizes the information in terms of type of entity placing the ad, rather than the number of position announcements. Three categories are listed: firms, universities and other not-for-profit, including government. In both years the majority—about 63 percent—of entities placing ads were firms.

The results of our current survey make it clear that the majority of these jobs are not being filled by graduates of formal programs—who by our count represent about 15 percent of the positions advertised in 1997. And, we believe the 15 percent figure to be an overestimate given that ads have been growing over time and our most recent ad count is for 1997, a year earlier than our hiring data. This leads us to infer that most of the advertised positions are being filled by individuals trained in informal programs and by individuals who change jobs. The distinct possibility exists that a number of these jobs remain vacant for a period of time, an issue not studied here. Furthermore, our pipeline estimates (see Table 2) lead us to conclude that the number of individuals currently enrolled in formal programs falls far short of the number of positions that have recently been advertised.

journals that consistently publish employment ads related to computational biology. Our index was computed by examining job advertisements in every issue of *Science* for the years 1996 and 1997. A position was counted if the ad specifically asked for a computational biologist or a bioinformaticist or the position announcement explicitly mentioned experience in computational biology or bioinformatics. Counts are lower bounds of actual position announcements in *Science* because some advertisements do not state the specific number of position openings but instead indicate more than some specified number. In such instances the lower bound was recorded. Within each calendar year every effort was made not to count repeated ads for the same position.

¹⁰In the 1996 supplement SmithKline said that they wanted to about double their staff of 30. In the 1997 supplement they again said they wanted to about double their staff, this time reported at 40, suggesting that SmithKline has plans to grow and is experiencing difficulty filling positions in bioinformatics/computational biology.

Table 1
Summary of Training Programs

| Institution | Program Description |
|---|---|
| Baylor College of Medicine | Since 1993, offers undergraduate, doctoral and postdoctoral training as part of a joint program with 3 institutions comprising the Houston-based W. M. Keck Center for Computational Biology. In addition, offers doctoral training in the Structural and Computational Biology and Molecular Biophysics Program. |
| Boston University | Beginning in Fall 1999, will offer M.S. and Ph.D. training; prior informal, doctorate-level training has existed; establishing a Bioinformatics Industrial Program for local job placement of students |
| George Mason University | Beginning in Fall 1999, will offer M.S. training in bioinformatics through the Master of New Professional Studies program which began in 1996 |
| Georgia Institute of Technology | Beginning in Fall 1999, will offer M.S. training in bioinformatics, with fourteen students having already accepted admission |
| Northwestern University | Beginning in Fall 1999, will offer undergraduate training; since 1996, offers a bioinformatics track in the biotechnology M.S. program. Does not have a formal Ph.D or post doc program in areas at this time but trains Ph.D.s and post docs informally |
| Rice University ^a | Since 1993, offers undergraduate, doctoral and postdoctoral training as part of a joint program with 3 institutions comprising the Houston-based W. M. Keck Center for Computational Biology |
| Rutgers University | Since 1996 offers Ph.D. training through the Computational Molecular Biology Program |
| Stanford University | Offers M.S. and Ph.D. bioinformatics specialization within the Medical Information Sciences program begun in 1982; since 1997, offers postdoctorate training through the Department of Genetics |
| University of California - Davis ^a | Offers informal training through the Department of Computer Science at the B.S., and M.S. levels; since 1992, offers informal Ph.D. training through a joint program with UC-Berkeley; since 1990, offers postdoctorate training through the Department of Computer Science |
| University of California - Santa Cruz | Offers bioinformatics specialization through M.S., Ph.D., and postdoctorate training in the Departments of Computer Science and Computer Engineering; offers informal undergraduate research training; since 1996, offers a course in bioinformatics with annual enrollments of 20-30 students; beginning in 2001, will offer bioinformatics specialization through a new M.S. program in Biomolecular Engineering (a Ph.D. track will soon follow) |
| University of Colorado ^a | No formal program. A single course in areas has been taught for last 10 years, primarily to seniors and graduate students. |
| University of Connecticut ^a | No formal program. Students graduate from a number of different programs. Faculty are interested in starting an interdisciplinary program within the next year or two. |

| | |
|--|--|
| University of Houston ^a | Since 1993 offers undergraduate, doctoral and postdoctoral training as part of a joint program with 3 institutions comprising the Houston-based W. M. Keck Center for Computational Biology |
| University of Pennsylvania | Since 1995 offers Ph.D. and postdoctorate training through the Biology, Molecular Biology, or Computer and Information Sciences Departments; since 1996, offers B.A. training through the Biology, Computer Science, or Mathematics Departments; since 1997 offers M.S. training through a computational biology/bioinformatics track in the Biotechnology program |
| University of Southern California ^a | No formal Ph.D. program. Graduate students interested in area get degrees in Computer Science or math and programs are tailored to the individual. USC has had a number of post docs in the area; program is ad hoc. Plans to start a masters program fall 2000 to prepare for industrial employment. |
| University of Washington | Since 1996 offers Ph.D. training in computational biology as part of the Molecular Biotechnology program; some informal postdoctoral training program exists |

^aNo formal degree program offered in computational biology or bioinformatics.

Table 2

Characteristics of Formal Training Programs as of March 1999 ^a

| | Undergraduate | Masters | Doctorate | Post Doctorate |
|---|---------------|--------------|---|---|
| Total Number of Programs | 3 | 5 | 9 | 7 |
| Number of Programs with Internal Support ^b | 1 | 1 | 3 | 0 |
| Number of Programs with External Support | 2 | 3 | 8 | 9 |
| Enrollments ^c | 23 | 35 | 86 | ~25 |
| Placements ^c (Percent who Completed Degree) | 3 (100%) | 23 (100%) | 13 ^d (90-100%) ^f | 14 ^{d,e} (90-100%) ^f |

^aBaylor College of Medicine, Boston University, Northwestern University, Rutgers University, Stanford University, University of California-Santa Cruz, University of Pennsylvania, University of Washington, W.M. Keck Center for Computational Biology. The Keck Center includes Baylor College of Medicine, Rice University and the University of Houston. Note that Baylor also has a program that is independent of the Keck Center. This program is counted separately here.

^bBased only on institutions responding to the question regarding internal sources of funding; several institutions did not respond to this question.

^cIncludes counts of students in degree programs in the Department of Computer Sciences at University of California-Davis and University of California-Santa Cruz; there are no formal bioinformatics/computational biology programs at UC-Davis and no formal undergraduate program at UC-Santa Cruz.

^dPlacement information is included in the respective programs for several Ph.D. students and post docs trained at the University of California-Santa Cruz. The nature of the reported data broadens the time period of placements, starting as early as 1995 and ending in May 1999; thus, the reporting period extends beyond the January 1998 to March 1999 period.

^ePlacement information is included for five 1997 post docs listed in the W.M. Keck Center's 1997 *Annual Report* and, thus, in the case of the post docs, the reporting period extends before January 1998.

^fDue to the lack of exact counts reported, the precise completion rate cannot be determined.

Table 3
Sources of External Funding for Training Programs Reporting Funding as of March 1999 ^a

| Source | Number of Institutions Receiving Support (of the Nine Institutions Reporting) |
|-------------------------------|--|
| Department of Energy | 2 |
| Industrial Affiliates | 1 |
| National Institutes of Health | 4 |
| National Library of Medicine | 3 |
| National Science Foundation | 6 |
| W. M. Keck Center | 3 |
| Welch Foundation | 1 |

^aInstitutions include Baylor College of Medicine, Boston University, Rice University, Stanford University, University of California-Davis, University of California-Santa Cruz, University of Pennsylvania, University of Houston, University of Washington.

Table 4
 Job Placements For Institutions Reporting Placements
 January 1998 to March 1999^a
 (Number of Hires if Reported)

| Undergraduate | Masters | Doctorate | Postdoctorate |
|---|--|--|--|
| Molecular Applications Group (1) Pangene (1) Socratix Systems (1) | Astra Pharmaceuticals (3) Bayer (1) Genetics Institute (4) Incyte Pharmaceuticals Molecular Applications Group Motorola (5) Paracel ThermoGen (1) Unnamed drug companies (2) Unnamed entities (3) Wyeth Ayerst (1) | Baylor College of Medicine (1) Ceres (1) Incyte Pharmaceuticals (2) Ingenuity [student start-up] (3) New Century Pharmaceuticals (1) Unnamed self-employment (1) Unnamed e-commerce entity (1) Unnamed industrial companies (2) Unnamed Japanese biotech research entity (1) | Columbia University (1) German Cancer Center (1) Massachusetts Institute of Technology (1) Mercator Genetics (1) Q.E.D (start-up) (1) SmithKline Beecham (4) Technical University of Denmark (1) U. of Houston (1) U. of Arizona (1) U. of Texas at Houston (1) Unnamed industrial company (1) |

^aIncludes placements for 1997 trainees listed in the W. M. Keck Center's 1997 *Annual Report* and for graduate students and post docs trained since approximately 1995 at the University of California-Santa Cruz.

Table 5
Salary Ranges by Training Level, January 1998 to March 1999

| Training Level | Salary Range (number of hires) |
|----------------------------|---|
| Undergraduate | 40,001-50,000 (1) 50,001-60,000 (2) |
| Masters | 40,001-50,000 (7) 50,001-60,000 (2) 60,001-70,000 (1) over 60,000 (8) over 100,000 (1) unknown (4) |
| Doctorate | 60,001-70,000 (1) over 70,000 (5) 80,001-90,000 (1) over 100,000 (1) unknown (5) |
| Postdoctorate ^a | 80,001-90,000 (3) over 100,000 (1) unknown (5) |

^aExcludes placements for 1997 trainees listed in the W. M. Keck Center's 1997 *Annual Report*.

Table 6
Number of Distinct Entities Advertising Positions in *Science*

| Sector | Year | | Number of distinct entities placing announcements in 1996 and 1997 | Growth between 1996 and 1997 (as percentage) |
|----------------------|--------------|--------------|--|--|
| | 1996 (share) | 1997 (share) | | |
| Firms | 44 (62.8) | 75 (63.6) | 90 | 70.4 |
| Not-for-profit | | | | |
| Universities | 17 (24.3) | 22 (18.6) | 36 | 29.4 |
| Other not-for-profit | 9 (12.9) | 21 (17.8) | 27 | 133 |
| TOTAL | 70 | 118 | 153 | 68.6 |

Source: Paula Stephan and Grant Black, "Bioinformatics: Does the U.S. System Lead to Missed Opportunities in Emerging Fields? A Case Study," November 1998.

Appendix A
Institutions Targeted for Bioinformatics/Computational Biology Training Program Survey

Baylor College of Medicine
Boston University

Carnegie Mellon University

George Mason University

Georgia Institute of Technology

Johns Hopkins University

Northwestern University

Rice University

Rutgers University

Stanford University

University of California - Davis

University of California - Santa Cruz

University of Colorado

University of Connecticut

University of Houston

University of Pennsylvania

University of Pittsburgh

University of Southern California

University of Washington - Seattle

University of Wisconsin

Washington University

Appendix B
Survey Questionnaire and Accompanying Cover Letter

BIOINFORMATICS/COMPUTATIONAL BIOLOGY

Name of individual returning questionnaire: _____
Institution: _____
Email address: _____

UNDERGRADUATE PROGRAM

Information concerning the degree:

Degree awarded (e.g. B.S.) ____ and brief description of degree program.

Did program receive financial resources from outside the university? If so, from what institution? _____

____ Did your institution give you extra resources to run your program? _____

Year first student enrolled. 19

____ Is degree joint with another institution(s)? If so, what institution(s)? _____

____ Contact person (name and email or phone number). _____

____ Number of students in the program as of March 1, 1999. _____

____ Number of students in the program first year program accepted students. _____

Information concerning placements:

Number of students in the program who have taken a job in the field during the period January 1998 until March 1, 1999. _____

____ How many of these students completed their degree before leaving to accept the job? _____

Number of students who have gone on to enroll in a graduate program during the period January 1998 until March 1, 1999. _____

A goal of this research is to identify companies/institutions which are hiring significant numbers of students. Please take a moment to list the names of companies/institutions hiring the individuals (e.g. SmithKline Beecham, Pfizer, National Center of Biotechnology Information, Amgen). *If you do not know the name of the hiring institution, identify areas such as drug companies, genetic research companies, etc.*

1. _____ Number of students placed there _____;
2. _____ Number of students placed there _____;
3. _____ Number of students placed there _____;
4. _____ Number of students placed there _____;

____ Please add additional lines if needed at end of questionnaire, indicating the degree program in which the

Return completed questionnaire to Paula Stephan, fax: 404-651-3996; email: prcpes@langate.gsu.edu

individual was enrolled.

Starting salaries for these students were

- _____ Less than \$30,000
_____ Between \$30,001 to \$40,000
_____ Between \$40,001 to \$50,000
_____ Over \$50,000
_____ I have no information concerning starting salaries

Did any students receive signing bonuses? Yes/No/Don't know (circle appropriate answer).

Information concerning how students find out about jobs:

- Recruiters from companies call faculty: Often _____ Sometimes _____ Never _____
Recruiters from companies visit campus: Often _____ Sometimes _____ Never _____
Headhunters call faculty: Often _____ Sometimes _____ Never _____
Headhunters visit campus: Often _____ Sometimes _____ Never _____
Students/faculty read ads in journals such as *Science*? Often _____ Sometimes _____ Never _____
Other? Please elaborate _____

Return completed questionnaire to Paula Stephan, fax: 404-651-3996; email: prcpes@langate.gsu.edu

MASTERS PROGRAM

Information concerning the degree:

Degree awarded (e.g. M.S.) _____ and brief description of degree program.

Did program receive financial resources from outside the university? If so, from what institution? _____

_____ Did your institution give you extra resources to run your program? _____

_____ Year first student enrolled. 19 _____

_____ Is degree joint with another institution(s)? If so, what institution(s)? _____

_____ Contact person (name and email or phone number). _____

_____ Number of students in the program as of March 1, 1999. _____

_____ Number of students in the program first year program accepted students. _____

_____ Number of students who applied for admission for fall of 1998. _____

_____ Number of students admitted for fall 1998. _____

_____ Number of students who accepted admission for fall 1998 and enrolled. _____

Information concerning placements:

Number of students in the program who have taken a job in the field during the period January 1998 until March 1, 1999. _____

How many of these students completed their degree before leaving to accept the job? _____

Number of students who have gone on to enroll in a Ph.D. program during the period January 1998 until March 1, 1999. _____

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A goal of this research is to identify companies/institutions which are hiring significant numbers of students. Please take a moment to list the names of companies/institutions hiring the individuals (e.g. SmithKine Beecham, Pfizer, National Center of Biotechnology Information, Amgen). *If you do not know the name of the hiring institution, identify areas such as drug companies, genetic research companies, etc.*

1. _____ Number of students placed there _____;
2. _____ Number of students placed there _____;
3. _____ Number of students placed there _____;
4. _____ Number of students placed there _____;

Please add additional lines if needed at end of questionnaire, indicating the degree program in which the individual was enrolled.

Starting salaries for these students were

- _____ Less than \$30,000
_____ Between \$30,001 to \$40,000
_____ Between \$40,001 to \$50,000
_____ Between \$50,001 to \$60,000
_____ Over \$60,000
_____ I have no information concerning starting salaries

Did any students receive signing bonuses? Yes/No/Don't know (circle appropriate answer).

Information concerning how students find out about jobs:

- Recruiters from companies call faculty: Often _____ Sometimes _____ Never _____
Recruiters from companies visit campus: Often _____ Sometimes _____ Never _____
Headhunters call faculty: Often _____ Sometimes _____ Never _____
Headhunters visit campus: Often _____ Sometimes _____ Never _____
Students/faculty read ads in journals such as *Science*? Often _____ Sometimes _____ Never _____
Other? Please elaborate _____

Return completed questionnaire to Paula Stephan, fax: 404-651-3996; email: prcpes@langate.gsu.edu

Ph.D. PROGRAM

Information concerning the degree:

Degree awarded (e.g. Ph.D.) _____ and brief description of degree program.

Did program receive financial resources from outside the university? If so, from what institution? _____

_____ Did your institution give you extra resources to run your program? _____

_____ Year first student enrolled. 19 _____

_____ Is degree joint with another institution(s)? If so, what institution(s)? _____

_____ Contact person (name and email or phone number). _____

_____ Number of students in the program as of March 1, 1999. _____

_____ Number of students in the program first year program accepted students. _____

_____ Number of students who applied for admission for fall of 1998. _____

_____ Number of students admitted for fall 1998. _____

_____ Number of students who accepted admission for fall 1998 and enrolled. _____

Information concerning placements:

Number of students in the program who have taken a job in the field during the period January 1998 until March 1, 1999. _____

_____ How many of these students completed their degree before leaving to accept the job? _____

Number of students who have gone on to a postdoc program during the period January 1998 until March 1, 1999. _____

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A goal of this research is to identify companies/institutions which are hiring significant numbers of students. Please take a moment to list the names of companies/institutions hiring the individuals (e.g. SmithKline Beecham, Pfizer, National Center of Biotechnology Information, Amgen). *If you do not know the name of the hiring institution, identify areas such as drug companies, genetic research companies, etc.*

1. _____ Number of students placed there _____;
2. _____ Number of students placed there _____;
3. _____ Number of students placed there _____;

4. _____ Number of students placed there _____;

Please add additional lines if needed at end of questionnaire, indicating the degree program in which the individual was enrolled.

Starting salaries for these students were

- _____ Less than \$30,000
_____ Between \$30,001 to \$40,000
_____ Between \$40,001 to \$50,000
_____ Between \$50,001 to \$60,000
_____ Between \$60,001 to \$70,000
_____ Over \$70,000
_____ I have no information concerning starting salaries

Did any students receive signing bonuses? Yes/No/Don't know (circle appropriate answer).

Information concerning how students find out about jobs:

Recruiters from companies call faculty: Often _____ Sometimes _____ Never _____
Recruiters from companies visit campus: Often _____ Sometimes _____ Never _____
Headhunters call faculty: Often _____ Sometimes _____ Never _____
Headhunters visit campus: Often _____ Sometimes _____ Never _____
Students/faculty read ads in journals such as *Science*? Often _____ Sometimes _____ Never _____
Other? Please elaborate _____

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POSTDOCTORAL PROGRAM

Information concerning the program:

Brief description of program _____

Did program receive financial resources from outside the university? If so, from what institution? _____

Did your institution give you extra resources to run your program? _____

_____ Year first student enrolled. 19

_____ Is program joint with another institution(s)? If so, what institution(s)? _____

Contact person (name and email or phone number). _____

Number of postdocs in the program as of March 1, 1999. _____

Number of postdocs in the program first year program accepted students. _____

Number of individuals who applied for a postdoc position for fall of 1998. _____

_____ Number of individuals accepted for fall 1998. _____

Number of individuals who were accepted and began postdoc study fall of 1998. _____

Information concerning placements:

Number of postdocs in the program who have taken a job in the field during the period January 1998 until March 1, 1999. _____

How many completed their postdoc before leaving to accept the job? _____

Number of postdocs who have gone on to take another postdoc during the period January 1998 until March 1, 1999. _____

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A goal of this research is to identify companies/institutions which are hiring significant numbers of postdocs. Please take a moment to list the names of universities, companies/institutions hiring the individuals (e.g. SmithKline Beecham, Pfizer, National Center of Biotechnology Information, Amgen). *If you do not know the name of the hiring institution, identify areas such as drug companies, genetic research companies, etc.*

1. _____ Number of postdocs placed there _____;
2. _____ Number of postdocs placed there _____;
3. _____ Number of postdocs placed there _____;
4. _____ Number of postdocs placed there _____;

Please add additional lines if needed at end of questionnaire, indicating the degree program in which the individual was enrolled.

Starting salaries for these students were

- _____ Less than \$30,000
- _____ Between \$30,001 to \$40,000
- _____ Between \$40,001 to \$50,000
- _____ Between \$50,001 to \$60,000
- _____ Between \$60,001 to \$70,000
- _____ Between \$70,001 to \$80,000
- _____ Over \$80,000
- _____ I have no information concerning salaries

Did any students receive signing bonuses? Yes/No/Don't know (circle appropriate answer).

Information concerning how post docs find out about jobs:

- Recruiters from companies call faculty: Often _____ Sometimes _____ Never _____
- Recruiters from companies visit campus: Often _____ Sometimes _____ Never _____
- Headhunters call faculty: Often _____ Sometimes _____ Never _____
- Headhunters visit campus: Often _____ Sometimes _____ Never _____
- Students/faculty read ads in journals such as *Science*? Often _____ Sometimes _____ Never _____
- Other? Please elaborate _____

Return completed questionnaire to Paula Stephan, fax: 404-651-3996; email: prcpes@langate.gsu.edu

General Comments

We would be interested in knowing in your opinion what level of training should be emphasized, i.e., BA, MS, PhD, postdoc and, if you think one should be emphasized at the expense of another, why you have reached this conclusion.

We would welcome any other comments you have concerning programs in computational biology/bioinformatics and/or issues that are of concern to you in starting programs in the area.

Return completed questionnaire to Paula Stephan, fax: 404-651-3996; email: prcpes@langate.gsu.edu

March 22, 1999

Dear _____,

The Alfred P. Sloan Foundation has asked me to survey programs in computational biology/bioinformatics concerning the hiring patterns of students and post docs. I am working on the study with Grant Black, a doctoral student in our Ph.D. program. We are particularly interested in information concerning job placements and starting salaries. We are also interested in knowing more about programs that are currently being offered.

As you know, there is considerable anecdotal evidence that the job market for bioinformatics/computational biology is booming. The scientific press stresses the high salaries paid to new hires and the intensity with which headhunters seek out possible candidates. Yet, little information has been collected in a systematic matter concerning this market. We seek to do so with this survey by collecting information from every institution that had students enrolled in a program by the fall of 1997. We will make the aggregated survey results available to participating institutions by May 1st.

If someone else in your institution is better equipped to answer these questions, or part of the questions, please let me know and I will send them a copy of the survey. In some instances, more than one individual may need to be involved since we are interested in information for post doctoral programs as well as graduate and undergraduate programs.

We would also appreciate your assistance in identifying other institutions that have programs in computational biology/bioinformatics. We know of programs at Baylor College of Medicine, Boston University, Carnegie Mellon University, George Mason University, Rice University, Rutgers University, Stanford University, University of California-Santa Cruz, University of Houston, University of Pennsylvania, University of Pittsburgh, University of Southern California, University of Washington, University of Wisconsin and Washington University. If you know of others, we'd appreciate the name of the institution and a contact person at the institution.

Many thanks for your help. The survey instrument looks more formidable than it actually is since many institutions only have a program at one degree level. You may return it as an attachment or fax it to me at 404-651-3996. *I would appreciate your returning it by March 31st so that the aggregated information can be used to inform discussions taking place at the Sloan Foundation.*

Sincerely,

Paula E. Stephan
Professor of Economics
Associate Dean, School of Policy Studies

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