

FASEB Consensus Conference on Graduate Education

Executive Summary

During most of the 1970s and 1980s, production of biomedical Ph.D.s in the U.S.A. was fairly constant. From 1985 to 1995, however, there was an increase of more than 50% in the number of biomedical Ph.D.s awarded by U.S. institutions; nearly 70% of this increase can be accounted for by the increase in the number of non-citizens getting their Ph.D. in the U.S.A. What are the driving forces that have resulted in this increase? Can the increased production of biomedical Ph.D.s continue without altering the job market for new graduates? Should this growth be curtailed in order to achieve a new steady state and, if so, at what point?

At the present time, unemployment among U.S. citizens with biomedical Ph.D.s is extremely low, less than 2.0%. However, there have been some important changes in the job market for biomedical Ph.D.s. The total number of biomedical scientists has grown, while the number of faculty positions has remained stable. As a result, faculty positions have declined as a percentage of total employment for biomedical scientists. Jobs in industry have increased and, in the future, might surpass academic jobs as the most prevalent form of employment for U.S. biomedical scientists.

Although nearly all biomedical science Ph.D.s are fully employed, the jobs they hold may not match the faculty positions in prestigious universities that they may have aspired to during their training. We recommend that current data on employment be readily available to the public, and that the employment information be updated regularly. Students and faculty should be made aware of the broad range of career options for a biomedical Ph.D., including opportunities outside the academic sector.

Research in the biomedical sciences is exciting, but we cannot predict precisely its impact on the job market or how much it might spur the creation of new job opportunities. Although the future job market demand cannot be predicted, the future supply can be estimated. Predoctoral applicants making career plans and institutions deciding on the size of their graduate programs should carefully consider current trends, while recognizing that variables dictating job market demands may vary. We oppose external regulation of the size of biomedical Ph.D. programs at the national level, especially since it is impossible to predict job market needs 10 years into the future (the time at which beginning graduate students will be ready to enter the job market). Instead, institutions should self-regulate the size of their graduate programs after consideration of many parameters.

Applicant ability should be the essential criterion for admission to graduate school. Underqualified predoctoral applicants should not be admitted simply to meet the workforce needs (e.g., teaching or research) of the institution, and alternate ways to fill workforce needs should be considered. The number of non-U.S. predoctoral students should not be capped arbitrarily, and there should be no discrimination with regard to race or gender for admission into graduate programs.

Quality of graduate programs should be promoted by frequent self-study, but redundant reviews by national, regional, and state accreditation bodies should be eliminated wherever possible. The success of a program should be assessed by testing congruence of the program's mission with the career outcomes of its students, and this information should be provided to applicants to the program.

To equip biomedical students for future jobs in research or in transmission of scientific knowledge in a variety of environments, they should be trained in depth in one specific area of biology and also be educated broadly in many other areas in the biological and physical sciences. The predoctoral training experience should continue to focus on independent research, and entire graduate programs should not be totally restructured to train students for the small number of diverse career options currently outside academia, industry, and government. Graduate programs should be sufficiently flexible, however, to allow individual students to broaden their education consonant with their career goals. Moreover, skills such as effective communication, ability to work in a team, and use of modern information technology should be developed. These skills will be valuable to the researcher in a variety of employment contexts. To insure completion of the Ph.D. in no more than 5-6 years, faculty committees should review the progress of graduate students at least annually. Mentoring is an important part of predoctoral and postdoctoral education to help students reach their full potential; the faculty should be supportive of the range of career options their students might follow. For some career paths, a Master of Biomedical Science degree alone or coupled with a degree in another field (e.g., law, finance, journalism, etc.) may be appropriate and sufficient.

Summary of Recommendations

Section I: What Are the Employment Trends for Biomedical Ph.D.s?

- Data on trends in careers for biomedical Ph.D.s should be published in a timely manner by federal agencies for careful consideration by students and faculty. Professional societies should describe current employment opportunities for their members; this may identify emerging areas. To enhance career tracking, predoctoral students and postdoctoral associates should be invited by their schools to provide their social security numbers for career tracking studies. Compliance with this request should be entirely voluntary, and the resulting reports should summarize aggregate findings without identifying individual students. Submission of social security numbers should not be a condition of funding, and should temporally follow the appointment.
- Although historical trend data can be a useful guide, many changes may occur during the 10 year period from the onset of predoctoral study to the completion of a postdoctoral. Therefore, applicants for Ph.D. programs should be made aware that the job market may look quite different when they are ready to enter it than it did when they began. Research in the biomedical sciences is exciting. There is tremendous potential, but we cannot predict the impact of biomedical research advances on the job market.

Section II: How Should Admission into Biomedical Ph.D. Programs Be Regulated?

- We oppose attempts to regulate biomedical Ph.D. production at the national level. Since future employment demands for biomedical Ph.D.s cannot be determined precisely, it is inappropriate to limit Ph.D. production on the basis of guesses about the future job market. Students with strong academic qualifications and other requisite criteria and intense motivation to pursue a biomedical Ph.D. should have the opportunity to do so. It is important that only students who meet high standards be admitted and only those of proven ability be awarded the Ph.D.
- Applicant quality based on past performance and potential for success should be the essential criteria for admission to graduate school. Predoctoral applicants should not be admitted primarily to meet the institutional needs for teaching assistants or research assistants. Alternate ways to fill workforce needs should be considered.
- Students of high caliber from other nations should continue to be accepted into biomedical predoctoral programs in the U.S.A. The number of students from other nations should not be capped arbitrarily.
- Admission into graduate programs should be based on applicant quality, without gender or race discrimination. Efforts must be made to improve K-12 science education in the U.S.A. as a necessary part of expanding minority recruitment to careers in science.

Section III: Length and Type of Training: Are They Appropriate to the Spectrum of Opportunity?

- The focus of biomedical Ph.D. training is, and should continue to be, original research as embodied by the Ph.D. thesis; this training will be used for a variety of career roles in research discovery and/or transmission of knowledge. Graduate programs should develop their students' skills for critical evaluation of research results and the scientific literature, effective oral and written communication, use of modern information technology, laboratory management, and upholding the highest ethical standards in research.
- Students should be trained in depth in one specific area of biology, but also be educated broadly in areas representing different hierarchies of biological organization and exposed to the physical sciences. We commend interdisciplinary training.
- To facilitate completion of the Ph.D. in no more than 5-6 years, faculty committees should review the progress of graduate students at least annually.
- Effective mentoring is an essential part of pre- and postdoctoral education. In addition to frequent, informal contacts with the faculty mentor, we recommend that formal meetings

be held at least yearly with the faculty mentor to review professional development and career aspirations.

- Faculty should be supportive of the range of career options available to their students. For some career paths, a Master of Biomedical Science degree alone or coupled with a degree in another field (e.g., law, finance, journalism, etc.) may be appropriate. Careers outside of academia, industry, and government are currently a small fraction of careers pursued by biomedical science Ph.D.s, and entire graduate programs should not be restructured to train students for these more diverse options. Nonetheless, graduate programs should be sufficiently flexible to allow individual students to broaden their education consonant with their career goals.

Section IV: How Should the Quality of Biomedical Graduate Programs Be Measured?

- The success of a predoctoral educational program should be assessed by testing the congruence of the program's missions with the career outcomes of its students. Biomedical Ph.D. programs should provide applicants with information on the career outcomes of all their predoctoral students who have completed training over the past 15 years, as this will assist students in their selection of programs matching their own goals.
- The most effective review of the success of graduate programs occurs at the local level through frequent self-study and periodic reviews by knowledgeable scientists from other academic institutions and industry. To conserve resources and valuable time of faculty and administrators, redundant reviews by national, regional, and state accreditation bodies should be eliminated wherever possible. We oppose efforts to introduce further accreditation at the national level, as it would be impractical because each program is unique; also, it might lead to homogeneity of programs, which is undesirable, at the expense of diversity, which is desirable.
- Institutions should aspire to have high quality graduate programs. For institutions seeking guidelines, the NIH and NSF training programs can be viewed as models for excellence in education in biomedical research. Since federal training grants enhance programmatic aspects of graduate education, it is desirable to spread them out to a somewhat larger number of schools, providing that their programs are high quality and merit federal support. Additional increases for pre- and postdoctoral stipends are desirable, but money for stipend increases should not compromise the federal funds for investigator-initiated research grants.

Approved by FASEB Board on May 6, 1997