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UNSELLING GRADUATE SCHOOL

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Currently, there is considerable interest in recruiting graduate students into the biomedical research area and related sciences. With pressures on faculty to obtain grants and publish research findings, many faculty and administrators see graduate students as an important mechanism to increase research productivity. In such an environment, it is possible to recruit some students who do not have realistic expectations, sufficient motivation, or adequate preparation/skills. This would increase student attrition and waste resources and faculty productivity. More importantly, it is unfair to the students who were oversold on graduate school, only to find that it is not appropriate for them.

In this short paper, I propose that academic scientists and their administrators work to increase the awareness of prospective graduate students about the realities of their chosen career. Increased efforts should be directed at the recruiting of appropriately motivated and qualified graduate students. Paired with a more careful selection of graduate students there would need to be increased recruiting efforts. While most recruiting efforts are directed at junior and senior undergraduates, increased recruiting of these students only represents more intense competition for a limited pool of students. Efforts directed at educating elementary school and high school students about the opportunities and realities of research Ph.D. careers, may have greater long-range impact on training future scientists.

Prospective students should be aware of several factors:

1) Work-effort expectations. The expected work-effort necessary to complete graduate training in normal time is very difficult to quantify, but the time input is generally considered to be well above 40 hours/week. Perhaps 60, perhaps 80. This number is further obscured by the fact that graduate work is sometimes associated with long, unproductive hours. At a minimum, students should enter programs knowing faculty expectations. Apart from the question of the effort that is necessary to accomplish the Ph.D., is the separate question of how much effort is necessary to generate the credentials to be competitive for jobs of the type the student is seeking. The necessary credentials will be different for different jobs.

2) Doctoral training duration. In the biomedical research field, the average years of graduate training to reach the Ph.D. is nearing 7 years (6.9 years in 1995, up from 5.7 years in the 1970s)[1]. At my institution (UNMC), the time to Ph.D. is approximately 5 years, presumably reflecting the predominance of research assistantships over teaching assistantships.

3) Job market. While the unstated goal at many institutions appears to be to prepare students to fill academic positions supervising biomedical research laboratories, the reality is that most students do not reach this goal. This leads to the question if students are aware of the different job markets for biomedical Ph.D.s and if students have accurate expectations. As surveyed in 1997, 40% of recent Ph.D.s reported entering employment that differed from their initial objectives upon starting graduate school[2]. Students should probably also learn just how competitive are the different job positions. Presumably, this would screen for the appropriately motivated (and unrealistic) students and may give some students further motivation to achieve. In either case, it may be helpful for graduate student recruiters to know and to provide student-outcomes information.

   Currently about 50-55% of biomedical research Ph.D.s find a position in academia[1] and many of these positions are teaching without significant research. About 30% of Ph.D.s find jobs in industry, and the remaining occupy a variety of related niches in government (10%) and other areas[1]. Overall, unemployment is very low (1%), and underemployment, or involuntarily out of field, has been estimated to be about 3%. While there is significant competition for many individual faculty jobs, positions have been available for the Ph.D.s generated. Estimates for the future job market is generally positive but closely tied to economic recovery and growth[3]. Other student-outcome information is available at: www.phd-survey.org/related_sites.htm

4) Job preparation. Given that many of the future jobs for biomedical Ph.D.s are non-academic and/or non-research, are students being prepared for the jobs they are likely to seek? What training prepares them for job activities such as grant writing, teaching preparation, lecture skills, industry research, budget management, administration, personnel management, and student mentoring? We appear to largely assume (correctly?) that if one can do research, one can do anything else. Internship programs can help close these gaps as well as “survival skills” workshops and outside speakers from nonacademic professions.

5) Postdoctoral training process. Many incoming graduate students have little awareness of postdoctoral training. This is becoming more relevant since the average duration of postdoctoral training has been increasing. In 1981, 24% of individuals 4 years after being awarded their Ph.D. were still postdoctoral fellows. This number increased to 32% by 1995. Still, by

1995, biomedical Ph.D.s, most (about 2/3rd) had a satisfactory potentially permanent job by their 4th year after receiving their Ph.D. degree[1]. Furthermore, since the NIH 1st year postdoctoral fellowships will soon be at $45,000/year, being a postdoctoral fellow is not necessarily a hardship. Nevertheless, for a student to go through roughly 11 years of predoctoral and postdoctoral training, they should be aware of this process and they had better enjoy the process.

6) Value of School Name Recognition? In recruiting graduate students to a school of minimal name recognition, students should ask if getting into a more prestigious school would increase their career potential. While it may be self-serving (and minimally researched), I suggest that school name probably does not meaningfully affect outcome. In one study of students entering college, students who were accepted to Harvard, but went elsewhere, did as well as those who went to Harvard[4]. Bright, motivated students do well. At the research graduate student level, the quality of training is more closely related to the quality of individual mentorship rather than the overall quality of multiple departments, thus the identity of the institution is less relevant than the identity of the mentor. And, in turn, the identity of the student is more critical than the identity of the mentor. This conclusion is consistent with NIH findings that students who went to non-NIH training institutions were only about 20% less likely to obtain an NIH or NSF grant 7 years after receiving their doctorate[5]. A greater advantage is seen for students who received individual predoctoral training grants compared to students at NIH-training institutions. An evaluation of publications and citation rate at NIH-training and non-NIH-training institutions yields similar results. Given that bright, motivated students do well, the limited disparity between non-NIH and NIH training institutions speaks well to the recruiting at non-NIH training institutions.

It is hoped that by better informing incoming graduate students about the realities of graduate school and the Ph.D. job market, students with unrealistic ideas or limited motivation would choose other careers. By taking just those students who are appropriately motivated and capable, Ph.D. programs would suffer less attrition, and both students and faculty would waste less time. (However, it could be argued that a couple years in a Ph.D. training program are worthwhile to the student even if the student drops-out. In addition, some students may mature into the role successfully). With a limited pool of graduate student applicants, such a truth-in-advertising campaign may even further reduce graduate student applicants. Thus, to offset this potential decrease, it may be helpful to increase the pipeline of interested students. From talking with many students, it appears that there is a huge potential student pool, but that these students have no idea as to the nature of graduate studies. I have known students who have graduated in biology, have had many classes from Ph.D.s and many laboratory sessions with graduate student teaching assistants, and yet, the students have never entertained the idea of getting a Ph.D. and they

frequently have little idea as to what it would involve (other than being a T.A.). Direction on the career path to medical doctor is apparently a birthright; yet, we have failed to educate our undergraduate students (and younger) about careers involving Ph.D. training. I suggest that if we in academics can better inform students of all ages about the nature of our business, there would be a stronger applicant pool. By making sure that these recruits have accurate and realistic expectations, as well as sufficient motivation and talents, academics could be further strengthened.

Conclusions

Inform students early about the facts and best estimates regarding graduate school training and Ph.D. careers. Select highly motivated, talented students who enjoy the process of research discovery.

End Notes

1. National Research Council. (1996). *Survey of earned doctorates.* Washington, DC: NRC.

2. National Science Foundation publication NSF 02-304, Oct. 30, 2001. *Employment preferences and outcomes of recent science and engineering doctorate holders in the labor market.* www.nsf.gov/sbe/srs/issuebrf/nsf02304/sib02304.htm

3. Committee on National Needs for Biomedical and Behavioral Scientists, Education and Career Studies Unit, National Research Council (2000). *Addressing the nation's changing needs for biomedical and behavioral scientists.* National Academy Press.

4. Alan B. Krueger, (April 27, 2000). Children smart enough to get into elite school may not need to bother, *New York Times*, pg. C2.

5. NIH web site. Data from the NIH Consolidated Grant Applicant File (1995).

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