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# What If Four Years of College Aren't Enough?

## Choosing a Graduate School in the Experimental Sciences: A Seminar for Juniors and Seniors Considering Graduate School

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This article presents a synopsis of a seminar that has been presented at Lynchburg College and Providence College. Participants were primarily upperclass students in the experimental sciences (biology, chemistry, and physics) who wanted to learn about graduate school.

### Purposes of the Seminar

1. To dispel misconceptions held by undergraduate students about graduate school.
2. To provide a list of questions that would help students make informed decisions about whether to attend graduate school and especially about which school to attend.
3. To offer advice regarding choosing a graduate school, an advisor, and a project.

The need to dispel undergraduate student misconceptions about graduate school has been discussed previously in *this Journal* (1). Sawyer has surveyed undergraduates' misconceptions and argued that at least in some cases students make choices about graduate school for invalid reasons. We believe that providing information about advanced-degree programs is especially important at four-year colleges where students are not able to observe the nature of the graduate school environment.

With regard to making choices among graduate schools, an article recently appeared in *this Journal* (2) listing criteria for evaluating graduate advisors and projects. Recognizing that the same criteria will not apply to all prospective graduate students, the outline presented here instead provides a list of questions. We have chosen deliberately *not* to provide "right answers" to these questions because we believe that the right answer ultimately depends on the student asking the questions. In this manner, students can formulate their own criteria when selecting a graduate school.

Nevertheless, the most effective aspect of the seminar tends to be the examples and advice that derive from personal experiences of the authors or of our friends and acquaintances. We, therefore, strongly encourage faculty to share their own experiences. By hearing about how some of the issues raised here have affected their mentors, students can gain an appreciation for the less obvious aspects of graduate school selection.

The seminars presented at Lynchburg College and Providence College took the form of informal "fireside chats" where the faculty's remarks were similar to those presented below. Student questions were answered as they arose. Students were provided with a one-page outline at the beginning of the seminar and a more detailed summary of the seminar's contents at the end. A "fireside chats" review that was presented to an audience of junior and senior undergraduate students at the authors' institutions is shared here and is followed by a general summary.

### The Seminar

#### *What if Four Years of College Aren't Enough?*

Has your undergraduate-degree program given you the experience and credentials necessary to place you in a rewarding and fulfilling career? Or does it seem to you that your professional goals will require something beyond your BA or BS degree? Although there may be many ways for you to reach your goals, the purpose of this seminar is to help you consider whether graduate school in the experimental sciences can be a means of achieving your goals, and if so to help you make an informed decision about which graduate school to attend.

The information that may help you make your decision has been divided into three categories: the school, the department, and the research group. Under each category is a list of questions that highlights issues that may be important to you in making your decision. Although some of these decisions, such as which research group to join, may not be made at the same time as your decision to enroll in a graduate program, it will be helpful to you to think about both short-term and long-term issues. Thus, you would be well advised to obtain as much information about all three of these categories as is possible while you are considering which graduate school to attend.

The answers to some of the questions posed here can be found by consulting published materials. Two helpful reference guides are the *Directory of Graduate Research* (3) and *The Chemical Sciences Graduate School Finder* (4), both published by the American Chemical Society. The *Directory* lists colleges and universities that offer masters and doctoral degrees in chemistry and chemically-related sciences such as biochemistry, chemical engineering, medicinal/pharmaceutical chemistry, forensic science, and toxicology. Biographies of faculty members at each institution are listed, along with a list of papers published in the preceding two years. The *Directory* also lists other resources that might be helpful to prospective graduate students. The *Finder* lists department information such as admission requirements, degree requirements, a description of research facilities (including the annual research budget), and a list of faculty research areas. In addition to the *Directory* and the *Finder* more detailed information concerning faculty and research projects is published by individual departments and will be provided to you if you write to the department and inquire about the program. Other information about graduate schools can be found in periodicals published by professional societies. For example, the ACS Committee on Professional Training Annual Report is periodically published in the weekly journal of the American Chemical Society, *Chemical and Engineering News*. The number of bachelors, masters, and doctoral de-

degrees awarded at ACS-approved institutions is listed in the report (5).

In addition to this published information, you will want to gather information that can be obtained only by visiting the schools that you are considering and by talking to as many people as possible while you are there. The discussion that follows illustrates the types of questions you might want to ask faculty and students to get a feel for what it would be like to be a graduate student at that particular school.

### *The School*

The school's overall reputation, as opposed to that of a particular department, may be of value. The school's name may open doors, and the presence of strong departments other than yours may be of benefit if your interests are interdisciplinary. You also should think about the importance of the living environment because you may be living there for four to six years.

- Is the school well-recognized regionally? Nationally?
- Do you have a reasonable chance of being admitted to this school and to the department/program in which you are interested?
- Are there any interdisciplinary programs that are relevant to your interests?
- Would you prefer to live in a large metropolitan area, a medium-sized city, or a small college town?
- Will you be able to live in a location convenient to campus?
- Will you be able to afford to live by yourself if you wish to?
- Is personal safety a concern?
- Is it important that you live in close proximity to friends or family?
- Are job opportunities for a spouse or significant other essential?
- Is convenient access to air or ground transportation important to you?
- Are there sufficient opportunities for you to pursue or develop outside interests?

### *The Department*

Probably several schools will combine many of the factors you consider desirable from the list above. Now you need to find those schools where the department's interests and yours mesh. You should ask the faculty members in your department about the reputation of a particular graduate program. (*U.S. News and World Report* (6) annually publishes results of surveys of chairs of graduate and professional schools ranking the top 10 in many fields.) Note that both fields (analytical, organic, etc.) and subfields within a field (e.g., synthetic or physical organic) have their own reputations that may not be exactly in line with that of the department as a whole. Some strong departments have weak areas and some weak departments have strong ones. Other important aspects of this decision include the department's infrastructure, the financial commitment they will make to you, their academic requirements, and perhaps the social environment.

- Does the department have a good reputation as a whole? In your field?
- Are you interested in a particular subfield? If so, is the department strong in that subfield? If not, are a wide range of subfields represented?
- What support staff and facilities are available? Are those that you will need most frequently in a convenient location?
- What is the physical condition of the building(s) in which the department is housed? Are any major construction/renovation projects planned for the time you will be in graduate school?
- How much financial support will you receive from the department, in what form, and for how long?

- If you are providing your own money through a fellowship, what happens if/when the fellowship runs out?
- If teaching is associated with your stipend, what courses are you likely to be teaching and how much teaching will be required during your career?
- Is summer support included?
- Are there any fees that will need to be paid out of your stipend?
- What are the department's academic requirements?
- Does the department administer entry/placement exams?
- How much course work is required, and how is it distributed?
- What is the qualifying procedure for admission to candidacy in the PhD program?
- How is the climate for discussion and dissemination of ideas? Is there an active seminar schedule with participation by both inside and outside speakers? What is the quality of the speakers? Are the seminars intended for general audiences or are they addressed to an audience based on area of specialization? Do the students have an opportunity to interact with the outside speakers?
- In addition to the formal seminars, are there informal discussion/seminar groups where student participation is encouraged?
- Is the social environment of the department formal or relaxed? Is there a spirit of cooperation among faculty, staff and students in the department?
- Are opportunities set aside for social activities, and are there common rooms available for informal gatherings?

### *The Research Group*

The decision of which research group to join usually will not be made until after you arrive on campus during your first year. Nevertheless, it is worth thinking about the members of the faculty as prospective advisors and their groups as prospective colleagues when you are choosing schools. There are three aspects of this decision that can be identified: the advisor, the project, and the group.

*The Advisor.* The importance of this aspect of your decision cannot be overstated. This person will have a great deal of influence over your professional life during your entire graduate career and perhaps much longer than that. Therefore, you should consider the many aspects of the interactions you will have with this person and assure yourself that you are comfortable with the relationship. Some aspects to consider:

- What is the advisor's mentoring style? Will he or she approach you or wait for you to come forward?
- How does the advisor's personality mesh with yours?
- How does the advisor spend his/her time? Does the advisor teach undergraduate- or graduate-level courses? What is the advisor's teaching load? Does the advisor spend time working in the lab or the office? Does the advisor spend a great deal of time travelling?
- Does the advisor have tenure? If not, when will the decision be made, and how will it affect you if it is not favorable?
- When is the advisor next due for sabbatical leave, and how will the timing of that leave impact on your progress toward your degree?
- What are group finances like? Are projects well supported in terms of salaries, equipment, and supplies? Does the budget regularly get tight at the end of a grant?
- What is the advisor's reputation in your field? Is the advisor well-connected with or recognized by others in the field?
- Is the advisor successful at training students for what you want to do after you finish graduate school? How much assistance will you receive when it is time for you to look for a job?
- Does the advisor attend conferences and make presentations and encourage the students to do the same? If you attend a conference with the advisor, will he or she introduce you to others in the field?
- What kind of publishing habits does the advisor have? Does the advisor publish regularly? Is the advisor slow or quick to publish? How much of the writing is done by the students?

How much of a contribution must be made to earn shared authorship credit?

**The Project.** The choice of project might be less important than it appears on the surface. The odds are that when things are going well, you will find the project interesting and exciting; whereas, when things are going badly, you will find the project sheer drudgery. You should choose a project that interests you, but you also should think about some other aspects of the project:

- What are the probabilities for success? Is this the advisor's pet project that everyone has steered clear of in the past? Has it been tried before and failed? If it has previously failed, did the project fail or did the student fail?
- What are the opportunities for switching projects if it is not working?
- Will you be working with a more experienced graduate student or are you expected to start the project from the ground up?
- What future does the project have? Are there natural follow-ups, or do you need to start a new project?
- Does the project have adequate technical support?

**The Group.** The members of the research group will be the individuals with whom you will spend the most time during your graduate career. The dynamics of groups are always complicated and can change dramatically with the arrival or departure of a single strong personality. Thus, the group that you observe from the outside before you join will become an entirely different entity after you join and will continue to evolve as some members graduate and move on and others take their places. Even so, there are some aspects of groups that, once established, can perpetuate simply out of inertia, so it will be useful to think about the personalities in the groups you are considering joining, both individually and collectively.

- What size is the group? Is the group so small that discussion is limited? Is information adequately passed on from one "generation" of students to the next? If the group is large, is it fragmented into smaller groups working on different projects? If so, have rivalries developed among these projects for resources or attention from the advisor?
- What is the organization of the group? Do senior students or postdoctoral associates act as "advisors" to beginning students?
- How does the group interact scientifically? Do they discuss their results with one another and know what the others are doing, or do they keep to themselves? Will they talk about topics other than the problems they are working on at the moment? Will they give you feedback if you have a problem or idea that you wish to talk about?
- Do they have group meetings, and if so, what format do they follow? How often does the group meet? Do group members present their own results, or do they present current topics in the field? How large of a portion of the meeting is taken up by group business? (It is a good idea to attend at least one

group meeting before you decide to join a particular research group.)

- What is the social environment of the group like? (Some students find it important to be good friends with their colleagues, while others prefer to maintain a purely formal working relationship and to form friendships away from the lab.)

### A "Fireside Chats" Review

The decision of which graduate school to attend is an important one because your experience there will affect the future of your career very directly. The preceding discussion contains a long list of considerations that will guide your decision-making process. It is up to you to take all of this information and decide which of the many factors we have discussed are important to you. However, even if you do carefully consider each of these factors and ask the right questions, it is difficult to evaluate a situation when viewed from the outside. This means that you might make mistakes. If this happens, it is important to realize that none of the decisions that you make is permanent. If it becomes clear to you that you have made a bad decision, it is possible for you to change groups, departments, or schools. It is especially true that if you make a change within the first year or two of your graduate career, you will not lose all that much time and will benefit from having made the change.

### Summary

The graduate school seminars have been well-received by students at both institutions at which they have been presented. Students report gaining a new perspective on the graduate school environment and often display greater enthusiasm about their prospects for attending graduate school than before the seminar. Students who have since been admitted to graduate school report that they continue to refer to the summary for guidance and acknowledge that the information gained through discovering the answers to the questions presented helped them to make a choice that was satisfying to them.

### Acknowledgment

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### Literature Cited

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