CONTRIBUTIONS

Commentary

A Primer on How to Apply to and Get Admitted to Graduate School in Ecology and Evolutionary Biology

In my experience, most students considering graduate school have little knowledge of how to gain admission, how to choose a program, or how to find and select an advisor. Here, I try to remedy these problems with a basic step-by-step guide for the application process and for the prelude to that process. It is my hope that faculty and graduate students who read this and find it valuable will pass it on to interested undergraduates. This guide should get students started down the right track and allow them to ask more refined questions about the whole application process. Overall, this primer applies mostly to graduate programs in ecology, evolution, systematics, and natural resources. In general, students should know right off that applying to graduate school in these disciplines is much different than applying to universities from high school, or applying to medical school, law school, or even graduate programs in other areas of biology.

For the student, it is never too early to start thinking about graduate school. Before applying, however, you should be pretty confident that graduate school is right for you. It can be a long haul (typically 5-6 years for a Ph.D.) and complete commitment is required for success. If you are not sure, or if you are burned out, take a year or two off, gain some experience, travel, or get a job and bank some money, and then carefully consider postgraduate education.

I. Prelude 1: Grades and GREs

Most schools require that you take the Graduate Record Exam (GRE). Although your grade point average (GPA) and the GRE are not always good predictors of success in graduate school, universities will use these metrics to compare and evaluate applicants. Here is some advice:

1. *Try to graduate with at least a 3.0 GPA.* The vast majority of graduate schools have a 3.0 as their cut-off. This is reasonable and suggests that you took your coursework seriously and learned the basics. Still, if you are below this, all is not lost, so do not lose hope (see sections on the GRE and gaining research experience). Note that some programs will emphasize your GPA in the last two years of your degree program, or within your major. If your GPA is higher in these areas, emphasize this in your application. The best or most competitive programs will typically look for GPAs that are substantially higher than a 3.0, while smaller programs, and programs that only offer a Master's degree, may be somewhat less picky.

2. *Try to score well on the GRE.* Most universities or departments will require that you take the general GRE exam, which attempts to evaluate your quantitative, verbal, and analytical abilities. Some will require that you take the biology exam as well. Check with the prospective school or department to be sure.

Your score on the GRE will often be more important than your GPA because there is some belief that GRE compares students on a more equal footing than a GPA. A high score on the GRE can make up for a low GPA (or sometimes vice versa). Note that, like the GPA, most schools will have a cut-off or minimum acceptable score. Some guides to graduate schools or information provided by the university will specify acceptable scores, or the average scores of recently admitted students. Remember, however, that these are usually just targets, and students with lower scores are often admitted, so if you really want to go to Stanford, you might as will give it a try.

3. *Study for the GRE.* When you study for the GRE, you should at the very least purchase one of the many preparation guides available at local bookstores. Practice taking the test under the actual conditions of the exam until you feel comfortable with the format of the test, the speed at which you should work to finish each section, and the overall length of the test from start to finish. At most, if you can afford it, consider taking a formal course on preparing for the GRE (e.g., Kaplan) or check to see if your undergraduate institution offers free help and instruction on preparing

for the GRE. Studying and practicing for the GRE has been shown to significantly increase your score! Note that some universities and other funding agencies award multiyear fellowships and scholarships based on your performance on the GRE, so even a modest improvement in your score at the high end may help you qualify for one of these awards.

4. *Hang in there.* Overall, if your grades and GREs are both relatively low, but your ultimate goal is a Ph.D., do not despair. Consider trying to find a quality Master's program where your chance for admission might be higher. In a Master's program, you can conduct interesting research and demonstrate directly that you have the skills required to pursue a Ph.D. A quality Master's thesis, along with enthusiastic letters of recommendation, can more than make up for relatively low GRE scores and a mediocre GPA.

II. Prelude 2: Gaining experience

1. *Start doing or participating in actual scientific research early.* Know that classes are only one part of your education. You should begin to obtain real hands-on research experience as early as your sophomore year. *Research is the most important thing you can do to prepare yourself for graduate school* because it will teach you not only how to do research, but whether you like research and if so, what areas of research you enjoy the most. Try to obtain research experience by finding a graduate student or faculty member who is doing interesting work, and see if you can:

a) Volunteer.

b) Work as a paid field or laboratory assistant.

c) Conduct independent research (field or laboratory research project).

d) Conduct an independent study (library project that will require reading in the primary (journal) literature).

A note of caution is due here. Do not do any of these things if you are just trying to fill out your resume. You should be genuinely interested in the research project. If you are not, it will end up being a bad experience for you and the researcher. Overall, look around and try to find a lab that is doing research that interests you.

2. *Participate in a scientific meeting.* After gaining experience by one of the above means, try to attend and, if possible, present a paper or poster at a scientific meeting. A paper is usually a short 12-minute oral presentation of your research, while a poster displays your research with text and figures. There are many possible scientific meetings to choose from, beginning with more local meetings that are often sponsored by state-wide scientific academies, to national meetings such as the Ecological Society of America's meeting held annually at different locations around the US. Ask graduate students and professors for advice on which meetings to attend and see if you might be able to go along with them.

Even if you do not have independent research to present, you should still try to attend scientific meetings. Meetings typically last 2–4 days, and consist of a series of short scientific presentations on current research by both students and professors. Meetings will give you a flavor of the type of research that is out there, give you a chance to meet prospective advisors, and probably convince you that you can do interesting research. Most of all, meetings are fun!

3. *Write and try to publish a scientific paper.* This could result from your independent research or an independent library project; it will almost always require the help of a professor or graduate student. Do not think that this is beyond your ability, but it will require dedication and perseverance. Nothing impresses a prospective advisor or graduate school like a publication in a refereed scientific journal! This will no doubt help you get into a top program or is an excellent way to survive low GRE scores or a low GPA.

4. *Get to know your professors.* Recommendations that only include your performance in class will be considerably less influential than recommendations that evaluate your performance both in class and outside of class, conducting independent research, participating in an independent study, or working as a volunteer or paid field assistant. To gain admission to graduate school, you will need three recommendations and sometimes four. These recommendations are extremely important. Your professors are likely to be friends with, or at least acquaintances of, the professors that you are applying to work with. Potential graduate advisors will often trust the recommendation of a close colleague or scientific peer more than a GPA or GRE score.

5. *Participate in departmental events.* These could include departmental picnics or socials, undergraduate biology clubs, and perhaps most importantly, if your department has a weekly seminar series or journal club (an informal meeting of scientists to discuss recent scientific papers), by all means attend it. At first these meetings may seem boring or unintelligible, but with time, as you understand more, they will become more interesting and comprehensible.

6. *Enroll in graduate-level courses or seminars.* Do not think these courses will be over your head; often they are no more difficult than undergraduate courses. They can expose you to the flavor and tone of graduate school and will allow you to interact on a regular basis with graduate students. These courses can give you a window into the graduate school experience.

III. Applying

1. *Should you do a Master's degree first?* Graduate students at research universities typically plunge right into a Ph.D. program. However, don't turn your nose up at completing a Master's degree first. Consider completing a Master's degree if you are unsure whether you want to commit to a lengthy Ph.D. program, or if you are not sure if research is your thing. You will get much-needed experience, and will be able to choose a Ph.D. program with much greater insight.

2. *Application deadlines.* Applications are due usually from mid-December to early February for a program that begins the following September. Only a small number of programs accept graduate students in the middle of the year; thus, it is a once-a-year process!

3. *Choosing an area of research.* Identify the general area of research you would like to pursue. It should be more specific than just ecology or plant ecology. Seek advice from faculty and graduate students. Although it may be difficult, it is important to try to narrow your interests. This is also why it is important to gain exposure to different research areas as an undergraduate so that you can *begin* to narrow your interests.

4. *Selecting a potential advisor.* Identify 6–10 professors who might serve as your potential advisor in graduate school (begin by using the Internet). These should be professors who are conducting research in an area you are interested in, and at universities you are interested in attending. Do not go into this blind! Ask professors, graduate students, and anyone else you trust for advice on appropriate advisors. Your selection of an advisor is *the most important choice* you will make with regard to your graduate degree. It is almost always more important than your choice of a university. Although it may be possible to switch advisors once you enroll, switching advisors can often be awkward and politically difficult, and there may not be another professor who has an opening for a student or one who matches your research interests. Thus, choose your advisor wisely in the first place (for some advice, see *The interview* below).

5. *Selecting an institution.* Select a range of institutions in terms of quality, from major research universities to smaller colleges. You should choose at least one university where you are fairly certain of being admitted. Note: it is sometimes the case that large research universities may be less likely to accept Master's students, or that these applicants are given lower priority than students applying for doctoral programs. This varies by department and discipline, so check to be sure.

6. *Do your homework.* You should read the most recent scientific papers authored by the faculty member you are interested in working with, and find out whatever you can about this person. You will not necessarily be expected to fully comprehend these papers. Still, having a reasonable understanding of the research being conducted in the field or lab will allow you to ask better questions (during an interview, see below), make you seem more astute, and make you a better applicant. *Do not forget to do this!* The strongest applicants will be those who can discuss issues in their field of interest; these candidates will stand above the rest.

7. *The letter of introduction and resume.* Write a personal letter or send an e-mail to each faculty member with whom you are interested in working. This letter should go out well ahead of the application deadline (no later than mid-October to mid-November). In the e-mail, you should say briefly who you are, why you want to work with that person, and your background and experience. Find someone to read and edit this letter, preferably a graduate student or faculty member. In this letter, focus first on your research experience and secondarily on your academic performance. If you have research experience, give the name of the professor(s) with whom you have worked. Ask specifically whether the prospective faculty advisor will be taking on any students in the next academic year. This letter should be limited to one page. Include a resume or Curriculum Vitae (a long resume used in academics) at the end of the e-mail or appended to the letter. Ask advisors, graduate students, or faculty about how to construct a resume or Curriculum Vitae, or contact your placement office.

8. *The follow-up letter.* When you hear back from your initial letters of inquiry, follow whatever recommendations or advice they give you in the letter. If you do not hear anything, follow up your inquiry about 3 weeks later with a short and polite e-mail asking if they received your initial inquiry, and if so, whether they would consider you as a prospective graduate student. Faculty may be out of town for extended periods, so you might consider calling the department secretary, and inquiring about that faculty member's whereabouts.

9. *The interview.* Hopefully some of the professors you contacted will be interested in you. Prior to being accepted, arrange a trip to any and all institutions you can afford to visit. Some universities will have money to fly in excellent prospective candidates for an interview. Wear clothes that are nice but casual. To get into many programs, and for you to evaluate the program, *an interview or informal visit is extremely important.* This visit or interview will:

a) Let you know if you want to work with this person. Major personality differences between a student and an advisor can become a disaster. Ask yourself what you want in an advisor. While at the interview, ask yourself the following questions: Can I get along and work comfortably with this person? How does this person currently interact with their students (regular lab meetings, daily guidance, moderate guidance, total independence)? Have past students done well? Did past students publish their research in good journals? Are students finding jobs on completion of their degree? How are students supported financially (part time teaching, research assistantships, Pizza Hut? see *Financial support* below).

Ask the graduate students what they think of their advisor and of the program in general. Get individual graduate students alone, one on one, so they can tell you what they really think, and so there is less fear that this information will leak out. Ask them if they had to do it all over again, would they? Remember, your selection of an advisor is *the most important choice* you will make with regard to your graduate degree. In general, if the graduate student population is excited and enthusiastic about their advisors and the program, then

you have probably found a great place. A note of caution is in order here: many graduate programs will have a small number of disgruntled students who are often vocal and overly negative. Make sure you gauge the graduate population and program as a whole and not the sour comments of a few unhappy students. Nonetheless, a general negative tone from the graduate students is a bad sign.

b) Let the prospective advisor, graduate students, and laboratory personnel evaluate you and decide whether they want you hanging out in their lab. Note that current graduate students will likely have input into the decision on selecting new students. Additionally, you will likely meet with other faculty who will often have a say or vote in graduate admissions. Thus, before your interview, you should read up on the other most relevant faculty and their research interests. Reading some of their recent publications is highly recommended.

c) Allow you to inquire further about the program. You may want to ask such questions as: how many courses are required for the degree? How reasonable are the exams and hurdles associated with the degree? Graduate students are an excellent source for this information, but remember to query as many students as possible. A trip to the local pub may be helpful here.

10. *The application packet.* Fill out the application completely and type it. Make sure you get it in on time. Note that universities charge a fee to apply ($25–100). Most application packets will include an application form that will typically require you to write an essay about your goals or reasons for wanting to pursue a graduate degree. Consider your goals carefully and remember that most faculty are looking for committed, mature students, who will make research their priority. Generally, the more specific you can be in the essay the better. It is important to demonstrate that you have knowledge in the research area you hope to pursue.

11. *Recommendations.* You will need to secure three and sometimes four recommendations. These recommendations should come primarily from faculty, but one may also come from senior graduate students or job supervisors. Choose people who know your abilities both inside and outside the classroom. Ask each person if they are willing to write you a positive letter of recommendation (most will be quite frank). After choosing which programs to apply to, give each reference a brief description of your goals and interests, a copy of your resume, any forms they are required to fill out (typically, there is a formal recommendation form), and stamped envelopes addressed to each institution. Give them this information all at once and well before the application deadline (at least 3–4 weeks). Overall, these materials will allow your references to write a detailed and personal letter and get them in on time. Faculty can be notoriously bad about getting recommendations in on time. It is your job to insure that individuals who are writing your recommendations actually send them in. *Double check* this, preferably by contacting the universities you are applying to, not by asking the faculty member. If the letters have not arrived by close to the due date, contact the faculty member with an e-mail, phone call, or personal visit and request that they send the letter ASAP.

12. *Financial support.* Most institutions offer financial support in the form of Teaching Assistantships, Research Assistantships (sometimes provided directly by the professor), and Fellowships. This support often comes with full tuition remission (i.e., school is free) and a modest but usually livable salary in exchange for conducting research or teaching. A fellowship typically includes a salary and tuition remission with relatively few strings attached. The National Science Foundation offers prestigious 3-year fellowships that you can apply for in the year prior to enrolling or in your first year of graduate school (see <http://www.ehr.nsf.gov/EHR/DGE/grf.htm>). Find out whether you are likely to be awarded financial support upon admission. If so, what kind? Support can vary dramatically among institutions in terms of the actual amount of the salary, whether the salary comes with tuition remission, and how long the support will be guaranteed (from no guarantees to 5 years or more). *Find out the facts regarding your support!* Other questions to ask include: Will there be support during the summer and is there funding for graduate student research? Graduate students enrolled in the program are often a good source of information about whether the financial support is reliable and also livable. Support of $15,000 a year goes a long way in Beaumont, but not so far in New York City.

13. *Accepting an offer.* Once you have decided that a program is right for you, call them to accept their offer and send them a written acceptance. Do not accept an early offer as a "back-up" in case your preferred school declines your application; your acceptance means you agree to attend that school. If a deadline is approaching at one school and you still have not heard from other schools, call and see if you can obtain an extension.

14. *Declining an offer.* Once you have crossed a school off your list or have accepted an offer from another school, immediately contact the other schools and let them know you plan to go elsewhere. Write a short e-mail to each faculty member with whom you interviewed, thank them for considering your application, and let them know where you decided to enroll. Do not forget this simple courtesy; it will save you embarrassment when you run into them at scientific meetings. Additionally, there are students on waiting lists who will appreciate your timely decisions regarding these matters.

IV. Some concluding remarks

1. *Thoughts from a successful graduate student.* When I gave this to a number of graduate students to critique, one had this insightful commentary. Tell prospective students that "Graduate school is not for everyone. It is hard work at low pay,

and the few jobs available at the other end offer hard work at low pay. Do not go to graduate school because you like school; graduate school is very different from the undergraduate experience. Sometimes the choice not to go will be the right choice and send you off on an alternative and rewarding path." This is sound advice.

2. *Get advice from others.* Overall, this is just a primer on applying and getting accepted into graduate school. It reflects primarily my opinion and experiences. Seek out additional advice from professors, graduate students, and advisors. Procedures and strategies on admission can vary from one institution or discipline to another.

3. *Thrive in grad school and dodge the train.* Remember, you are trying to go from one who consumes knowledge to one who produces it. Make research your priority. Know that for every Ph.D. student, there *is* light at the end of the tunnel, but for many, that light will be the headlights of an oncoming train. To help yourself avoid the train, the following two articles are highly recommended and have been read by hundreds of graduate students.

Stearns, S.C. 1987. Some modest advice for graduate students. ESA Bulletin **68**:145–150.

Huey, R.B. 1987. Reply to Stearns: some acynical advice for graduate students. ESA Bulletin **68**:150–153.

These two articles offer a pithy and provocative exchange on how to be a successful graduate student. They each offer humorous advice and sage wisdom. *They should be read by all beginning graduate students.* For a lengthy and more formal treatise on surviving and thriving in graduate school, see: *Getting What You Came For: the Smart Student's Guide to Earning a Master's or a Ph.D.* Robert L. Peters, Noonday Press, 1997.

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Research Productivity and Reputational Ratings at United States Ecology, Evolution, and Behavior Programs

Reputation is an idle and most false imposition; oft got without merit, and lost without deserving.
—Shakespeare

It is well known that the reputation of a research program has a major impact on its ability to attract top-caliber graduate students and faculty, to secure external funding from federal agencies, and to compete for resources within universities (Roush 1995). In 1995, the National Research Council (NRC) published a survey (Goldberger et al. 1995) of reputational ratings for 41 research fields at Ph.D.-granting universities in the United States. Included in this survey was a reputational rating of 127 Ecology, Evolution, and Behavior (EEB) programs across the US. One of the main stated objectives of the NRC survey was to "permit analysts to extend their work on the nature of 'reputational ratings' or the opinions of faculty peers about a program." This analysis will discuss the broader interpretation of the NRC ratings, and specifically, how these ratings relate to research productivity at the 63 top-rated Ecology, Evolution, and Behavior programs in the United States.

In the original NRC ratings, considerable discussion was devoted to the meaning of "reputation" and factors that might bias ratings. Authors of the NRC report were acutely aware that many factors besides the actual quality of a program might influence its NRC reputational rating. An important assumption of the NRC survey is that a program's reputation is related to its scholarly productivity. It was also clear from prior NRC reputational surveys that the size of a program is often correlated with its reputational rating. There are a number of fair and perhaps unfair reasons why this is generally the case (Goldberger et al. 1995). Other factors that might influence or bias a program's NRC rating include the presence of "stars," or "visibility," and the overall reputation of the university. Highly prestigious universities "may cast a 'halo' over [programs] which do not merit as lofty a reputation" (Goldberger et al. 1995).

Toutkoushian et al. (1998) recently published a general analysis of the NRC ratings across most research fields using data published in the NRC assessment. Their study found that NRC reputational ratings are positively correlated with the size (e.g., number of faculty) and per capita productivity (publications per faculty) of programs across all research fields. There is also a strong tendency for programs located at private and at prestigious universities to have substantially higher reputational ratings than expected based on their size and productivity alone. By comparing the ratings for fields examined in both the 1982 (Jones et al. 1982) and 1995 (Goldberger et al. 1995) NRC reputational assessments, Toutkoushian et al. (1998) found that program reputations change quite slowly; the best predictor of a program's 1995 reputational rating was its 1982 rating. (EEB was not one of the fields assessed in the 1982 survey.) The 1995