Contributions

Demystifying the Graduate School Application Process

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Abstract

Navigating the graduate school application process is often challenging, requiring intricate knowledge of academia and graduate institutional structures. This "Hidden Curriculum of Academia" includes what different graduate degrees offer, how to connect with a faculty member of interest, and the skills needed to submit a "competitive" application. We hope to demystify a portion of this hidden curriculum by focusing on the process of applying to graduate school in research-oriented science programs. This article provides an overview of graduate school, the application process, how to prepare for it, and potential career paths to pursue following a Master's or Doctoral degree. Our work contributes to the larger literature that aims to increase the transparency of academia and create a more diverse, equitable, and inclusive space.

Key words: ecology; EEB; graduate school; graduate school application; hidden curriculum; JEDI.

Introduction

Graduate school presents a variety of unique challenges, especially for those from marginalized and oppressed backgrounds (Berhe et al. 2021). Yet, before individuals even enter graduate school, they must surmount the hurdle of the application process. Success in this process, similar to most success in academia, lies behind a wall (sometimes referred to as an "invisible barrier"; Gardner and Holley 2011).

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Over this wall, one finds what is commonly referred to as the "Hidden Curriculum of Academia." Here you learn, for example, how to contact faculty members for research positions, what skills you should be building prior to applying, how to develop strong proposals and grants, and where to find funding. This knowledge and the associated skills are foundational to success in graduate school and, more broadly, academia. Generally, this information is passed on through (and between) academic lineages (i.e. between labs or faculty members to postdocs and graduate students), making the process daunting for those who have either not established a strong faculty mentor, do not feel comfortable approaching a faculty member, or are not yet part of a research lab. Thus, the exclusivity in access to these resources via mentorships, exposure, and other research-related experiences prevents the success of all individuals interested in graduate school for research-oriented science programs. This likely plays a significant role in the demographic makeup of graduate students in the United States and, consequently, the makeup of those who further pursue tenure-track positions in academia.

Many potential graduate students from marginalized backgrounds are barred from applying and/or being accepted into graduate programs by a lack of understanding, or the complexity, of the process, which is common for pursuing higher education generally (Gardner and Holley 2011, Ramirez 2011). This feeling is likely exacerbated in graduate programs that are more complex than a simple "apply and wait," such as non-rotation research-driven science programs. Although this hidden curriculum for graduate programs is not the sole reason for disparities in the representation in academia (e.g. racialized experiences, McGee and Bentley 2017), it continues to prevent academia from becoming a more just, diverse, equitable, and inclusive (JEDI) space. Access to resources is important for transparency in how academia works and is especially relevant for groups such as first-generation students (Gardner and Holley 2011).

In this article, we aim to provide those interested in graduate school with a general understanding of the graduate school application process to increasing the success of applicants from marginalized backgrounds. Individual steps for a successful application will vary by the potential faculty advisor, graduate program/department, advisor, and institution. Here, we discuss (1) graduate school and considerations to make before applying, (2) the process of applying to graduate school, including finding a lab and crafting statements, and (3) career paths available for those who pursue graduate school, with distinctions between positions available with Master's degrees (M.S.) and Doctoral degrees. We conclude by briefly discussing how this article may benefit JEDI efforts and provide a table of resources useful for undergraduates considering graduate school. Additionally, we include a compact version of this paper as a supplemental flyer (Appendix S1).

What is graduate school and how do you set yourself up for it?

While "graduate school" can encompass everything from professional degrees (law, medicine, business) to academic degrees (M.S. and Ph.D.), we focus this article on the latter. M.S. are generally 1–3 years and are started by students any time after they receive their undergraduate degree, with some students opting to begin immediately after obtaining their undergraduate degree and others opting for taking some time out of school between degree programs. At some institutions, opportunities for joint undergraduate and M.S. programs at an accelerated rate are available. M.S. degrees can be research- or course-focused, depending on your discipline and the university department. It' is worth noting that M.S. degrees are a requisite for starting Ph.D. programs in many countries. However, in the United

States graduate school system, M.S. are often (but not always) optional prior to starting a Ph.D. For students with research experience and a vision for what they intend to study but not a M.S. degree, going straight to a Ph.D. is possible. Ph.D. degrees, in contrast to M.S. degrees, are always research-focused. These degrees vary widely, taking anywhere from 3 to 8 years (or longer!) depending on the country, discipline, university, etc.

Deciding whether graduate school is the right next step

Graduate school is a thrilling experience; it allows you to spend your time delving into a topic of interest to you within a community of other researchers with whom you can collaborate and learn. At the same time, it is also a challenging experience in which you will surely have both successes and failures. And it is time consuming; once you decide to enter into a graduate program, there is a long process before you are complete. This should not daunt you, but suggests the importance of carefully considering the motivation for entering in the first place.

The first thing to consider is why you want to go to graduate school. To do this, you should consider your career plan; a M.S. or Ph.D. is required for some positions, while a graduate degree over-qualifies you for other positions. See the "What next? Careers after graduate school" section for more information on what you can do with a graduate degree. You should also think about the timeline and lifestyle to determine whether this is something you can afford mentally and financially. Finally, you should think about what you want to gain from graduate school; a M.S. degree provides you with the scaffolding to apply the skills, while a Ph.D. sets you up to determine research directions.

Undergraduate vs. graduate degree

After completing your undergraduate degree, you may wonder if going to graduate school is right for you. And if not now, then when? A major question to ask yourself to help understand if pursuing graduate school is right for you is: "what can I accomplish with my undergraduate degree for my career, and am I satisfied with that?" The core difference between an undergraduate degree (i.e. Bachelor's) and a graduate degree (i.e. M.S. or Ph.D.) is the post-graduate opportunities opened up (or removed) when the degree is earned. For example, in a museum, you may be able to be an assistant rehabilitator or a zookeeper with your Bachelor's but to conduct and lead research, a M.S. or Ph.D., is likely required. Because pursuing a graduate degree is time-consuming and requires an investment (see *Earning a M.S. vs. Ph.D. Degree* below), it is worth having a general long-term plan that includes your general career of interest before committing to a graduate program.

When you have a general idea of the career you are interested in, or the exact position you want to pursue, it is useful to find individuals that are in that position or career via search engine or other avenues such as Twitter. You can then look into what degree they hold or send an email to ask more about educational requirements for the position. In addition to locating specific people working in the position you are interested in, you may find it useful to browse job boards (e.g. USAJobs, Texas A&M Wildlife Job Board); you can then examine the job requirements for positions of interest. Perhaps the position you thought required a Ph.D. only recommends having one, or asks for a M.S. instead. During this time, you may also find other positions that spark your interest and only require a Bachelor's degree.

Earning a M.S. vs. Ph.D. degree

Once you decide that graduate school is right for you, you need to determine what degree you are interested in earning. No single answer is "best." The decision depends upon your desired career path, interest in research, funding availability, and timeline (Clark 2021).

The research M.S. is generally a 1–3 year degree. Funding varies, with some research M.S. providing tuition coverage and stipend support through either teaching assistant (TA) or research assistant (RA) opportunities while others require a student to self-fund their degree program. In some M.S. programs, you also apply to the program rather than to a specific faculty advisor. The M.S. degree consists of both coursework and research, providing you with the content and skills to be successful in your career. Since the program is short and you need to start research immediately, your faculty advisor will likely assign you to a research project. Your degree is earned when you complete the research project, write it up as a thesis (and often as a manuscript submitted to a journal with you as the first author), and sometimes complete an oral defense of your research. You complete the program with the knowledge and ability to apply these skills to other settings and to be actively engaged in research programs or interpretation of research findings.

The Ph.D. degree is generally a 4–6 year degree, though it can be longer or shorter. Funding is generally guaranteed through TA and RA opportunities and internal fellowships. Coursework for Ph.D. programs varies by department; some have specific required courses or required credit hours, while others are more flexible. The coursework is intended to provide the foundation for mastery of a subject and the research you will conduct during your program and career. The majority of your time will be spent conducting research. Typically, a Ph.D. dissertation consists of at least three "chapters." Each chapter is an individual paper that is submitted for publication in a journal either during or following your degree program. The Ph.D. has two major milestones: a qualifying exam or cumulative exam and a defense. The qualifying/cumulative exam, which generally occurs during your second or third year, is an oral and/or written exam that allows you to demonstrate mastery of your coursework and of your proposed dissertation research. The defense occurs when you have completed your dissertation and generally consists of your written dissertation, an oral presentation of your research, and either a public or private question and answer session. Due to the longer nature of a Ph.D. program, you ultimately finish your degree as a, or the, world expert on your dissertation topic.

The decision you initially make regarding a M.S. vs. Ph.D. program does not need to be your final decision. Once you have completed your M.S. degree, if you are interested in continuing your graduate studies, you can either remain at your current institution to earn a Ph.D. or apply for a Ph.D. elsewhere. There are advantages to this approach, as it allows you to ensure that you are interested in a Ph.D. before committing. If you decide to switch institutions or faculty advisors, it provides you with the opportunity to work with multiple mentors on multiple projects forming multiple connections. Alternatively, if you apply for a Ph.D. but decide that it is not the right fit for you, you can often leave the program with a M.S. degree. While it can sometimes be difficult to leave a program that you have committed to, making this decision represents maturity and shows your commitment to doing what is best for you (Flaherty 2019).

Structure of a lab

Before you start preparing for graduate school, it is helpful to understand how a lab is generally structured; in other words, who makes up the general lab population. The lead of the lab is the faculty member, known as the Principal Investigator. The faculty member is responsible for recruiting people into the lab, applying for funding to support all the people and projects in the lab, setting the lab culture and expectations, and guiding the research that is occurring in the lab. Some labs will have research scientists who are also leading projects within the lab, but who are a source of additional mentoring and support. The bulk of the lab group will consist of graduate students at various stages in their graduate career. Additionally, lab groups may have postdocs; people who have already received their Ph.D. and are "post doctorate." In many fields, 1–5 years of postdoc experience is the norm prior to receiving a permanent academic position. Postdocs and senior graduate students are important mentors for beginning grad students. Lab groups may also have undergraduate students working in the lab, either mentored by a specific graduate student or postdoc or generally available to help with projects. Finally, labs may have lab managers and/or technicians whose job are to help with the activities in the lab, including ensuring the instruments are working, collecting data, and analyzing samples.

Preparing for graduate school

Expectations for graduate school applicants vary by program and university, but there are some general core traits. First, applicants are typically expected to have some experience in a research lab. This experience does not have to be directly related to the work you are proposing to complete during your M.S. or Ph.D. as it is common for researchers to pivot between taxa and study sites. The discipline of your previous research is also generally not important, as graduate programs are focused on seeing whether you can be successful in a lab environment, conducting research and carrying out the scientific process, to then extrapolate to your future success as a graduate student and your exhibited interest in science. Moreover, a broad skill set with diverse research tools, taxa, and research questions can highlight your ability to learn different approaches. This is to say, it is never too late to change study organisms or discipline (e.g. genetics vs. behavioral ecology). Second, applicants are expected to be able to articulate potential projects of interest. At this stage, your research questions can be broad, and you are not expected to know your dissertation in its entirety. For example, stating that you are interested in how organisms compete for resources will not help your application impress reviewers. Instead, narrowing this down and expressing a question such as "How do individuals change foraging strategies to avoid spatial or temporal overlap with conspecifics, and does this change along an environmental gradient?" can show faculty members you are thinking deeper about ecological questions. Lastly, leadership experience related to the natural sciences and community outreach can be incredibly helpful, though it is not required.

Applying to graduate school

Finding a faculty advisor

Once you decide to apply to graduate school, the next step is to determine where you want to go. Some M.S. programs and a few Ph.D. programs are similar to undergraduate programs: you apply to a department and are admitted based upon the submitted documentation. However, for most graduate

programs, you are applying to work directly with a faculty member on research they are conducting. Therefore, the most important step in your graduate school application process is to determine, and make connections with, a potential faculty advisor. If you have a geographic location or preferred institution in mind, you can search through the faculty on individual department websites to find people whose work interests you. But for most without these limitations, there are an endless number of institutions to examine; therefore, other methods are needed.

There are many possible avenues for finding a faculty member to work with, and it is generally best to pursue a combination of these suggestions to find someone who is both a good fit and has open funding to hire a graduate student. The first is to ask your mentors (e.g. professors you took classes with, faculty who led research experiences that you took part in) if they have any suggestions for potential faculty conducting research in areas that are related to your interests (Witz 1994). Do not be shy about approaching them; your mentors will generally be excited that you are continuing your studies and that you have turned to them for advice.

The next source to find a faculty member is social media, especially Twitter. Many faculty members have an active Twitter account that they use to post opportunities both in their labs and in their colleagues' labs. Following faculty from a variety of institutions and identities on Twitter will increase the number of opportunities that you come across. Moreover, leveraging Twitter to share your research progress, projects you are working on, and community outreach you are involved in can help spread who you are amongst the scientific community. In addition to following faculty members, you can also follow departments, societies (e.g. Society for Freshwater Science, American Geophysical Union), specialty groups (e.g. Graduate Women in Science, Earth Sciences Women's Network), and graduate students to find postings about graduate positions or to learn about new people who have tweets similar to your research interests.

A potential third way to find a faculty advisor is through job boards (Appendix S2). These are often listservs that you can join with daily or weekly announcements. Some job boards are devoted entirely to open positions (e.g. American Geophysical Union Job Board), while others include a variety of announcements (e.g. ecology-l). You can even join these listservs months to years in advance of when you want to start grad school, allowing you to begin to compile lists of potential faculty advisors.

Finally, you can find faculty advisors by compiling names of people whose research you find interesting. This can be drawn from journal articles that you read for classes, examples provided by textbooks, or people who you have seen present at conferences. You can also read through the abstracts (and then the full articles) within a journal related to your field. When you find an article that you find to be exciting, look up the co-authors. Usually, the faculty member responsible for the paper will be the last author on the publication, or you can also look at who the faculty mentor is for the first author of the paper.

Contacting potential faculty advisors

Once you identify a list of faculty with whom you'd be interested in working with, the next step is to read more about them on their personal and/or department websites and to read a few of their recent papers. You can use Google Scholar to find these recently published articles, which may not yet be on their webpage. If you remain excited about their work, it is then time to reach out to them via email (Fig. 1). Drafting this first email is important, as it represents the first point of

Dear Dr. XXX,

My name is [insert name] and I recently graduated from [insert university], where I studied [insert major/minor]. Currently, I'm working at [insert current position, if applicable] researching [short research description]. My research experiences include [insert broad but relevant skills to the lab]. I am planning on applying for [degree] and your research lab interests me greatly.

After working on [broad topic] with [professor's name] for my honor's thesis where I examined [specific research description], I developed an interest in [general research interests for graduate school]. I am particularly interested in this field because [explanation of research interest]. Your lab's recent work in [topic related to what you mentioned] would build upon my interest in [connect their work to your research]. In graduate school, I'm interested in working with [insert tools/species/methods] to pursue broad questions such as [question 1, question 2]. I believe my interests fit into your lab and that working with you will allow me to further develop my skills while exploring my strong interest in [field].

Are you considering new graduate students for Fall XXXX? If so, I would love to discuss the possibility over email or by phone/Zoom and would be happy to provide any additional details about my background. I have attached my CV, transcripts, and honor thesis for your reference, and I hope to hear from you soon.

All the best,

XXXX

Fig. 1. Email template for contacting potential advisors.

contact that they will have to you (Gill 2013, Belasen 2021). In this email, you want to succinctly explain to them: (1) your academic background, (2) why you are excited about their research, and (3) research questions that you would be interested in pursuing. You should include your curricula vitae (CV) and undergraduate transcript, making it easy for them to have all the information that they need to evaluate you immediately. You should also ask them whether they are planning to take students to start during your desired time period and if you can arrange a meeting to further discuss opportunities. To help facilitate scheduling a conversation, it is best to include a list of times that work for you over the subsequent few weeks.

You should plan to reach out to several faculty members since not all faculty will have funding or space in their lab to take on new students. This step of the process is exploratory; you are not committed to applying to work with anyone yet. Rather, it's a two-way street; you need to interview them just as much as they need to interview you. When you work with a faculty member for your graduate studies, they are committing to mentoring you and helping to develop you into a professional who can succeed in the field. Your task at this stage is to set yourself up with someone who has a record of serving as a positive mentor and whose style fits your needs. Finally, if you do not hear back following the initial inquiry, do not hesitate to send a follow-up after 2 weeks.

During your phone or video conversation with potential faculty advisors, you should ask them questions to ensure they will be a good fit (Golde 2001, Xhakaj et al. 2011, Liang et al. 2020). The conversation will likely begin with you telling them about yourself and why you are interested in graduate school. They will then want to know what drew you to their lab and broadly, what research you are interested in pursuing. These are questions you should prepare answers to in advance. Note that a lot of faculty websites are out of date, so be prepared for them to share with you new research avenues that they are currently pursuing or have recently received funding to pursue. You should ask them questions to learn more about these projects and how a graduate student could be involved in them.

After discussing research, it is important to learn about them as a mentor (Langin 2019). You will want to prepare a list of questions in advance (see above). This list should include inquiries about their mentoring style, lab culture, expectations, and time to degree completion. It should also include questions about the department, including professional development opportunities, collaboration, internal funding, and whether the department stipend provides a livable wage in the institution's city (see Carson et al. 2021 for more considerations). It is also important to discuss how you will be funded (i.e. TA, RA, fellowship) and whether funding is guaranteed and for how long. Finally, you should also ask for the names and contact information of current and former graduate students in the lab. You should then reach out to them and ask them similar questions.

Many faculty advisors will also suggest working on a fellowship proposal, together during the application process, such as the National Science Foundation's Graduate Research Fellowship Program. If funded, the Graduate Research Fellowship Program would provide you with 3 years of stipend support, allowing you more flexibility in designing your research project since you will not need to TA or be tied to a research grant for your support. Note, however, that you will still need funding to support any fieldwork or labwork that you do. This is also an excellent opportunity to get to know a potential faculty advisor as you receive feedback on your fellowship application.

Following this conversation, you can decide whether you would want to work with any of the faculty members that you contacted. If you are still interested, you should send a follow-up email to thank them for their time and state your intention to apply to work with them. At this time, if you would like to set up another meeting for clarification purposes or other reasons, this is also the time to do that. If you are no longer interested, you should still send them a follow-up email to thank them for their time and state that you have decided that their lab is not a good fit for you but that you hope there will be opportunities to work together in the future. Then you should look into department application deadlines and requirements for the faculty with whom you are interested in working.

Application process

Graduate schools often require a personal/diversity statement, research statement, CV, three letters of recommendation, and GRE scores (however, some departments are beginning to remove the GRE as a requirement). The personal/diversity statement is the chance for you to show why you want to apply to graduate school. Include unique experiences that you have had that led to your decision and what you plan to do with your degree. In the research statement, outline ideas for research projects, basing your statement on the conversation(s) you have already had with your potential faculty advisor. This statement should build on ideas you have already brought up in your personal/diversity statement. There are excellent online resources about how to craft these statements (OpenAcademics 2020). It is recommended that you start working on these documents early and receive feedback from various people. Submission of the application also requires an application fee; note that these can often be waived if you reach out to departments directly to request it.

This will likely be the first time you have written a CV, but there are also great online resources (OpenAcademics 2020). It is also helpful to look at the CVs of graduate students in some of the labs you are applying to if they are available on the faculty member's website. If you are working with a graduate student or faculty member at your institution, they are likely more than happy to share multiple CVs and help you with formatting. Note that, unlike a resume, there is no page limit on a CV, and it, therefore, allows you to list all jobs, research opportunities, teaching experiences, services, publications, and training that you have completed. You will want to create a CV that is appropriate to your field, and you will build upon this initial CV throughout your career.

You should request letters of recommendation from people who know you well and can speak to your ability to succeed in graduate school and the field. If you have previously conducted research, taken part in independent studies, or participated in an internship, you should request letters from your mentors. Professors with whom you have taken classes can also write strong letters of recommendation, but only if you have interacted with them enough for them to know you well. It is important to mention here that although you may have done incredibly well in a class, if the Professor does not know you well, their letter of recommendation may not be strong. When you decide on the individuals who will write your letters of recommendation, reach out to them early and provide them with your statements, CV, and transcript. It is also helpful to provide them with a list of skills/traits you want them to highlight or specific experiences you have had working with them. Numerous online resources are devoted to how to properly reach out to recommenders (Lundsteen 2018).

The final submitted application requirement is the GRE. This standardized exam must be taken in advance of the application and, similarly to the SATs or ACTs, is used to compare applicants from a variety of backgrounds. There are many efforts underway (generally at the department level) to remove the GRE requirement (Sealy et al. 2019, Nietzel 2021), so you should look into specific requirements at the institutions to which you are applying.

The final piece of the application process is a formal interview, which generally occurs in the winter. In some departments, this interview is used to assess which students to accept. In other departments, students are accepted prior to the interview, and it is used as a means for students to decide if they want to accept the invitation. In either case, the interview allows you to learn more about the faculty member, lab, and department. It is a chance for you to continue to interview the faculty member and graduate students to determine if this is a good fit for you (Oudekerk and Bottoms 2007).

What next? Careers after graduate school

A graduate degree can be an important step toward a fulfilling career. It provides you with the toolset to succeed in the career track you choose. But higher degrees are not always "better" when it comes to career opportunities; different degrees have different strengths (Wendler et al. 2012). It is worth considering what type of work and structure you enjoy. Look for people who have jobs you think you would enjoy and chat with them; what does their day-to-day look like? What degree did they need? Keep an eye out for job ads; what sort of degrees and skills do they seek?

Careers that require a Ph.D. vs. M.S.

A Ph.D. is required for most academic jobs. You'll need a Ph.D. if you want to be a teaching-focused professor (e.g. at a community college, undergraduate-only institution) or a research-focused professor (e.g. running a lab at a university with graduate students). But a Ph.D. can also be a valuable credential outside of academia: it is required (or preferred) for some government science and policy jobs (e.g. USGS, NOAA), as well as some non-governmental (NGO) science positions (e.g. WWF). Additionally, a Ph.D. can also be useful for science journalism and science policy. Generally those positions that require a Ph.D. involve deciding research directions, leading teams of researchers, and applying for research funding.

While a Ph.D. may open some additional career opportunities, M.S. degrees can be the most sought after for industry, applied NGO jobs, cultural institutions (e.g. museums), and government positions (e.g. wildlife biologist or data scientists for NOAA, USGS, EPA). M.S. degrees can also set you up for becoming a data scientist. Generally, those positions that require M.S. degrees will involve you working as a member of a larger research team or working with data collected by others. These jobs also generally involve more concrete outcomes.

Conclusion

Applicants to graduate programs can be deterred from applying (or unsuccessful in their pursuit, Appleby and Appleby 2006) because they do not understand how to apply or how they will be evaluated. Finding

information about the graduate process online can be difficult and time-consuming, which may deter students from applying even if they locate and meet the evaluation criteria. Those who do find information online about how to appropriately apply may be unable to put together a competitive application due to a lack of mentorship, understanding of what a strong application looks like, and other resources critical for success in the process (e.g. example statements). In this article, we clarified how to apply to graduate school in research-driven science programs to remove barriers associated with graduate school applications. In addition to providing generalized but highly relevant information, we have provided links we have deemed helpful for demystifying more of academia and graduate school (Appendix S2). These links include resources such as job boards and a document compiling links on navigating the academic environment. Efforts such as this article (e.g. Carson et al. 2021) are crucial for individuals, especially those that are marginalized, to understand the process behind entering academia and learning its hidden curriculum, which can be a major barrier to success (Gardner and Holley 2011). Providing ease of access to these resources is essential for transforming academia into a more equitable space, providing an opportunity for more diverse applicants.

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