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# A Guide to Graduate School

# in Ecology, Evolution, Conservation Biology and Animal Behavior

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**Types of Graduate Degrees**

After completing a B.S. degree in Biology, you have the option of attending graduate school to receive additional training and ultimately an advanced degree, either a Master of Science (M.S.) degree and/or a Doctor of Philosophy (Ph.D.).

There are two types of M.S. degree programs, “non-thesis” and “thesis.” If you do a non-thesis degree, you simply take a set of graduate level courses (usually about 30 credits worth) and you have your degree. In some situations, you will do a small research project as part of one of your courses (sometimes called a “capstone” project) and produce a research paper. If you do a thesis degree, you will do a *major* research project and describe your findings in a written “thesis.”

Ph.D. programs always involve a major research project followed by data analyses and preparation of a written “dissertation” (like a thesis, only bigger!)

**Why Do People Go to Graduate School?**

People go on to graduate school for several different reasons:

Some people attend graduate school to gain promotion or higher pay in their *current* profession, e.g., teachers.

Some people attend graduate school because an advanced degree is either recommended or required for the career that they want. In many career areas, a B.S. degree in biology only qualifies you for an entry-level position, which often involves doing work designed by the individuals that *do* have advanced degrees. If you are interested in obtaining higher-paying, more interesting, decision-making level positions in Biology, you often need graduate-school training.

However, MOST people go to graduate school because they want to study and explore some particular area of Biology in more detail. In particular, they want to do their *own* research, discover new things about the natural world, and publish their results for others to see. In other words, they want to become true *scientists*.

**Two Great Misconceptions About Graduate School**

Many TU undergraduates do not even consider graduate school because they suffer from two misconceptions about graduate school. First, they mistakenly assume that “grad school” is just more of the same, i.e., *more* classes and *more* tests (but probably a lot harder). Yes, some coursework is involved in getting a graduate degree but the difference is that you take primarily courses in your specific area of interest. For example, a student may come to TU *generally* interested in conservation biology. After taking a number of undergraduate courses, the student discovers that he/she is intrigued by the question of how to design nature reserves. If this student heads off to grad school to study this topic in more detail, he/she may take graduate courses almost exclusively in the areas of ecology, conservation, population biology, wildlife management and closely related fields. These courses will often be taught by professors actively doing research in these areas. Moreover, the structure of graduate courses usually differs from that of undergraduate courses. Much more time is spent on the cutting-edge, *i.e.,* examining new and exciting discoveries. You will spend much of your time reading recently published research papers, rather than out-of-date textbooks. Class time will be spend discussing new and interesting research.

Note also that taking additional coursework in one’s chosen area of interest is usually just a small part of the graduate experience. One’s main focus in thesis-type M.S. programs and especially Ph.D. programs is *conducting original research*. Under the guidance of a professor – a research mentor - who is an expert in the student’s chosen area of interest, graduate students conduct research on questions that nobody has ever studied before. The results are written up in a thesis or dissertation and are frequently published in scientific journals. *There is nothing quite like the thrill of making an original contribution of new information to one’s favorite area of Biology.*

The second great misconception about graduate school is that it will cost a fortune and put one into debt or further into debt. Actually, in most cases it costs you very little money to go to graduate school. Huh? Is this really possible? Indeed it is, and this is discussed in more detail below.

###### M.S. vs. the Ph.D. degree

If you do decide to go to graduate school, one of the biggest choices that you will face is whether to get a Master’s (M.S.) degree, a Ph.D., or both*, i.e*., complete an M.S. and *then* a Ph.D.

Some professions only require and expect individuals to have an M.S degree. This is the case, for example, for people that want to be wildlife technicians, working for various state or federal agencies. These people don’t want to “run the show” (they will leave that hassle to the Ph.D.s) but they also don’t want to be one of the “drones” with only a B.S. degree that gets stuck with all the grunt work.

Some professions, however, like professor or “lead researcher” *require* a Ph.D. These professions are ones where you have a decision-making role – you *do* run the show – and you get a higher salary for it.

Your decision as to whether to do an M.S. or Ph.D. or both will also be affected by how much time and effort you are ready and willing to put into getting an advanced degree. Completing a Biology Master’s degree usually takes 2–3 years whereas a Ph.D. usually takes 4-5 years. If you are not absolutely certain that you want to devote 4+ years of your life to graduate school, you may start with an M.S. degree and see what graduate work is like before making a bigger commitment. (Be aware, however, that having an M.S. does necessarily mean that it will take you any less time to earn your Ph.D., especially if you change schools.)

Even if you *are* certain that you want to get a Ph.D., you may still want to consider completing an M.S. before going on for the Ph.D. If you ask around, you will find that some of your professors feel that completing an M.S. first is a wise move, particularly for students who have not done any substantial research during their undergraduate studies. Also, if a student’s academic record is not particularly strong, then they may not be able to get into a Ph.D. program. They may instead need to do a M.S. degree to “prove” that they are both motivated enough and competent enough to do a Ph.D.

Other professors will tell you that, if you have a strong academic record and already have some research experience, if you are certain you want a Ph.D., then the M.S. degree may be a waste of time.

More detailed arguments for and against completing an M.S. before the Ph.D. appear below. Ultimately, you will have to decide what is the best strategy for you. This is a big, big decision and one you should talk over with several of your professors.

*Some reasons why you might want to do an* ***M.S. degree before the Ph.D.***

As stated above, you may want to do M.S. degree first, or only, if:

* You want a career that typically only requires an M.S. degree (it will take some investigation on your part to determine whether careers of interest to you fall into this category).
* You want a career that involves at least some research but you are not interested in a high-stress, labor-intensive supervisory position that requires a Ph.D. You want to be part of a team but you don’t want to be the leader. There are many of these types of jobs, and many of them can be done with a B.S. degree (especially if undergraduate research has been a solid part of the education). But there is a great deal of competition for these types of jobs and having a thesis-driven M.S. may allow you to edge out other candidates with B.S. degrees. A M.S. degree can also put you in a “middle management” position in the lab, which means you will make more money (and have to do less of the tedious grunt work).
* Your academic record is not strong enough to get you into a Ph.D. program, and you need to not only boost your GPA but also prove that you are motivated to succeed in graduate school.
* You have no research experience as an undergraduate and need to gain that experience before you tackle the Ph.D.

However, even if none of the above are true in your case, there are still some reasons you might want to consider doing an M.S. degree first:

1) When you finish your doctorate, you will be competing with many other Ph.D.s in your field for jobs. Employers will mainly be interested in two things. First, they will look at the skills that you have acquired during your graduate training. If you do both a Master’s and Ph.D., you will get more research experience and will likely obtain a greater variety of research skills. This could make you more attractive to employers. Second, employers will look at your ability to do work/research and “produce” new findings. As an indicator of both your abilities and your work/research potential, employers will review the nature, number, and quality of scientific publications that you have produced. You are likely to have a larger number, and perhaps variety, of publications if you have completed two graduate degrees. Again, this could make you look more attractive to an employer.

2) Doing an M.S. degree gives you extra time and opportunity to do research and learn how to do research. Research is not easy, and there are many skills that one must acquire to be successful. One gets better and better at research with practice. If you choose to go straight into a Ph.D. program, the pressure is very much on you to succeed at what will probably be your first try at conducting a major research project. Specifically, a Master’s research-based thesis, gives you a chance to learn the basics of research with a smaller scale project. Moreover, a good record from a research thesis-based M.S. program, including one or more publications, should enhance your chances of gaining entry into, and succeeding in, a high quality Ph.D. program, one that might have been out of your reach as an inexperienced undergraduate. Conversely, if you run into some trouble with your Master’s research and you are not able to publish your research findings, all is certainly not lost! You have gained valuable experience and wisdom that you can take into a Ph.D. program. In short, you get a second chance.

3) Completing a Master’s degree first allows you to spend a few extra years in graduate school. Most professors will tell you that the years that they spent in graduate school were some of the best years of their lives. You don’t make much money, usually just enough to live on, but otherwise life is pretty good. Almost all your time is spent studying and researching subjects that are of intense interest to you. You are surrounded by other graduate students who are keenly interested in Biology and what you are doing. Many of these people will become life-long friends.

4) Doing an M.S. degree first can allow you to see more of the world, if you choose to do your Master’s at one institution and your Ph.D. at another. Imagine, for example, doing your undergraduate at TU, your Master’s at the University of Alaska and your Ph.D. at the University of Miami!

*Why you might want to* ***go straight into a Ph.D. program***

1) As indicated above, one of the benefits of doing an M.S. degree first is it allows a person to gain experience doing research. This usually enhances one’s chances of success when one gets to a very serious, research-intensive Ph.D. program. Some professors would argue that the M.S. degree is redundant and unnecessary for those students who have had extensive experience conducting research as undergraduates; such students should be ready for a Ph.D. program. To some extent, this depends on how extensive the undergraduate research experience was. Undergraduates do not get near as much training in research techniques, data analysis, and scientific writing that they get in an M.S. program. If the extent of your undergraduate research experience is limited to one semester of “lab participation,” that more than likely will not be sufficient to qualify as research experience in the eyes of the graduate program’s admissions committee.

2) Graduate school can be an exciting, fulfilling experience but graduate students get paid very little and feeling “poor” gets really old after a while. It is also extremely difficult to raise children on a graduate student salary. The sooner that you can complete the Ph.D., the sooner you can move into the job market and start making real money…assuming that you are competitive. Furthermore, while many Ph.D. programs provide stipends/fellowships that pay enough such that you do NOT need to take out (additional) student loans, M.S. stipends/fellowships at many schools (including TU) are often meager (if they exist at all). Students at such schools need to take out additional student loans (and/or borrow money from their parents or a spouse) to cover basic living expenses.

If you are thinking about how long it will take you to be ready for the job market, you also need to keep in mind that, after you get your Ph.D. you may need to get further training as a post-doctoral researcher. Most jobs require at least some post-doctoral training. A “post-doc” can span 3-5 years. During a post-doc, one does additional research, under supervision, at a governmental lab, university, or even a company.

The point here is that completion of a Ph.D. and post-doctoral fellowship alone can take anywhere from about 5-7 years before you are ready to hit the job market. If you do a Master’s degree first, add another 2-3 years.

3) Certain graduate programs, such as colleges of graduate studies at medical universities, may only admit students that intend to pursue a Ph.D.; they have no formal Master’s program. At these institutions, students enter a Ph.D. program and, after two years of coursework and preliminary research, take written and/or oral qualifying examinations. Students who pass these exams are allowed to go on to complete the Ph.D. degree. If a student does not pass the qualifying exams, but has successfully completed a certain amount of coursework, some institutions give a terminal Master’s degree as a sort of “consolation prize” and then the students are kicked out of the program.

###### Financial Support: Teaching and Research Assistantships

As noted above, one reason that many undergraduates hesitate to consider going to graduate school is that they feel they don’t have the money and don’t want to incur more debt (*e.g.,* student loans). This is unfortunate because, in reality, **for most students, *it should cost very little to get a graduate degree***.

However, a quick clarification is in order: If you choose to do a non-thesis Master’s degree, *i.e.,* just take graduate-level courses to get the degree you will have to pay for your schooling, housing and all related expenses (sometimes, however, an employer will cover your expenses if they want you to get the degree).

In contrast, when you do a thesis/research-based M.S. or a Ph.D., some form of financial aid should be available to make it possible for you to go to school. Indeed, you should not enter a research graduate program unless it provides you with a substantial amount of aid.

Financial aid for research-oriented graduate students may come in the form of a **graduate assistantship**. There are two types of assistantships, *teaching assistantships* and *research assistantships*. Both pay you a **stipend** (salary), usually just enough to live on in the local economy (usually $12,000-$25,000 depending on the location and university; possibly more if you are in a Ph.D. program), and both typically come with a full or partial tuition waiver (in-state or out-of-state) and possibly paid health insurance. You may still have to pay fees and will definitely have to pay for books.

If you have a **teaching assistantship (TA)**, then in exchange for your stipend and tuition waiver, you will be assisting professors in teaching laboratories, usually in non-majors courses or lower-level majors courses (like BIOL 120, 201, 202, 221, and 222 here at TU). You give lab lectures, run the lab, grade lab reports, make up and grade quizzes, and often assist the professor in grading lecture exams. You are expected to devote an average of about 20 hours a week to teaching. The rest of the time is yours to take courses and do research (but not work elsewhere….working an outside job while in graduate school, especially in Ph.D. program, is often discouraged or outright prohibited).

If you have a **research assistantship (RA),** you are paid to do your research; you don’t have to teach. As you might guess, RAs are very coveted positions. In some instances, students are awarded an RA by the university. In other instances, your research mentor will have enough grant money to give you an RA.

When you apply to a graduate program, you should indicate that you want to be considered for both an RA and a TA. Competition for such positions can be intense and awards are usually based on a student’s qualifications (GPA, GRE scores, letters of recommendation, past research experience and productivity – see below). In some cases, schools will admit you into their graduate program but not offer you an assistantship. Again, we strongly advise that you *not* enter any program without an assistantship (unless you are independently wealthy or have a spouse or other individual that will cover your costs). It is nearly impossible to work enough hours at an outside job to support yourself while still devoting enough time to your coursework and research to be successful. For this reason, you absolutely want to apply to several graduate schools in an effort to find one that will both accept you *and* provide you with financial support.

###### Financial Support: Fellowships

Another way to support yourself in graduate school in whole or in part is to get a grant or a fellowship from a private foundation or a government agency. For example, the National Science Foundation awards “full-ride” Graduate Research Fellowships to a select group of students each year. For further information on this program, see: <http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=6201&org=NSF>.

There are numerous other sources of fellowships and grants that can be found with some search time online. For example, we suggest that you check out *Foundation Grants to Individuals* website at: <http://gtionline.fdncenter.org/> and the Smart Student Guide to Financial Aid website: <http://www.finaid.org/>

**When Should You Start Investigating Graduate Schools?**

Applications for graduate school are typically due sometime between December and April (students then begin graduate work the following August or September). As such, your investigation of potential graduate schools should begin no later than early in the fall of your senior year. It is at this time that you want to contact potential graduate supervising professors and arrange visits (for details on how to do this, see below). You should also make arrangements to take the Graduate Record Exam (described below) that same fall or very early in the next year.

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###### Strategies for Finding a Graduate School and a Graduate Supervisor

In graduate school, you do research under the supervision of usually one professor (two or more other professors will sit on your “graduate committee” and will usually provide advice and help as well). It is sometimes said that your choice of a supervising professor is second in importance only to your choice of a mate. True enough! There are numerous horror stories of supervisors so bad that they caused their students to take several extra years to finish their degrees or simply drove them out of graduate school altogether in utter frustration. You must find a supervisor that is knowledgeable, supportive, and reasonably easy to work with. You want someone that wants to see you succeed and is obviously willing to help you do so. You want to avoid someone that takes a hands-off “sink or swim” attitude to their graduate students because they really don’t care about you all that much. You also want to avoid a potential supervisor that is too busy to provide you with enough help even if they want to do so.

While your choice of a supervising professor is most important, it is also important that the department in which that professor is based is also of good quality. All else being equal, it is desirable to be in a department where there are multiple professors and graduate students doing research in your general area of interest (ecology, evolution, conservation, behavior, etc.). It can, for example, get mighty lonely and boring if you are, say, the only field-oriented person in a department where everyone else is doing molecular or cellular biology.

Ok, so how do you find a good supervising professor (and school)?

1. Start by talking to TU faculty members who work in your general area of interest. Tell them your specific area of interest and ask them to help you identify potential graduate research mentors. If faculty members are active in research themselves, they will know who is publishing research in your area of interest, or they will know whom to ask about this. Depending on your interests and the faculty member’s knowledge, a faculty member may be able to come up with a list of 3 or even 6 or 10 names of people to investigate online.

2. Look at the literature and find out who is doing the research that you want to do. There are a number of databases – especially Google Scholar and Scopus (the latter is available through the Cook Library website – see “Databases”), where you can search for recently published research papers. Using these databases, you can do searches for publications using sets of keywords. TU faculty can help you design these searches. When you find a publication, you can, with a little investigation, identify which author is the “research mentor/supervisor” (also called the “principal investigator or PI”). Their name will often be last on the publication and their name will be the one that keeps popping up on various publications. TU faculty can also help you identify the research mentor. Once you have their name, department, and institution, you can hunt down their website and learn much more about them.

Now, what if you love, say, Animal Behavior and are particularly intrigued by insects, but are just not able to narrow down your interests much further? Again, start by talking to TU faculty members who work in your general area of interest, e.g., in our hypothetical example the student would talk to the professors who teach Entomology and Animal Behavior. Tell them your area(s) of interest and ask them to help you identify potential graduate supervisors and programs. If faculty members are active in research themselves, they will know who is doing research in your general area of interest or will at least know who you can talk to who would know.

You can also go to the websites of different universities, find the website for the Department of Biology or other appropriate department or program (some schools don't just have a Department of Biology but rather have, say, Department of Ecology and Evolution. On the department's website, find the list of faculty. Click through to each faculty member's personal webpage, where you should find descriptions of their research interests. See if any of the faculty are doing research that is of potential interest to you.

Now, this is, admittedly, a slow and tedious process. However, it can be well worth the time, especially if TU faculty are unable to provide you with a list of potential graduate supervisors. You can’t look at the websites of *all* faculty in *all* universities in the United States so you will have to narrow down your search to some degree. If you know that you have to (or would like to) live in a particular state or particular region, you can get online and get a list of all colleges and universities in that state/region and explore those.

**How Many Potential Graduate Programs/Supervisors Should You Identify?**

The short answer is: A lot, generally at least 10 and preferably more. It is not easy to get into graduate schools. You will be competing for positions with many other students.

Be prepared to relocate. Ideally, you should be willing to go to the *best* graduate program available considering the potential research mentors, the program’s reputation, and the financial aid available. The better the program, the better your chances for a long and successful career! You should be prepared to discover that the best program is located in Texas, Georgia, British Columbia, or some other seemingly far off place! (Wait… British Columbia? Yes, indeed! Do not hesitate to explore graduate programs outside the U.S., especially Canada. Some foreign schools have special scholarships for high-quality students coming from other countries.)

Having said that, we realize that in some instances, a student may not be able to travel far and wide for graduate school. For example, their “significant other” may have a great job, forcing you to look for graduate schools in a particular area. In this situation, you should obtain a list of colleges and universities within a 100-200 mile radius (easily found with a Google search using keyword combinations such as “Colleges and Universities Virginia”), then locate the home pages for these institutions. Click on “Academics” to see if they have a Department of Biological Sciences (or Molecular Biology or Pathology, etc.) and, if so, whether they have a graduate program. If they do, find a list of faculty, their research interests, and their publications.

###### Contacting a Graduate School and Potential Supervisor

Once you have identified several potential graduate programs and supervisors, it is time to make two contacts. First, you need to request application materials and a graduate catalog. Most departmental websites will have instructions on whom to contact. Most departmental websites will have instructions on whom to contact. Otherwise, there will be a link on their homepage for something like the “Graduate School,” the “College of Graduate Studies,” or the “Graduate Admissions Office,” which will provide instructions as to how to get application materials.

Second, you need to contact the professors with whom you would be interested in working. It is best to do this by e-mail. The body message should be in the form of a “cover letter.” A sample cover letter appears in the Appendix below, along with much more information on how to how to make the initial contact.

###### What Graduate Supervisors and Schools Consider

###### When Reviewing Applications

Graduate programs take into consideration several factors when deciding whether to accept you and

provide you with financial support. These are:

1. What undergraduate courses you have taken

Obviously graduate schools are going to want you to have an appropriate set of Biology courses. For example, if you are interested in the conservation of endangered mammals, then it would be wise to have courses such as Conservation Biology (of course!), Ecology, and Mammalogy on your transcript. In addition, top graduate schools, especially those with Ph.D. programs, usually some coursework in organic chemistry, physics, and calculus.

2. Your academic performance (courses grades and GPA)

Admissions committees will examine your overall GPA and sometimes your GPA in science and math courses as well as your GPA in your junior and senior year. The minimum overall GPA to enter a graduate program is often around 3.0. However, depending on the program, you can expect most applicants to have a GPA at or above 3.5. It is thus important to have the best possible GPA. In some cases, schools and potential supervisors will look at your grades in specific courses. For example, say that you are applying to do graduate research in Ecology, your grades in General Ecology and related courses better be pretty good.

3. Scores on the Graduate Record Exam (GRE)

Almost all schools will require scores from the *GRE General Test*. This test measures basic critical thinking, analytical writing, verbal reasoning, and quantitative reasoning skills that all university graduates should have, regardless of their major (further details on this test appear below).

Some schools also require students to take the *GRE Biology Subject Area Test* (also described in more detail below). NOTE: One might think that a graduate program in Biology would be much more concerned about an applicant’s *Biology* knowledge and thus would weigh scores on the Biology subject area test more heavily than scores on the General Test. In fact, the opposite is true. Many schools do not even require the Biology subject area test because scores on the three different parts of the test (see below) just reflect what elective courses a student took as an undergrad and do not predict success in graduate school. In contrast, a student’s ability to think critically, write, reason, and do math, measured by the General Test, does tend to predict success in graduate school.

4. Letters of recommendation

You should be able to provide three letters from professors and/or undergraduate internship and research supervisors who know you well and, preferably, can speak to your capabilities and your motivation to attend graduate school and do research, if appropriate.

5. Research Experience

Research, while often exciting and rewarding, can be a tedious, frustrating, painstaking endeavor. All else being equal, graduate programs and supervisors will give the edge to applicants that have learned this lesson and so know what they are getting themselves into! Research also requires a variety of skills, many of which are not taught in regular courses. Students who have some pre-training for graduate research are often preferred, and in some graduate programs admissions, research experience is actually required.

6. A graduate professor’s desire to take you on as a student

At most graduate schools, there are always more applicants than positions available. Decisions as to which applicants get admitted, and which of those individuals get assistantships are made by the department’s Graduate Committee. This committee takes into account coursework, GPA, GRE scores, letters of recommendation, and experience as described above, but they also take into account how strongly a faculty member wants a student to come and join their research team. If a professor really wants you to come join them, they will make this known to the Graduate Committee verbally or by letter. This can be a huge boost to your chances of being admitted. Indeed, strong support from one of the department’s faculty members can, in fact, override some shortcomings that you might have. For example, your GPA and/or GRE scores may not be spectacular but if a professor still pushes for you to get into the program because they are impressed with your hands-on experience and your motivation to succeed, you will be considered seriously. This is one of many reasons why it is so essential that you make contact with potential supervising professors and, if possible, visit schools in person (see more on visits and interviews below).

7. How well you interview

As discussed below, you will want to try and visit at least your top two professors/schools before deciding where to go. You will be interviewing them but they will be interviewing you too! The people you meet with, not just the potential supervising professor but also members of the Admissions Committee, will be assessing your level of preparation for graduate school, enthusiasm for research, work ethic, willingness and ability to engage in scientific discussions, etc. All else being equal, students who interview well obviously have the best prospects of being admitted to the program.

###### The Graduate Record Exam

**The GRE General Test**

Almost all U.S. graduate schools require the Graduate Record Exam-General Test as this test does, to a significant extent, predict success in graduate school. A detailed description of the General Test can be found at the website of the company that created this test, the Educational Testing Service: <http://www.ets.org>. Briefly, the Revised General Test has three sections:

* **Verbal Reasoning** — Measures your ability to analyze and evaluate written material and synthesize information obtained from it, analyze relationships among component parts of sentences and recognize relationships among words and concepts.
* **Quantitative Reasoning** — Measures problem-solving ability, focusing on basic concepts of arithmetic, algebra, geometry and data analysis.
* **Analytical Writing** — Measures critical thinking and analytical writing skills, specifically your ability to articulate and support complex ideas clearly and effectively.

Much more information on the format of the test can be found at the website above.

Take the GRE General Test very seriously. Relatively low scores in any one of the three test areas can be the “kiss of death” when it comes to getting into a good graduate school. Prepare extensively for the test; don’t take it “cold.” A wise strategy is to devote some of your time in the summer after your junior year and the early fall of you senior year preparing for the exam, and then to take it shortly after that (by early January). Your motivation to work on the exam during the summer will be much greater if you obtain and take a practice test during your junior year. This will show you what you are up against and how much you don’t know, or have forgotten.

Most bookstores have preparation guides for the GRE, which include practice tests (such guides may also be available on-line). You can also take one of the GRE preparation courses offered by companies like Kaplan. These courses are routinely advertised on the bulletin boards in Smith Hall.

If you do poorly on the exam, you can take it again. Repeating the test is fairly common. However, be aware when the Educational Testing Service sends your scores to the graduate schools to which you are applying, they send scores from *all* of your attempts at the test. Some graduate schools consider only your most recent test scores but some average scores. Be as ready as you can the first time you take the test. Many schools require a better than average verbal plus quantitative score on the GRE.

If you take the test and know right away that you did very poorly, you may be able to have your scores canceled altogether – and they will never be reported. Check the ETS website for information on the cancellation procedure.

**The Biology Subject Area Test**

The Biology GRE test is described in detail at the ETS website given above. Briefly, the test contains roughly 200 multiple-choice questions organized about equally into three major areas: 1) Cellular and Molecular Biology; 2) Organismal Biology; and 3) Ecology and Evolution. In addition to the total combined score, a subscore in each of these subfield areas is reported by ETS to graduate schools. Much more detail on what the test covers in each of these three areas is found at the ETS website.

###### Graduate School Interviews

Once you have narrowed down your list of potential graduate programs and graduate supervisors to two to four schools or so, you should if at all possible try to arrange a visit to each school or at least your top two schools. This will give you a chance to meet your potential research supervisor and get a good feel for whether you would be comfortable working with this person. You can also meet the professor’s current graduate students and other faculty members, and get a tour of the facilities available. (Note: You might consider visiting *before* you actually apply to a school, assuming there is enough time to do so before the application deadline. This can save you money if you decide not to apply to a school based on your visit. Graduate schools typically charge you $40-70 just to process your application).

To plan an on-site visit, you should first contact the potential research mentor, indicate that you would like to visit, and ask when this would be convenient for them. You can also provide a list of various dates that would be convenient for you (try to be as flexible as possible). In planning a visit, make sure you don’t overstay your welcome. Plan initially to be on campus only one full day coming in the night before and/or leaving the next morning. You may be invited to stay longer by the professor, but wait for the invitation.

Also, don’t hesitate to ask your potential mentor whether there are funds available to bring in prospective graduate students. Some programs routinely cover all or at least part of the travel costs for top graduate student prospects.

**Preparing for the interview**

The potential graduate supervisor will likely have an itinerary for you visit worked out in advance (if they don’t, that is a sign they are overworked or disorganized! Caution!). This itinerary will list the people with whom you will meet and when. You can for the itinerary several days before your trip. Before you arrive, do some background work on the individuals with whom you are scheduled to meet. Get online, find their websites, memorize their specific area of interest in Biology, and read at least some of the abstracts of their recent publications. It would be wise to come ready with a few specific questions to ask about their research. This sort of initiative and will *really* impress people making it more likely that you will get accepted into the program and get an assistantship. This is especially true if these individuals sit on the graduate admissions committee.

When it comes to the potential supervisor/research mentor doing your “homework” is an absolute must. You will want to read through several of their recent publications (not just the abstracts) and come with a list of questions about the research.

You should also come to the interview with a lengthy list of *other* questions to ask the various people with whom you meet. You should, of course, ask for more **details about assistantships**. Ask what the chances are of getting a research assistantship? a teaching assistantship? If you are most likely to get a teaching assistantship, ask what classes you are likely to help teach. Also, find out how long assistantships last (how many years), and what the requirements are for getting your assistantship renewed or extended.

If the program offers primarily teaching assistantships, you are also likely to meet with the person(s) in charge of supervising graduate teaching assistants. This is a crucial interview for you. They will try to assess whether you would be an *effective* teaching assistant. They will want to get a sense as to whether you will be an enthusiastic and motivated teacher who takes their teaching responsibilities seriously... or are you someone that is dreading teaching will just go through the motions, doing the minimum to get by? If it seems you fall into the latter category, you won’t get into the program.

When talking to potential research mentors, perhaps most important will be a discussion of **what *you* might do for your research**. Ask about potential research projects. In most cases, incoming graduate students will either work on a project that is already ongoing, or something else that fits with the research goals of the laboratory. When potential projects are discussed, focus on two things. First, consider the *feasibility* of the study. Can it be done in the amount time you will have to do research? Have many of the methods and techniques been worked out by others working before you, or is this a new avenue of research in the lab such that you will be starting from scratch?

Also consider the *publishability* of the project. You should specifically ask: If successful, where do you think this work could be published? (By “where” we mean in what scientific journal). Your success and potential as a scientist is measured by the contributions you make to knowledge in the form of publications. Publications are your ticket to a great career. You may have heard the expression: “Publish or perish.” Absolutely true. This is why you *must* choose a mentor who has published regularly and recently. Such professors will know what research will and will not be publishable in respected scientific journals.

After discussing various potential research projects, ask about **how your research might be funded** if that has not been discussed. Does the professor have funds from a grant that will support your research? Does the department or university provide grants to graduate students to support research? Are undergraduate students available to serve as research assistants?

Ask potential mentors to talk about the **last several graduate students that completed their degrees** under his or her supervision. If you are applying to do a Master’s degree, ask specifically about Master’s students. Did they publish their research? What are they doing now? If most students have gone on to Ph.D. programs or have a good job in the field, that is a good sign. If most students never published and are no longer working in science, not so good.

Finally, one thing that you should request, especially when you arrange your own interview, is a **meeting with a potential mentor’s current graduate students - *alone***. If this is not on the itinerary you are sent in advance, ask that it be added. This meeting is crucial. In this meeting, ask the current graduate students tactfully but very directly what it is like to work with the mentor. Assure them that anything that they relate will be held in strict confidence (and make sure you keep it in confidence). However, also remember that anything you ask (or your reaction to their answer) may be related to their mentor, especially if it seems as if you might be a difficult lab member or not be a team player. Carefully assess the situation. Include the following among the things you ask current students:

* Ask whether the students feel that the professor has enough time to help them. If students routinely have to wait a week or more to see a professor and then get a hurried, distracted 10 minutes, of their time, that’s a sign of trouble.
* Ask the students about the professor’s policy and reputation for publishing with students. Does the professor have a reputation for generously including on papers the names of all students who contribute to the research? Watch out for publishing horror stories such as professors putting their names first on research done primarily by students.
* Ask if graduate students are regularly going to scientific meetings to present their research.
* Ask if the professor is consistent in their advice to students. Some professors are so scatter-brained or manic that they will tell students to do their research one way and turn around several months later and criticize them for doing it that way, not remembering that this was their advice in the first place.
* Ask the students what *they* know about students who recently worked with the professor. Do they mention students that the professor did not, especially students that dropped out or ended up working at Starbucks? If one or more students washed out of the program, try and find out why. Was it the student’s fault, the professor’s fault, or some of both? If there are *numerous* accounts of students quitting before finishing, or finishing but not publishing, that is another danger sign.
* Ask the students about what it is like to be a teaching assistant in the department. Are students required to work more than their contracts say they are supposed to (usually 20 hours per week)? Are students regularly thrown into classes with little training or help? Are they asked to teach classes for which they have no background?
* Ask what the rental situation is like in the local area and whether assistantships pay enough money to exist, *i.e.,* pay for the rent, utilities, food, and at least a little fun. If campus is in an urban area, can students only afford to live in the more crime-ridden parts of town?

All the usual other advice for job interviews applies to graduate school interviews as well. Dress nicely but not formally. You do not need to wear a coat and tie or a dress and heels. Avoid faded, ratty looking jeans, shorts, flip-flops, etc. This will suggest a lack of maturity, respect, and seriousness. A clean, relatively new pair of jeans or slacks and a collared shirt or nice top will be fine.

Don’t chew gum. Try to avoid colloquial, immature speech (especially overuse of words such as “like” and “you know” and “awesome”). You may be asked about certain classes and professors that you had a Towson. Feel free to speak highly of positive experiences but avoid demeaning or belittling classes and professors that you felt were of low-quality. We are not suggesting this to protect the egos of faculty at TU. Our concern here is that, if you are willing to bad-mouth your *undergrad*uate professors and classes, it is assumed that you will do the same wherever you go and this will not be welcome. Keep in mind that anything that you say to the students may get back to the professors.

Finally, after you return, you should send a thank you e-mail to both the professor who hosted you, and the graduate students or others who housed and fed you.

**APPENDIX: Contacting A Potential Graduate Research Mentor**

As discussed above, in some situations, it is advisable to contact one or more potential graduate research mentors. Before you make such contact, however, talk to a trusted TU faculty member first, as this is advisable only in certain instances.

**The Cover Letter**

If you are encouraged to make contact, you will want to send potential mentors an email that contains a cover letter. An example of a cover letter appears below. Take a moment to read it through.

As you can see, the purposes of the cover letter are to introduce yourself, express an interest in working under this person’s supervision, tell them something about your *specific* research interests, and ask them to get back to you.

The best professors get dozens or more e-mails each year from prospective graduate students. Many of them, however, are boring form letters with no real content. To be noticed, your letter should be informative and personalized. As regards the latter, you should indicate to the professors why you are contacting *them* in particular. Make sure that they know that you are familiar with their research and that your interests are similar to their interests. Indicate that you have read certain papers of theirs (which you should have done) and mention the findings that you find intriguing. Sell yourself in this cover letter! Give the impression that you are a highly motivated, well-organized, hard-working student who will not only be productive in research but will add vigor to their research team.

Make sure you spell the professor’s name and the name(s) of their study organism and research topics correctly! In fact, make sure the entire letter is completely free of spelling errors, typos, and grammatical mistakes. You absolutely want to have a trusted, helpful TU faculty member review your letter and other materials before they are sent out.

One other thing: Although it is important to show a familiarity with the professor’s research and indicate your specific research interests, DO NOT suggest a research project and then indicate that this professor would be ideal for mentoring this. In general, this will not be expected. More likely you will develop a research project in collaboration with the mentor once you enter the graduate program. The project will be based on the mentor’s current line of grant-supported research. Because the professor likely is “footing the bill” for your research, it needs to be a mutually beneficial project.

**Other Documents To Send: CV and List of Courses**

You should include two important attachments with your cover letter. First, attach your “CV” (stands for *curriculum vitae*, which roughly translates from Latin into “what I have done with my life”)*.* This is a scientific resume. See below for instructions on how to put a CV together).

Also attach a list of science and math courses that you have had and the grades that you obtained (an example of this document appears below as well).

**What To Expect In Response**

Responses to your e-mail will vary greatly. Some professors will not respond at all. It is most likely that they are not taking on new students and are too busy to send you a brief message indicating this. This is rather rude on their part but don’t take it personally.

Other professors will write back and tell you, in some way, that they are not interested. Most often professors will say something like: “I am not taking on new students at this time.” Assume this is true and don’t take it personally. Professors really do have many legitimate reasons for not taking on more students in any particular year. Each professor has a “carrying capacity” and can handle only so many active graduate students at a time.

Finally, some professors will express an interest in you and want to pursue things further. Make sure that *you* respond promptly with an e-mail or a phone call. If things look good, think about a visit.

***Continued…***

##### Sample cover letter to send to prospective graduate supervisor

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| --- |
| 31 September 2018  Dr. Russell N. Winges  Department of Biology  Minnesota State University  Frozen Lakes, MN 55332  Dear Dr. Winges,  I would like to introduce myself and inquire about applying to do graduate work under your supervision, starting in the fall of 2019.  I am currently an undergraduate at Towson University, near Baltimore, and will be graduating in May, 2019, with a B.S. in Biology. I have attached my CV and a list of science and math courses that I have taken, along with grades received. My overall GPA is 3.65, my GPA in Biology courses is 3.58, and my GPA in all science and math courses is 3.49. My scores on the GRE General Test were 550 on the Verbal section (72% below), 700 on the Quantitative section (68% below) and 5.5 on the Analytical Writing section (86% below).  I have recently developed a strong interest in the reproductive behavior and ecology of birds. I would like to pursue this interest in graduate school. I am familiar with your recent work on extra-pair mating and polygamy in different species of blackbirds and think that our interests match up well. I am particularly interested in studying the evolution of mating strategies in birds and am intrigued by the application of techniques from molecular biology in this research. However, I am very willing to become involved in research on other aspects of avian biology.  I have had some experience conducting biological research. This past summer I worked as an assistant to Dr. Earl J. Waggendorn on a project investigating extra-pair mating in Baltimore Orioles. During the course of this research I learned a number of field techniques including mist-netting, banding, measuring adult birds and taking blood samples from adults and nestlings. I also learned DNA extraction and PCR analysis in the laboratory. Before that, I worked with Dr. Forrest Bufophile on a project that examined habitat use in wood turtles.  I would appreciate knowing whether you are taking new students for the fall of 2019. If so, I would also like to know more about the application process and about opportunities for financial support.  Finally, I would appreciate any suggestions for other potential graduate supervisors and programs that I might contact, especially if you are not taking on new students.  Thank you for your time and consideration.  Sincerely,  Maria Q. Student *Mailing address:*  Mstude1@towson.edu203 Heartbreak Hill Road  410-555-9876 Baltimore, Md. 21228 |

**Sample Curriculum Vita (CV)**

A curriculum vita or “CV” is a lengthy scientific resume that is frequently used primarily when applying for graduate school and jobs in science and technology. A sample CV is provided below.

In general, a CV should contain the following information:

* Your contact information
* Your post-secondary educational history, including your GPA
* Scholarships, fellowships, honors, and awards
* Employment history
* Research/technical experience
* Research funding
* Relevant extra-curricular activities
* Scientific publications on which you are an author
* Papers presented at scientific conferences
* Membership in professional societies
* Teaching experience, if any
* References with contact information

|  |
| --- |
| Maria Q. Student 203 Heartbreak Hill Road 410-555-9876  Baltimore, MD 21228 [Mstude1@towson.edu](mailto:kcavey1@tiger.towson.edu) Education Program B.S. Biology  Date degree expected 5/2019  Institution Towson University  Overall GPA: 3.65 GPA in science/math courses: 3.49 GPA in biology courses: 3.58 Scholarships, Fellowships, Honors, and Awards  * Honorable Mention, Barnard Rubble Award; Best Undergraduate Researcher   Towson University – Department of Biological Sciences, 2017   * Elected to Beta Beta Beta Biological Honor Society, 2017 * Alfred E. Newman Scholarship for Outstanding Transfer Student   Towson University – Department of Biological Sciences, 2016   * Lions Clubs of Maryland University Scholarship, 2016  Employment Position Animal Caretaker, Veterinary Technician  Dates Mar. 2016-present  Location Cat Hospital at Towson  Position Sales Clerk  Dates Sept. 2015-Apr. 2016  Location Eddie Bauer - Towson MD Research Experience Position Participant, NSF Research Experience for Undergraduates Program, Indiana University  Dates Summer 2017  Project Effect of breeding synchrony on extra-pair mating in Baltimore Orioles  Supervisor Dr. Earl J. Waggendorn  Duties/skills Nest-finding, behavioral observation, mist-netting, banding, blood sampling, DNA extraction, PCR analysis |
| Position Undergraduate Research Assistant, Towson University  Dates October 2016-May 2017  Project Description of home ranges and habitat use of wood turtles in fall and spring  Supervisor Dr. Forrest Bufophile  Duties/skills Radio telemetry, territory mapping  **Research Funding**  Undergraduate Research Grant, Fisher College of Science and Mathematics, Sept 2016, $500  Sigma-Xi Scientific Research Society Grant-in-Aid-of- Research, Sept 2016, $650  **Presentations**  Student, M.Q. and F. Bufophile. “Effect of temperature on daily movement patterns in wood turtles”. Herpetological Association meeting, Laramie, WY, Aug 2017. Publications Bufophile, F., Student, M.Q., and Smart, M. 2007. Home range size of wood turtles in central Maryland. *Southeastern Naturalist* 45: 908-911.  **Membership in Professional Societies**  Animal Behavior Society, 2017 to present  **Teaching Experience**  Undergraduate Teaching Assistant, Comparative Animal Physiology, Towson University, Fall 2016  Duties: Assist in setting up laboratories, helping students during experiments, some mini-lectures Extra-curricular Activities Secretary, Beta Beta Beta Biological Honor Society 2017-present  Volunteer instructor, K-6 grades, Irwin Nature Center, Baltimore, 2016-present  Initiate Advisor of Phi Sigma Pi National Honor Society, 2015 References Dr. Earl J. Waggendorn Dr. Forrest Bufophile Dr. Darwin Chuckles  Dept. of Biology Dept. of Biological Sciences Dept. of Biological Sciences  Indiana University Towson University Towson University  Bloomington, IN 33445 Towson, MD 21252 Towson, MD 21252  346-555-2373 410-555-4389 410-555-4388  [ejwaggedorn@iu.edu](mailto:ketter@iu.edu) [fbufo@towson.edu](mailto:fbufo@towson.edu) cdarwin@towson.edu |

**Sample listing of courses and grades to send to prospective graduate supervisor**

|  |
| --- |
| SCIENCE AND MATH COURSES AND GRADES – Maria Q. StudentBIOLOGY BIOL 201: Introduction to Cellular Biology and Genetics A-  BIOL 202: Introduction to Ecology, Evolution and Behavior A-  BIOL 205: General Botany A  BIOL 207: General Zoology A-  BIOL 325 Animal Physiology B  BIOL 347: Marine Biology B+  BIOL 353: Invertebrate Zoology A-  BIOL 402: General Ecology B-  BIOL 406: Limnology B  BIOL 408: Cell Biology A  BIOL 413: Evolution A  BIOL 456: Ornithology A  BIOL 467: Herpetology currently enrolled  BIOL 470: Comparative Animal Physiology B  BIOL 484: Discussion Seminar in Ecology & Evolution currently enrolled  BIOL 491: Independent Research A CHEMISTRY CHEM 131: General Chemistry I C+  CHEM 132: General Chemistry II B  CHEM 330: Essentials of Organic Chemistry B- PHYSICS PHYS 211: General Physics I B  PHYS 212: General Physics II currently enrolled  **MATHEMATICS AND STATISTICS**  MATH 211: Calculus for Applications B  PSYC 212: Behavioral Statistics A- |