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# A Guide to Graduate School in

**Cellular and Molecular Biology,**

**Physiology, and the**

**Biomedical Sciences**

#### **Prepared by the faculty of Towson University’s**

**Department of Biological Sciences**

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What is Graduate School and Why Would You Want To Go?

**Two Types of Graduate Degrees**

After completing a B.S. degree in Biology or Molecular Biology, Biochemistry and Bioinformatics (MB3), 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 conducting experiments 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.

Some people attend graduate school to improve their “academic record” to give themselves a better chance of getting into medical, dental, physician’s assistant, pharmacy or some other professional school. They take more courses to try and boost their GPA and they may engage in a small research project or even thesis research to get the “research experience” that so many professional schools want students to have.

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 molecular biology. After taking a number of undergraduate courses, the student discovers that he/she is intrigued by how a particular human disease, like multiple sclerosis, works at a molecular level. 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 advanced immunology, medical molecular biology, pharmacology, cancer biology, advanced virology 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 spent 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, involving observation and experiments*. 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., or even go for an M.D./Ph.D.

In large part, your decision will be determined by your career aspirations. If you are only attending graduate school to increase your chances of getting into a professional school (e.g., medical school), then you will just want to do a M.S. degree, and choose between a non-thesis or thesis degree.

If, however, you want a career that is focused on research, then you have to choose between a M.S. and Ph.D. degree. 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 advanced technicians or managers in major research laboratories. 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” in a laboratory at a biomedical firm *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 at least 4-7 years, depending on area of research and how well things go in the laboratory. If you are not absolutely certain that you want to devote at least 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 successfully complete a Ph.D. program.

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 the best strategy is 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:

* Your only reason for going to graduate school is to increase your chances of getting into medical, dental, veterinary, physician’s assistant, or pharmacy school. (In this case we should note that a Masters in Public Health (MPH) is also an option).
* You want a career in 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 in a major research lab, 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. An 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) It gives you a chance to find out whether graduate school is really for you before you make a major, 4-7 year commitment to complete a Ph.D. When doing a Master’s degree, many people find that they really enjoy graduate school. They enjoy the research and the thrill of making discoveries. They enjoy the camaraderie with their supervisors and especially others in the laboratory. Others, however, find that graduate school is not what they expected. They don’t, for example, like the tedium and frustration that is inherent in research. They also find it is too demanding on their time. They stick it out and finish their degree, but choose not to go on and spend the 4-7 years it would take to get a Ph.D.

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) Doing a Master’s gives you a chance to learn much more about different potential avenues of research in your field. That is, it gives you a chance to discover what really intrigues you. A person might, for example, go to graduate school intending to study how cell membranes function. However, while doing their Master’s they learn about related research being done on how viruses are able to get through cell membranes. They find themselves more and more captivated by this subject and decide to then do their Ph.D. dissertation research in this area. They pour their heart and soul into the Ph.D. work because they are so intrigued by the subject matter. Sometimes students who go straight into a Ph.D. program find, after a few years, that they have committed to spending 4-7 years of their life researching something that turns out to be not all that interesting to them. If only they had had a better chance to explore all the different possible avenues of research before starting the Ph.D. Time spent doing a Master’s degree can provide that opportunity.

4) 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.

5) 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, especially in the molecular/biomedical sciences, 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 5-6 (rare) or even 9-10 (more likely) 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-$30,000 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, 222, and 315 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.

Some schools, e.g. medical universities with graduate programs (like Johns Hopkins Medical School or University of Maryland Medical School) automatically give an RA to all accepted Ph.D. students for their first 1-2 years. After that initial period, your advisor is expected to fund your RA from his or her grant funding, and/or you are expected to apply for competitive funds through outside agencies, such as the National Institutes for Health, the National Science Foundation or many private, federal, or for-profit agencies (also see below). Often a school will have one or more “training grants”, often multidisciplinary, sponsored by the NIH or NSF, that fund RAs. You may be able to start on a training grant, and then, when you’ve picked an advisor, be supported by the advisor’s grants.

We strongly advise that you *not* enter any program without being promised some kind of 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. These fellowships may be obtained before entering graduate school, but can also be applied to during your first years. 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/> . The National Institutes of Health maintains a website with an extensive number of links to other potential sources of funding: <http://www.training.nih.gov/careers/careercenter/fellow.html>.

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

Application guidelines for graduate school vary widely. Usually they are 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. You should also make arrangements to take the Graduate Record Exam (described below) that same fall or very early in the next year.

**Strategies for Finding a Graduate Program**

In general, students take one of two approaches in deciding to which graduate programs they will apply.

First, a student may identify graduate programs where there are *numerous* people – potential research mentors - doing research that is of potential interest. The student would apply to this program and then, once in the program, explore their options in terms of potential research mentors and research projects. Indeed, in most cellular/molecular/ biomedical and some physiology graduate programs, especially Ph.D. programs, students spend the first semester or first year “rotating” through different research labs. During that time, students have an opportunity to work with different research mentors and on different research projects for several weeks. Ultimately the student decides, in consultation with the faculty involved, with whom they want to work and what they want to research.

This strategy is ideal for students who know that they want to do research in the area of cellular or molecular biology, some physiology or biomedical sciences, but have not narrowed down their areas of interest much farther than that.

Secondly, a student may identify particular individuals – again, potential research mentors - at various universities who are doing research of great interest to the student. For example, say that after taking Cancer Biology at TU a student may want to study regulation of cancer pathways. There may be six or eight people in the country who are doing cutting-edge work in this area. The student would apply to the graduate programs with which these people are associated with the intent of working in one of these individual’s laboratory. If admitted to the program, the student may still be expected to do “rotations” through a variety of research labs, including the one run by the person that attracted them to the school in the first place. But that is OK as it gives students a chance to meet a variety of other people, professors and graduate students alike, and learn about *all* their research options. Who knows, there may be someone even better to work in that program!

Of course, a student can take both approaches, that is, applying to some programs because they seem to have many good research opportunities and applying to other schools because there is one person there they want to work with.

**Finding a graduate program that offers a variety of research options**

For students who want to take the first approach to identifying potential graduate programs above, we recommend the following:

1. Start by talking to TU faculty members who work in your general area of interest. Tell them your area(s) of interest and ask them to help you identify potential graduate programs. If faculty members are active in research themselves, they will know which programs are turning out top-notch (and employable!) researchers.

For example, stay that you are generally interested in, say, cancer biology, but you are not sure what aspect of this sub-discipline you would like to study. Start by talking to the TU faculty member who teaches TU’s Cancer Biology course. Ask that person about current hot topics in the area of cancer biology, *i.e*., major areas of research. Ask the faculty member what institutions are renowned for turning out strong, successful graduate students in that field. You may learn, for example, that the University of California–Davis, Michigan State, and the University of Montreal in Canada have particularly strong and well-respected programs. You can then get online, look at the programs, and see what specific topics the faculty are researching. If the research being conducted in one or more laboratories looks intriguing, make some inquiries (see below).

2. 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 Cellular and Molecular Biology or Department of Pathobiology or Department of Pharmacology). 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 how many 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 programs/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.

**Finding specific people who are doing the type of research that you want to do**

For students that want to take the second approach above, we recommend the following:

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 PubMed, Google Scholar, and Scopus - available through Cook Library, 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.

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

Short answer: 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.

**Getting Application Materials**

Once you have identified several potential graduate programs/supervisors, it is time to request application materials. 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.

**Should You Contact Potential Research Mentors Directly?**

Contacting potential research mentors directly is both common and expected in the areas of Organismal Biology and Ecology and *sometimes* Physiology and you may hear your friends in these areas talking about this. Contacting potential mentors is, however, uncommon in Cellular or Molecular Biology or the BioMedical Sciences, even if there is a specific person in the program you really want to work with.

Rather, as discussed above, what typically happens is you apply to the graduate program and, if admitted, you will begin with a “Core Curriculum” in which you, along with other “newbies” will take a certain set of courses and do “rotations” for 6-12 months in different laboratories run by different research mentors. When you finish your rotations, you will request to join a certain research mentor in their laboratory.

This may all seem unnecessary if you absolutely know who you want to work with in a particular graduate program. However, as also noted above, this system has a big advantage: It allows you to get to know your chosen research mentor, their research, and the other personnel in their laboratory *before making a commitment.* It is sort of like dating before becoming engaged or married! You may find after a few “dates” that a certain person that you thought would be terrific is not so terrific!

As we discuss in the next section, it is *extremely* important to choose a research mentor that is right for you. Fortunately, the rotation system allows you to get to know several potential mentors and their research, making it easier to identify the person that might be the best fit for you.

Having said all this, there may be situations in which contacting a potential mentor IS advisable. This is especially true when applying to a smaller Master’s degree program. This is also true in certain Physiology graduate programs. *We strongly suggest that you talk to trusted faculty at TU about whether you should make direct contact with individuals.* If this is advised, then please see Appendix X, where we provide information on how to make such contact.

**Identifying a Good Graduate Research Mentor: Things to Start Thinking About**

In a research-based M.S. or Ph.D. graduate program, you usually do research under the supervision of 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 spouse. True enough! There are numerous horror stories of supervisors who were 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.

Here are some things to think about:

You *must* find a supervisor who is knowledgeable, supportive, and reasonably easy to work with. You also want someone who wants to see you succeed and is obviously willing to help you do so. You want to avoid someone who is just using you as a “drone” to do the research they want to do. 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.

Another thing to look at is *productivity*. You want to work with someone who is publishing fairly often, since you will be judged based on your publication record. No publications in the last 3-5 years? Keep looking.

A third think to consider is the success of graduate students that have recently worked in the supervisor’s laboratory. How many Master’s students went onto a good job or, if they chose, a quality Ph.D. program? How many Ph.D. students got a good job or post-doctoral position? In contrast, how many students left the laboratory without finishing their degree? That occasionally happens, and often it is because the student lost interest or did not have the fortitude to handle the rigors of graduate school. However, there are some supervisors who have a reputation for “losing” one good student after another.

In addition, it is important to find someone who fits your style of learning and working. Given your personality and your research experience, are you someone who will expect and/or need a lot of interaction and help from your supervisor? If so, then you want to find someone who has a reputation of working closely with the students, checking on their progress, asking if student have issues or concerns. On the other hand, if you don’t want someone constantly looking over your shoulder, then a more “hands-off” supervisor could work for you.

Finally, you might consider your preferred work schedule: If you do your best work in the late evenings but abhor working before noon, and your graduate advisor works from 5 am – 3 pm, the amount of time for significant and important interactions with your mentor are limited, and the rate of success is rather low, especially if there are no senior graduate students or postdoctoral researchers around to help.

**What Graduate Schools Consider When Reviewing Applications**

Graduate programs take into consideration several factors when deciding whether to accept an applicant and provide them with financial support. These are:

1. What undergraduate courses the student has taken

Obviously graduate schools are going to want you to have an appropriate set of science courses. For example, if you are interested in Virology, then it would be wise to have courses such as Virology (of course!), Cell Biology, Molecular Biology, and Immunology on your transcript. The fact that you took Ornithology as well will not impress them much (even if you did get an A).

In addition to Biology courses, top graduate schools, especially those with Ph.D. programs, usually require two semesters of organic chemistry, two semesters of physics, and one semester of calculus.

2. Academic record (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 molecular genetics. Your GPA is not spectacularly high; you are generally a B to B+ student. However, you did get A’s in Genetics, Cancer Biology, Molecular Biology, and Introduction to Bioinformatics. This should help you.

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. How Well You Interview

As discussed below, top applicants are often brought to the university (at the university’s expense) to interview with the graduate programs’ Admissions Committee. Committee members will be assessing a student’s 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.

**Interviewing**

**Interviews Arranged By the Graduate Program**

Depending on the school and the program, a mandatory interview may be arranged for you by the Graduate Admissions Committee. After first reviewing the paper credentials of all the applicants, the committee will decide whether to extend an interview offer. During the interview all applicants generally meet with members of the Admissions Committee and possibly with faculty members in their area of research interest, sometimes as a group, sometimes individually. Opportunities for applicants to meet with current students in the department may be arranged. After applicants are interviewed, the Admissions Committee meets to make decisions as to who will be offered admission to the program. Applicants are then notified of the admissions committee's decision.

See also the *Preparing for the Interview* section just below.

**Interviews That You Arrange Yourself**

In some situations it may be wise to arrange your own interview at a school. Talk to a trusted TU faculty member about whether or not do consider this. This is most common when applying to Master’s degree programs at smaller schools. It is also often a good idea when there is only one person at a school that you would consider as a potential research mentor. Such interviews will give you a chance to the potential research mentor and get a good feel for whether you would be comfortable working with them. You can also meet the professor’s current graduate students and other faculty members, and get a tour of the facilities available.

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 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**

Regardless of whether you are invited to interview or arrange your own interview, there will likely be an itinerary for your interview worked out in advance. This itinerary will list the people with whom you will meet. You should request the itinerary several days before your trip if you can. Before you arrive, do some background work on these individuals. Get online, find their websites, memorize their area of interest, and read at least some of the abstracts of their recent publications. You might come armed with a few specific questions to ask about their research. This sort of initiative 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 potential research mentors, especially if there are just one or two such individuals, you will want to do more homework. 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 admissions committee, potential mentors and graduate students that you will meet. You should, of course, ask for more details about assistantships. Ask what the chances are of getting a research or 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, 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 get a sense of 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 in the lab, 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 can 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, then that is 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?
* Ask what a typical day is like – what time do lab members usually show up and when do they leave? Is weekend/holiday work expected, assumed, appreciated or not expected at all?
* Ask how much time is expected in the lab while taking classes. Some professors may understand that classwork needs to be a priority before passing qualifying exams while other professors may expect you to do everything simultaneously – take classes, teach, study for exams, and do research - with perfection.

You may also get a chance to meet with lab employees, including lab techs and managers. If so, be sure to be particularly respectful. The technicians will be the “constant” presence in the lab. They will be the ones who know where everything is, how to run many of the experiments that you’ll be running, how to order supplies, who to turn to with particular issues. They are potentially a great ally in your graduate career.

All the usual other advice for job interviews applies to graduate school interviews as well. Dress nicely; even though biologists are generally pretty informal and often wear the typical jeans and t-shirt in lab, depending on the school and the department, a certain level of business-attire is expected for interviews and presentations. You probably do not need to wear a coat and tie or a dress and heels (unless you are interviewing at a medical university’s graduate school). On the other hand, don’t dress down. For example, avoid faded, ratty looking jeans, shorts, flip-flops, etc. This will suggest a lack of maturity, respect, and seriousness.

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 *undergraduate* professors and classes, it is assumed that you will do the same wherever you go and this will not be welcome. Again, 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.

*continued…***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**

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.

**Sample Cover Letter to Send to Prospective Graduate Research Mentor**

|  |
| --- |
| 31 September 2018  Dr. Carol Greider  School of Medicine - Johns Hopkins University  Dear Dr. Greider,  I would like to introduce myself and inquire about applying to do graduate work under your supervision, starting in the fall of 2019.  Currently, I am 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 3.78, and my GPA in all science and math courses is 3.59. My scores on the GRE General Test were 161 on the Verbal section (86% below), 155 on the Quantitative section (64% below) and 4.5 on the Analytical Writing section (86% below).  Recently, I have developed a strong interest in the mechanisms behind DNA damage and chromosomal rearrangements, and would like to pursue this interest in graduate school. I am familiar with your recent Nobel-prize winning work in the discovery of how chromosomes are protected by telomeres and the enzyme telomerase, and am intrigued by the application of techniques from molecular biology in this research to identify genes that induce DNA damage in response to short telomeres. However, I am very willing to become involved in research on other aspects of chromosome maintenance and stability.  During my undergraduate career, I have had some experience conducting molecular biological research. This past summer I worked as an assistant to Dr. Wes Blotto at Indiana University. During the course of this research I learned a number of molecular biology techniques including DNA & RNA extraction, protein and PCR analysis in the laboratory. Before and after that, I worked with Dr. Regina Peaciahr on a project that involved biochemical and cell-based assays to study mammalian DNA damage response pathways.  I would appreciate to know, 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.  Thank you for your time and consideration.  Sincerely,  Maria Q. Student *Mailing address:*  Mstude1@students. towson.edu203 Learning Road  410-555-8309 Baltimore, MD 21228 |

**Sample Curriculum Vitae (CV)**

A curriculum vitae or “CV” is a lengthy scientifically oriented resume. CVs are frequently used when applying for graduate school and jobs in science and technology. Unlike regular resumes, CVs are *not* restricted to one page, which makes them much easier to put together. A sample CV starts on the next page. (Note: You do not need a “box” around your resume.

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 (get those professors’ permission first!)

|  |
| --- |
| **Maria Q. Student**  203 Learning Road 410-555-8309  Baltimore, MD 21228 [Mstude1@students.towson.edu](mailto:Mstude1@students.towson.edu)  **Education**  Program: B.S. Biology/Molecular Biology, Biochemistry & Bioinformatics  Degree expected: May 2019  Institution: Towson University  Overall GPA: 3.65 GPA in science/math courses: 3.59 GPA in biology courses: 3.78  **Scholarships, Fellowships, Honors, and Awards**   * Honorable Mention, Barnard Rubble Award; Best Undergraduate Researcher   Towson University – Department of Biological Sciences, 2018   * Elected to Beta Beta Beta Biological Honor Society, 2017 * CoSMiC Scholarship, Towson University – Department of Biological Sciences, 2016-2017 * Lions Clubs of Maryland University Scholarship, 2015   **Employment**  Position: Animal Caretaker, Veterinary Assistant  Dates: March 2015-present  Location: Cat Hospital at Towson  **Research Experience**  Position: Participant, NSF Research Experience for Undergraduates Program, Indiana University  Dates: Summer 2018  Project: DNA damage in response to excessive meat consumption  Supervisor: Dr. Wes T.R. Blotto  Duties/skills: DNA & RNA extraction, protein and PCR analysis |
| Position: Undergraduate Research Assistant, Towson University  Dates: September 2017-May 2018  Project: Mammalian DNA damage response pathways  Supervisor: Dr. Regina T. Peaciahr  Duties/skills: Biochemical and cell-based assays, including tissue culture  **Research Funding**  Undergraduate Research Grant, Fisher College of Science and Mathematics, Fall 2018, $500  Sigma-Xi Scientific Research Society Grant-in-Aid-of- Research, Fall 2018, $650  **Presentations**  Student, M.Q. and Peaciahr, R.T. “Effect of polyphenols in the UV light-induced damage in skin epithelial cells.” Experimental Biology meeting, Boston, NE, October 2018.  **Publications**  Peaciahr, R.T., Student, M.Q., and Smart, I. M. 2019. UV light-induced oxidative damage can be prevented with green tea polyphenols. *Journal of Biological Chemistry* (in press).  **Membership in Professional Societies**  American Association for Cancer Research, 2017- present  Beta Beta Beta Biological Honor Society, 2017-present  Sigma Xi Scientific Research Society, 2016- present  **Extra-curricular Activities**  Secretary, Beta Beta Beta Biological Honor Society, 2018-present  Volunteer, Habitat-for-Humanity of Baltimore, 2015-2017  **References**  Dr. Wes T.R. Blotto Dr. Michael Menten Dr. Regina T. Peaciahr  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  [wblotto@iu.edu](mailto:wblotto@iu.edu) [mmenten@towson.edu](mailto:mmenten@towson.edu) [rtpeaciahr@towson.edu](mailto:rtpeaciahr@towson.edu) |

**Sample listing of courses and grades to send to prospective graduate research mentor**

|  |  |
| --- | --- |
| **SCIENCE AND MATH COURSES AND GRADES – Maria Q. Student** | |
| **Biology** |  |
| BIOL 201: Introduction to Cellular Biology & Genetics | B- |
| BIOL 202: Introduction to Ecology, Evolution and Behavior | B+ |
| BIOL 204: Career Planning for the Biologist | S |
| BIOL 205: Biodiversity | A- |
| BIOL 309: Genetics | B+ |
| BIOL 325: Animal Physiology | B |
| BIOL 389: Current Developments – Cancer Biology | A |
| BIOL 408: Cell Biology | A- |
| BIOL 409: Molecular Biology | B+ |
| BIOL 410: Molecular Biology – Lab | A |
| BIOL 489: Directed Reading (Biology) | A |
| BIOL 490: Undergraduate Research | S |
| BIOL 491: Independent Research | A |
| BIOL 499: Undergraduate Thesis Project | Currently enrolled |
| MBBB 301: Introduction to Bioinformatics | A |
| MBBB 315: Genomics | B+ |
| MBBB 493: Seminar in Bioethics | Currently enrolled |
|  |  |
| **Chemistry** |  |
| CHEM 131/131L: General Chemistry I | A – (lecture), A (laboratory) |
| CHEM 132: General Chemistry II | B+ (lecture), B+ (laboratory) |
| CHEM 210: Intro to Analytical Chemistry | B+ |
| CHEM 331: Organic Chemistry I | B |
| CHEM 332: Organic Chemistry II | A |
|  |  |
| **Physics** |  |
| PHYS 211: General Physics I | B |
| PHYS 212: General Physics II | Currently enrolled |
|  |  |
| **Mathematics & Statistics** |  |
| MATH 273: Calculus I | B |
| PSYC 212: Behavioral Statistics | A- |