

The Biology Major's Handbook

6th Edition – Fall 2011

Prepared by the Faculty of Towson University's
Department of Biological Sciences

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To the Biology major:

Congratulations on choosing what we, the faculty of TU's Department of Biological Sciences, think is the most fascinating and intriguing of all pursuits: the study of life on earth, *Biology*. We very much want your time at TU to be both exciting and valuable. It is our goal to see that the degree in Biology that you obtain from TU helps you move onto a satisfying, rewarding career, whatever you may choose to do.

To this end, we have put together the *Biology Major's Handbook*. This handbook contains, among other things, a review of important university policies and procedures, a detailed description of course requirements for your degree, suggestions on how to obtain hands-on experience, such as research or an internship, some advice on how to secure a good job, and a comprehensive guide to graduate school. Different parts of this handbook should be useful to you during different phases of your undergraduate career and even beyond your graduation.

We update this handbook each year and add new information that we deem important to our students. To this end, we very much appreciate feedback from students. If you encounter material that is out-of-date, possibly incorrect, unclear, or downright confusing, please let us know. If you have questions or concerns about issues that are not currently addressed in the handbook, we would like to know about them so we can include them in the next edition. Please send your comments, questions, and suggestions co-editor of the handbook, Dr. Scott Johnson, at sjohnson@towson.edu.

The most updated version of the handbook will be posted on the Biology Department's website each fall. We urge you to consult this version when you are a junior or senior preparing for a career, professional school, or graduate school.

We wish you all the best,

The Faculty of TU's Department of Biological Sciences

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THE DEPARTMENT OF BIOLOGICAL SCIENCES

Administration, Staff, and Faculty

Each department at Towson University is headed by the “Department Chairperson.” The current chair of the Department of Biological Sciences, also known as the “Biology Department,” is Dr. Joel Snodgrass.

The Biology Department Office is located in Smith Hall, Room 341, and can be reached by phone at 410-704-3042, or by e-mail at dreuther@towson.edu. The Biology Department has several staff members but the two people with whom students interact the most are the office manager, Ms. Dolores Reuther, and the administrative assistant, Ms. Cindy Evans.

The Biology Department has more than 30 full-time faculty members. One can find the names of all full-time faculty, a list of courses that they teach, and their specific research interests at the departmental website (address below). In addition to full-time faculty, the department employs a number of skilled part-time or “adjunct” faculty to assist in teaching courses.

Student Services Available in the Biology Department Office

The staff in the Biology Department Office can help you find and contact faculty and can answer various questions about classes that are offered by the department. In addition, students can obtain certain forms they might need for various purposes. Also available is the most recent schedule showing when different Biology courses will be taught in upcoming semesters. In addition, the department maintains three bulletin boards displaying (1) current office hours and locations of all Biology faculty (directly across the hall from the office); (2) recent Biology faculty and student publications (to the left of the first bulletin board); and (3) upcoming departmental seminars and other current events of general interest (to the right of the first bulletin board, just before the stairwell).

Departmental Website

The Biology Department maintains the website: <http://wwwnew.towson.edu/biology/>. This website contains the following information of potential interest to students:

- The latest department “news”
- A list and description of all Biology courses
- A list of faculty, their research interests, and links to their individual webpages
- A list of undergraduate research and internship opportunities
- Employment opportunities for students within the department
- Links to sites describing different career options for Biology majors
- Links to sites posting jobs in Biology
- Announcements of upcoming seminars

If you have any corrections, questions or suggestions regarding the website, please contact the webmaster, Dr. Colleen Winters at cwinters@towson.edu.

Departmental Seminars

Several times each semester, the Biology Department brings biologists from other universities, government agencies, and various industries to campus to give presentations on their research. In some cases, individuals giving “seminars” are applicants for a faculty position in the department. Students are encouraged to attend seminars. In some Biology courses, students can get “points” or credit if they attend seminars and write brief reports on what they observed and learned. Check with your professor to see if this is true for a particular class that you are taking.

If You Have Concerns or Suggestions about Courses or Other Biology-related Matters

If you have a concern about a particular Biology course that you are taking, you are encouraged to first approach the professor of the course and clearly and tactfully relay your concerns. If you are uncomfortable talking to the professor directly, or if you have talked to the professor and you don't feel that your concerns are being adequately addressed, you can speak to your academic advisor and/or the chair of the department, Dr. Joel Snodgrass. Dr. Snodgrass can be reached by e-mail at jsnodgrass@towson.edu or you can call the Biology Department Office at 410-704-3042 to make an appointment to see the chair in person. Students should also feel free to address any general concerns or suggestions that they have about the Biology Department, course requirements, etc., to their advisor and/or the department chair.

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THE FISHER COLLEGE OF SCIENCE AND MATHEMATICS

Administration and Staff

The Department of Biological Sciences is one of five departments in the Jess and Mildred Fisher College of Science and Mathematics. Each college within Towson University is headed by a dean. The dean of the Fisher College of Science and Mathematics is Dr. David Vanko. The dean's office is located in Smith Hall, Room 312.

Student Services

Students do not normally have much interaction with the dean or the dean's office. In particular, if students have concerns or complaints about their Biology courses, instructors, or advising, they should set up an appointment to talk to the course instructor, academic advisor or chair of the department, respectively.

Jess and Mildred Fisher

You may have noticed above that the official name for our college is the *Jess and Mildred Fisher College of Science and Mathematics*. Who are Jess and Mildred Fisher, that they have an entire college named after them? Jess Fisher was a Baltimore native who attended TU in the early 1930s. He attended classes in Stephens Hall (the only building with classrooms back then) and played basketball and football. Although he never graduated, his time at TU clearly made a positive impression on him. After leaving the university, he married his wife, Mildred, and worked for a time as a beer salesman,

eventually becoming a real estate developer. He established the Robert M. Fisher Memorial Foundation to honor his son Robert, who died in 1969. This foundation supports local organizations, offers scholarships, and provides research funding. Jess Fisher felt strongly that science and mathematics were important in a university education. When he passed away in 2003 at the age of 89, he left \$10.2 million to TU to support the College of Science and Mathematics. Many Biology majors will experience direct benefits from Fisher's generosity. In particular, funds from the Fisher Gift will be used to support undergraduate student research projects.

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MAJORS CLOSELY RELATED TO THE BIOLOGY MAJOR

Molecular Biology, Biochemistry, and Bioinformatics (MBBB)

Students majoring in Biology obtain relatively broad training in this subject, taking course work that touches, to some degree, on everything from biochemistry to cells to whole organisms to entire ecosystems. An alternative major, the Molecular Biology, Biochemistry, and Bioinformatics or "MB3" major, offers students the chance to specialize their training at the undergraduate level. The MB3 Program offers a Bachelor's degree for students who want to focus their coursework in either: 1) molecular and cellular biology and genetics; 2) biochemistry; or 3) applications of computer technology to genetic and other biological information (bioinformatics). Courses are taught by faculty in four departments: Biology, Chemistry, Mathematics, and Computer Sciences.

MB3 majors take basic courses in three areas: molecular biology, biochemistry, and bioinformatics. They then choose one of these three areas as a "concentration" in which to specialize. In addition, all MB3 majors are required to participate in an independent research project for at least one semester or summer with a faculty member at Towson University or with a mentor from a nearby biotechnology company, government laboratory, or other academic institution.

Students wanting more information about this major, or wanting to discuss whether their career goals might be better served by this major are encouraged to visit in person with the director of the MB3 program, Dr. Larry Wimmers. Dr. Wimmers can be found in Smith Hall, Room 360, and can be reached by e-mail at MB3@towson.edu or by phone at 410-704-3491. The program's website is: <http://wwwnew.towson.edu/mb3/index.asp>.

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Environmental Science

Students in the Environmental Science (ENVS) Program develop the multidisciplinary background and skills required to address the complex environmental issues/problems that confront us today. The program draws on the skills, talents, and expertise from faculty across the campus including faculty from the Fisher College of Science and Mathematics, the College of Liberal Arts, the College of Business and Economics, and the College of Health Professions. An interdisciplinary approach is necessary because solutions to most environmental problems require input and expertise from multiple fields of study.

The ENVS program has two primary educational functions. One is to provide the fundamental scientific, technical, and social knowledge that graduates will need to assess and evaluate environmental concerns, particularly those confronting metropolitan regions. The other is to instill content mastery and a wide range of cognitive skills, which students will need to propose and implement realistic plans for solving environmental problems at local, regional, and national levels. The program is structured so that all students, regardless of their area of specialization, take courses in the environmental sciences, mathematics, and the social sciences. This core establishes the scientific principles and awareness of the social and political context of environmental debates and decision-making. After completing the core, students choose to continue coursework in one of four concentrations: Environmental Biology, Environmental Chemistry, Environmental Geology, or General Environmental Science. The environmental problems addressed in many of the program's courses focus on the adjacent urban/suburban environment including its impact on the surrounding regions. In their senior year, students take a senior seminar course that emphasizes application of concepts to real world problems. A required senior internship/research experience gives first-hand practice in an environmental field.

Students wanting more information about this major, or wanting to discuss whether their career goals might be better served by this major are encouraged to visit in person with the director of the Environmental Science and Studies program, Dr. Jane Wolfson. Dr. Wolfson can be found in the Administration Bldg, Room 213 and can be reached by e-mail at jwolfson@towson.edu or by phone at 410-704-4920. The program's website is: http://www.towson.edu/ess/e_science.asp.

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Animal Behavior

TU offers several interdisciplinary studies programs, one of which is Animal Behavior. Students in the Animal Behavior program take a complementary combination of specialized courses from two disciplines, Biology and Psychology. The courses required for this major focus on animals, especially their behavior, but also their diversity, structure and function, ecology, and conservation. Students who complete the program are awarded a Bachelor of Science degree in Interdisciplinary Studies, with Animal Behavior listed as their "track" on their diploma and transcript. Unlike students majoring in Biology, Animal Behavior majors are not required to do ancillary coursework in Chemistry and Physics. However, Animal Behavior majors must complete all prerequisites for required Biology or Psychology courses. Animal Behavior majors are also required to obtain hands-on experience working with the behavior of animals, either through an internship or through independent research supervised by a faculty member at TU or at another institution.

The Animal Behavior major prepares students for entry-level positions in zoos, aquaria, and environmental education facilities such as nature centers. Students wanting to pursue other careers in Animal Behavior, especially research, will need to obtain a graduate degree, either a Master of Science or a Ph.D. Students need to be aware that the vast majority of graduate programs that offer opportunities to study the behavior of animals, especially in the wild, are within Departments of Biology at various universities. Entry into these programs generally requires some undergraduate coursework in Chemistry and Physics, and a course in Calculus. For this reason, students interested in

the Animal Behavior major are *very strongly* encouraged to either: 1) double major in Biology and Animal Behavior or 2) complete some extra coursework in science and mathematics to qualify them for Animal Behavior graduate programs based in Biology departments. For assistance in choosing an optimal set of courses, students should talk to their advisor and/or the director of the Animal Behavior Program.

An alternative path to graduate studies in behavior would be to major in both Interdisciplinary Studies – Animal Behavior and Psychology. Students who do this have the option of applying to those Psychology graduate programs that have faculty conducting research on some aspect of Animal Behavior. Keep in mind, however, that research in a Psychology graduate program will obviously have more of a psychological than a biological focus. That is, your research will likely concentrate on subjects such as learning, memory, and motivation rather than on the ecology and adaptive value of behavior. Also, much psychological-based research on behavior still involves domesticated or captive organisms (e.g., rats, pigeons, mice, primates), which may not appeal to some students.

Students wanting more information about the Animal Behavior major, or wanting to discuss whether their career goals might be better served by this program are encouraged to visit in person with the director of the Animal Behavior Program, Dr. Erik Scully. Dr. Scully can be found in Smith Hall, Room 261, and can be reached by e-mail at escully@towson.edu or by phone at 410-704-3012.

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UNIVERSITY REQUIREMENTS FOR THE BACHELOR'S DEGREE: AN OVERVIEW

Your Towson University Undergraduate Catalog as a “Contract” Between You and TU

Requirements that students must meet to obtain a bachelor's degree are laid out in detail in the TU Undergraduate Catalog (accessible online) for the year in which you entered the university. That catalog also describes all critical university policies and procedures. Your catalog is the *ultimate authority* on what you must do to obtain a degree. It is also, in essence, a “contract” between you and the university. As long as you meet the requirements and abide by the policies and procedures within that catalog, you will get your degree. Even if the requirements for a degree in Biology change while you are at TU (e.g., if the Biology Department decides next year that a different set courses should be required for a Biology degree), *your* requirements remain unchanged; you are held only to the requirements in effect when you entered TU, as spelled out in the catalog for your entry year.

The TU Undergraduate Catalog is not the most exciting read (some claim it cures insomnia better than any drug), but key parts of it are well worth reading. Read through the introductory sections entitled the “University Curriculum” and “Academic Regulations.” Also read through the section in the middle of the catalog describing the Department of Biological Sciences.

Finally, it would be wise to read Appendix F of the catalog, the Code of Conduct, which describes student rights and responsibilities, prohibited conduct, and other key policies. Posted separately at <http://www.towson.edu/studentaffairs/policies/academicintegrity.asp>, but really part of the Code of Conduct, is the Academic Integrity Policy. Be sure to read it carefully, as you are subject to these rules

and penalties and are expected to be fully aware of them. (See also ‘**Cheating, Plagiarism, and Academic Integrity**’ section, below.)

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Changing Your Catalog of Record

When you arrive at TU, you enter under an Undergraduate Catalog for a certain year, e.g., the “2011-2012” catalog. You are told in no uncertain terms that this catalog is your “academic bible” as it spells out exactly what your requirements are for graduation in terms of coursework, number of credits, grades and GPA, etc. It is your “Catalog of Record.”

Technically you have 10 years to complete the requirements of that catalog in order to graduate. However, it is sometimes to a student’s advantage to request to complete the requirements in a later catalog. For example, say that there is a change in degree requirements such that students have to take, say, *two fewer* courses to complete a certain degree. That change could appear in the catalog that is issued when, say, the student is a junior. Actually, this is a reality for BIOL majors in the Secondary Education concentration. In the 2010-2011 catalog there is major change in the required amount of coursework for students choosing this concentration. These changes substantially reduce what was an exceptionally heavy courseload. Thus, any student in the Secondary Education concentration would probably want to switch to the new requirements, i.e., have a new Catalog of Record. One caution, however, is that ALL requirements in the newly adopted catalog must now be met for graduation, not just those for completing the major. This may entail additional coursework, as changes in other areas may also occur (as seen in the 2011-2012 catalog, in which University Core requirements replaced General Education requirements).

As described in more detail in the Undergraduate Catalog (see “Catalog Selection”), a student can request to fulfill the new degree requirements spelled out in catalog that is different than their current “catalog of record.” (Note that this will not alter the original transfer package/option received at the time of formal admission to Towson University as long as the student has maintained continuous enrollment.) Students wanting to change to a new catalog must fill out a Catalog Selection Petition form, found at http://www.towson.edu/registrar/Forms/documents/CatalogSelectionPetitionForm-INAC_002.pdf. This form must be signed by their major department’s chairperson. This form is then submitted to the Registrar’s Office for final approval. (Students who are unable to access the above link may go to <http://onestop.towson.edu/Forms/> and click the corresponding link under ‘Petitions to Academic Standards’.)

Students should see their academic advisor before submitting this form in order to determine the impact their catalog selection may have on their degree requirements.

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Course Requirements for a Bachelor's Degree

For students entering as freshmen before Fall 2011 or as transfer students before Fall 2013

Students must earn a minimum of 120 credits for a Bachelor's degree, and have a cumulative minimum GPA of 2.0. Of these 120 required credits, 32 must be upper-level credits (300 level or above). The 120 credits required for graduation include both courses required for the student's chosen major and 14 General Education (Gen Ed) courses in 12 Gen Ed categories. Your mathematics Gen Ed requirement (category IC) and your science requirements (category IIA) are completed automatically by fulfilling course requirements for the Biology major. Courses that fit within each Gen Ed category are listed on the first few pages of your TU catalog and should be selected in consultation with an advisor, in accordance with your interests.

For students entering as freshmen Fall 2011 or later or as transfer students Fall 2013 or later

Requirements are the same as stated above, except that 14 University Core courses replace 14 Gen Ed courses. Again, by fulfilling the course requirements for the Biology major, students automatically complete the University Core mathematics requirement (#3), and science requirements (#7 and #8). The University Core categories are listed at <http://inside.towson.edu/UniversityRelations/Core/CoreRequirements.cfm>. A full listing of courses satisfying each category is found by clicking on the category heading(s) of interest at www.towson.edu/core.

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Credit for Advanced Placement, International Baccalaureate and Other Prior Study/Experience

Students who have taken Advanced Placement exams or who have participated in an International Baccalaureate program will receive course credit as detailed in the TU catalog. These credits can fulfill both Gen Ed/University Core and major course requirements. International students with GCE or other certificates can have these evaluated for TU course credit as well.

Students who have taken advanced courses in high school or elsewhere but who did not take the corresponding AP or IB exams may earn "credit for prior learning" by taking what are called CLEP or Departmental exams. In essence, students can try to "test out of" certain courses by passing what are essentially comprehensive final exams for those courses. If one passes an exam for a course, one is awarded TU credit for that course that can count towards graduation and degree requirements. Note, however, that no such exams are available for Biology courses. More information on receiving advanced credit for courses is found at <http://www.towson.edu/registrar/CLEP/index.asp> (Credit for Prior Learning Program, Office of the Registrar, Enrollment Services Bldg., Room 231; 410-704-2471).

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Transferring in Courses Taken Before You Enrolled at TU

Courses taken at other universities may, if approved, transfer to TU and count towards TU degree requirements. However, students are limited to a maximum of 64 credits from 2-year institutions and 90 credits from either 4-year institutions or from a combination of 2- and 4-year institutions. At least 30 of the 120 credits for your degree must be taken at TU and 15 of these 30 credits must be completed after you formally become a degree candidate at TU. Requests for exceptions to this policy may be made to the Academic Standards Committee (contact Enrollment Services for more information, Enrollment Services Bldg., Room 288; 410-704-4351).

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Taking Courses During the Summer at TU or Elsewhere

Some students will want to take a course or two during the summer at a community college or other institution near home. While this is by no means mandatory, there are some benefits to taking summer courses. One can potentially graduate sooner or, alternatively, one can reduce the number of courses that one has to take during any given regular semester at TU. Reduced regular semester course loads are often helpful to overburdened science majors. Also, when you register for the next semester's courses depends on how many credits you have; the more credits under your belt, the earlier your date and time of registration. If you acquire more credits during the summer, you will be able to register sooner in the next semesters and will have less competition for seats in highly desirable courses.

Below are some cautionary notes, followed by a detailed description on how to transfer summer credits to TU, if you take summer coursework at a different institution.

Special Notes on Taking Chemistry or Physics or Human Anatomy/Physiology during the summer

The Biology major requires taking two courses of basic chemistry. At TU, these courses are CHEM 110 and 111. Most Biology majors also take two semesters of organic chemistry, which at TU are CHEM 331 and 332. The Biology major also requires two courses in Physics. At TU, most students take PHYS 211 and 212. Finally, many Biology majors take a two-semester sequence of human anatomy and physiology, BIOL 213 and 214 at TU.

If you want to take basic chemistry, organic chemistry, physics, or human anatomy and physiology during the summer at a school other than TU or one of Maryland's community colleges, then it is strongly recommended that you take BOTH semesters of coursework at that school. The problem is that what is covered in the first semester of basic chemistry at say, a community college in New Jersey, may not be the same material that is covered in the first semester at TU. Thus, one could come back to TU for the second semester of coursework and not know all that one needs to know for that second semester! This is not a problem if you take a course at a Maryland community college because TU and Maryland community colleges have coordinated their course content.

Having said that, there is a potential glitch when trying to take only the first semester of chemistry during the summer, either at TU or at a Maryland community college. Say you were planning to take

CHEM 110 at TU (or equivalent at a community college) over the summer and CHEM 111 at TU in the fall. When you register for fall classes in the spring, the registration system will not let you register for CHEM 111 if you have not enrolled in CHEM 110. What to do? First, if you are doing your summer coursework at TU, you can register for CHEM 110 in the summer first and *then* try registering for CHEM 111. If that does not work, immediately contact the Department of Chemistry office (Smith 541) to get permission to register for the desired section of the chemistry course in the fall. Chemistry will then check before the fall semester starts to make sure that you completed the first course, say CHEM 110, with a C or better, in the summer. Again, you must work with the Dept of Chemistry to make this happen.

The same is true for anatomy and physiology (BIOL 213 and 214). If you wish to take just BIOL 213 over the summer and to take BIOL 214 the following fall, you must contact the coordinator for these courses, Dr. Colleen Winters (cwinters@towson.edu), and she will give you the permission you need to enroll in BIOL 214 in fall. You must then also follow up with her when you have completed BIOL 213 and provide evidence that you have earned a C or better.

At present, you will NOT run into the same problems with physics courses. Even if you have not yet had the first semester course (PHYS 211 or 241), you can still sign up for the second course (PHYS 212 or 242) for fall. However, if you fail to take or pass the first course in the summer, you will be ejected from the second course in the fall.

As always, we recommend that you consult your advisor before making big decisions about summer courses.

Transferring in coursework taken at a Maryland community college

Many TU students who live in Maryland take courses at their local community college during the summer. The affordability and convenience of taking summer courses at a community college make this an attractive option. Community colleges offer many of the same introductory level and Gen Ed courses as TU does, so the transfer of credits to TU is relatively painless. Students interested in taking a summer course at a Maryland community college should do the following:

- 1) **Obtain a Summer Course Schedule** - Most community colleges publish their summer course schedules in March on their websites. Identify the course(s) you would like to take.
- 2) **Check Out Transferability** - For courses offered at community colleges, you will be able to determine whether a particular course is transferable to TU and determine what TU course it matches and hence what requirement (e.g., Gen Ed category) the course might fulfill at the following site: <http://www.aff.usmh.usmd.edu/artweb/chgri.cgi?1406861281971714>
- 3) **Complete and Submit a "Petition to Transfer Credit" Form** - In order to transfer credits back to Towson, you must submit this form to the Office of the Registrar, (Enrollment Services Bldg., Room 288) *prior to registering for the course*. The petition form may be printed from: http://www.towson.edu/registrar/Forms/documents/TransferPetitionFormcombinedrvsdfinalcopy-INAC_000.pdf. (Students who are unable to access the above link may go to <http://onestop.towson.edu/Forms/> and click the corresponding link under 'Petitions to Academic Standards'.)

- 4) **Register for the Course** - Keep in mind that you will have to complete the admission process as a “special” or “visiting” student at the institution you wish to attend.
- 5) **Send an Official Transcript to Towson** - This is a very important step! Have this sent prior to the start of the Fall Semester, if possible. Follow up by checking your transcript online to see if the course(s) have been posted.

Transferring in coursework taken at a school other than a Maryland community college

- 1) **Obtain a Summer Course Schedule** – Sometime in the spring, visit the website of the school at which you might take a summer course(s) and see what courses are offered and when.
- 2) **Complete a “Petition to Transfer Credit” Form** – In order to transfer credits back to Towson, you must complete and submit a petition to do so *prior to taking the course*. The petition is available at:
http://www.towson.edu/registrar/Forms/documents/TransferPetitionFormcombinedrvsdfinalcopy-INAC_000.pdf. (Students who are unable to access the above link may go to <http://onestop.towson.edu/Forms/> and click the corresponding link under ‘Petitions to Academic Standards’.)

On this petition you will list the name and number of each course that you might take. You must also obtain a copy of the course description. This can be photocopied from a printed catalog, if you have one. Descriptions are usually available online, as well, at the school’s website (or the department’s website). If not, you may have to make some phone calls to get descriptions sent to you.

You then must take the petition form, along with course descriptions to the appropriate department. For example, say that you are planning to take “CHEM 100 and 101” at Garden State Community College near your home in New Jersey. You are hoping that these courses will transfer to TU as the equivalent of CHEM 110 and CHEM 111 here. You need to take your petition, and a description of the courses to TU’s Chemistry Department for evaluation. The department will tell you up front whether or not the two courses will substitute for our CHEM 110 and 111. If you are also planning to take a history course, after or before you get Chemistry to sign off on your petition form, you will have to visit the History Department.

When you have all the required signatures, take your petition and course description(s) to the Office of the Registrar, (Enrollment Services Bldg., Room 288) for final approval. Again, you must get permission to transfer in credit for the course *prior* to taking the course. You do not want to take the course and then find out after the fact that the course will not transfer to TU.

- 4) **Register for the Course** - Keep in mind that you may have to complete the admission process as a “special” or “visiting” student at the institution you wish to attend.
- 5) **Send an Official Transcript to Towson** - Have this sent prior to the start of Fall Semester, if possible. Check your transcript online to see if the course(s) have been posted.

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Course Loads: Limits and Recommendations

A full-time course load at TU is 12 or more credits. Students may take up to 15 credits without additional cost. An “overload fee” is charged for each credit above 15 credits. Students who are comfortable with a large number of credits may take up to 19 credits without special permission if they have at least a 2.0 cumulative GPA. However, taking more than 16 credits is usually not recommended because of the extra time that Biology majors must spend in laboratory. Students thinking about taking more than 16 credits should discuss their reasons for doing so with their advisor.

Students may take up to 6 credits during the January Minimester. Students may also take up to 9 credits in any one of the four summer sessions, and a maximum of 15 credits in all four summer sessions combined. Keep in mind, however, that courses in these special sessions are very intensive. In a single day, you can expect to take as many notes and get as much homework as you would during a full week during the fall or spring semesters. It is therefore a good idea to take only one Minimester or summer course at a time. You should also plan to work very few hours or not at all when taking Minimester and summer courses.

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The Final 30 Credits Rule and Exceptions

The TU Undergraduate Catalog states “Students are expected to complete the final 30 units towards their degrees at Towson University.” However, the catalog also states that “Exceptions may be granted in cases of documented extraordinary circumstances.” Students must petition the Academic Standards Committee to take some of their last 30 credits somewhere other than TU. This petition should be made prior to taking those credits to ensure that they will transfer. It is wise to have your advisor attach a letter confirming your need to do this.

A little known fact is that *financial hardship* is usually considered a reasonable circumstance in which to take a few of the last 30 credits at, say, a community college. The fact is that it is less expensive to take courses at community colleges. Students can explain that their finances are such that, to afford to complete their degree, they need to take some of their credits elsewhere.

Likewise, *transportation restrictions* are another reasonable circumstance in which to take a few of the last 30 credits elsewhere, at least during the summer. For example, if a student’s lives in New Jersey, it is obviously much easier for them to take a summer course in that state than to come all the way back to TU.

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Learning and Other Disabilities: Disability Support Services

Towson University is committed to providing equal access to its programs and services for students with disabilities, including various learning disabilities (e.g., dyslexia). Disability Support Services, located in the Administration Bldg, Room 232 (410-704-2638) is the office designated to provide

reasonable accommodations to students with disabilities. Students seeking accommodations must identify themselves to DSS, request an appointment to discuss their needs, and provide DSS with up-to-date and complete documentation of their disabilities. DSS determines what accommodations are reasonable on a case-by-case basis, taking into account the student's disabilities and needs, nature of their learning task, course standards and essential requirements of the program of study, and educational environment. Students are encouraged to register with DSS as soon as possible after admission to the University to ensure timely provision of services. Much more detail is available at: <http://www.towson.edu/dss/studentguide/index.asp>.

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Attendance Policies

A student who fails to appear for the first two classes of a daytime, weekday course (including laboratories) or the first class in an evening or a weekend course, may be forced to forfeit their space in that class. This means that the professor can give your seat in the class to another student. You must then drop the class immediately if you want to avoid paying for the class. If you do not drop the class before the Change of Schedule period ends, you then must officially withdraw from the class or you will receive an "FX" grade on your transcript. In the event of an emergency that prevents attendance at the first class sessions, it is the student's responsibility to contact the instructor in advance to request that he/she hold a seat in the course, and to explain the reasons for their absence. It is up to the instructor to decide whether to hold a seat in the class for you.

The syllabus for a course will state attendance policies for that course for the remainder of the semester. Note that each of your professors can and will have a different attendance policy! Also, you should recognize that success in a course generally correlates with your attendance in that course. This is especially true for science courses.

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Cheating, Plagiarism, and Academic Integrity

All students should review TU's Student Academic Integrity Policy which can be found at: <http://wwwnew.towson.edu/studentaffairs/policies/academicintegrity.asp>. Here, infractions such as **cheating, plagiarism, fabrication/falsification, and multiple submission (of assignments)** are all defined.

While most students are aware of what constitutes cheating, students are often not clear on the different forms of plagiarism and that can get them into trouble. According to the university, plagiarism is "presenting the work, products, ideas, words, or data of another as one's own." When most students think of plagiarism, they think of taking material from books or the Internet without giving proper reference. Note that regardless of whether you use exact quotes or put the material in your own words or not (i.e., paraphrase), if you got your information from another source, you have to

give credit to that source. If you do use any of the original wording is used, you must put quotation marks around this material and provide a citation to the source of the material.

There is, however, another form of plagiarism that students often do not recognize: copying another student's assignment. This could be a student in the same class or a student that has taken the class in a previous semester. *Such copying is NOT permitted.* Note: students often get themselves into trouble when they work on an assignment together (especially one done on the computer that will be printed out and submitted) and then turn in the same or similar assignment. In this instance, it appears that one student copied – plagiarized – the other. This may not be true – the work may truly have been a joint effort - but that is how it appears. If you want to work on an assignment with another student, it is best to talk to your instructor first.

Copying your *own* work from a previous class is also considered plagiarism (self-plagiarism or multiple submissions) and is not allowed.

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Grade Requirements

Towson University uses a +/- grading scheme for most courses. Students must earn a C or better in ENGL 102 and in all letter-graded courses required for their major, minor, and certificates (e.g. a teaching certificate). Some courses are graded on a “Satisfactory/Unsatisfactory” (S/U) basis, rather than on a letter-grade basis (these do not count when calculating the GPA). Students must get an S grade in any such courses required for their major (e.g., BIOL 204).

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The Pass Grading Option (formerly known as the “Pass/Fail” option)

Students may elect to be graded on a Pass basis for up to 12 credits of coursework. *However, students may not elect the Pass grading option for courses that are required for their major or minor or a certificate, e.g., a teaching certificate.*

If a student elects to take a course on a Pass basis, any grade of C or higher results in a passing grade (“PS” on their transcript) for that course and does not count in calculating the GPA. However, any grade below C, i.e., D+, D, or F, is recorded as such on the transcript as that letter grade and is computed into the GPA. For this reason, students who are in danger of getting less than a C in a course should avoid changing to the Pass grading option and should instead consider withdrawing from the course. This option is described in more detail in the next section. It is wise to discuss any decision like this with the professor of the course in question and with your advisor.

Note that some courses are not graded with letter grades, e.g., BIOL 204. In such courses, students get a grade of S for “Satisfactory” or U for “Unsatisfactory.” Although they are often referred to as “pass/fail” courses, the “Pass Grading Option” refers just to courses in which students normally receive letter grades.

Changes to the Pass Grading Option must be done by a specific date each semester. That date can be found on the official university calendar, which is posted at: <http://onestop.towson.edu/calendars/>. You *cannot* change to the pass option online. Instead, you must complete a Course Schedule Change Form (http://www.towson.edu/registrar/Forms/documents/1_DROP_ADD_FORM.pdf) and drop it off at the Enrollment Services Office (Enrollment Services Bldg., Room 223). You do *not* need an instructor's or advisor's signature on this form. After normal business hours, there is a drop box for forms outside the ES office that will be available for as long as the ES building is open (usually until about 7 PM). (Students who are unable to access the above link may go to <http://onestop.towson.edu/Forms/> and click the corresponding link under 'Registration'.)

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Withdrawing from a Course

Students may withdraw from one or more courses in a semester. Withdrawal results in a grade of “W” on the transcript. W grades do not figure into calculation of the GPA. The “W” is not erased from the transcript, even if the student completes the same course in a later semester. Withdrawal from a course may be done in person at the Registrar's office (Enrollment Services Bldg., Room 223) or online through a student's Towson Online Services account.

Contrary to popular opinion, having a W or even a couple of W's on one's record is not severely detrimental, especially if the withdrawals come early in the student's undergraduate career. Employers, graduate schools, and professional schools realize that some students take longer than others to “adjust” to the pace and intensity of university coursework, and that some students face situations beyond their control that may force them to withdraw from a course or two in a given semester. When employers and others are judging the quality of a student, they focus much more on other factors, among them a student's overall performance, as measured by the GPA. Some students foolishly stay in a course in which they are not doing well because they want to avoid what they assume will be a serious “negative” on their transcript, a W. In reality, a grade of D+, D, or F *is* a real negative that not only is never erased, but drags down the GPA (until the course is repeated, if it ever is).

Withdrawing and full-time status

In some cases, after withdrawing from one or more courses, the student will have less than 12 “active” course credits for the semester. It is a common misconception of students and their parents that the student is then no longer a “full-time” student. Maintaining full-time status can affect auto insurance rates, health insurance coverage, tax deductions for parents, etc. In reality, students are still considered full-time for the semester by Towson University as long as they have *attempted* to complete at least 12 credits. Two notes of caution are in order, however: First, *some* insurance companies require students have at least 12 *active* course credits. Second, the above does NOT apply for international students and student athletes; they must maintain 12 active course credits during the semester, even if it means failing one or more courses.

Withdrawing and scholarships

There are many different scholarships that TU students can get and each has its own set of rules and policies. Students who are thinking about going below 12 active credits as a result of withdrawing should check with the Financial Aid Office (Enrollment Services Bldg, Room 339; 410-704-4236; finaid@towson.edu) to see if their scholarship(s) would be affected.

Withdrawing and on-campus housing

It is university policy that students be full-time, i.e., “carry a minimum of 12 course credits” to occupy University housing (note: West Village Apartments are excluded from this policy). Students who, as a result of withdrawing from one or more courses, have fewer than 12 *active* course credits are required to request a “waiver of the full-time status requirement for housing” by filling out a form at the University Housing and Residence Life Office in Newell Hall. In general, if a student does not have a history of trouble in the residence and will still have 9-11 active credits, he/she will be allowed to stay in University housing. However, if the student has a history of behavioral problems and/or regulation violations, or if the student’s course load will drop below 9 active credits, greater scrutiny is applied and the request could be denied. For this reason, students should request the waiver of the full-time status requirement prior to withdrawing from courses.

Deadline for withdrawing

Withdrawals must be done by a specific date each semester. That date can be found on the official university calendar, which is posted at: <http://onestop.towson.edu/calendars/>. Students may withdraw from classes through Towson Online Services up until 11:59 PM on this date. Students do not need an instructor’s or advisor’s written permission to do so but students are strongly encouraged to consult with their advisor before withdrawing from a course.

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Late Semester Medical and Emergency Withdrawals

If an unexpected medical condition, a family emergency, or other major disruptive event prevents a student from continuing with a full load of coursework during a semester, and it is past the official withdrawal deadline, a student still may request to withdraw from some or all of their courses (obtaining a grade of “W” in affected courses).

Students wanting to withdraw must submit a written appeal to the Academic Standards Committee (ASC) to request a retroactive withdrawal. Appeals should include name, address, student ID, name/number/section/term of all affected courses, as well as supporting documentation (i.e. medical documentation on letterhead indicating dates of treatment).

Written appeals may be faxed to Academic Standards Committee at 410-704-6393 or delivered or mailed to the Office of the Registrar, Enrollment Services Room 288.

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Repeating Courses

Students may elect to repeat courses in which they have earned poor or unsatisfactory grades. Only the higher of the two grades earned for a course is used in the calculation of the student's GPA. However, both grades remain on the transcript (the lower of the two grades has a "repeated" statement below its listing to show that this course was repeated later). Caution: even if you "passed" the course twice, say with a "D" the first time and a "B" the second time, the course counts only once towards the total number of credits you need for your major and for graduation.

Note, however, that all of the above applies only if the course is repeated *at TU*. One cannot, for example, repeat a course at a community college during the summer and have the grade replace the grade at TU in the calculation of the GPA (transfer courses of any kind are *not* included in the calculation of your TU GPA). The course can, however, count toward the major and graduation, if the grade is at least a C and the course is transferred to TU properly. In terms of the total number of credits required for graduation, credits from the course will only be counted once even if you did take the course twice, once at TU and once elsewhere.

No special permission is needed to repeat a course once. However, students must complete a petition in the Enrollment Services Office (Enrollment Services Bldg., Room 223) or online (go to <http://onestop.towson.edu/Forms/> and click the corresponding link under 'Petitions to Academic Standards') to attempt a course a third time. Without this special permission, the repeat is considered unauthorized, and the grade earned may not replace the prior grade in the student's GPA.

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Not Completing a Course and the I Grade

Professors may give a student the grade of "I" ("Incomplete") when, late in a semester, circumstances beyond the student's control prevent the student from completing the final course requirements.

Professors can request documentation to verify the student's excuse for not completing a course. However, note that regardless of such documentation, professors are *not* required to provide a student with an I grade. If a student's request for an Incomplete is denied, he/she may want to consider withdrawing from the course if the deadline for withdrawal has not passed. This, again, is a decision that students should discuss with their advisor.

Faculty who do grant a student an I grade may request that the student sign an Incomplete Grade Agreement Form, which the professor will supply. This form establishes a date by which students must complete work for a particular course (which cannot be later than the end of the next regular semester) and describes the work that is required. It is then the student's responsibility to complete the work required by the designated date.

After successful completion of the coursework, the professor fills out a Change of Grade Form (students get a copy of this form in the mail) and the grade of I is converted to the appropriate grade. If the work is not made up within 180 days, the grade automatically converts to an F.

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Satisfactory Academic Progress and “Making the Dean’s List”

To remain in what the University calls “good academic standing”, a student must maintain a minimum cumulative GPA. The required minimum depends on total number of course credits earned, as follows:

- 1 – 29.5 credits: GPA of 1.50
- 30 – 59.5 credits: GPA of 1.75
- 60 credits and above: GPA of 2.00

Failure to remain in good academic standing will result in Academic Warning, Probation, Suspension, or Dismissal, as detailed in the TU Undergraduate Catalog. This may affect eligibility for on-campus housing and participation in collegiate athletics. Students receiving financial aid have even more stringent requirements for satisfactory completion of courses and should consult their Financial Aid advisor for details, if their GPA becomes quite low.

Students who obtain a GPA of 3.5 or higher when taking 12 or more credits in any given semester (excluding Pass grading option, Audit, S/U and developmental courses) will be recognized by inclusion on the Dean’s List. Dean’s List recognition is not awarded for a particular semester if a student receives an ‘I’ grade for a course in that semester, even after the course is completed.

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Applying for Graduation

Students must apply for graduation several months before they expect to complete their graduation requirements and be given their degree. In recent years, deadlines for the application for graduation have been: Spring graduation - January 20th, Summer - July 10th, Fall - August 21st. Students should, however, check for any changes in these deadlines. Deadlines and instructions on how to apply for graduation online are at: <http://www.towson.edu/registrar/graduation/index.asp>.

Students approaching graduation can also make an appointment with Ms. Mara Lauterbach in the Biology Department Office to confirm that they have met all the requirements for the B.S. degree in Biology. Students are not required to do this but can and should do this if they are uncertain about whether they have met all requirements. To make an appointment with Ms. Lauterbach, students should contact the Biology Department Office by phone at 410-704-3042.

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Taking Graduate Courses as an Undergraduate

The Department of Biological Sciences offers a graduate degree in Biology (Master of Science) and offers a variety of interesting 600-level courses designed for graduate students. Senior undergraduates with a GPA of 3.0 or higher may take up to 6 credits of 600-level coursework. *However*, these credits may not be used to complete the 120 credits for graduation. Students wishing to take one or more graduate courses must present a Drop/Add Form, signed by the course instructor, to the Graduate School Office during the Change of Schedule period at the start of the semester.

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Changing Your Address and/or Your Name with the University

Throughout your undergraduate career, the University will send you quite a bit of paperwork by mail. Some of this material you will not want to miss. If you move, you can quickly and easily update your address online through a link found at: <http://onestop.towson.edu/Forms/>. This same site can be used for name changes as well.

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COURSE REQUIREMENTS AND COURSE OPTIONS FOR THE BIOLOGY DEGREE

Core, Ancillary, Breadth, and Elective Courses

All Biology majors are required to take a set of core, ancillary, breadth, and elective courses. **Core courses** are the Biology courses that provide the fundamentals upon which advanced courses build. **Ancillary courses** are basic courses in chemistry, physics, and mathematics that support learning and understanding in Biology. **Breadth courses** are designed to ensure that all Biology majors have at least a basic knowledge of the key facts and concepts in three major areas of Biology: Cell and Molecular Biology; Physiology; and Organismal Biology, Ecology and Evolution. **Elective courses** are advanced Biology courses that students select for more depth in their chosen area of specialization.

Students must obtain a grade of C or higher in all courses required for the major, including ancillary courses. If the course has S/U (Satisfactory/Unsatisfactory) grading (such as BIOL 204—Educational and Career Planning for the Biologist), a grade of S is required.

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Concentrations

All Biology majors must select a concentration, i.e., a particular area in Biology in which they would like to specialize their coursework (see below). There are four concentrations to choose from:

- Cell and Molecular Biology
- Functional Biology of Animals
- Organismal Biology and Ecology
- Secondary School Biology and General Science Teaching

Selection of a concentration is required by the end of the freshman year, but switching from one concentration to another is possible at any time in one's undergraduate career. Instructions on how to declare a concentration appear in the next section. Note, however, that changing concentrations after the end of your second year may increase the time required to complete your degree. Students *must* have declared the *appropriate* concentration (i.e., that matches the coursework that they have taken) by the time they apply for graduation. Students who do not have the appropriate concentration will not receive their diploma until this concentration has been declared.

All course requirements and course choices for the Biology major are described in detail in the TU Undergraduate Catalog. They are also summarized in a comparative format in [Appendix 1](#) of this handbook. Check-off lists for each concentration are also available in the Biology Department Office.

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How to Declare a Concentration

One declares a concentration using an online form which can be found at:

<http://www.towson.edu/registrar/changingmajor.asp> .

In the box that is marked **>New Major/Second Major/New Minor** you need to request Biology as your major. Do this again, even if that already is your current major. You can then select your concentration. Note that, at present, the special options are not choices. If you want the Pre-professional option, select Functional Biology of Animals. If you want either the Zoology or Botany options, select Organismal Biology and Ecology.

In the box marked **>Delete Major(s)/Minor(s)**, you need to delete your existing major *even if this major is Biology*. Basically, the online system needs you to “wipe the slate clean” and start fresh. You are replacing the previous declaration of major with new, more detailed information.

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Prerequisite Courses

The curriculum for the Biology major is carefully constructed to allow students to build upon a solid foundation in gradual and logical steps. Because of this, many courses at or above the 200-level have *prerequisites*, which are courses that you must take *before* the course in question (in some cases you are allowed to take prerequisite course “concurrently,” i.e., during the same semester). Prerequisite courses cover skills and/or content required for the more advanced courses. Faculty teaching courses

with prerequisites will assume that students have this prior knowledge base and will move on with little or no review of the prior material.

Descriptions of each BIOL course are found in the online TU catalog. Required “prereqs” for a course can be found at the end of the description for that course. For example, the end of the description of BIOL 435–Plant Ecology reads: “Prerequisites: BIOL 202 and BIOL 205.” This means you must take both BIOL 202–Introduction to Ecology and Evolution and BIOL 205–General Botany *before* taking Plant Ecology.

TU’s online course enrollment system often will simply not allow a student to enroll in a course for which he/she has not completed all prerequisite courses with a grade of C or better. Sometimes, however, the system does not work quite right and a student may slip into a course without the prerequisites. Think twice about this. If a professor discovers that a student enrolled in the course without the proper prerequisites, the student may be asked to drop or withdraw from the course; otherwise they will receive an F for the course.

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Taking Required Courses with the “Pass Grading Option”

As indicated above, letter-graded courses required for a major, minor, or certificate (including ancillary courses in chemistry, physics, and math) may not be taken with the Pass Grading Option.

Anticipated Two-year Sequence of Elective Courses

Not all courses are offered every semester. Indeed, many of the advanced elective courses are offered every year or every other year. Students thus need to plan carefully ahead with regard to which courses they will take in which semester. A list of what Biology courses are being offered during the next two years (four semesters) can be found in the Biology Department office and also on the Biology Department website. An example of this list can be found in [Appendix 3](#). This list is updated twice yearly, early in the fall and spring semesters. Changes in when certain courses will be offered occur on a regular basis. Thus, students are urged to obtain an updated copy of projected course offerings every semester.

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Independent Study and BIOL 481-Directed Readings in Biology

During their time at TU, some students will want to explore an area of interest in much more detail than is found in any of the courses that TU has to offer. For example, a student may want to delve deeply into the biology of HIV/AIDS or learn as much as possible about conservation biology of large cats. To do this, and get credit for it, students can enroll in BIOL 481-Directed Readings in Biology. Students then research their subject using books and published scientific articles under the supervision of a faculty mentor who has some expertise in the area. Typically BIOL 481 students are expected to present a major summary and synthesis of what they have learned in the form of a lengthy term paper.

Note that students cannot simply sign up for BIOL 481; they have to first find a faculty member who is willing to act as their mentor and supervise and grade their efforts. Students must also recognize that faculty members are not obligated to supervise each and every student that comes to them with a proposed BIOL 481 project. Supervising a BIOL 481 project is very time-consuming if done correctly, and many professors will legitimately already have a “full plate.” As such, you can expect most professors to say “no” if you request that they mentor your BIOL 481 project on short notice, e.g., just before the Change of Schedule period ends at the start of the semester. Students who wish to do independent study and get BIOL 481 credit should contact a professor well in advance of the semester in question to discuss with the faculty member their interests and objectives.

Before a student signs up for BIOL 481, the student and mentor must come to an agreement on the topic(s) to be studied, the nature and amount of literature to be read, the nature and length of the paper that the student will produce, how the student will be graded, the number of credits to be awarded (see below), how often the mentor and student will meet to discuss findings and progress, and deadlines for submission of drafts and the final paper.

BIOL 481-Directed Readings in Biology can be taken for 1-3 credits (and can be repeated for a total of up to 3 credits). The number of credits a student takes should correspond to the scope of the project, i.e., the amount of literature being reviewed and the extent and detail of the paper submitted at the end of the semester. In most cases, students should expect to obtain 1-2 credits for their efforts. Students must have completed at least 10 credits of Biology coursework prior to enrolling in BIOL 481.

One final note: Credits earned in BIOL 481 cannot be used to fulfill elective course credit requirements for your degree in Biology. Credits earned, however, will count towards the 120 total credits (including 32 upper-division credits) that are required for the B.S. degree.

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Departmental Honors

Graduating “with honors” can be extremely advantageous. It is certainly one of the first things that employers and graduate and professional schools recognize on a student’s resume.

Biology majors may achieve recognition as an “honors graduate” in two main ways. One way is to be admitted to the Honors College and fulfill its specific requirements (e.g., taking a certain number of special honors courses and seminars). The second way is to complete the Departmental Honors program, which is open to any Biology major willing to meet the requirements.

To graduate with Departmental Honors in Biology, students must finish with a cumulative GPA of 3.25 or higher and a 3.5 GPA in their coursework required for the major. Students must also do a major project, for which they will receive 6 credits. Three types of projects are open to students:

- 1) The **traditional thesis**, which is based on original research conducted by the student.

- 2) An extensive, supervised **internship**, during which the student obtains practical, hands-on experience with an applied focus.
- 3) A **teaching project**, which is especially appropriate for students who are interested in education or the teaching/learning process.

At the end of their project, students prepare a written thesis or report, and must describe and answer questions regarding their work to an advisory committee of three faculty members. Students will also give an oral presentation describing their work, which will be open to the general public.

For more detailed information, see [Appendix 8](#). Students still interested in obtaining Department Honors should consult with the Biology Honors Coordinator, preferably by the end of their sophomore year. Please call or visit the Biology Department office to get the name and contact information of the Biology Honors Coordinator.

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Minimester and Summer Course Offerings in Biology

[Appendix 3](#) provides a list of courses the Biology Department expects to offer in all upcoming semesters as well as the January Minimester and summer.

Few Biology courses are normally offered during the minimester. Notable exceptions are the required online only course, BIOL 204 –Education and Career Planning for the Biologist and BIOL 425 - Dissection of the Upper Extremity, which involves the dissection of cadavers. Students must have successfully completed BIOL 213 before taking BIOL 425. Unlike other courses, students cannot simply sign up for BIOL 425 online. Rather, students must apply to take this course. For an application, students should visit or contact the Biology Department Office.

Some of the Biology core and breadth courses are offered during the summer. Elective courses are almost never offered during summer.

BIOL majors who do take courses during the minimester and summer typically take required ancillary courses or GenEds (or University Core courses) so as to leave more openings and time for majors courses during the regular academic year.

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Double Majors and Minors: Why and How

Double Majors

Some students elect to complete the requirements for more than one major. In some cases, students do this to enhance career opportunities. For example, students who are interested in the biology or conservation of the rainforest should seriously consider majoring in both Biology and Spanish, as they will likely be working at least some of the time in a Spanish-speaking environment. Students

interested in medicine or education might be in the same situation. Students interested in a career in medical illustration or biological photography might consider majoring in Art as well as Biology.

Double-majoring is easiest when a student comes to TU already having credit for several courses in a potential second major as a result of AP or IB exam scores. For example, students proficient in a foreign language can start taking mid- or upper-level classes in that language. If these classes are passed, students are automatically given credit for the lower-level courses. It certainly is possible to also start and complete two majors “from scratch”, but sometimes scheduling conflicts result in students’ needing extra time to complete both majors.

Students wanting to add a second major must formally declare their intentions by submitting a ‘Change of Major/Minor Form’ online at: <http://onestop.towson.edu/Forms/>. Note that in this case, no major is deleted; a second major is just added. Caution: It is crucial that students visit the department office of their new major a week or so after declaring that major so that they can be assigned a new advisor in that major. Otherwise, there may be headaches and costly delays next time they try to register.

Minors

If a student wants to study a second subject in *some* detail, but does not want to dedicate him/herself to completing two entire majors, he/she can consider *minoring* in that second field of study. Students might be surprised at how few courses are required to obtain a minor. In particular, a considerable number of Biology majors elect to minor in Chemistry because, in addition to the Chemistry courses they need for the Biology degree, students typically need to take CHEM 210–Introduction to Analytical Chemistry, and one other upper-level CHEM course.

The courses required to obtain different minors are listed in the TU catalog. Simply look up the subject area (e.g., “Geology” or “Sociology”) and find the section for the “minor.” Students wanting to add a minor must do so using the ‘Change of Major/Minor Form’ online at: <http://onestop.towson.edu/Forms/>.

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General Education Courses of Potential Interest to Biology Majors

Gen Ed category IB

These courses all teach information management and evaluation, but in the context of different disciplines. There is a version of this course specifically designed for science majors: IDNM 101-Using Information Effectively in Science. Unfortunately, because of staffing issues, this course will not be offered for the foreseeable future. Other IB category courses that may appeal to Biology majors are IDHP 110-Using Information Effectively in the Health Sciences, and COSC 119-Using Information Effectively in the Computing Sciences.

Gen Ed category ID

One of the courses in this category, BIOL 381-Biological Literature, is taught by the Biology Department. Among other ID category courses that are available, those most suited to Biology majors

include: WRIT 312-History of Science; CHEM 301-Professional Ethics for Scientists, GEOG 383-Natural Resources and Society: A Geographic Perspective; ENGL 317-Writing for Business and Industry; and ENGL 318-Advanced Informational Writing. Two other ID category courses that may appeal to students with certain interests and career goals include: EDUC 301-Writing and Communication Skills for Teachers and PSYC 314-Research Methods in Psychology. Be aware that most or all ID category courses have specific prerequisites.

Gen Ed category IIB3

Courses of possible interest include: PHIL 255-Environmental Ethics; GERO 101-Introduction to Gerontology; OCTH 103-Leisure and Health Issues in Contemporary Society; and HLTH 101-Wellness for a Diverse Society or HLTH 207-Health Care in the US.

Gen Ed category IIC1

PHIL 111-Logic is of potential interest and value to Biology majors.

Gen Ed category IIC2

PSYC 203-Human Development will interest many Biology majors. However, students are warned that they must use courses from different departments to fulfill the two courses required for the IIC2 category. Thus students using PSYC 101 (a prerequisite for PSYC 203) to fulfill the first IIC2 requirement cannot use PSYC 203 to fulfill the second course requirement in this category.

Gen Ed category IID3

ANTH 208-Human Evolution and Prehistory will appeal to many Biology majors.

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University Core Courses of Potential Interest to Biology Majors

Core #1

Towson seminar courses of possible interest include Bioethics; Death and Dying; Food for Thought; Food Politics; Science of Healthy Habits; Science, Technology, and Global Trends; and Stem Cell Research.

Core #5

PHIL 111-Introduction to Logic is of potential interest and value to Biology majors.

Core #6

Courses of possible interest include: ANTH 208-Human Evolution and Prehistory; GERO 101-Introduction to Gerontology.

Core #9

One of the courses that should appear in this category, BIOL 381-Biological Literature, is taught by the Biology Department. Among other ID category courses that are available, those most suited to

Biology majors include: WRIT 312-History of Science; CHEM 301-Professional Ethics for Scientists, GEOG 383-Natural Resources and Society: A Geographic Perspective; ENGL 317-Writing for Business and Industry; and ENGL 318-Advanced Informational Writing. Courses in this category that may appeal to students with certain interests and career goals include: EDUC 301-Writing and Communication Skills for Teachers, PSYC 313-Research Design and Statistical Analysis in Psychology II, and PSYC 314-Research Methods in Psychology. Be aware that most or all of these courses have specific prerequisites.

Core #11

Students may be interested in either HLTH 101-Lifestyles of a Healthy Nation or HLTH 207-U.S. Health Care.

Core #14

Several courses of possible interest include: ASTR 301-Cosmic Origins; CLST 311-Science, Technology, and Culture; PHIL 361-Biomedical Ethics; and RLST 305-Faith Perspectives in Medical Ethics.

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Elective Courses in Other Departments

Other departments across the campus have certain non-Gen Ed courses that may be of interest to some Biology majors because of their interdisciplinary content. In particular, students should check out all courses with the MBBB (Molecular Biology, Biochemistry, and Bioinformatics) label in the list of courses in the back of their catalogs for possible inclusion in their Plans of Study. CHEM (Chemistry) courses should also be reviewed. Examples of courses from other disciplines that may appeal to Biology majors appear below. Note that these courses may have prerequisites (which are usually Gen Eds), so interested students need to plan accordingly.

Anthropology: ANTH 321-Gender in a Cross-cultural Perspective
ANTH 37x-Topics in Anthropology: Introduction to Forensics

Astronomy: ASTR 301-Cosmic Origins

Geography: GEOG 317-Energy Resources
GEOG 319-Soils and Vegetation
GEOG 329-Medical Geography
GEOG 410-Environmental Geography

Geology: GEOL 121-Physical Geology
GEOL 123-Historical Geology
GEOL 305-Environmental Geology
GEOL 357-Physical Oceanography

Health Science: HLTH 311-Chronic and Communicable Disease
HLTH 331-Nutrition for Health Professionals
HLTH 333-Food Safety Science

	HLTH 435-Epidemiological Basis of Disease and Environmental Health HLTH 451-Ecological Aspects of Health
Kinesiology:	KNES 311-Biomechanics KNES 313-Physiology of Exercise
Psychology:	PSYC 309-Psychopharmacology PSYC 317-Sensation and Perception PSYC 461-Cognitive Psychology PSYC 465-Physiological Psychology
Sociology:	SOCI 367: Sociology of Death, Dying, and Bereavement SOCI 37x: Topics in Sociology: Principles of Criminal Investigation SOCI 37x: Topics in Sociology: Death Investigation
Women's Studies:	WMST 336: Women and Medicine

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THE BIOLOGY MINOR: COURSE REQUIREMENTS AND COURSE OPTIONS

To complete the Biology minor, students are required to take CHEM 110-111-General Chemistry I, II, and a minimum of 24 credits in Biology, of which at least 6 credits must be upper level (300-400 level), as follows:

- BIOL 201 + BIOL 202
- BIOL 205 *or* BIOL 207 *or* BIOL 208 (*one of these*)
- Any other Biology elective courses approved for Biology majors to a total of 24 credits. These may include BIOL 213-214-Human Anatomy and Physiology I, II, but additional coursework will then be necessary to attain the required total of 6 upper-level credits. Note also that any restrictions in place for Biology majors are also in place for Biology minors, e.g. students will not receive credit toward the minor for BIOL 325-Animal Physiology if they successfully completed BIOL 213 and 214.

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TIME REQUIRED TO COMPLETE THE BACHELOR'S DEGREE

Can You and *Should You* Be Done in Four Years?

Although most Biology majors finish in 8 semesters or four years, a substantial number of students take 4, 4 1/2, or 5 years or even longer to finish their B.S. degree. Sadly, there is a stigma attached to not finishing in exactly four years. Students who take longer to get their Bachelor's degree sometimes consider themselves, or are considered by other students, as "deficient" or "incapable" in some way. In addition, parents can put pressure on their offspring to finish in four years not only because parents,

too, may consider finishing in exactly four years a sign of competence and efficiency, but also because they don't necessarily want to pay for more than 4 years-worth of courses.

The fact is that there are many very legitimate reasons to take somewhat longer than four years to get a degree. These reasons include, but are not limited to, the following:

1. A Biology degree requires an unusually large number of courses, many of which have laboratories. If you started university with a different major and switched to Biology partway through, you may need one or more extra semesters to "catch up" and finish all requirements.
2. The Department of Biological Sciences strongly recommends that students spend a semester studying abroad. If you do this, you will miss a semester of "regular" coursework and hence may need an extra semester to complete all required courses for the major. However, in the scheme of things, this is a very small price to pay for the tremendous experience that you will likely have going abroad.
3. Some students will stay an extra semester, or delay graduation, so that they can get in a valuable research, internship, or other type of critical hands-on experience. Also, sometimes students purposely take a light course load in a particular semester so that they can devote more time to a research project or internship that semester.
4. Students sometimes take an extra semester to take some interesting or useful Biology classes that they were just not able to schedule during their first four years. Likewise, some students take an extra semester to complete a double-major or minor.
6. Some students pay for most or all of their educational expenses and even living costs themselves. These students may be working 20, 30 or more hours a week to cover their many expenses. Students with this kind of work schedule are *strongly* advised to take fewer courses per semester so that they have enough time to devote to each course and still earn decent grades. This strategy will lengthen the time needed to finish, but it is the most reasonable strategy under the circumstances. *Your success at getting a career will depend quite heavily on the strength of your academic record.*

In sum, if you can finish in four years, that's fine. But realize there may be very good reasons for taking more time to get your degree. Convince yourself (and your parents if need be) that what is most important is a solid, complete undergraduate education with good grades and valuable experiences, even if that takes a little bit longer than four years. Medical schools, dental schools, graduate schools, and employers are less interested in the number of semesters that a student takes to finish their degree than in the student's performance, experience, and potential.

Balancing the Demands of Work and University

You are not spending four or more years of your life and a considerable amount of money to get a B.S. degree in Biology just so you can say: "I have a B.S. in Biology." No! You are getting this degree because you want to get an interesting job in some Biology-related field. The competition for interesting, well-paying jobs in Biology is ferocious, as is the competition for slots in medical, dental and graduate schools. To put it bluntly: Poor or mediocre performance in your classes will exclude you from most or all careers in Biology.

As mentioned in the section above, many students at TU are paying for their education themselves with little or no help from their parents. Many of these students also have to pay for their own food, housing and other day-to-day expenses. This requires working 20 or 30 or more hours at one or more jobs. Unfortunately, too many students with heavy work commitments insist on taking a full load of courses, i.e., 12 or 15 or even more credits, each semester. With all the hours that they must devote to work, they are left with an inadequate amount of time to put into each course. There are only 168 hours in a week. Hours spent working reduce hours spent on studying, sleeping, relaxing, etc. Both reduced study time and reduced sleep can negatively impact your grades. This will directly affect your success and competitiveness for schooling and jobs beyond college. Every Biology professor at TU can tell you sad stories of bright, motivated, promising Biology students who, because they tried to do too much at once, ended up with rather poor grades. These students did not go on to the jobs that they wanted – a heartbreaking conclusion to an undergraduate career.

When you ask students why they are overloading themselves, you almost always hear the same answer: “I want to finish in four years” as though there is some kind of penalty that will be imposed on them if they don’t finish in exactly that time frame. *There is no such penalty!* Medical schools, graduate schools, and employers will not be concerned about the fact that it has taken a student an extra semester or even an extra year or more to finish their degree. Their focus will be on the student’s performance, experience, and potential.

Think about it this way: Imagine that you overload yourself just so you can say that you finished in four years. But your grades are relatively poor and, as a result, you can do no better than a relatively crummy job that might not be related to Biology at all. Your life will have been permanently affected by the poor grades that you got because you overwhelmed yourself each semester just so you could graduate in four years. *Alternatively*, say that you limited the number of courses you took each semester so that you could devote adequate time to each course. Consequently, it took you an extra semester or two to finish, which cost you some extra time and money. However, you got decent grades which ultimately led to the job you wanted. If this is the case, twenty years from now, how much will it matter to you that it took you a little longer than four years to finish your degree? Will you even remember how long it took?

Our hats are off to those of you paying your own way through school. We sincerely admire your motivation and initiative. But please consider pacing yourselves appropriately.

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GETTING ADVICE DURING YOUR SOPHOMORE, JUNIOR, AND SENIOR YEARS

Declaration of a Concentration and Assignment of a Departmental Advisor

At the end of the freshman year or, in the case of transfer students, upon first registering for courses at TU, Biology majors are asked to complete a “Change of Major/Minor Form.” Even if you are already officially a Biology major, you still need to use this form to declare a concentration (concentrations are described above).

Also at the end of their first year (freshmen) or first semester (transfers), students are asked to fill out a Biology Major's Information/Interest form that is used to assign them an appropriate faculty advisor, i.e., one whose expertise is a match to the student's interests. Students are welcome to request a certain faculty member as their advisor. When the advisor is assigned, students will be given the advisor's business card that has his/her contact information including phone number, office location, and e-mail address. Students are encouraged to introduce themselves to their new advisor shortly thereafter.

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Advising Prior to Registration... and other Advice

Students are required to meet with an advisor at least once during the semester to discuss the courses that they should take in the coming semester. After the meeting, the advisor will lift the "advising hold" in the computer system, which will allow students to register. Students have two options. First, they can meet with their assigned advisor one-on-one in the advisor's office. Students can email their advisor to request such a meeting. Alternatively, the Biology Department holds several open advising sessions before registration deadlines each semester just for this purpose. Students can attend one of these sessions on a walk-in basis to be advised and have their advising holds lifted. Times of open sessions are announced in Biology classes and posted throughout the department. During a walk-in session, students can see their assigned advisor, if present, or another advisor. *Students who do not have their advising hold lifted in one of these ways will not be able to register until they do so.*

Good advising goes well beyond this pre-registration check of course selection, however. Students can and should discuss many things with their assigned advisor in addition to what courses to take, including opportunities for research, internships and off-campus study, potential careers, graduate and professional schools, and overall strategies for getting their desired career. Also, if you get to know your advisor well, this person can be one of the people who can provide you with an informative letter of reference.

Finally, advisors, being faculty members, have more clout than you do and can help you cut through any red tape or confusion you are facing at various campus offices. In short, get to know your advisor well and take advantage of what they have to offer you!

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Changing Advisors

Most students stay with their originally assigned advisor. However, students may want to change advisors if:

- the student's interests/concentration change and he/she wants a faculty member with more expertise in this new area of interest
- students come to know and respect a different faculty member and want to seek their advice

- personality conflicts between the student and the advisor interfere with appropriate advising
- the advisor is difficult to find and/or doesn't respond to e-mail or telephone contact in what the student feels is a timely manner

Students can change advisors without fear of retribution of any kind. Students do not need the permission of their current advisor. Advisors do not take such a switch personally; they recognize that changes can be warranted for many reasons.

Students who wish to change advisors but do not have a particular new advisor in mind can request a new assignment from the administrative assistant in the Biology Department Office. Students wishing to change to a particular new advisor should contact that person first to get his or her permission. If that person agrees, the change can then be formalized through the Biology Department Office.

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Special Advising for Premedical and Predental Students

See below under *Career Options: Medicine and Dentistry*.

STUDENT HONOR SOCIETIES AND ORGANIZATIONS

Beta-Beta-Beta Honor Society

Beta-Beta-Beta (TriBeta) is a national honor society for Biology students. TriBeta's three purposes are to promote scholarship in the biological sciences, to promote the dissemination of biological knowledge, and to encourage research. TriBeta was founded in 1922 at Oklahoma City University. The idea of an honor and professional society for Biology students spread rapidly and by 1925, the society was a national organization. Biennial national conventions of student and faculty members began that year and, in 1930, the society journal, *BIOS*, began publication of student research, articles of interest to biologists, and society news. As the society grew, it was divided into regional and district groups, each of which holds a convention annually. At the heart of every district and national meeting are student research papers presented in the style of professional scientific meetings. Today, more than 175,000 persons have been accepted into lifetime membership in TriBeta and more than 430 chapters have been established throughout the United States and Puerto Rico. Towson University's chapter, *Upsilon Eta*, was founded in 1968.

To become an active member of The *Upsilon Eta* chapter of TriBeta, an individual must: 1) be a Biology major; 2) have completed 40 hours of coursework (transfer students must also have completed one semester at Towson University, 3) have taken three Biology courses (beyond BIOL 201 and BIOL 202), 4) have a GPA of at least 3.0 in Biology coursework and 2.75 overall, and 5) pay a membership fee of \$40 (or \$10 if previously an associate member, see below). Active members may participate in the chapter activities, hold chapter offices, vote on chapter membership nominations and national questions, attend district or national conventions, and represent the chapter or vote at national conventions.

Individuals can become associate members of TriBeta if they do not meet all the requirements above, but have a strong interest in Biology. Associate status allows members to participate in chapter activities and attend district or national conventions. There is a \$30 membership fee for associate members.

To apply for either Active or Associate Member status in TU's TriBeta chapter, students should contact the faculty advisor for the organization, Dr. Vonnie Shields (Smith Hall, Room 345, vshields@towson.edu, 410-704-3130).

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Golden Key Honor Society

The Golden Key International Honor Society was founded over 25 years ago and now has over 350 chapters in the United States and several other countries. Unlike many other honor societies, membership in Golden Key is not restricted to a particular major. Membership is by invitation, and is offered to Juniors and Seniors (i.e., students who have completed more than 60 credits) who rank in the top 15% of their class. Currently this requires a GPA of 3.55 or higher.

Although membership in Golden Key is offered based on academic achievement, the primary activities of the Towson University chapter are service-oriented. Recent activities have included sponsoring events at the House of Ruth, participating in an "adopt a school" program in Baltimore, and collecting textbooks for use in Africa. General information about Golden Key can be found at its website, www.goldenkey.org. Information about the Towson University chapter can be obtained from the faculty advisor, Dr. Erik Scully (Smith Hall, Room 261; escully@towson.edu; 410-704-3012).

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The Premedical and Predental Student Organization

The mission of the Premedical and Predental Student Organization is to prepare, encourage and support students in their quest(s) to become future medical professionals. The organization is open to all students interested in careers in medicine or dentistry. To become a member, one can attend a meeting of the organization in person and provide an e-mail address to be notified of future meetings. Meetings are advertised on flyers posted through Smith Hall.

Each year the organization sponsors a number of programs on topics relevant to students interested in pursuing careers in medicine or dentistry. These include presentations by:

- admissions officers from medical and dental schools
- representatives of MCAT and DAT test preparation organizations
- physicians, osteopaths, dentists, podiatrists, and other medical professionals
- TU alumni currently in medical or dental school
- TU students participating in special programs or clinical experiences

Students are also provided with opportunities to take practice MCAT and DAT exams to learn about their academic strengths and weaknesses.

For further information on the Premedical/Predental Student Organization, contact the Director of Premedical and Predental Studies, Dr. George Harrison at Pre-professional@towson.edu.

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The Women in Science Program and the Women in Science Club

The current TU *Women in Science Program* (WISP) grew out of an initiative in 1998 to enhance the support for, and foster the success of, women faculty and students in science, and thus retain and enlarge the pool of women scientists. WISP and its members (which include both women and men) have created a variety of new courses, opportunities, and activities, including the following:

- Women-centered science courses
- Brown bag lunches to discuss issues important to women's career-related concerns and to women-centered teaching.
- A yearly Women in Science Forum in the spring, at which students and scientists at all levels are invited to listen to prominent female guest speakers in a variety of scientific disciplines talk about their interests and career paths, and then to mingle with these speakers informally over lunch.
- A mentoring program for women students in science.
- A program to foster student study groups.
- Women in Science Club for science students.

The current director of WISP is Dr. Gail Gasparich (ggasparich@towson.edu). See also the WISP website, <http://www.towson.edu/wisp> for more information.

The *Women in Science Club*, which is open to members of both genders who wish to participate, meets about once monthly. It invites speakers to talk about specific careers in science, organizes study groups and tutoring, participates in and organizes social events in the science departments, and sponsors science-related community service initiatives. The faculty advisor for this club is Dr. Cindy Ghent (Smith Hall, Room 226; cghent@towson.edu; 410-704-5918).

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ON-CAMPUS AND DEPARTMENTAL EMPLOYMENT FOR STUDENTS

Federal Work-Study Program

The Federal Work-Study Program (FWS) is a student employment program that is available to many students who qualify for financial aid. FWS allots students a certain amount of money, which they can earn by working part-time during the school year (up to 20 hours per week) and full-time during the summer months and school breaks.

Students can determine whether they have been awarded FWS money by contacting the Financial Aid Office (Enrollment Services Bldg, Room 339; 410-704-4236; finaid@towson.edu). If a student is not offered FWS funds in their initial financial aid package when they start at TU, they can ask the Financial Aid Office to consider them for a FWS award.

A wide variety of positions are available both on and off campus for FWS students. Students can review available positions at the Hire@TU website: <http://www.myinterface.com/towson/student>. Several FWS positions are available in the Biology Department. For example, FWS students routinely do secretarial work in the department office, assist in the preparation of laboratories for non-majors Biology courses, help take care of lab animals in the department's Animal Room, and even work as research assistants for faculty members. Open FWS positions in the Biology Department are posted at the "Employment Opportunities for Students" link on the department's website. Students with FWS funds can inquire in person about different jobs with the following individuals:

- for Biology Dept. secretarial positions: Ms. Cindy Evans, Smith 341 (410-704-3044)
- for lab preparation positions: Mr. Steve Skinner, Smith 322 (410-704-3037)
- for animal care technician positions: Ms. Darlene Godman, Smith 270 (410-704-3061)

Additional FWS positions may be available within the Molecular Biology, Biochemistry, and Bioinformatics program. You can contact the director of the program, Dr. Larry Wimmers, for a list of current openings (Smith Hall, Room 360; 410-704-3491; MB3@towson.edu).

For much more detail on the FWS program, visit the following site:

<http://wwwnew.towson.edu/main/finaid/typesoffinaid/workstudy/federalworkstudy.asp>.

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Employment Opportunities in the Biology Department and Elsewhere

Positions within the Biology Department that are open to students can be viewed on the "Employment Opportunities for Students" page on the Biology Department's website. Some positions will be open only to students with Federal Work-Study awards (see section above) while other positions are open to all students.

Additional employment opportunities that are available within and outside the university are posted at the Hire@TU website maintained by TU's Career Center. Hire@TU is a searchable online database posting not only jobs but also internship opportunities. To begin searching for jobs, you must create a

Hire@TU account which can be done at the TU's Career Center website:
<http://www.towson.edu/careercenter/>.

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SCHOLARSHIPS, FELLOWSHIPS, AND AWARDS

Biology majors may qualify for a number of scholarships and awards offered on a competitive basis by the Department of Biological Sciences, the Fisher College of Science and Mathematics, Towson University, and external foundations and agencies. However, before applying students should carefully examine the requirements for each scholarship or award of interest to them.

Department of Biological Sciences Scholarships and Awards

The Department of Biological Sciences awards up to seven monetary scholarships and three outstanding student awards a year, on a competitive basis. The monetary value of the scholarships varies from year to year. The specific requirements for each scholarship are listed below. Calls for applications for scholarships appear in the fall semester. Calls for applications for Outstanding Student Awards appear in the spring semester. Application materials are available in the Biology Department Office.

Scholarships

James Moniodis Scholarship for a Returning Major

This scholarship is named for James Moniodis, a Biology major and member of the TU Gymnastics Team. The scholarship was established by his friends and family following his untimely death in a trampoline accident. Biology majors may apply for this award in the fall of their junior year if they:

- Have completed at least 8 credit hours of 300 and 400-level elective Biology courses at TU
- Have at least a 3.3 GPA in Biology coursework and an overall GPA of at least 3.0
- Have been actively involved in extra-curricular activities for which no academic credit or remuneration was or is being received

Biology Alumni Scholarship

This scholarship is funded by individuals who graduated previously from TU with a degree in Biology and now wish to provide support to current outstanding Biology majors. Students may apply for this award if they:

- Have a least a 3.5 GPA in all coursework
- Have been active in departmental student organizations (e.g., Tri-Beta, Premedical and Pre dental Student Organization, WIS club) and/or have conducted research with a faculty member

Preference is given to students who have completed 8-12 credit hours of 300 and 400-level elective Biology courses.

James Edward Ewig Memorial Scholarship for Academic Achievement by a Senior

This scholarship honors Dr. James Ewig who was a neuroendocrinologist and mammalian physiologist trained at Penn State. He was a faculty member in Biology from 1971 until his unexpected death in 1990. This award is based on the student's GPA (no minimum GPA is required for application) and letters of recommendation from Biology faculty members. Biology majors may apply for this award if they have completed a least 80 credit hours of coursework at TU.

Lois D. Odell Scholarship for Outstanding Transfer Student

A native of New York state, Lois Odell joined the "Science Department" of the "Maryland State Teacher's College" (later to become Towson University) in 1947. She taught botany, natural history, and science education, serving the university until her retirement in 1981. Dr. Odell died in 2002. More than one award may be made depending on availability of funds. Students who transferred to TU from a community college or other institution may apply for this award if they:

- Took at least 55 but not more than 65 credit hours of coursework from another two or four year institution before attending TU
- Have a least a 3.2 GPA in all coursework

Preference is given to students who have completed 8-12 credit hours of 300 and 400-level elective Biology courses.

Betty Kennedy Dale Scholarship

This scholarship is awarded by the Biology Department Scholarship Committee to a highly qualified student. Completion of the application for one of the previous scholarships will qualify you for consideration.

Outstanding Student Awards

Lois D. Odell Award for the Outstanding Senior Biology Major

Like the scholarship for the outstanding transfer student, this scholarship is named for Dr. Lois Odell, a Biology faculty member for over 35 years. Students receiving the award get a plaque and recognition at the annual Fisher College of Science and Mathematics Student Awards ceremony. Biology majors may apply for this award in the spring of their junior year if they:

- Have completed at least 89 credit hours of coursework at TU
- Have at least a 3.3 GPA in Biology coursework and an overall GPA of at least 3.0
- Have distinguished academic performance, research, and/or service to the department, college or university

Compton N. Crook Award for the Outstanding Junior

This scholarship honors Dr. Compton Crook who came to TU in the 1940s when it was known as "Towson Teacher's College." A ranger in Yellowstone National Park before coming to Towson, Dr.

Crook taught ecology and ornithology. He also wrote science fiction books under the pseudonym “Stephen Tall” while he was a member of the Biology Department. The Baltimore Science Fiction Society still gives out their own Compton Crook Award for the best new local science fiction writer. Students receiving the Crook award get a plaque and recognition at the annual Fisher College of Science and Mathematics Student Awards ceremony. To be considered for this award, students must be nominated by either a Biology faculty member or an officer of a Biology student organization. Students may ask appropriate individuals to nominate them if they:

- Have completed 56-89 credit hours of coursework at TU or, in the case of transfer students, have at least one semester completed at TU
- Have at least a 3.3 GPA in Biology coursework and a GPA of at least 3.0 overall
- Have distinguished academic performance, research and/or service
-

Carl Henrikson Award for Academic Achievement by a Junior

This scholarship is named for Dr. Carl Henrikson who came to TU in 1970 from the University of North Dakota. He specialized in tissue culture, immunology, and microbiology. He stayed at TU until his unexpected death in 1991. Students receiving the award get a plaque and recognition at the Fisher College of Science and Mathematics Student Awards ceremony. This award is based on the student’s GPA (no minimum GPA is required for application) and letters of recommendation from Biology faculty members. Biology majors may apply for this award if they have junior status (at least 60 credit hours of coursework completed).

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Fisher College of Science and Mathematics Scholarships and Awards

Jess Fisher Scholarship

The Jess Fisher Scholarship is awarded to an incoming freshman who intends to pursue one of the many majors offered within the Fisher College of Science and Mathematics, including Biology. The awardee must enroll as a full-time student (at least 12 credit hours). This scholarship is given to a student who demonstrates outstanding academic potential based on their high school record, SAT/ACT scores, a personal statement of career plans, and letters of reference from high school teachers.

Towson University Scholarships

Various scholarships are available from Towson University. For further information, students should visit the TU Financial Aid Office (Enrollment Services Bldg, Room 339; 410-704-4236) and peruse their website <http://wwwnew.towson.edu/main/finaid/>.

External Scholarships, Fellowships, and Awards

A substantial number of scholarships, fellowships, and awards are given to students each year by various government agencies and private foundations. A page on TU's Financial Aid Office's website (<http://wwwnew.towson.edu/main/finaid/financialaidwebsites.asp>) provides links to sites either describing certain scholarships or fellowships or sites that specialize in searching for scholarships and fellowships. However, this webpage contains only a *partial* list of useful sites and students are encouraged to do their own search for scholarships and fellowships using keyword phrases such as "undergraduate scholarships fellowships." For example, a recent search on Google quickly turned up the following useful sites, many of which are not on TU's Financial Aid website:

<http://www.finaid.org/>

<http://www.collegeboard.com/student/pay/>

<http://www.fastweb.com/>

<http://www.college-scholarships.com/>

<http://www.theoldschool.org/>

<http://www.cse.emory.edu/sciencenet/undergrad/scholarships.html>

<http://www.jkcf.org/>

<http://www.orau.gov/dhsed/>

<http://www.act.org/goldwater>

One important note of caution is in order. There are several online sites that offer to find money for you for a fee. *Never* pay for scholarship/fellowship information. Many of these sites are illegitimate scams. Even if a site is above board, there are plenty of free scholarship/fellowship search engines that will get you the same results.

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OBTAINING HANDS-ON EXPERIENCE: RESEARCH AND INTERNSHIPS

Research

Why do research?

Biology is an enormous, diverse, complicated field of study. Consequently, Biology majors, especially in their first couple of years, must spend a great deal of time learning and memorizing a myriad of terms, definitions, key facts, and fundamental concepts. Although rather grueling at times, this is essential as one must learn the language and essential principles of Biology before one can actually become a practicing Biologist of one sort or another.

However, no student chooses to major in Biology just to memorize enormous amounts of basic information! Rather, most students major in Biology so that they eventually can spend their time studying some aspect of life on Earth, be it the workings of biological molecules, cells, the human

body, or entire ecosystems. In other words, most students major in Biology so that they can become Biologists.

We strongly encourage our Biology majors to start making the transition from Biology student to working Biologist while they are still undergraduates. For many students, that means *doing research*. Professional Biologists spend much of their time conducting research to discover new information about living things (and, of course, gathering more information for Biology majors to learn!).

Although research can be tedious, difficult, and extremely frustrating at times, it is incredibly exciting to learn something about the world that nobody else knows; to contribute new knowledge to science. From a more practical perspective, doing research can also enhance one's chances of getting into a high-quality professional school or graduate school and getting a good job in Biology.

There are numerous avenues open to students to gain research experience. These are described in more detail below.

Doing research with a TU faculty member

Most professors in the Biology Department are actively involved in research projects that involve undergraduates. Students wanting to participate in research with a TU faculty member should consider the following course of action:

1. Familiarize yourself with the type of research in which the various faculty members are engaged by talking to your advisor, other faculty, and by looking at faculty webpages on the Biology Department's website.
2. Contact faculty members whose research is of interest to you and arrange to meet them in person. For example, send an e-mail that indicates that you are "interested in discussing the possibility of doing research with them" and give them a complete list of days and times that you are free to come to their office to learn more.
3. In your face-to-face meeting with each faculty member, find out what types of projects they are pursuing and whether or not they are accepting new undergraduate students for those projects. Be prepared to describe what courses you have had, what your career goals are, and how much time per week you can commit to the effort (and when you are available each week). You may also ask to talk to the faculty member's current research students to see what "life" is like in that faculty member's laboratory.
4. Based on your "interviews" with various faculty, you should be able to decide in whose lab you would most like to work. Contact your top choice and ask if you can join their research team. Do not be discouraged if your first choice ultimately decides not to take you on as a research student. Faculty have to make a very large commitment of time and resources when they accept a new student, and they can only handle so many students at one time. Thus, rejection is likely not a reflection on your qualifications or abilities. Move on to your second choice.

Off-campus research opportunities

There are several reasons to consider seeking research experiences at places other than TU. First, research opportunities within the Biology Department are limited in number by the number of faculty and the time that they have available. Second, the range of potential research topics is limited by the interests and current projects of the faculty within the department. For example, if you are interested in studying the biology of the human eye, currently there is no Biology faculty member who studies the human eye. However, there are scientists in the Baltimore/Washington area and elsewhere that do.

Many opportunities for off-campus research exist, especially during the summer, but you will need to put some time and effort into finding such opportunities. Most of these opportunities are in the form of “research assistantships,” “research internships,” or “research fellowships.” Some research positions pay you an hourly wage or a stipend. Other opportunities are strictly volunteer; you won’t get paid for your time and you may or may not get travel and/or living expenses. However, if a volunteer position comes up that is perfect for you, and you can afford to do it, by all means take advantage of it and gain valuable experience. In some cases, researchers will take on a student as a volunteer to start and, if the student proves to be reliable, efficient, and interested, the student will ultimately be offered a paid position.

Students can locate off-campus research opportunities/assistantships in several different ways. First, you can, of course, search the internet using keywords like “undergraduate biology research internship opportunity” etc. Online searches will also occasionally turn up helpful sites whose purpose it is to provide undergraduates with links to sites describing research and internship opportunities. This include sites set up by Columbia University (<http://www.columbia.edu/cu/biology/ug/intern.html>) Kalamazoo College (<http://www.kzoo.edu/biology/internopps.html>), and the Rochester Institute of Technology (<http://people.rit.edu/gtfsbi/Symp/calalpha20011.htm>).

Second, many Biology professors know where to find listings of student research opportunities in their field of study. So, for example, if you are interested in doing research in animal physiology, talk to one of the professors that teaches and/or does research on animal physiology. They may have contacts that either have positions or will know where positions are listed.

Third, there are usually a good number of research assistant positions/opportunities available in the Baltimore/Washington area at medical schools (e.g., Johns Hopkins University and the University of Maryland, e.g., see: <http://www.hopkinsmedicine.org/graduateprograms/sip.cfm> as one example of the *many* programs at JHU), private industries (e.g., MedImmune and Beckton Dickinson), state agencies (e.g., Maryland Department of Health and Mental Hygiene, Maryland Department of Natural Resources), and federal agencies (e.g., Aberdeen Proving Grounds, U.S. Department of Agriculture, U.S. Fish and Wildlife Service, National Institutes of Health and many more). Students can check the websites of these organizations for information on research opportunities, or contact them directly by telephone. Again, opportunities exist but don’t expect them to fall in your lap! You will need to doggedly investigate potential possibilities.

Fourth, the U.S. government funds a large number of undergraduate research positions each year. Some positions are available through the Oak Ridge Institute for Science Education (ORISE) (<http://orise.orau.gov/sep/catalog.htm>), which places students in military research laboratories, including Aberdeen Proving Grounds. Other positions are available through the Summer Internship

Program in the Biomedical Sciences run by the National Institutes of Health (NIH; <http://www.training.nih.gov/student/sip/index.asp>). NIH places students in research laboratories throughout the country, including in Baltimore.

Particularly valuable and exciting are paid summer research opportunities funded by the National Science Foundation under a program called “Research Experience for Undergraduates” (REU). Most REU programs last 8-10 weeks. Students receive a substantial stipend (\$2500-3500) and usually receive free housing, meals and even travel expenses. REU programs are established at various universities around the country. Each program is required to take half of their students from campuses other than their own. You can find an interactive list of REU programs at the NSF web site. Go to www.nsf.gov and search using the keyword “REU.” You should find a link to “REU Sites,” i.e., universities that have REU programs (most recently, sites were listed at: http://www.nsf.gov/crssprgm/reu/list_result.cfm?unitid=5047). In recent years there have been about 100 REU programs and 1000 positions for undergrads. If you are interested in marine biology and/or the Chesapeake Bay, you may want to check out the Maryland Sea Grant program’s REU program (<http://www.mdsg.umd.edu/programs/research/reu/>).

There are other, smaller established summer research programs for undergraduates. For example, students particularly interested in microbiology and closely related fields should investigate summer undergraduate research fellowships available through the American Society of Microbiology: <http://www.asm.org/>. Students interested in conducting research at the Smithsonian's National Museum of Natural History should investigate their Research Training Program: http://www.nmnh.si.edu/rtp/other_opps/internship_summary.html. NASA also has a undergraduate research program that includes opportunities for students that are majoring in life sciences such as Biology: <http://www.epo.usra.edu/usrp/>. The University of Oregon has their Summer Program in Undergraduate Research which offers opportunities in all areas of Biology (<http://biology.uoregon.edu/SPUR/>).

Other summer research opportunities for undergraduates undoubtedly exist, but you will have to spend some time online tracking them down. For example, a student interested in dolphins and whales might type in “undergraduate research marine mammals.” Obviously trying many different keyword combinations will be wise (“research assistantship internship dolphins” etc.).

Obtaining course credit for doing research on-campus

How one obtains course credit for conducting research changed substantially starting in the Fall of 2011. Students now have a greater variety of options, each of which is described below.

BIOL 490 Research Participation (1-3 credits)

This course is designed for students who will be *assisting* a professor or graduate students in doing research, helping to gather data and learning various procedures and techniques in the process. (After gaining experience, the student may move on to do a more independent project where they are primarily responsible for data collection and analysis. In this situation, they would enroll in BIOL 491 or 492 – see below).

Some details:

- To enroll in BIOL 490, students must have an overall GPA of 2.75 or greater, must have completed 30 or more credits (i.e., have junior or senior standing), and must have completed a minimum of 11 credits worth of Biology courses.
- Students cannot simply sign up for this course; they must have the written approval of the instructor that will oversee their research (generally, the instructor will email the department's administrative assistant indicating the permission).
- Students can sign up for 1, 2, or 3 credits, depending on extent and scope of the research project. In general, the more time that the student will invest in the project during the semester (or minimester or summer), the greater the number of credits allowed. In general, you will be expected to work an average of 3-4 hours per week for each credit hour earned. Students will have to consult with instructor regarding the expected number of hours invested per week and hence the appropriate number of credits. The instructor will indicate the number of credits when conferring permission for the student to register.
- This course can be repeated up to a maximum of 6 total credits earned, but each time the student enrolls they must be working with a different faculty member.
- Credits do *not* count towards requirements for the Biology major (i.e., BIOL 490 credits do *not* count as elective credits) but do count as upper-level credits, 32 of which are required for any B.S. degree.

BIOL 492 Independent Research for Variable Credit (1-3 credits)

This course is designed for students who are taking the lead on a particular project, i.e., for situations in which students are largely responsible for data collection and analysis and will be preparing a research paper and/or oral or poster presentation. Students can do a “small,” “medium,” or “large” research project and receive 1, 2 or 3 credits, respectively.

NOTE: If a student intends to use independent research credits as *elective* credits counting towards requirements for the Biology major, they must enroll in BIOL 491 for 3 credits (see below). Students who have already taken BIOL 491 or who are not using research credits for their major requirements or who are doing small to medium-sized projects that will net only 1-2 credits should enroll in BIOL 492.

Some details:

- To enroll in BIOL 492, students must have an overall GPA of 2.75 or greater, must have completed 30 or more credits (i.e., have junior or senior standing), and must have completed a minimum of 11 credits worth of Biology courses.
- Students cannot simply sign up for this course; they must have the written approval of the instructor that will oversee their research (generally, the instructor will email the department's administrative assistant indicating the permission).
- As indicated above, students can sign up for 1, 2, or 3 credits, depending on extent and scope of the research project. In general, the more time that the student will invest in the project during

the semester (or minimester or summer), the greater the number of credits allowed. In general, you will be expected to work an average of 3-4 hours per week for each credit hour earned. Students will have to consult with instructor regarding the expected number of hours invested per week and hence the appropriate number of credits. The instructor will indicate the number of credits when conferring permission for the student to register.

- This course can be repeated up to a maximum of 6 total credits earned.
- Credits do *not* count towards requirements for the Biology major (i.e., BIOL 490 credits do *not* count as elective credits) but do count as upper-level credits, 32 of which are required for any B.S. degree.

BIOL 491 Elective in Independent Research (3 credits)

Like BIOL 492, BIOL 491 is designed for students who are taking the lead on a particular project, i.e., for situations in which students are largely responsible for data collection and analysis and will be preparing a research paper and/or oral or poster presentation. However, students should enroll in BIOL 491 instead of 492 if: 1) their project is extensive enough in terms of scope and amount of time to be invested that 3 credits are warranted (averaging at least 9 hours of work a week) and 2) if they intend to use the credits as “elective” credits counting towards the Biology major.

Some details:

- Students cannot simply sign up for this course; they must have the written approval of the instructor that will oversee their research (generally, the instructor will email the department’s administrative assistant indicating the permission).
- BIOL 491 cannot be repeated. However, students can get additional research credit by enrolling in BIOL 490 or 492.
- Credits can count towards requirements for the Biology major, i.e., BIOL 491 can stand in as an “elective” course for students in all concentrations.

Obtaining course credit for doing research off-campus

You can obtain course credit for doing research off-campus with someone other than a TU faculty member. In this situation, students can sign up for either BIOL 493 - Internship in Biology *or* BIOL 490- Research Participation (see description of course above). In either case, you must find a TU faculty member who will serve as your on-campus sponsor and supervisor. The faculty member will need to know specific details about the research project and may even consult directly with your off-campus supervisor. The faculty member can then help you decide how many credits of BIOL 493 or BIOL 490 to take (i.e., 1, 2 or 3 credits). This person will also be responsible for recording your grade in the course.

If you choose BIOL 493, you will need to submit certain paperwork for credit (see *Evaluation and Reports* under the **Internships** section below).

Before you start your off-campus research project, you should secure a TU faculty sponsor/supervisor. You then need to come to an agreement with that faculty member as to: 1) in what semester you will sign up for course credit; 2) how many credits you will take; 3) what you will be required to do for these credits (e.g., number of hours spent in research, papers and/or presentations); and 4) what kind of performance will be required for a certain grade (A, B, etc.). This agreement must be put in writing and signed by both the student and the faculty member.

Obtaining Departmental Honors when doing research

Students planning to do a substantial research project may wish to think about applying for “graduation with Biology Department Honors.” Details are found [above](#) and in [Appendix 8](#). Students doing research would choose the “Thesis” option for honors.

Expectations of students doing research

Research students should anticipate that their mentor/supervisor will have certain expectations of them:

Time - In general, most mentors will expect *an average* of 3-4 hrs of work per week for every credit hour that a student receives in independent research. Students can expect to work more hours some weeks and fewer hours other weeks. Most mentors will be happy to allow you to work your schedule around exams and other responsibilities, if plans are made in advance.

Intellectual Involvement – Research mentors are looking for students who will not just “go through the motions” to get credit or pad their resume, but who instead will make a real effort to understand the objectives and significance of the research. Research mentors also want students who will pay close attention to all facets of the project and ask questions when they have them. In short, student researchers are expected to be fully *engaged*.

Reliability – Without question, research mentors are most concerned about a student researcher’s reliability. It is critical that students show up do to research when they say they are going to do so. It is also critical that students pay close attention to what they are doing so that they gather accurate, quality data. Research mentors can and will dismiss a student very quickly if they cannot trust them to either show up or gather data in a thoughtful, careful manner.

Expectations that students should have of their research mentors

Just as research mentors have expectations of students, students should have expectations of mentors:

Doable, Meaningful Research Projects - The research mentor should put considerable time and thought into the research projects that they design for students. Mentors should choose projects that they expect will produce some results by the time the student finishes their work. This will allow students to have the valuable experience of presenting their results at scientific meetings and, in some cases, in a scientific publication. Mentors should also choose projects that are not simply a repetition of what has been done before. Rather, the project should produce results that will potentially advance scientific knowledge in some respect.

Adequate Time Spent Mentoring - Students should expect to have extensive, face-to-face interaction with their research mentor. This does not mean a mentor should spend every minute with you when you are doing research. Mentors should, however, work closely with you in planning, developing, and implementing the research project. The mentor should spend adequate time training you in techniques, and should be available to you when you have questions or problems. If you do not feel that your mentor is providing enough advice and supervision, you should tactfully bring this up to him or her. If the situation does not improve, you should contact your advisor or the department chair for advice.

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Internships

What is an internship and why do one?

Gaining experience doing research (described in the section above) is beneficial if you are considering graduate school or a career focused on research. However, many of the careers that one can get with a Biology degree do not involve doing research. For these careers, other types of “hands-on” experience can be very valuable. Indeed, you have probably heard some version of the tale of someone who applies for a job and is told that she or he is unqualified due to a *lack of experience*. The obvious question is how can you get experience before being hired? One smart approach is to participate in an internship.

Internships are sometimes referred to as “work-learn” experiences because they offer a work experience and a learning experience simultaneously. Internships are like “apprenticeships” because they typically involve some version of employment (unpaid) in a particular field, which offers the opportunity to learn about aspects of a career in that field. Internships also provide students with an occasion to *apply* the skills and concepts that they have learned in their courses, something that is particularly satisfying.

In addition to providing students with technical skills and experience that will enhance their chances of getting a job, internships can be particularly valuable in helping students decide, early on, whether or not a specific career is right for them. Most careers in Biology require a degree of specialization as an undergraduate and many require additional post-graduate training. Before committing a tremendous amount of time (and money) to training for a particular career, it would most advantageous to know what that career would be like. Internships can do this for a student.

Requirements for engaging in an internship and obtaining basic information on internships

Internships may be done during the fall or spring semester, Minimester, or summer.

To engage in an internship, especially for course credit (see below), a student must:

- Have Junior or Senior standing
- Have completed 11 or more credits of Biology coursework at TU
- Have a GPA of at least 2.75

Students interested in doing an internship are encouraged to start by attending one of the Internship Orientation Sessions held by TU's Career Center (7800 York Bldg, Room 206; 410-704-2233). Sessions are offered multiple times weekly. For exact times, as well as other basic information on internships, students should visit the Career Center's website: <http://wwwnew.towson.edu/careercenter/student/internship.asp>.

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Finding an internship or creating your own internship

Before engaging in an internship, you should have some idea of what careers might be of interest to you (for help, see the "Career Options and Job Opportunities for the Biology Major" page on the Biology Department's website). Obviously, you will want an internship that is close to your interests and career goals. For example, if you are interested in health-related careers, you could intern at a local hospital, e.g., the St. Joseph Medical Center right next door to TU. If you are interested in zoo or aquarium work, you could intern at the Maryland Zoo or the National Aquarium, both in Baltimore. The possibilities are almost endless.

There are three basic routes that you can take to obtaining an internship. First, you can apply for one of several already-established internships that are available to TU students. Pre-existing internships are listed at the Hire@TU website: <http://www.myinterface.com/towson/student>, which is maintained by TU's Career Center. The Career Center also maintains a list of *international* internship programs that some students may find particularly intriguing (see their website, given above). Students are also encouraged to visit with the Biology Internship Coordinator, Dr. Erik Scully (Smith Hall, Room 261; escully@towson.edu; 410-704-3012). Students interested in medicine, biochemistry, or molecular and cell biology should check in with Dr. Larry Wimmers (Smith Hall, Room 360; MB3@towson.edu; 410-704-3491). Both Drs. Scully and Wimmers are likely to know of internships that are not listed on the Hire@TU website.

Second, you can use an internet search to find internships. You can also use an internet search engine such as Google to find internships (e.g., using key phrases such as "biology internship"). If you are lucky, this type of search will turn up sites designed to provide students with links to sites offering internships in Biology, such as Kalamazoo College's site (<http://www.kzoo.edu/biology/internopps.html>) and a site based at the Rochester Institute of Technology (<http://people.rit.edu/gtfsbi/Symp/summer.htm>). The Epcot Center in Orlando always offers an interesting suite of biology-related internships (see: http://disney.go.com/disneycareers/internships/epcot_science_horticulture.html). The Smithsonian Institution has a wide variety of internships available, most in Maryland: <http://www.si.edu/ofg/intern.htm#inmnh>.

Third, you can take the initiative and develop your *own* internship experience. As we have said before, above all else, the internship experience should be a good match to your interests and especially your career goals. So why not "custom design" an internship to fit your exact needs? For example, if you are considering a career in dentistry, with a specialization in Orthodontics, you might try to develop an internship with your own orthodontist or an orthodontist near campus. Think about your own interests and perhaps "toss around" different internship ideas with your advisor or other professors.

If you decide to go the “custom internship” route, the first step is to contact an individual or organization with whom you would like to serve as an intern. If that individual or organization is open to the idea, a number details must be worked out. You and your perspective internship supervisor need to develop a plan specifying things such as what you will actually *do*, with whom you will train, and when you will work, i.e., what weeks, and when during those weeks. You are expected to devote no fewer than 100 hours to the internship, which, over the course of a regular semester, adds up to about 8 hours per week. You must maintain a work-hours log. For the proper format of this log, see the Career Center’s Internship website (address given above).

Before significant planning occurs, you should direct your potential supervisor to the Career Center’s Information for Employers at <http://wwwnew.towson.edu/careercenter/employer/internship.asp>, which has a complete description of TU’s expectations for internships and spells out responsibilities of internship supervisors. Ultimately, the supervisor must complete and give you an Employer Agreement Form, which is available on this webpage.

Once the details for the internship have been worked out, you and your supervisor need to complete a Learning Plan form (this form, and all other required forms for internships, are available at the Career Center’s Internship website, above). The Biology Internship Coordinator (contact information above) must then review and sign off on both the Learning Plan form and the Employer Agreement form.

Course credit

Once you have identified and planned a suitable internship, and that plan has been approved by the Biology Internship Coordinator, you can enroll in BIOL 493-Internship in Biology for 3 credits. This course is graded S/U (Satisfactory/Unsatisfactory). Note that the 3 credits earned count toward the required 32 upper-division credits for graduation, but not toward elective course credit in the Biology Major or Minor. You can enroll in BIOL 493 up to two times for credit (i.e., you can do two internships).

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Evaluations and reports

To obtain a grade of S (Satisfactory) for the internship, you must complete and submit certain required paperwork to the Biology Internship Coordinator. At the mid-point of the internship, you must complete a Mid-semester Evaluation Form and, at the end of the internship, you must:

- Submit your work-hours log, after it has been verified and signed by supervisor.
- Complete a Final Evaluation Form (the supervisor completes their own version of the form).
- Complete and submit a reflective summary of your experience, describing what you did, what you learned, how this will affect your educational and career choices in the future, and changes that you think would improve the experience for future interns.

Obtaining Departmental Honors by participating in one or more internships

Students planning to do one or more highly involved internships may wish to think about applying for “graduation with Biology Department Honors.” Details are found [above](#) and in [Appendix 8](#).

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OFF-CAMPUS COURSEWORK

Some students are surprised to learn that they do not have to take all of their remaining coursework at TU. Indeed, as explained below, there are many really good reasons to consider doing some of the rest of your coursework away from TU.

Taking Courses at Other Local Colleges and Universities

On occasion, students want to take a particular course that is not offered at TU, but is offered at one or more of the many local colleges or universities. There are two programs that allow a student to do this. The [Inter-Institutional Registration Program](#) is designed to allow students to take courses at other University System of Maryland schools (e.g., UM-College Park, UMBC, University of Baltimore). The [Baltimore Student Exchange Program](#) allows students to take courses at local non-USM schools including Morgan State, Johns Hopkins, Loyola, Stevenson University, Baltimore Hebrew University, and the College of Notre Dame. Students can take courses at these other schools *without having to pay extra tuition*. Students must, however, maintain a full load of courses, taking at least 6 credits at TU. Further information can be obtained by contacting the Readmission, Inter-Institutional Registration & National Exchange Programs Office in Enrollment Services (Enrollment Services Bldg, Room 235; 410-704-2007).

Summer Courses in North America

Summer is a particularly good time for students interested in ecology, marine biology, and organismal biology (e.g., zoology, botany) to take highly specialized elective courses that may not be available at TU. Most of these courses are offered at “field stations” that are run by various universities. For example, in past years, TU students have taken courses in “shark biology” at the University of Miami’s marine station in Florida and “field ornithology” at the University of Virginia’s Mountain Lake Biological Station near Charlottesville. A nearly complete summary of available field courses from the Organization of Biological Field Stations can be found at: <http://www.obfs.org/>.

Summer courses and specialized workshops in virology, microbiology, cell biology, and molecular biology are less common but do exist. Students can identify such courses through online searches using key phrases such as “summer course molecular biology.” An example are courses available through the Cold Spring Harbor Laboratory. See: <http://meetings.cshl.edu/courses.html>

Students interested in taking specialized summer courses should begin exploring their options no later than February.

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Spending a Semester Elsewhere in North America: The National Student Exchange Program

As will be explained below, it is amazingly easy to take courses at another university in North America during a fall or spring semester. Students choose to do this for two main reasons. First, they want to experience living in a location other than Maryland (or nearby states). Have you always thought it would be interesting to live in Arizona or Montana or even Canada? Then why not attend school at one of these locations for a semester and see what it is like? Second, students sometimes want to take certain classes that are not available at TU. For example, students interested in marine biology may want to spend a semester at one of the many coastal universities that have major undergraduate programs in marine biology and offer multiple, specialized courses that provide hands-on experience in the ocean environment (see <http://life.bio.sunysb.edu/marinebio/mocolleges.html> for a list of such programs).

A network of over 180 colleges and universities, including TU, participate in a program called the National Student Exchange (NSE). In this program, students from TU can attend a different university for a semester. Tuition and fees are paid to Towson; any scholarship money toward tuition and fees applies. Students pay the host university for the cost of room and board (costs are usually about the same as or less than at TU). Students also have to pay a small administrative fee to the NSE (currently \$185) and cover the costs of getting themselves to and from the host university.

A list of all participating universities both by state and by program offerings is available online at <http://www.nse.org/>. A more detailed list appears in the printed *NSE Directory of Exchange Opportunities*, which is available on campus in the Undergraduate Academic Advising Center (Lecture Hall, Room 6). Participating universities are found in 48 states and D.C., as well as Puerto Rico, Guam, the U.S. Virgin Islands, and five Canadian provinces. Students wishing to enhance their ability to speak Spanish for career or other reasons are particularly encouraged to study at one of the Puerto Rican NSE schools or at an NSE school with a large Hispanic population (e.g., University of Texas – El Paso or New Mexico State University). Likewise, students wishing to bolster their abilities in French might consider universities in francophone areas of Canada such as Quebec.

The TU catalog states that students must take their last 30 credits of coursework at TU. However, because NSE participants are officially still considered to be TU students, students can take some of their last 30 credits while in an NSE program.

The application process is rather simple. You submit only one application to the NSE coordinators at TU and they assist you with all preparations for the exchange (except travel arrangements). For further details, see the website above, and the following site: www.towson.edu/nse. Interested students should also contact the coordinator of the NSE program for TU, Ms. Tracy Miller (Lecture Hall, Room 6; tmiller@towson.edu; 410-704-3583).

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Study Abroad Programs through Towson University

To “study abroad” means to do coursework in a foreign country. Picture yourself studying tropical marine ecosystems while snorkeling on the Great Barrier Reef or taking classes taught by leaders in the field of molecular biology in Denmark. Or picture yourself taking a break from Biology for a semester to explore the art and history of Paris. TU provides students with incredible opportunities to study, live, and travel outside the United States. Indeed, most students will never have a better opportunity to do so in their lifetimes. Almost without exception, students who have studied abroad have found it a remarkable, life-changing experience. Each year the Study Abroad Office helps approximately 300 Towson University undergraduates study abroad for a summer, Minimester, semester, or full academic year. The Biology Department *strongly* encourages all Biology majors to consider going abroad for a semester at some point in their undergraduate careers.

TU students can choose from hundreds of study abroad programs around the world. During their time abroad, students certainly can take Biology courses to fulfill major requirements. Indeed, some programs are purposely designed to offer an interesting set of Biology courses. Examples include the several programs in Australia (see: <http://www.towson.edu/studyabroad/oceania.asp>).

Biology majors going abroad should also feel free to have some or all of their courses be non-science courses (many of which will fulfill Gen Ed requirements). Sometimes this makes more sense, given one’s location. For example, a student who goes to London should really consider taking courses in, say, art, history, and Shakespeare to take advantage of the incredible museums, historic sites, and theatres that London has to offer. Let’s face it: a course in endocrinology in London is going to be pretty similar to the endocrinology course you can take back at TU.

Unfortunately, many students immediately reject the notion of studying abroad because they suspect that they cannot afford it. However, all federal financial aid and most scholarships can be used for study abroad. In addition, special scholarships are available for many programs to help offset expenses. See: <http://www.towson.edu/studyabroad/scholarshipsfinancialaid.asp>.

The Study Abroad Office, which is located on the second floor of the Administration Building, offers 40 minute information sessions to students many times each semester. The dates and times of these sessions, along with much additional information on studying abroad can be found at their website, <http://www.towson.edu/studyabroad>. The various study abroad exchanges and programs are introduced at these information sessions. Policies regarding earning credits abroad and using financial aid and scholarships are also explained. At the end of the session you can make an appointment to meet with a staff member to review programs that are of specific interest to you.

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CAREER OPTIONS AND JOB OPPORTUNITIES FOR THE BIOLOGY MAJOR

What Can I Do With a Biology Major... and Where Do I Look for Jobs?

The “Career Options and Job Opportunities for the Biology Major” page on the Biology Department’s website has links to: 1) lists of different careers that one can pursue with a Biology major, 2)

descriptions of many different potential careers and tips preparing for those careers, and 3) sites posting jobs related to Biology.

Students are also encouraged to visit the TU Career Center's website for information on upcoming career fairs and other on- and off-campus recruiting events (<http://wwwnew.towson.edu/careercenter/>).

In addition to the information on preparing for different careers that is available through the Biology Department website, below you will find additional information on several careers that are particularly popular with TU students.

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A Career in Research

Researchers spend their time making new discoveries about life and adding to biological knowledge. Discovering something that nobody else knows, especially something that will be of substantial benefit to, say, the environment or human health, is nothing short of exhilarating. As such, "researcher" is perhaps the most coveted job of all in Biology. This also makes research jobs difficult to get. Competition for research jobs is intense and one's credentials must be top notch.

Many types of jobs involve research to some extent but the amount of time that one spends actually "doing research" (gathering data, running experiments, etc.) varies from job to job. Some research jobs are often referred to as "pure research" because one typically has few responsibilities other than doing research (some of one's time must be spent applying for funding, writing reports, and supervising technicians, etc., but most of the time is spent in the lab or field). People with pure research jobs typically work for state or federal agencies, private companies (especially in the biotechnology field), or non-profit foundations (e.g., American Cancer Society, World Wildlife Fund, The Nature Conservancy).

Other jobs will have you spend some fraction of your time doing research but you will have several other major responsibilities as well. One example is a college or university professor. Depending on the institution, professors typically spend anywhere from 20-80% of their work time actually gathering data and preparing scientific publications. The rest of their time is spent teaching or doing administrative work.

Becoming an effective researcher requires *extensive* post-graduate training. Almost all quality research positions require a Ph.D. degree and, in many cases, one, two or more years of "post-doctoral" training. You can obtain a job that involves research with just a Master's or even a Bachelor's degree but you will likely be working for individuals with Ph.D.s and functioning more or less as a technician. Although acceptable to some individuals, for others this type of job can be a bit boring and repetitive.

If you are interested in being the one who actually chooses the research topic and directs the project, you need to start thinking about attending graduate school. An extensive description of graduate school is found below.

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Medicine and Dentistry

Medicine and dentistry are demanding careers that require extensive training. The three phases of training are: four years of undergraduate work at a college or university leading to a Bachelor's degree, four years at a medical or dental school culminating in an M.D. or D.D.S. degree, and additional years of training for certification in specialized areas.

There is no “premedical” or “predental” major at Towson University (or most universities, for that matter). Instead, students interested in these careers generally major in one of the sciences, usually Biology. A student must have an outstanding undergraduate record to be competitive for admission to medical or dental school. Criteria that medical/dental schools use to evaluate applicants include:

- Academic achievement, with emphasis on performance in Biology, Chemistry, Physics and Mathematics
- Scores on the Medical College Admission Test (MCAT) or Dental Admission Test (DAT)
- Demonstrated motivation to pursue a career in medicine or dentistry
- Clinical and/or research experience
- Participation in extra-curricular activities
- Letters of recommendation

Towson University's Premedical/Predental Faculty Committee

TU's Premedical and Predental Committee is composed of faculty members from several departments, including Biology, Chemistry, and Physics. The main function of the committee is to accurately and honestly assess the strength of each student's credentials as a medical or dental school applicant and prepare a recommendation letter for each individual. Known as a 'composite letter' or 'Committee letter', these recommendation letters are required by medical and dental schools. All aspects of a student's record are taken into consideration when preparing the letter, including GPA, letters of recommendation from three science professors, MCAT or DAT scores, personal statement prepared for the medical or dental school application, and an interview with the student. The interview not only helps the committee in the assessment of the student, it also prepares the student for subsequent interviews by medical or dental school admissions committees. The interviews are offered each year during Spring finals week. Students should be interviewed the year they apply, or in the Senior year if they anticipate applying a year or more after graduation.

The committee is headed by the Director of Premedical and Predental Studies. The current director is Dr. George Harrison (7800 York Rd. Bldg, Room 371; Pre-professional@towson.edu; (410) 704-2275). Students can request a conference with the director to obtain basic information about gaining entry to medical or dental school and/or to ask questions about their specific situations. The director maintains a list of e-mail addresses of premedical and predental students. It is very important that interested students e-mail the director to be included on this list. Using this list, the director calls

meetings of all students to convey important information pertaining to MCAT/DAT scheduling, application deadlines, and interview protocols. The director also invites speakers to address students (e.g., Deans of Admissions from various medical or dental schools, alumni in medical/dental school or the profession).

All pre-medical/pre-dental students should join the Premedical and Predental Student Organization (described above) as soon as they enter TU. Through this organization, students will learn many critical things such as how the application to medical/dental school process works at TU, when to prepare for and take entrance exams (MCAT/DAT), etc.

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Physician Assistant

Physician assistants (PAs) are medical practitioners who see, diagnose, and treat patients in both general and specialized physicians' practices. PAs are now commonly part of Family Medicine, Internal Medicine, Geriatric, and Pediatric group practices. PAs may also specialize in such areas as Emergency Medicine, Gynecology and Obstetrics, Cardiology, and even Surgery. Management and research may also be part of a PA's duties, depending on the particular practice (see <http://www.aapa.org>).

With the growing need for medical care and shortage of physicians, PAs are ever more in demand, and jobs promise to be readily available for many years to come, particularly in underserved areas such as the inner city and rural settings. Median annual incomes for new PAs in 2006 was on the order of \$70,000 (<http://www.bls.gov/oco/ocos081.htm>).

The course of study for PAs is similar to that of medical students – the subjects and clinical rotations are essentially the same – but PA training is shorter and so less extensive. Therefore, by law, PAs practice under the supervision of a physician and are required to report to and consult with the supervising physician on a regular basis. The actual form that the supervision takes can vary from practice to practice, based on the personal styles of different supervising physicians.

Many PA training programs exist in Maryland, surrounding states, and nationally. All must be accredited by the Accreditation Review Commission on Education for the Physician Assistant. PA training usually comes after attaining a bachelor's degree; many PA programs also require up to four years of prior experience in health care, for example as a nurse, EMT, or paramedic. PA training takes just over two years. At the end of this training, PAs must pass the national certification examination in order to receive state licensing and go into practice. PAs have no internship or residency requirement, but maintaining certification requires 100 hours of continuing medical education every two years and passing a recertification examination every six years.

Because the training for PAs is so similar to that for physicians, the same general preparatory set of undergraduate courses is appropriate for both. Biology is one of the most appropriate majors for a student planning to be a PA because the degree requirements are a good match for the entrance

requirements into PA school. Other majors that would be appropriate are Nursing or Exercise Science. In general, PA candidates should have courses in Biology, Chemistry, Mathematics, English, Psychology, and the Social Sciences.

Towson University has a joint 26-month Master's (M.S.) in Physician Assistant Studies program (<http://www.towson.edu/chp/pa/>) with the Community College of Baltimore County-Essex (<http://www.ccbcmd.edu/past/index.html>). The program begins in June each year. Individuals seeking admission to this joint program would submit an application for both parts of the program to the Central Application Service for Physician Assistants (CASPA; see <https://portal.caspaonline.org/>). Applicants must be accepted to both parts of the program in order to do either, and coursework proceeds in both institutions throughout the period of study. Successful completion of both parts of the program is required for graduation from either institution.

Specific requirements for admission include the following:

- Completion of a bachelor's degree with a GPA of 3.00 or better for the last 60 credits of undergraduate study;
- Completion of the following specific science and math courses with a "C" or better:
 - Anatomy and Physiology (8 credits)
 - Essentials of Organic and Biochemistry (8 credits)
 - Microbiology (4 credits)
 - College level statistics (3 credits)
 - Medical terminology (3 credits – available online prior to the start of the program);
- At least 700 hours (1400 hours preferred) of professional experience in a health-care field, working with patients.

The grade requirements listed above are definitely the minimum required for consideration. Students with one or more "C" grades in their science and math courses will be at a disadvantage for admission.

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Veterinary Medicine

Students wanting to become veterinarians need to complete their B.S. in Biology and then go to a school of veterinary medicine to obtain their doctoral (D.V.M.) degree. Each school of Veterinary Medicine in the United States has its own set of admission criteria in terms of required coursework, minimum GPA, previous animal care experience, and scores on entrance examinations. Most schools require that students take either the Medical College Admissions Test or the GRE General Test (the latter is described in detail in the section on Graduate School below). Students interested in veterinary medicine are urged to visit the websites of schools to which they might apply and review those schools' specific admission requirements. Fortunately, links to *all* vet schools in the U.S. can be found on the website of the Association of American Veterinary Medical Colleges: <http://www.aavmc.org/>. This website also contains detailed information on careers in veterinary medicine, how to apply to vet school, "externships" that allow students to gain hands-on experience, and much more. For additional information and guidance, pre-veterinary students are strongly urged to contact the Biology Department's Pre-Vet advisor, Dr. Jack Shepard (Smith Hall, Room 259; jsheward@towson.edu; 410-704-2394).

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Pharmacy

In Maryland and many other states, pharmacists must obtain a Doctor of Pharmacy degree (Pharm.D.) before they can be licensed. Students wanting to pursue a Pharm.D. degree may follow one of three paths, described in turn below:

Option 1: Completion of basic coursework at TU then application to a Doctor of Pharmacy program at the University of Maryland or elsewhere

Students may complete approximately two years worth of “pre-pharmacy” coursework at TU, and then apply to a Doctor of Pharmacy program either at the University of Maryland School of Pharmacy or elsewhere. Coursework required by the University of Maryland is shown below. It is important to remember that requirements vary among schools and students who plan to apply to schools other than the University of Maryland (e.g., in a different home state) should review these schools’ admission requirements early in their undergraduate career.

Core Pre-pharmacy Requirements (70 credits):

BIOL 201-Biology I; Cellular Biology and Genetics (4 credits)
BIOL 315-Medical Microbiology (4 credits)
CHEM 110-General Chemistry I (4 credits) *and* CHEM 111-General Chemistry II (4 credits)
CHEM 331-Organic Chemistry I (5 credits) *and* CHEM 332-(Organic Chemistry II (5 credits)
ENGL 102-Writing for a Liberal Education (3 credits)
and another ENGL course, (e.g., ENGL230-Main Currents in American Literature)
MATH 119-Pre-Calculus (4 credits), if needed
MATH 273-Calculus I (4 credits)
MATH 231-Basic Statistics (3 credits) *or* MATH 237-Elementary Biostatistics (4 credits)
PHYS 211-General Physics I (4 credits) *and* PHYS 212-General Physics II (4 credits)

In addition, students need 18 other credits that can be chosen from a variety of disciplines, and must meet several other basic requirements. Again, students should check individual pharmacy school websites for a listing of all requirements. Students with questions can also contact the Pre-pharmacy Program Coordinator, Dr. Boon Loo (Smith Hall, Room 555; bloo@towson.edu; 410-704-2667).

Option 2: Medicinal Chemistry/Pharmacy Dual Degree Program

TU and the University of Maryland School of Pharmacy have a cooperative arrangement wherein students take 90 credit hours of coursework at TU and 164 credits of coursework at the UMSP. Ultimately, students receive a B.S. in Medicinal Chemistry from TU and a Pharm.D. degree from the UMSP. For further information on requirements, see http://www.towson.edu/chemistry/academic_programs/medicinal_chemistry.asp and contact the Pre-pharmacy Program Coordinator, Dr. Boon Loo (Smith Hall, Room 555; bloo@towson.edu; 410-704-2667). Students may also wish to visit the University of Maryland’s School of Pharmacy website at: <http://www.pharmacy.umaryland.edu/>.

Option 3: B.S. in Biology at TU then application to Doctor of Pharmacy Program

In some instances, students may decide after they are well into their undergraduate careers that they would like to become a pharmacist. Such students may complete their B.S. degree in Biology and then apply to a doctoral program (Pharm.D.) at the University of Maryland or elsewhere. Students should, however, make sure that they have met the course requirements for entry into the program(s) to which they want to apply (see websites of the programs in question).

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Secondary Education

Teaching is one of the most noble and satisfying of all professions. Teaching in secondary schools (middle and high schools) affords Biology graduates exciting, challenging opportunities to teach their subject and share in the joy of learning with adolescents. Currently there are two forces driving a strong need for secondary school science teachers in the United States. First, there is an increase in the secondary school-age population. Second, the teaching profession is heavy with veteran professionals, many of whom will soon retire.

TU has a Biology teacher education program that is approved by the Maryland State Department of Education. Upon graduation, students are eligible for certification to teach not only in Maryland but in 23 other states as well.

Students who are pursuing a teaching certificate in Biology are rooted within two departments on campus, Biological Sciences and Secondary Education. Students begin their undergraduate careers as Biology majors, and have, as their advisor, a Biology faculty member with expertise in secondary school Biology teaching. After completing 45 credits of coursework, and obtaining a GPA of 2.5 or higher, students can apply for formal admission into the Department of Secondary Education's professional program. Once admitted, students are assigned a second advisor in the Department of Secondary Education. It is essential that students meet with both of their advisors on a regular basis to ensure that all degree requirements are met.

Students must complete courses in the Secondary School Biology Teaching concentration. Students must also complete several professional education courses, certain Gen Ed or University Core courses, and have a successful internship in both a middle school and a high school setting. For details on course requirements, see [Appendix 1](#) and [Appendix 2a](#) (for students on GenEd system) or [Appendix 2b](#) (for students on University Core system) below.

Required professional education courses include:

- PSYC 201-Educational Psychology
- SPED 301-Introduction to Special Education K-12
- ISTC 301-Utilizing Instructional Media

Note that PSYC 201 has a prerequisite of PSYC 101 (Introduction to Psychology), which is a course in Gen Ed category IIC2/Core #6. Other Gen Ed/Core courses required for prospective teachers are:

- HIST 145- History of the U.S. to the Mid-19th century
or HIST 146- History of the U.S. since the Mid-19th century (Gen Ed category IIB1/Core #11)
- COMM 131-Fundamentals of Speech Communication (Gen Ed category IIB3/Core #5)

Finally, prospective teachers much take SCIE 380-Teaching Science in the Secondary School. To enroll in this course, students must meet the following requirements: GPA of at least 2.5 in Biology coursework, passing scores on the PRAXIS I: PPST Examination (Reading, Writing, and Mathematics), and completion of speech and hearing screening.

Immediately following successful completion of SCIE 380, students enroll in a teaching internship (formerly known as “student teaching”). The internship involves a seven-week experience in a middle school setting, and a seven-week experience in a high school setting. To engage in the internship, students must have a GPA of at least 2.75 in Biology coursework, 2.75 in professional education coursework, and 2.5 overall.

Finally, it is recommended that students pursuing a teaching certificate take advantage of opportunities available to them that will allow them to gain experience working with and teaching youngsters before graduation. Such opportunities include summer and day camps, substitute teaching, and enrichment programs. It is also desirable to pursue research opportunities in the student’s area of interest.

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SOME PRACTICAL ADVICE FOR STUDENTS SEEKING JOBS

Preparing a Cover Letter

Cover letters are needed for almost all job applications. You use a cover letter to introduce yourself and review/highlight particular qualifications that you have for the position. Cover letters can also be critical in relaying your interest and enthusiasm for a position.

A cover letter should:

- state who you are
- state which job you are applying for and how you found out about it (e.g., where you saw it advertised)
- briefly explain or show (details will be in your resume/CV) how your background, experience, interests, coursework, etc. match the stated job requirements
- give a brief but specific overview of your relevant coursework and experience
- provide a listing of documents that you are attaching to your letter (e.g., resume)
- close with a statement indicating that you are looking forward to hearing from (or having a chance to meet with) the person to whom you are writing
- provide your contact information (e.g., under your name at the bottom of the letter include your email address and phone number)

Although all your cover letters should contain the elements above, avoid the common mistake of creating one “form” letter and using it for all job applications. Rather, tailor the contents of each cover letter to the job for which you are applying. Before writing your first set of cover letters, you should look at a variety of examples. Examples can be found online. Also, TU’s Career Center, (York Road Bldg, Rm 206; 410-704-2233), maintains the *Career Resource Center*, a library full of excellent references that can provide examples of, and further guidance with, the preparation of cover letters, resumes, etc. Students are encouraged to take advantage of this library.

Letters (and resumes) should be printed on good quality paper. Avoid using cheap, dull copy machine paper but also avoid using super-expensive, rigid paper (which suggests that you have no qualms about wasting money) or paper of unusual color (white is fine and tan is ok but purple might make you look a little strange).

Above all else, letters must be carefully spell-checked and proofread (e.g., *their* or *there* or *they’re*?). Without question, you should show letters to trusted classmates and/or professors prior to mailing them. Every person, no matter how gifted at writing, has difficulty finding mistakes in their own compositions. The cover letter is the first view that a potential employer will have of you, so careful attention to content and presentation is of paramount importance. The competition for high-quality jobs is ferocious and students need to do everything in their power to give themselves an advantage over others.

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Preparing a Resume or a *Curriculum Vita*

A standard resume provides a *brief* (usually one page) summary of an individual’s relevant education and work experience for a potential employer. A curriculum vitae or scientific resume does the same (*curriculum vitae* literally means “the course of your life”). However, a “CV” differs from a standard resume in that it provides more information and more details and, consequently, can stretch to several pages. Curriculum vitae are commonly requested for jobs that involve research or other types of scholarly work.

Resumes

The specific contents of a resume can and should vary, depending on the nature and requirements of the job for which you are applying. For example, when applying for a zookeeper position, you should definitely put on your resume that you worked for a summer as a research assistant in a study of rattlesnakes for Dr. Seigel AND that you worked at a summer camp (message to employer: I have experience working with animals AND with the general public). If space is limited (and it often is), you may have to leave off the fact that also you spent a semester learning basic techniques in microbiology as an assistant in Dr. Snyder’s research laboratory. However, if you are also applying for a veterinary technician position elsewhere, then for that job the summer camp experience should come off the resume and the microbiology experience should go on.

The following information is generally included on a resume:

- Contact information: You may give both current and permanent addresses or just include the more relevant of these (depending on where you will be when employers are likely to contact you). Make sure that you provide just one telephone number for yourself. Have a *professionally appropriate message* waiting at that number in case you don't answer an employer's phone call ("Yo, dude, we're probably too drunk to get to the phone so leave a message" is amusing but is not going to leave a good impression). Also include just one *professionally appropriate e-mail address* (like your TU address, as opposed to your KegMasterPartyAnimal@aol.com address) that you will check regularly for perspective employer responses.
- Educational History: Starting with your most recent schooling, list the educational institution(s) that you have attended, the degree(s) that you have received or anticipate receiving (e.g., "B.S. in Biology), and actual or anticipated graduation date (e.g., "May 2007"). If you are currently a TU student, you only need to list Towson University, even if you previously attended one or more community colleges or other four-year institutions. Do not list your high school.
- Scholarships, Fellowships, Awards, and Honors: List relevant items, giving specifics and dates. Be sure to include membership in honor societies such as TriBeta and Golden Key.
- Relevant Work/Vocational History: List jobs, volunteer work, internships, and/or research experiences that are at least tangentially related to the job for which you are applying (generally avoid listing basic service jobs such as sales clerk, waitress, etc., unless these are the only jobs you have had and you want to show that you have had responsible employment). Include paid jobs, volunteer work, internships, research positions. For all, indicate where you worked, inclusive dates, position held, your supervisor's name, and give a brief list of your tasks and responsibilities and the knowledge and skills that you acquired.
- Skills: List languages other than English that you speak/read/write, any special computer/software skills that you have (use of Word is assumed but expertise in Excel or PowerPoint might not be), any special knowledge from advanced courses, and laboratory or other research skills.

If space permits, your resume could also contain the following information, especially if this information seems particularly critical or relevant to the position:

- Other Jobs and Experience: Above we suggested not listing non-relevant work experiences like service jobs. However, it may be well worth listing jobs where you had a supervisory/managerial role and responsibilities. List these in the same format as other jobs, as described above.
- Relevant Coursework: If you have completed courses that are required, essential, or particularly relevant to a job, list them if you have space, and your grades (if they were good).
- Membership in Professional Societies – By their junior or senior year, some students have become members of professional societies (e.g., the American Society of Plant Taxonomists, the Society for Integrative and Comparative Biology, the American Society of Ichthyologists and Herpetologists, etc.). This shows a certain level of dedication that can potentially impress certain employers.
- Extracurricular activities: You can provide a list of activities, hours/days/years of involvement, special positions held, and awards earned.

The structure/format of the resume

Now, how in the world does one squeeze all the above information onto a single page? There are many acceptable formats for a resume and many little tricks for condensing your critical information. Before preparing your first resume, we urge you to look at different examples of resumes, either online or in books at the Career Center. We also recommend that you make an appointment with a career counselor at the TU Career Center for feedback and suggestions on your resume, cover letter, and other documents.

Curriculum vitae

A detailed description of how to prepare a curriculum vitae is found below in [Appendix 5](#).

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Essays/Writing Samples

Graduate schools, professional schools, and employers may request, or even require, a writing sample as part of the application. The best writing sample will be high-quality work that you have submitted as an assignment for a course, or a final report from a research project or internship that demonstrates your scientific/vocational knowledge as well as your writing skills. Again, carefully spell-check and proofread this document.

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All employers will want you to provide names and contact information of individuals who can provide information about your experience, abilities, work ethic, personality, etc. These people are called your “references.” Some employers, and all graduate, professional, and technical schools, will ask you to provide a formal “letter of recommendation” from two or three of your references.

Choosing references

You should use professors, especially science professors, as your primary references for Biology-related jobs and advanced schooling. You can also use supervisors that you have had for Biology-related jobs, research experiences, and internships. Avoid using high school teachers as references (anything they have to say will be “old news”). Also avoid using supervisors from jobs unrelated to science and education, unless perhaps you held a position of significant responsibility.

Ideal references are persons who: 1) have gotten to know you personally, beyond simply grading your assignments and tests and 2) seem to hold you in high regard perhaps because you performed well when in their class or when working under their supervision. Individuals that can attest to the fact that you are a highly motivated, interested student can also make very good references. If at all possible, at least one of your references should be a person who taught you or supervised you recently, and thus

can speak to your current level of scientific and intellectual maturity and motivation. If you are applying for a specialized position, you should try to get a reference from a faculty member with expertise in the same area. For example, if you are applying for a position as a research technician in a microbiology lab, the person who taught your Medical Microbiology or Virology course will usually be a more valuable reference (at least to your employer) than the person who taught your Biodiversity course. On the other hand, you may have developed a particularly good relationship with your Biodiversity professor and that person may know you and your career desires particularly well. That's fine. Use them as a reference too. Indeed, usually it won't hurt you to list an extra reference on a job application or to submit one letter of recommendation beyond what is asked for (but limit yourself to just one extra).

How to approach a reference to request a letter of recommendation

Once you have identified those individuals you would like to have as your references, you should send each of them an e-mail stating something like:

I was a student in your BIOL xxx course in the Fall of 2013. I plan to apply soon for [job(s), medical school, graduate school]. I am writing to ask if I can list you as a reference. Also, I wanted to ask whether you would be willing to write a letter of recommendation for me, if needed.

If you already know that you will need a letter, state this, indicate the date by which you need the letter, and offer to forward or drop off any special form that is required. This way, the person knows both what is required and the time frame for responding. Make sure that you are giving letter writers as much lead-time as possible; two weeks to a month is appropriate. If the lead-time is shorter than that, then you should apologize and offer a good reason for asking on such short notice.

Do not be offended and do not argue if the person you ask turns you down. There are many possible reasons for this. The faculty member may be too busy to meet your deadline (especially if you ask at the last minute). The faculty member may feel that he/she doesn't know you well enough to comment as specifically as required. A faculty member from a class that you had several years ago may feel that they have not had recent enough contact with you to know your current strengths and aspirations. It is also possible that the faculty member may feel that they cannot speak strongly enough for you, especially if you did rather poorly in their class or were frequently absent. You gain nothing by insisting, no matter what the reason for the denial. Pick someone else.

What to provide your references

If an individual agrees to act as a reference for you, and especially if they agree to provide one or more letters, then you should provide them with information on what you are applying for and information on yourself. The background information that you provide helps the person writing the recommendation to prepare a more informed, complete, and up-to-date letter. You should provide your references with the following:

- Any required form, with your part of the form filled out and signed (especially the "waiver of right to read the recommendation" - see below)
- A description of what you are applying for, be it a job, scholarship, further schooling, etc.

- A brief summary of your interests, activities and special qualifications, and a statement of why you are seeking the job/experience/further schooling
- An up-to-date unofficial transcript and resume or curriculum vitae
- The name, title, and address of the person(s) to whom the letter should be written
- The date that the letter is due, and an indication as to whether you want the reference to mail it out directly* or whether you will pick up the letter** to include in an application package
- Information on how to contact you to tell you that the letter is ready or has been sent

* Students sometimes provide professors with stamped, pre-addressed envelope for each letter to be sent. You can ask your reference if they would like you to do this; but most professors will be happy to mail the recommendation at TU's expense in an official TU envelope.

** Many professors will put your letter in a sealed envelope with your name on it and tape it to their office door for you to pick up at your convenience. Offer to have the professor do this; it is convenient for them too.

Consider packaging all of the above materials in a plain manila folder so that they do not scatter the pieces to different parts of their desk or office (a distinct possibility with many professors).

Important note: Waiving your right to inspect the recommendation

Almost all professional and graduate schools and many employers will want you to provide your references with a specific "recommendation form." This form usually has a place for you to list your name and some other basic information about yourself. Also, there is almost always a place on the form for you to indicate whether you "do waive" or "do not waive" your right to review the recommendation after it is submitted. You should *always* indicate that you *do waive* your right to read the recommendation. Almost all references, even ones that are going to give you a glowing recommendation, want their recommendation to be kept in confidence. Many references will politely refuse to provide a recommendation unless you have waived your right to review the recommendation.

Follow-up after requesting the letter

It is appropriate to send a polite, tactful, reminder e-mail a few days before the due date if you have not heard back from the reference since you requested the letter. References will usually appreciate a reminder because they usually are very busy and face many distractions, and they really do want to accommodate you if they agreed to write the letter in the first place. You can also check with the receiving institutions (if the letter is being mailed directly) to make sure that the letters have arrived.

Take the time to thank the reference for writing the letter(s). Nothing special is needed; a brief e-mail or personal thank-you is fine. Also, let the reference know the outcome of your application(s) as soon as you know. Your references probably care more about you than you might guess and will be eager to know your fate!

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The Job Interview

The job interview is your opportunity to find out the details about a potential job and determine whether it is a good fit for you. The interview also allows the prospective employer to find out about you and your fit to the position they are seeking to fill. Following the guidelines below will help you make a positive impression and also obtain the most helpful information.

- Know the details of the job/position and its expectations ahead of time.
- Be prepared to talk about why you are interested in the job/position.
- Know as much as possible about the firm/company as you can by researching any printed information that is sent to you and available websites, etc. Also learn as much as possible about the person(s) interviewing you, including their name, position, and responsibilities.
- Prepare a list of questions you have about the firm, position, and responsibilities.
- Be prepared to describe your previous relevant experience and coursework, and why you think you are a good candidate for the job/position.
- Keep a positive attitude and refrain from being judgmental, even if you are not initially impressed. Act like you want the job/position. There's always time to turn down an offer later, but first you need to get the offer!
- Dress professionally and arrive slightly ahead of time.
- Follow up with a thank-you note.

Note that the TU Career Center offers both mock and real interviews on campus (see below).

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What TU Career Center Can Do For You

The TU Career Center (7800 York Bldg., Suite 206; 410-704-2233) offers many services for TU students and alumni. These include the following:

- ❖ Appointments with counselors to discuss career choice issues
- ❖ Testing to identify interests, aptitudes, and personality preferences related to career choices
- ❖ A library with a variety of books and other materials describing careers in the sciences
- ❖ A 2-credit course, GENL 121, Personal Life and Career Planning, that explores and provides discussions of career options, and that provides a battery of interest, aptitude, and preference tests.
- ❖ Real and mock interviews with prospective employers
- ❖ Review of resumes, cover letters, and other materials
- ❖ Listing of internships and jobs (on and off campus, full and part-time, year-round and temporary) on their Hire@TU database, for which all students and alumni may register free-of-charge online

- ❖ Posting of student/alumni resumes and cover letters on the Hire@TU database so that employers can search potential applicants
- ❖ Maintaining a collection of reference books with sample letters, resumes, and other materials

For more information, visit the website: <http://wwwnew.towson.edu/careercenter/>.

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GRADUATE SCHOOL

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

After completing a B.S. degree in Biology, you may want to attend 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.).

People go on to graduate school for many different reasons. For some, obtaining an advanced degree, especially an M.S., is necessary for promotion or higher pay in their *current* profession. These individuals typically enroll in a “non-thesis” M.S. program, which involves coursework only (no major research projects). After completing 30 or so credits of advanced coursework, they have their degree.

Another reason that people attend graduate school is because an advanced degree is either recommended or required for the career that they want. In many career areas, a B.S. degree only qualifies you for an entry-level position, which often involves doing primarily grunt or “go-for” work for those individuals that *do* have advanced degrees. To obtain higher-paying, more interesting, decision-making level positions, you may need graduate-school training.

Finally, people go to graduate school because they want to study and explore some particular area of Biology in more detail. However, many undergraduates 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 the biology of animals. After taking a number of undergraduate courses, the student discovers that they are particularly intrigued in how animals adapt physiologically to different environments. If this student heads off to grad school to study “ecological and evolutionary physiology” in more detail, they will take graduate courses almost exclusively in the areas of physiology, ecology, evolution, 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. Many of your assignments will be to read articles from the primary literature and class time will often be spent discussing and debating the implications and value of the methods used and the results reported in these articles.

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 graduate school is *conducting original research*.

Under the guidance of a professor who is an expert in the student's chosen area of interest, graduate students do research on questions that nobody has ever studied before. The results are written up in a "thesis" or "dissertation" and are normally 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.

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The 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.

In large part, your decision will be determined by what you want to do for a career. Some professions only require and expect individuals to have an M.S. Other professions require a Ph.D., leaving students to decide whether to get an M.S. before completing the Ph.D. For some careers, one can get into the career with either an M.S. or a Ph.D. degree, however, with a Ph.D. you will have greater status, i.e., be more likely to be in a supervisory/decision-making role, and you will earn a higher salary.

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. takes 4–6 years. If you are not absolutely certain that you want to devote 4–6 years of your life to graduate school, you are strongly advised to start with an M.S. degree and see what graduate work is like before making a bigger commitment.

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. Or not. If you ask around, you will find that some of your professors strongly feel that completing an M.S. first is a wise move. Others will tell you that if you are certain you want a Ph.D., the M.S. is something of a waste of time. 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.

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. Because your M.S. and Ph.D. research projects will likely be different, doing both degrees gives you the opportunity to learn a greater variety of skills. Second, they 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.

2) Doing an M.S. degree first also 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. Doing an M.S. degree, and specifically a Master's thesis, gives you a chance to learn the basics of research with a smaller scale project. Moreover, a good record from an 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!

Some reasons 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. It is probably fair to say that most undergraduates do not get near as much training in research techniques, data analysis, and scientific writing as they would in an M.S. program.

2) Graduate school can be an exciting, fulfilling experience but graduate students get paid very little and being 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. As argued above, completing an M.S. degree can make you more competitive for jobs in several ways. The question then becomes: Will completing an M.S. degree first enhance my competitiveness enough that it is worth the extra time spent not making much money?

3) Certain graduate schools 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 qualifying examinations. Students who pass these exams

are automatically given an M.S. degree and 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, they are given a Master's degree as a sort of "consolation prize" and then shown the door.

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Financial Support: Teaching and Research Assistantships

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*.

A quick clarification is in order: if you choose to do a "non-thesis Master's degree," i.e., just take enough graduate courses to get an M.S. degree (usually done to obtain a promotion or salary increase at work), you (or your employer) will have to pay for your schooling. However, 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 generally comes in the form of a **graduate assistantship**. There are two types of assistantships, *teaching assistantships* and *research assistantships*. Both pay you a stipend or salary, usually just enough to live on in the local economy (usually \$12000-\$24000 depending on the location; possibly more if you are in a Ph.D. program), and both come with a full tuition waiver (in-state or out-of-state). You still have to pay fees and pay for books, but that is all.

If you have a teaching assistantship or "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 115, 201, 202, 213, 214, 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.

A research assistantship or "RA" is a coveted position because you are essentially paid to do research. You may get paid simply to do your thesis or dissertation research and, in some cases, some extra research that a professor wants done.

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 (overall GPA, GPA in majors courses, 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.

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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/>. The National Institutes of Health also maintains a useful website:

<http://www.training.nih.gov/careers/careercenter/fellow.html>.

When Should You Start Investigating Graduate Schools?

Applications for graduate school are typically due sometime between mid-December and early March (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) in the fall or very early in the new 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 working in your general area of interest. 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. It is also wise to choose a department that has numerous interesting graduate courses for you to take.

Again, though, we must stress that your choice of a research supervisor is most critical. Some students assume that if they just can get into a highly regarded school like Harvard or Berkeley or Stanford, they will be successful no matter what because these schools have such a good reputation. However, these schools, like all others have their share of faculty who are exceptionally bad graduate supervisors. You are far more likely to be successful with a supportive, attentive, concerned supervisor at a mid-level school than an unengaged, unhelpful, egomaniac at a top-tier school.

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

Finding a graduate supervisor/university when you have specific interests in Biology

Finding a good graduate supervisor and school is easiest when you know what *specific* area(s) of Biology are of interest to you. For example, you may be generally interested in cell biology but are especially intrigued by the, say, phenomenon of apoptosis (programmed cell death), or cell-to-cell signaling, or tumor biology. Or you may be generally interested in mammals but specifically interested in, say, bat biology, or in mammalian conservation. In this situation, it is relatively easy to identify those individuals that are actively conducting research (and supervising graduate students) in your specific area(s) of interest. For example, while many hundreds of professors study the biology of mammals, probably fewer than 15 are actively working on bats. More people are working in the area of mammalian conservation but the number is still manageable.

So how do you find out who these people are? We suggest several strategies:

1. Start by talking to TU faculty members who work in your general area of interest. Tell them your specific area(s) of interest and ask them to help you identify potential graduate supervisors in that area. If a faculty member is active in research themselves, they will know the major “players” in field.
2. Get to the library or get online and find out who is publishing papers in your area of interest. For example, you can access the “Web of Science” database through Cook Library and do a search for papers published in the last year on “apoptosis.” Acquire 10-15 or more of the papers that, based on titles and abstracts, seem most intriguing to you. Using information in the paper, or an online search, find out where the authors are based, i.e., their school and department*. You can then go to departmental websites and try to find out more information about those individuals and their interests**. You can also discuss the papers, their authors, and their schools/departments with TU faculty members who may very well know these individuals personally. By the way, do not hesitate to contact professors outside the U.S., especially in Canada. Many foreign schools have special scholarships for students from other countries.

*Note that rather than just having a “Department of Biological Sciences,” many larger universities have more specialized departments such as Departments of Molecular Biology, Microbiology, Neuroscience, Health Sciences, Population Biology and Ecology, etc.

**Note that the “quality” of faculty websites varies quite a bit. While many active, wonderful professors take the time to maintain interesting, informative websites, some do not. Some professors are just too busy doing things like teaching up-to-date, fascinating classes and helping their graduate students with research to maintain a fancy website. So don’t let a simple website deter you. If the professor is actively doing research in your area of interest, consider them regardless of the state of their website.

3. As described in detail below, once you have identified a few researchers in the field, you will be contacting them to inquire about doing graduate work under their supervision. You can ask *them* to recommend other potential graduate supervisors and schools.

Finding a graduate supervisor/university when you have not narrowed down specific interests

Now, what if you love Biology but are just not able to narrow down your area of interest very far? What if, for example, you are generally interested in, say, plant physiology, but you are not sure what aspect of this sub-discipline you would like to study. You might again start by talking to the TU faculty member who teaches plant physiology. Ask that person about current “hot topics” in the area of plant physiology, i.e., major areas of research. Ask the faculty member what institutions are renowned for turning out strong, successful graduate students in plant physiology. You may learn, for example, that the University of California – Davis, Texas A & M University, and the University of Calgary in Canada have particularly strong and well-respected programs. Get online, look at the programs, and see what specific topics the faculty are researching. If the research topics in one or more laboratories look intriguing, make some inquiries (see below). Ask the people you contact to recommend other potential supervisors and graduate programs.

Another option is to look through the latest edition of *Peterson's Graduate Programs in the Biological Sciences*, which is on reserve in Cook Library. Just go to the main (circulation) desk 2011 and ask for it (call number: L901 .P444).

Be prepared to relocate

Ideally, you should be willing to go to the best graduate program available given the quality of the potential supervisor, the department, and the financial aid available. The better or more appropriate 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 New York, New Mexico, Nova Scotia, or some other seemingly far off place!

Having said that, we realize that in some instances, individuals may be not be able to travel far and wide for graduate school. For example, your “significant other” may get a great job or position in say, the D.C. area, forcing you to look in that general area for graduate schools. In this situation, you should obtain a list of colleges and universities within, say, 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 Zoology) and, if so, whether they have a graduate program. If they do, find a list of faculty, their research interests, and their publications. If there are faculty doing research of interest to you, with good track records (an active laboratory, recent publications including publications with graduate students), contact them, as described in the next section. Avoid “deadwood” professors that have not published in the last 3-4 years. Chances are good that their ideas and abilities will be out-of-date.

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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. 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.

NOTE: At some schools, you must obtain and complete *two* different applications, one that goes to the general “Graduate School” or “College of Graduate Studies” or perhaps the general admissions office and another that goes to the department to which you are applying. At other schools, students have to complete just one application. Check carefully to make sure that you have all required applications and an understanding of where they should be sent.

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.’ An example cover letter appears in [Appendix 4](#) below. As you can see from that example, 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. However, many of them 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 professor 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; i.e., 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 vim and vigor to their research team. Make sure you spell the professor’s name and the name(s) of their study organism correctly! In fact, make sure the entire letter is completely free of spelling errors, typos, and grammatical no-no’s. It would be wise to have a trusted, helpful faculty member at TU read and comment on your letter before it goes out.

You should include two important attachments with your e-mailed cover letter. First, attach your *curriculum vita*, which is a scientific resume (see [Appendix 5](#) below for instructions on how to put a

CV together). Second, attach a list of science and math courses that you have had and the grades that you obtained (for an example, see [Appendix 6](#) below).

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, to be sure, 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 that 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 (see below).

A Note on Graduate "Training" Programs

Much of the information and advice above was geared specifically towards students that want to do *research* in a specific subdiscipline in Biology, e.g., microbiology, ecology, environmental conservation, etc. However, there are a number of graduate programs that *train* students for a specific career, teaching them critical skills.

For example, one can obtain a Master's degree in Biotechnology, which will enhance one's chances of getting a job in a research or industrial lab. Johns Hopkins University has one such program, see: <http://advanced.jhu.edu/academic/biotechnology/?refsite=go&gclid=CNjM3trds6oCFRHGKgod6C5h9w>. Many other similar programs can be found online.

Other examples include the new Master of Arts (M.A.) in Zoo and Aquarium Leadership at George Mason University in Virginia (<http://chss.gmu.edu/programs/la-mais-isin-zal>) and the Master of Laboratory Animal Science at Drexel University in Philadelphia, which trains one in the care of animals kept in captivity for research (<http://www.drexel.edu/catalog/grad/med/mlas-index.htm>).

If you have a specific career in mind, get online and see if there is a graduate program specifically tailored for that career. You might be surprised at what you find.

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What Graduate 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 Virology, then it would be wise to have courses such as Virology (of course!), Cell Biology, Molecular Biology, and Immunology on your transcript. That you took Ornithology as well will not impress them much (even if you did get an A). In addition, top graduate schools, especially those with Ph.D. programs, require two semesters of organic chemistry, two semesters of physics, and one semester of calculus. Some programs that only offer an M.S. degree will admit students to study in some areas (e.g., Ecology, Zoology, Animal Behavior, Conservation) if they have less than four semesters of chemistry and two semesters of physics...but don't count on it. If you think you might go to graduate school, you need to complete a full year of organic chemistry and physics if at all possible, along with a semester of calculus.

2. Your academic performance (courses grades and GPA)

Performance in undergraduate coursework will be judged by your GPA. Different schools will examine either your overall GPA, your GPA in science and math courses, your GPA in your junior and senior year, and/or grades in courses that are critical to your proposed areas of study and research. Often you are asked to calculate and present your GPA in courses for your major. Instructions on how to calculate your GPA in a certain set of courses can be found at: <http://wwwnew.towson.edu/careercenter/student/gpa.asp>

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, Molecular Biology, and Introduction to BioInformatics. This should help you considerably.

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. Further advice on letters of recommendation

is found above in the section: *Some Practical Advice for Students Seeking Jobs: Letters of Recommendation*.

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.

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).

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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 General Test has three sections: 1) *analytical writing*, which measures a student’s ability to articulate complex ideas clearly and effectively in writing, examine claims and accompanying evidence, support ideas with relevant reasons and examples, sustain a well-focused, coherent discussion, and write standard English properly; 2) *verbal reasoning*, which measures ability to analyze and evaluate written material and synthesize information obtained from it, analyze relationships among component parts of sentences, recognize relationships between words and concepts; and, finally 3) *quantitative reasoning*, which measures ability to understand basic concepts of arithmetic, algebra, geometry, and data analysis, reason quantitatively, and solve mathematical

problems, including word problems. 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 your 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 that include practice tests (such guides may also be available online). 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.

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.

Note, as indicated above, not all schools require the GRE Biology Subject Area test. See the section above, “What Graduate Schools Consider When Reviewing Applications.”

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Graduate School Interviews

Once you have narrowed your list of potential graduate programs and graduate supervisors down to around two to four schools or so, if at all possible you should 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 supervising professor, 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.

Don't hesitate to ask your potential supervisor 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. Even if no funds are available, we cannot stress enough that it would still be worth spending some of your own money (or your parents' money) to visit different schools. Finding the right graduate program and supervisor is just that important and there is just no substitute for an on-site visit in helping you make an informed decision.

Your potential supervising professor will likely work out an itinerary for your visit in advance. You should request that itinerary several days before your trip so you can prepare (at least try to get the names of people that you will likely meet). You will probably have a long meeting with your potential supervising professor to start with. He or she will have a number of questions for you. In part, they will be trying to gauge your level of interest, enthusiasm, and motivation. They will try to get a sense as to whether you will be a good "fit" personality-wise with them and their other students. They will also try to get a feel for your level of preparedness. Without question, by the time that you arrive, you should have read your potential supervisor's most recent publications. Definitely ask questions about this work and the current work in the laboratory. Professors love inquisitive, curious students and tend to avoid "wallflowers."

You should come with a lengthy list of other questions to ask your potential supervisor. Perhaps most important will be a discussion of what *you* might do for your research. You may wish to bring up some subjects or projects that interest you. You should also ask the professor about potential research projects that they have in mind. Absolutely ask the professor about the potential "publishability" of different projects including both projects that you suggest and those that your potential supervisor suggests. Don't hesitate to ask something like: "Is this project likely publishable, and if so, in what journals?" As we have said before, 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. This is why you must choose a professor that has published recently and regularly. Such professors will know what research will and will not be publishable in respected scientific journals.

Ask the professor to talk about the last several graduate students that completed their degrees under his or her supervision. If you are applying to do an M.S., ask specifically about Master's students. Try to find out if these students have published or have submitted papers. Ask where the students are now and what they are doing. If most students have gone on to Ph.D. programs, post-doctoral fellowships, or jobs, that is a good sign. If most students are working at Wal-Mart or Starbucks or some such place, that is not so good.

You should also ask about how your research might be funded. Does the professor have funds from a grant that will support your research? Does the department or university provide small grants to graduate students to support research? Are undergraduate students available to serve as research assistants?

You should ask for more details about assistantships. If you are likely to get a TA, ask what classes you are likely to help teach. Also, find out how long assistantships last. Some schools rigidly provide M.S. students with two years of support and Ph.D. students with four years of support. Often students legitimately need an extra semester or two of support to complete their degrees. Is an extra semester or two of support available if needed?

During your interview, you will also meet with other faculty, especially those that have interests related to your own interests. Before you arrive, do some background work on these individuals. Get online, find their websites, memorize their areas of interest, and get and read one of their recent publications. Come armed with a few specific questions to ask about their research. This sort of initiative and interest (not to mention the ego boost for the professors) 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 committee.

Speaking of assistantships, you are also likely to meet with the person(s) in charge of supervising graduate teaching assistants, i.e., the Graduate Program Director. This is a crucial interview for you. They will try to get a sense of whether you would be an effective TA. Will you be an enthusiastic, motivated, confident instructor that will take your teaching responsibilities seriously?

Finally, one thing that should be on your itinerary is a meeting with your potential supervisor's current graduate students - *alone*. If this is not on the itinerary, 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 supervising professor. Assure them that anything that they relate will be held in strict confidence (and make sure you keep it in confidence). 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 10 minutes, 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 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 for Toys-R-Us? If one or more students washed out of the program, ask why, to get a sense of whether this was 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 a big danger sign. On the other hand, if current students go on and on about the great publications and good positions of recent students, that's a very good sign.
- Ask the students about what it is like to be a TA 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 pay rent and buy food. Can students only afford rent in the more crime-ridden parts of town?

In listening to the current students, try to get a feel for whether there is a cooperative or competitive relationship among the graduate students. Try also to get a feel for whether they generally like and respect their advisor as a mentor and as a scientist. If you sense much disdain for the professor, that is worrisome.

All the usual other advice for job interviews applies to graduate school interviews as well. Dress nicely but don't be overdressed; biologists are generally pretty informal. You do not need to wear a coat and tie or a dress and heels. On the other hand, don't dress too far down. For example, avoid faded, ratty looking jeans, really short shorts, flip-flops, etc. This will suggest a lack of maturity, respect, and seriousness. If you are a field-oriented person, be ready to be taken into the field, e.g., to see potential research sites (have available old jeans, hiking boots, etc.). Also have clothes for going out at night with current graduate students.

Don't chew gum and don't smoke without permission. Try to avoid colloquial, immature speech (especially overuse of words such as "like" 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 our egos. The point is that if you are willing to bad-mouth your undergrad professors and classes, it is assumed that you will do the same wherever you go and this will not be welcome.

After you return, you should send a thank you e-mail to both the supervising professor and the graduate students who housed and fed you.

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Choosing a School and Potential Supervisor – A Summary of What to Consider

If things go well, more than one graduate program will be interested in having you. In making your decision, weigh the following factors, in approximate order of importance.

1. Am I being offered a tuition waiver and assistantship and is it enough to live on?
2. Does the evidence suggest that my potential supervisor will be pleasant to work with, supportive of my research and other goals, and have time enough to provide help and advice when I need it?
3. Does it appear that I will be able to do research that is both interesting to me and readily publishable?
4. Does the school have the facilities and equipment that I need to conduct my research?
5. Is there funding available to support my research?
6. Will I enjoy interacting with other people in my professor's lab including graduate students, post-docs, and technicians?
7. Are there a number of interesting, useful graduate courses being offered?
8. Would I like living in the local area?

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Special Section: Graduate School Considerations for Prospective Teachers

Secondary school teachers can and should consider doing graduate work and earning at least an M.S. degree. In fact, almost all school districts require an M.S. degree, and many give teachers a certain time frame to complete this degree when they are hired. One major benefit to completing graduate work is a higher salary, all else being equal.

Teachers have three basic options when it comes to graduate work:

Option 1: Content area degree

One can do graduate work to enhance one's knowledge of the subject matter that one is teaching. For example, one can get a straight-forward M.S. degree in Biology, but one could also get degrees in Environmental Science, Biotechnology. Unlike the other options for graduate work described below, the focus here is on bolstering one's scientific knowledge, rather than pedagogy (i.e., teaching skill).

Individuals choosing to obtain a content area degree most often enroll in a “non-thesis” M.S. program, wherein one obtains a degree solely by taking advanced, graduate-level coursework (usually about 30 credits). Non-thesis students do not do a *major* research project, but can become involved in smaller research projects for course credit.

Ambitious individuals that are truly interested in research can do a thesis-based degree, which requires a substantial amount of research and the preparation of a written Master's thesis. Usually teachers do their thesis research during the summer months. Note: If one ultimately might want to teach at the community college, 4-year college or university level, they should strongly consider doing a content area degree. Individuals interested in doing a thesis-based, content area M.S. degree should follow the guidelines above when it comes to finding an appropriate program and advisor.

In contrast with other types of M.S. degrees (see below), a content area degree gives one a better chance of getting promoted within their school, which can mean taking more control over decisions of what is being taught to students (i.e., the biology/science curriculum), and makes it more likely that one will be promoted to department head.

Option 2: Science Education Degree

One can also obtain a graduate degree in the area of Science Education. In such a program, one typically takes a mix of science content courses and education courses, the latter of which cover issues such as assessment, curriculum development, and teaching methodology. If one is interested in enhancing their pedagogical skills and credentials, or they aspire to one day hold an administrative position in a school district, this degree would be a good choice.

One can do M.S. degree, a Ph.D. degree or an M.S. and then a Ph.D. degree. Obtaining a Ph.D. is recommended for those individuals that might someday want to become a professor in a 4-year college or university and teach undergraduates who are prospective teachers. Most of Towson University's science education faculty have degrees in both their content area and in science education.

Option 3: A Degree in an Education Specialty

One can obtain an M.S. and/or Ph.D. degree in Education, focusing on specific areas that may be of interest to you, including Instructional Technology, Reading, Secondary Education, Special Education, and Educational Leadership, to name just a few. At the M.S. level, one can do either a non-thesis or a thesis degree. The thesis option is recommended for individuals who want to make new discoveries in their area of interest and for individuals who may wish to pursue a Ph.D. in this area at a later date.

M.S. or Ph.D. or both?

Most K-12 teachers earn an M.S. degree. Earning a Ph.D. will result in a higher salary in most school districts. However, a Ph.D. is generally recommended only if you are considering teaching at the college or university level in the future or if you are aspiring to an administrative position in a school district, such as Supervisor of Science Education, Supervisor of Curriculum and Instruction, Principal, etc. In many school districts, a teacher can earn the same salary as someone holding a Ph.D. if they have "M.S.+30" status; i.e., they have an M.S. degree and 30 additional university credits at the graduate level.

When To Do Your Graduate Work: Things to Consider

There are several good reasons to wait until one has a full-time teaching position before starting a graduate degree program. First, this may be better financially because most school districts will pay all or part of the tuition costs for active teachers. Second, instructors of many graduate level classes, especially those dealing with pedagogical issues, will assume that you have had some classroom teaching experience. Much of the course content will draw on those experiences, and you may be asked by your instructors to pilot test or practice teaching methodologies and research methods with your students.

Also, if one is thinking of completing a graduate degree *before* searching for a teaching position, keep in mind that one will be competing for positions with those holding only a B.S. degree. People with M.S. degrees must be paid higher salaries, so it will be less costly for a school system to hire the person with a B.S. than M.S. degree, all else being equal. In other words, one may not get the job because one has too much education and therefore is too costly to employ.

On the other hand, entering a graduate program while you are still a beginning teacher can be stressful, as you will be juggling a full-time job with graduate classes in the evenings. Thus, there may be advantages to completing a graduate degree before you begin your job search, if this situation would be financially feasible for you.

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Recommended Reading for Students Thinking Seriously about Graduate School

We highly recommend, the following excellent, tell-it-like-it-is guide to getting into graduate school and succeeding in graduate school, which was written by a biologist:

Peters, R.L. 1997. *Getting What You Came For – The Smart Student’s Guide to Earning a Master’s or Ph.D.* (Revised edition). Farrar, Straus and Giroux. ISBN: 0374524777

Other guides to graduate school that may be helpful include:

Frank, Fredrick and Karl Stein. 2004. *Playing the Game : The Streetsmart Guide to Graduate School.* iUniverse, Inc. ISBN: 0595304869

Jerrard, Richard. 1998. *The Grad School Handbook.* Perigee Trade. ISBN: 0399524169

Mumby, D. G. and Quest, B. 2004. *Graduate School: Winning Strategies for Getting in With or Without Excellent Grades.* Proto Press Publications. ISBN: 0968217346

Kaplan Co. 2008. *Get Into Graduate School: a Strategic Approach for Masters and Doctoral Candidates.* Kaplan. ISBN: 1427797838

Finally, with a bit of searching online, you will find numerous other guides to getting into, and succeeding in, graduate school, some specifically designed for Biology majors.

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Appendix 1: Summary of course requirements for a B.S. degree in Biology.

NOTE: These requirements apply to students entering TU in the 2011-12 academic (catalog) years. Students entering TU in an earlier (or later) year should examine the requirements in their TU Undergraduate Catalog. *Some requirements may have been changed.* A list of requirements for different catalog years is also available from academic advisors, the Biology Department Office (Smith 341), and online on the Biology Department's website: <http://wwwnew.towson.edu/biology/>

REQUIREMENTS FOR THE BIOLOGY DEGREE

1) REQUIRED CORE BIOLOGY COURSES

BIOL 201 (4) or BIOL 203(4)

BIOL 202 (4)

BIOL 204 (1)

BIOL 309 (4)

2) REQUIRED BREADTH BIOLOGY COURSES

BIOL 208 (3) or BIOL 205+207 (4,4)

BIOL 408 (4) or BIOL 409 (4) or BIOL 405 (4)

BIOL 213+214 (4,4) or BIOL 325 (4) or BIOL 436 (3)

3) REQUIRED ANCILLARY SCIENCE/MATH COURSES

CHEM 110,111 (4,4)

CHEM 330 (5) or CHEM 331+332 (5,5)

PHYS 211+212 (4,4) or PHYS 241+242 (4,4)

MATH 211 (3) or MATH 273 (4) or MATH 237 (4) or PSYC 212 (4)

4) CONCENTRATION COURSES

See next three pages (including Appendix 2).

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REQUIREMENTS FOR THE BIOLOGY DEGREE (updated 8-12-11)

REQUIRED ANCILLARY COURSES

Chem 110,111 (4,4) **AND** Chem 330 (5) or 331+332 (5,5)
 Phys 211+212 (4,4) or 241+242 (4,4)
 Math 211 (3) or Math 273 (4) or Math 237 (4) or Psys 212 (4)

REQUIRED CORE COURSES

Biol 201 (4) or Biol 203 (4) **AND** Biol 202 (4)
 Biol 204 (1)
 Biol 309 (4)

REQUIRED BREADTH COURSES

Biol 208 (3) or Biol 205+207 (4,4)
 Biol 408 (4) or Biol 409 (4) or Biol 405 (4)
 Biol 213+214 (4,4) or Biol 325 (4) or Biol 436 (3)

BIOLOGY CONCENTRATIONS (Select one of the following – also see next page)

CELLULAR/MOLECULAR BIOLOGY	FUNCTIONAL BIOLOGY OF ANIMALS	ORGANISMAL BIOLOGY & ECOLOGY	BIOLOGY SECONDARY EDUCATION
<p><u>Breadth course notes:</u> - Must take <u>two</u> of the following Biol 405, Biol 408, Biol 409</p> <p><u>Ancillary course notes:</u> Math 211 or 273 <i>strongly recommended</i></p> <p><u>YOU ALSO NEED ONE</u> of: Biol 410 (Mol Biol lab) (2) Chem 356 (BioChem lab) (2)</p> <p><u>and TWO</u> of: Biol 315 (Med Microbio) (4) Biol 318 (Microbiology) (4) Biol 360 (Histology) (4) Biol 415 (Biotechnology) (3) Biol 420 (Microbio Infectious Disease) (3) Biol 421 (Immunology) (4) Biol 428 (Virology) (3) Biol 463 (Developmental Biol) (3) Chem 351 (Biochemistry) (3) MBBB 301 (Bioinformatics) (3)</p> <p>PLUS: 1) Take any other 3 or 4 credit 300-400 level majors' Biol course (can include Biol 405, 408, or 409 if course is not being used to fulfill breadth requirement; can also include Biol 214 if Biol 213 also taken) OR 2) complete Biol 491 for 3 credits OR 3) complete both Biol 498 and 499</p>	<p><i>For pre-medicine, pre-dentistry, and pre-veterinary medicine, see next pg</i></p> <p><u>Breadth course notes:</u> Must take Biol 213+214 or Biol 325</p> <p><u>Ancillary course notes:</u> - <i>Must</i> take Chem 331+332; - Math 211 or 273 <i>strongly recommended</i> (required by most graduate and some med/dental/vet schools)</p> <p><u>YOU ALSO NEED ONE OF*:</u> Biol 465 (Mammalian Physiology) (4) Biol 469 (Comparative Anim Phys) (4) Biol 470 (Advanced Physiology) (4)</p> <p>*Starting in 2009, Biol 465 & 469 are no longer offered. Must take Biol 470.</p> <p>And ONE (if you took Biol 213+214) <u>or TWO (if you took Biol 325) of:</u> Biol 315 (Medical Microbiology) (4) Biol 318 (Microbiology) (4) Biol 360 (Histology) (4) Biol 367 (Endocrinology) (3) Biol 420 (Microbio Infectious Disease) (3) Biol 421 (Immunology) (4) Biol 427 (Neuromusc mechanisms) (2) Biol 428 (Virology) (3) Biol 463 (Developmental Bio) (3)</p> <p>PLUS: 1) Take any other 3-4 credit 300-400 level majors' Biol course <u>that appears in a list of elective courses for a BIOL concentration</u> OR 2) complete Biol 491 for 3 credits OR 3) complete Biol 498+499</p>	<p><u>Breadth course notes:</u> - Should take Biol 205+207, not Biol 208 (if took Biol 208, see * below) - Biol 405 <i>very strongly recommended</i></p> <p><u>Ancillary course notes:</u> Must take Math 237 or Psys 212; Math 211 or 273 also <i>strongly recommended</i></p> <p><u>ALSO NEED ONE OF:</u> Biol 310 (Conservation Bio) (4) Biol 402 (General Ecology) (4) Biol 406 (Limnology) (4) Biol 435 (Plant Ecology) (4)</p> <p><u>AND ONE of:</u> Biol 334 (Humans, Science Chesapeake) (3) Biol 347 (Marine Biology) (3) Biol 353 (Invert Zoology) (4) Biol 371 (Anim Behavior) (4) Biol 413 (Evolution) (3) Biol 432 (Vascular Plant Taxonomy) (4) Biol 446 (Tropical Ecol and Consv) (3) Biol 447 (Tropical Field Ecology) (4) Biol 452 (Wetlands Ecology) (4) Biol 455 (Fish Biology) (4) Biol 456 (Ornithology) (4) Biol 458 (Mammalogy) (4) Biol 461 (Entomology) (4) Biol 467 (Herpetology) (4)</p> <p>PLUS: Complete 1) Any other 3-4 credit 300-400 level elective course in the list above (starting with Biol 310) OR 2) Biol 491 for 3 credits, OR 3) Biol 498+499</p> <p>*If you took Biol 208, need one other 300-400 level 3 or 4 credit course from the lists above.</p> <p>Biol 484 also <i>strongly recommended</i> for all students with the OBE concentration.</p>	<p><u>Breadth courses notes:</u> Must take Biol 205+207 (not Biol 208) Must take Biol 408 or 409 (not 405) Biol 325 recommended over the other anatomy/physiology options</p> <p><u>Ancillary course notes:</u> Chem 330 recommended over Chem 331+332</p> <p>Sec Ed students need only one semester of Physics, either Phys 211 or 241</p> <p><u>Elective courses:</u> Sec Ed students are not required to take any additional BIOL coursework, but are free to do so, esp. to increase their ability to teach in certain subdisciplines</p> <p><u>ALSO NEED ONE ONE OF:</u> GEOL 121 (Phys Geology) (4) GEOL 123 (Hist Geology) (4) ASTR 161 (Gen Astronomy) (4) GEOL 357 (Phys Oceanography) (3) GEOG 373 (Climatology) (4) GEOG 377 (Descrp Meteorology) (4)</p> <p>Students must also complete requirements for teaching certification (details in Undergraduate Catalog).</p> <p>Note: The above shows the requirements for students entering TU in Fall 2010 or later. Students that entered earlier who want to switch to the above plan can do so. They should talk to their advisor for details.</p>

<p>RECOMMENDATIONS FOR STUDENTS INTERESTED IN HUMAN MEDICINE, DENTISTRY, OR VETERINARY MEDICINE</p> <p>Within the <i>Functional Biology of Animals</i> concentration, choose coursework as follows:</p> <p><u>Core courses:</u> as on pg 1</p> <p><u>Breadth courses:</u> As on pg 1 but must take Biol 213+214 Also: Of Biol 405, 408 and 409, Biol 408 is most recommended; Biol 405 is not recommended</p> <p><u>Ancillary courses</u> as on pg 1 but must take Chem 331+332 Also: Math 211 or 273 strongly recommended as some med/dental/vet schools require a semester of calculus. Students advised to check requirements of schools to which they think they will apply.</p> <p><u>Elective courses:</u></p> <ol style="list-style-type: none"> For your Physiology elective take Biol 470 (Advanced Physiology) (4) For your Focused electives take <u>ONE</u> of: Biol 315 (Medical Microbiology) (4) Biol 318 (Microbiology) (4) Biol 360 (Histology) (4) Biol 367 (Endocrinology) (3) Biol 420 (Microbio Infectious Disease) (3) Biol 421 (Immunology) (4) Biol 427 (Neuromusc m echarisms) (2) Biol 428 (Virology) (3) Biol 463 (Developmental Bio) (3) Free elective: 1) Take any other 3-4 credit 300-400 level majors' Biol course <u>that appears in a lists of elective courses for a BIOL concentration</u> OR 2) complete Biol 491 for 3 credits OR 3) complete Biol 498+499 <p><i>Also recommended:</i> Chem 351 (Intro BioChem) (3) Chem 356 (BioChem lab) (2) Math 237 (Elem Biostats) (3)</p>	<p>RECOMMENDATIONS FOR STUDENTS PARTICULARLY INTERESTED IN THE BIOLOGY OF PLANTS/BOTANY</p> <p>Within the <i>Organismal Biology and Ecology</i> concentration, choose coursework as follows:</p> <p><u>Core courses</u> as on pg 1</p> <p><u>Breadth courses</u> as on pg 1 but you must take Biol 436 (Plant Physiology) (3) Also: Biol 205+Biol 207 should be taken instead of Biol 208. If Biol 208 is taken, you must take one extra course from Diversity Electives below - Biol 405 <i>very strongly</i> recommended over Biol 408 or Biol 409</p> <p><u>Ancillary courses</u> as on pg 1 but must take Math 237 or P syc 212</p> <p><i>Very strongly recommended that you also take</i> Math 211 or 273 (required by most graduate schools)</p> <p><u>Elective courses:</u></p> <ol style="list-style-type: none"> For your <i>Principles of Ecology</i> elective you must take Biol 435 (Plant Ecology) (4) You must also take: Biol 439 (Plant Anatomy) (4) or approved alternative (consult advisor) For your <i>Diversity</i> electives you must choose either: Biol 331 (Plant Morphology) (3) or Biol 432 (V asc Plant Taxonomy) (4) (both courses must be taken if you took Bio 208 instead of Biol 205+207 – if Biol 331 not available, consult advisor) <p>Biol 484 (Seminar Ecol Evol Bhv) (1) is also <i>strongly recommended</i></p>	<p>RECOMMENDATIONS FOR STUDENTS PARTICULARLY INTERESTED IN THE BIOLOGY OF WILD ANIMALS /ZOOLOGY</p> <p>Within the <i>Organismal Biology and Ecology</i> concentration, choose coursework as follows:</p> <p><u>Core courses</u> as on pg 1</p> <p><u>Breadth courses</u> as on pg 1 but you must take <i>either</i> Biol 213+214 <i>or</i> Biol 325 Also: Biol 205+Biol 207 should be taken instead of Biol 208. If Biol 208 taken, you must take one extra course from Diversity Electives below</p> <p><u>Ancillary courses</u> as on pg 1 but must take Math 237 or P syc 212 <i>Very strongly recommended that you also take</i> Math 211 or 273 (required by most graduate schools)</p> <p><u>Elective courses:</u></p> <ol style="list-style-type: none"> Take one of the following <i>Principles of Ecology</i> courses Biol 310 (C onservaion Biology) (4) Biol 402 (General Ecology) (4) Biol 406 (Limnology) (4) Take <i>Diversity</i> courses as follows: Take one of the following: Biol 371 (Animal B ehavior) (4) Biol 413 (Evolution) (4) AND take one of the following: Biol 353 (Invertebrate Zool) (4) Biol 455 (Fish Biology) (4) Biol 456 (Ornithology) (4) Biol 458 (Mammalogy) (4) Biol 461 (Entomology) (4) Biol 467 (Herpetology) (4) <p>Biol 470 (Adv Physiology) may also be recommended, depending on student interest and possibly can substitute for one of the above courses; see advisor</p> <p>Biol 484 (Seminar Ecol Evol Bhv) (1) is also <i>strongly recommended</i></p>
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Appendix 2a: Required General Education, Pre-Secondary Education, and Secondary Education Courses for Biology majors in the Secondary Science Education Program

<p align="center"><u>Required General Education Courses</u></p> <p>Unless otherwise stated one course is required from each category</p> <p>I.A. ENGL 102 or 190 (3)</p> <p>I.B. ISTC 201 (recommended) or any other I.B. course (3)</p> <p>I.C. Any course that satisfies the BIOL major (3-4)</p> <p>I.D. WRIT 312 or EDUC 301 (3)</p> <p>I.E. Student's choice (3)</p> <p>II.A. BIOL 201 (4) and CHEM 110-111 (8)</p> <p>II.B.1 HIST 145 or HIST 146 (3)</p> <p>II.B.3 COMM 131 (3)</p> <p>II.C.1. Student's choice (cannot be HIST course)</p> <p>II.C.2 Two courses required, incl. PSYC 101 and a non-PSYC course (3 + 3)</p> <p>II.C.3 EDUC 203 (recommended) or other II.C.3 course (3)*</p> <p>II.D Student's choice (3)*</p> <p>*Caution: In meeting category II requirements, no more than three courses can be taken from the same discipline.</p> <p align="center"><u>Required Biology Major Courses</u></p> <p>See Biology Curriculum document</p> <p align="center"><u>Other Required Courses</u></p> <p><u>One of the following:</u></p> <p>GEOL 121 Physical Geology (4)</p> <p>GEOL 123 Historical Geology (4)</p> <p>ASTR 161 General Astronomy (4)</p> <p>GEOL 357 Physical Oceanography (3)</p> <p>GEOG 373 Climatology (4)</p> <p>GEOG 377 Descriptive Meteorology (4)</p>	<p align="center"><u>Required Core Secondary Education and Science Education Courses</u></p> <p>Preliminary courses: <i>(may be taken prior to admittance to program and prior to remittance of PRAXIS I scores)</i></p> <p>PSYC 201 Educational Psychology (3)</p> <p>ISTC 301 Utilizing Instructional Media (3)</p> <p>SPED 301 Introduction to Special Education (3)</p> <p>EDUC 401 Foundations in Education (3)</p> <p>Core courses: <i>(to be taken after providing PRAXIS I or SAT scores and meeting with SCED advisor)</i></p> <p>SCED 341 Principles of Secondary Education (4) (Includes embedded field experience)</p> <p>SCED 460 Using Reading/Writing in Sec. School (4) (Taken concurrently with SCED 341)</p> <p>SCIE 421 Applied Seminar in Sec. Sci. Education (2)</p> <p align="center"><u>Professional Year</u></p> <p><u>Internship semester (Fall)</u></p> <p><i>To be taken concurrently:</i></p> <p>SCED 499 Internship in Secondary Education (6)</p> <p>SCIE 380 Methods of Teaching Biology (3)</p> <p><u>Student Teaching Semester (Spring)</u></p> <p><i>To be taken concurrently:</i></p> <p>SCIE 393 Student Teaching (12)</p> <p>SCED 461 Teaching Reading in Sec. Content Area (3)</p>
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Appendix 2b: Required University Core Curriculum, Pre-Secondary Education, and Secondary Education Courses for Biology majors in the Secondary Science Education Program

Required University Core Courses

Unless otherwise stated one course is required from each category; if no specific course or courses are specified, students are free to choose any eligible course within the category

Towson Seminar: (student choice)

English Composition: must take ENGL 102

Mathematics (required course depends on specialty)

Physics: MATH 273 **and** MATH 274

Earth Space: MATH 115

Chemistry: MATH 211 OR MATH 273

Biology: MATH 211 OR MATH 273
OR MATH 237 OR PSYC 212

Creativity and Creative Development: (student choice)

Arts and Humanities: must take COMM 131

Social and Behavioral Sciences: (student choice)

Biological and Physical Sciences: see next page

Advanced Writing Seminar: take WRIT 312 or EDUC 301

Metropolitan Perspectives: must take SCED 200

The United States as a Nation: take HIST 145 or HIST 146

Global Perspectives: (student choice)

Diversity and Difference: take EDUC 203
(note prerequisite is SCED 200)

Ethical Issues and Perspectives: SCED **XXX**
(note prerequisite is SCED 203)

Required Core Secondary Education and Science Education Courses

Preliminary courses: *(may be taken prior to admittance to program and prior to remittance of PRAXIS 1 scores)*

SCED 200 Foundations in Education (3)

SCED 305 Adolescent Development (3)

ISTC 301 Integrating Instructional Technology (3)

SPED 301 Introduction to Special Education (3)

Core courses: *(to be taken after providing PRAXIS 1 or SAT scores and meeting with SCED advisor) (Junior Year)*

SCED 341 Principles of Secondary Education (4)
(Includes embedded field experience)

SCED 460 Using Reading/Writing in Sec. School (4)
(Taken concurrently with SCED 341)

Professional Year

Internship semester (Fall)

To be taken concurrently:

SCED 499 Internship in Secondary Education (6)

SCED 461 Teaching Reading in Sec. Content Area (3)

SCIE 380 Methods of Teaching Biology (3)*

***Note: SCIE 380 offered only during Fall semester**

Student Teaching Semester (Spring)

To be taken concurrently:

SCIE 393 Student Teaching (12)

SCED 401 Analyzing Student Teaching (2)

SCED 462 Seminar in Teaching Reading in the
SCED Content Area (1)

Required Major Courses

Biological Sciences: For Secondary Ed – Biology only

REQUIRED BIOLOGY CORE COURSES: BIOL 201 (4) or BIOL 203 (4) ; BIOL 202 (4); BIOL 204 (1); BIOL 309 (4)

REQUIRED BREADTH COURSES: BIOL 205+207 (4,4); BIOL 408 (4), BIOL 409 (3) or BIOL 405(4);
BIOL 325 (4) or BIOL 213+214 (4,4)

REQUIRED ANCILLARY COURSES: CHEM 110,111 (4,4); CHEM 330 (5) or CHEM 331+332 (5,5); PHYS 211 (4) or 241 (4);

MATH 211 (3) or MATH 273 (4) or MATH 237 (4) or PSYC 212 (4)

GEOLOGY REQUIREMENT (ONE OF): GEOL 121 (4); GEOL 123 (4); ASTR 161 (4); GEOL 357 (3); GEOG 373 (4);
GEOG 377 (4)

Notes:

Recommended that students take Biol 325 rather than the other physiology options

Recommended that students take Chem 330 (rather than 331+332)

Sci Ed students need only one semester of Physics (Phys 211 or 241)

Elective courses: Sci Ed students are not required to take any additional BIOL coursework, but are free to do so, esp. to increase their ability to teach in certain subdisciplines

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Appendix 3: An example of the Anticipated Schedule of Biology Courses document.
Caution: This version is undoubtedly out-of-date. Students can obtain the most up-to-date version of this document in the Biology Department Office or on the Biology Department website.

Anticipated Offerings of Major's Biology Courses – 2012-2014 (as of 8-12-11)

MINIMESTER 2012 (PROVISIONAL)

BIOL 204 Educational/Career Planning for Biologists...1
 BIOL 425 Dissection of the Upper Extremity..... 2

SPRING SEMESTER 2012 (PROVISIONAL)

BIOL 204 Educational/Career Planning for Biologists...1
 BIOL 205 General Botany 4
 BIOL 208 Biodiversity3
 BIOL 213/214 Human Anat & Phys I & II..... 4
 BIOL 304 Natural Hist Interpretation/Publ Education...3
 ?*BIOL 306 Human Ecology and Sustainability+3
 BIOL 309 Genetics.....4
 BIOL 315 Medical Microbiology.....4
 BIOL 318 Microbiology.....4
 BIOL 325 Animal Physiology.....4
 BIOL 347 Marine Biology3
 BIOL 367 Endocrinology (unlikely, back Spring 2014).....3
 BIOL 371 Animal Behavior.....4
 BIOL 408 Cell Biology4
 BIOL 409 Molecular Biology4
 BIOL 410 Molecular Biology Lab..... 2
 BIOL 420 Microbiology of Infectious Disease 3
 BIOL 427 Neurousc. Mech. of the Upper Body.....2
 BIOL 428 Virology3
 BIOL 446 Tropical Ecology and Conservation..... 3
 *BIOL 450 Ecological Biochemistry..... 3
 BIOL 455 Fish Biology.....4
 BIOL 456 Ornithology..... 4
 MBBB 301 Bioinformatics..... 4

SUMMER 2012 (PROVISIONAL)

BIOL 204 Educational/Career Planning for Biologists...1
 BIOL 207 General Zoology..... 4
 BIOL 213/214 Human Anat & Phys I & II..... 4
 ?BIOL 315 Medical Microbiology.....4
 BIOL 447 Tropical Field Ecology in Peru.....4

FALL SEMESTER 2012 (PROVISIONAL)

BIOL 204 Educational/Career Planning for Biologists...1
 BIOL 207 General Zoology..... 4
 BIOL 208 Biodiversity3
 BIOL 213/214 Human Anat & Phys I & II..... 4
 BIOL 309 Genetics.....4
 BIOL 310 Conservation Biology.....4
 BIOL 318 Microbiology.....4
 BIOL 325 Animal Physiology.....4
 BIOL 353 Invertebrate Zoology (unlikely)4
 BIOL 402 General Ecology4
 BIOL 405 Molecular Ecol, Evol & Conservation4
 BIOL 408 Cell Biology4
 BIOL 409 Molecular Biology4
 BIOL 421 Immunology.....4
 ?BIOL 432 Vascular Plant Taxonomy4
 BIOL 470 Advanced Physiology..... 4
 BIOL 484 Seminar in Ecology, Evolution & Behavior ...1
 MBBB 301 Bioinformatics..... 4

SPRING SEMESTER 2013 (PROVISIONAL)

BIOL 204 Educational/Career Planning for Biologists...1
 BIOL 205 General Botany 4
 BIOL 208 Biodiversity3
 BIOL 213/214 Human Anat & Phys I & II..... 4
 BIOL 304 Natural Hist Interpretation/Publ Education...3
 *BIOL 306 Human Ecology and Sustainability+3
 BIOL 309 Genetics.....4
 BIOL 318 Microbiology4
 BIOL 325 Animal Physiology4
 BIOL 371 Animal Behavior4
 BIOL 406 Limnology 4
 BIOL 408 Cell Biology4
 BIOL 409 Molecular Biology4
 BIOL 410 Molecular Biology Lab.....2
 BIOL 427 Neurousc. Mech Of the Upper Body2
 BIOL 428 Virology3
 ?BIOL 436 Plant Physiology.....3
 *BIOL 450 Ecological Biochemistry..... 3
 ?BIOL 458 Mammalogy.....4
 BIOL 463 Developmental Biology.....3
 BIOL 467 Herpetology.....4
 MBBB 301 Bioinformatics..... 4

SUMMER 2013 (PROVISIONAL)

BIOL 204 Educational/Career Planning for Biologists...1
 BIOL 207 General Zoology..... 4
 BIOL 213/214 Human Anat & Phys I & II..... 4
 BIOL 315 Medical Microbiology.....4
 BIOL 447 Tropical Field Ecology in Peru.....4

FALL SEMESTER 2013 (PROVISIONAL)

BIOL 204 Educational/Career Planning for Biologists...1
 BIOL 207 General Zoology..... 4
 BIOL 208 Biodiversity3
 BIOL 213/214 Human Anat & Phys I & II..... 4
 BIOL 309 Genetics.....4
 BIOL 318 Microbiology..... 4
 BIOL 325 Animal Physiology4
 BIOL 333 Humans, Science, & the Chesapeake.....3
 BIOL 360 Histology4
 BIOL 402 General Ecology4
 BIOL 408 Cell Biology4
 BIOL 409 Molecular Biology.....4
 BIOL 413 Evolution3
 BIOL 421 Immunology.....4
 BIOL 435 Plant Ecology.....4
 *BIOL 450 Ecological Biochemistry..... 3
 BIOL 452 Wetland Ecology 4
 BIOL 461 Entomology (unlikely, back Fall '14 or '15).4
 BIOL 470 Advanced Physiology.....4
 BIOL 484 Seminar in Ecology, Evolution, Behavior...1
 MBBB 301 Bioinformatics..... 4

Continued on next page or reverse side

MINIMESTER 2014 (PROVISIONAL)

BIOL 204 Educational/Career Planning for Biologists...1
BIOL 425 Dissection of the Upper Extremity.....2

SPRING SEMESTER 2014 (PROVISIONAL)

BIOL 204 Educational/Career Planning for Biologists...1
BIOL 205 General Botany4
BIOL 208 Biodiversity3
BIOL 213/214 Human Anat & Phys I & II.....4
BIOL 304 Natural Hist Interpretation/Publ E ducation...3
+BIOL 306 Human Ecology and Sustainability*3
BIOL 309 Genetics.....4
BIOL 318 Microbiology.....4
BIOL 325 Animal Physiology.....4
BIOL 347 Marine Biology3
BIOL 367 Endocrinology-(unlikely, back Spring 2014)..3
BIOL 371 Animal Behavior.....4
BIOL 408 Cell Biology.....4
BIOL 409 Molecular Biology4
BIOL 410 Molecular Biology Lab.....2
BIOL 420 Microbiology of Infectious Disease3
BIOL 427 Neurom usc. Mech. of the Upper Body2
BIOL 428 Virology.....3
BIOL 446 Tropical Ecology and Conservation.....3
*BIOL 450 Ecological Biochemistry.....3
BIOL 455 Fish Biology.....4
BIOL 456 Ornithology.....4
MBBB 301 Bioinformatics.....4

+ Course does not count towards Biology major but may fulfill other B.S. degree requirements.

* Course can count as “free elective” for students with Organismal Biology and Ecology concentration.

? Currently some uncertainty as to whether course will be offered. Students should check for updates.

CAUTIONARY NOTE: The Department of Biological Sciences makes every effort to offer courses as shown but changes to the above plan are possible. Students should check with their academic advisor and/or other Biology professors to confirm that courses will be offered when shown. This is especially true for courses marked with a ? symbol

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Appendix 4: Sample cover letter to send to prospective graduate supervisor

31 November 2016

Dr. Russell N. Wings
Department of Biology
Minnesota State University
Frozen Lakes, MN 55332

Dear Dr. Wings,

I would like to introduce myself and inquire about applying to do graduate work under your supervision, starting in the fall of 2017.

I am currently an undergraduate at Towson University, near Baltimore, and will be graduating in May, 2008, 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, 700 on the Quantitative section and 5.5 on the Analytical Writing section.

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 have recently read with much interest your papers "Effects of breeding synchrony on extra-pair fertilizations in Red-winged Blackbirds" from the *Journal of Avian Biology* and "The costs of polygamy for second-mated Yellow-headed Blackbirds" from the *Journal of Ornithology*. I really 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. Waggedorn 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 looked at habitat use in wood turtles.

I would appreciate knowing whether you are taking new students for the fall of 2016. 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
Mstude1@towson.edu
410-555-9876

Mailing address:
203 Heartbreak Hill Road
Baltimore, Md. 21228

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Appendix 5: How to Prepare a Curriculum Vitae (CV)

A curriculum vitae or “CV” is a lengthy scientific resume that is frequently used primarily when applying for jobs in science and technology. A sample CV is provided starting on the next page and running two pages. That’s right: unlike a typical resume, a CV does *not* have to fit on one page.

In general, a CV can 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
- Languages and fluency (writing and speaking)
- Skills, including computer/software skills, laboratory skills, field skills
- 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

Obviously, students who are early in their undergraduate careers will not have entries for all of these categories. (One should not list a heading unless one has something to put under it!) However, as the years progress, more and more will be added to the CV.

Maria Q. Student

203 Heartbreak Hill Road
Baltimore, MD 21228

410-555-9876
Mstude1@students.towson.edu

Education

Program B.S. Biology
Date degree expected 5/2016
Institution Towson University Overall GPA: 3.7

Scholarships, Fellowships, Honors, and Awards

Honorable Mention, Barnard Rubble Award; Best Undergraduate Researcher
Towson University – Department of Biological Sciences, 2014

Elected to Beta Beta Beta Biological Honor Society, 2012

Alfred E. Newman Scholarship for Outstanding Transfer Student
Towson University – Department of Biological Sciences, 2011

Lions Clubs of Maryland University Scholarship, 2010

Languages and Skills

Fluent in conversational Spanish; comfortable reading and writing Spanish
Experienced with Microsoft Word, Excel, PowerPoint
Experienced with gel electrophoresis, PCR

Employment

Position: Animal Caretaker, Veterinary Technician
Dates: Mar. 2013-present
Location: Cat Hospital at Towson

Position: Sales Clerk
Dates: Sept. 2011-Apr. 2012
Location: Eddie Bauer - Towson MD

Volunteer Work

Habitat for Humanity, Eastern Shore of Maryland Division, Summer 2012
Gulf Coast Cleanup Trip, Aedon High School Senior Class, Summer 2010
Volunteer instructor, K-6 grades, Irwin Nature Center, Baltimore, 2007-2009

Research Experience

Position: Participant, NSF Research Experience for Undergraduates Program, Indiana University
Dates: Summer 2014
Project: Effect of breeding synchrony on extra-pair mating in Baltimore Orioles
Supervisor: Dr. Earl J. Waggedorn
Duty/skills: Nest-finding, behavioral observation, mist-netting, banding, blood sampling,
DNA extraction, PCR

Position: Undergraduate Research Assistant, Towson University
Dates: October 2012-May 2013
Project: Description of home ranges and habitat use of wood turtles in fall and spring
Supervisor: Dr. Forrest Bufophile
Duty/skills: Radio telemetry, territory mapping

Research Funding

Undergraduate Research Grant, Fisher College of Science and Mathematics, Fall 2013, \$500

Presentations

Jimenez, M.Q. and F. Bufophile. "Effect of temperature on daily movement patterns in wood turtles".
Herpetological Association meeting, Laramie, WY, Aug 2014.

Publications

Bufophile, F. and Jimenez, M.Q., 2013. Home range size of wood turtles. *Southeastern Naturalist* 45: 908-911.

Membership in Professional Societies

Society for the Study of Amphibians and Reptiles, 2011 to present

Teaching Experience

Undergraduate Teaching Assistant, Comparative Animal Physiology, Towson University, Fall 2012
Duties: Assist in setting up laboratories, helping students during experiments, some mini-lectures

Extra-curricular Activities

Initiate Advisor of Phi Sigma Pi National Honor Society, 2011
Secretary, Beta Beta Beta Biological Honor Society 2012-present

References

Dr. Earl J. Waggedorn (Research supervisor)
Dept. of Biology - Indiana University
Bloomington, IN 33445
346-555-2373
ejwaggedorn@iu.edu

Dr. Forrest Bufophile (Professor and research supervisor)
Dept. of Biology - Towson University
Towson, MD 21252
410-555-4388
fbufo@towson.edu

Ms. Marge N. Auferror (Manager, Eddie Bauer)
345 Towsontown Ct.
Towson, MD 21204
410-555-9874

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Appendix 6: Sample listing of courses and grades to send to prospective graduate supervisor

SCIENCE AND MATH COURSES AND GRADES – Maria Q. Student

BIOLOGY

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 351: Field and Systematic Vertebrate Zoology	A
BIOL 353: Invertebrate Zoology	A-
BIOL 381: Biological Literature	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 469: Comparative Animal Physiology	B
BIOL 484: Seminar in Ecology, Evolution, Conservation	currently enrolled
BIOL 491: Independent Research	A

CHEMISTRY

CHEM 101: General Chemistry I	C+
CHEM 102: General Chemistry II	B
CHEM 331: Organic Chemistry I	B-
CHEM 332: Organic Chemistry II	B

PHYSICS

PHYS 211: General Physics I	B
PHYS 212: General Physics II	currently enrolled

MATHEMATICS AND STATISTICS

MATH 273: Calculus I	B
PSYC 212: Behavioral Statistics	A-

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Appendix 7: How to calculate your GPA in a subset of courses (e.g., majors or science courses)

Students get a certain number of “grade points” for each letter grade, as follows:

A	4.00
A-	3.67
B+	3.33
B	3.00
B-	2.67
C+	2.33
C	2.00
D+	1.33
D	1.00
F	0.00
FX	0.00

To compute the Grade Point Average (GPA) for any set of courses, do the following:

1. Multiply the number of credits (what the university sometimes calls “units”) for each course by the grade points (the values above) assigned to the grade earned. So, if you got a B+ in Biol 202, which is a 4-credit course, you would multiply $4 \times 3.33 = 13.32$ “points” for that course.
2. After doing the above math, add up the total number of points for all courses under consideration. Also add up the total number of credits for all courses under consideration.
3. Divide the total number of points by the total number of credits to get the GPA for that set of courses.

Example: Susan needs to calculate her “GPA in courses required for the major” for a scholarship application. Her coursework (so far), along with grades and total grade points are shown in the table below:

<i>Course</i>	<i>Credits (units)</i>	<i>Grade</i>	<i>Points</i>
Biol 201	4	A-	$4 \times 3.67 = 14.68$
Biol 202	4	B-	$4 \times 2.67 = 10.68$
Biol 208	3	B	$3 \times 3.00 = 9.00$
Chem 110	4	C+	$4 \times 2.33 = 9.32$
Math 211	3	B+	$3 \times 3.33 = 9.99$
<i>Total credits: 18</i>		<i>Total points: 53.67</i>	

Dividing total points by total credits, i.e., $53.67 \div 18$ gives Susan a GPA of 2.98 in these courses.

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Appendix 8: Further Details on Obtaining Biology Departmental Honors

The current Honors College curriculum requires that students complete 6 credits of Honors course work based on some combination of the following: Departmental Honors; Honors Independent Study; Honors Independent Investigations; Honors Directed Readings; Honors Internship; Honors credit for Study Abroad; Upper-level Honors College Seminars; Honors Capstone; Honors Thesis.

The following sections describe three options that best complement the Biology major: Honors Thesis based on research in Biology; Honors Thesis based on research involving K-12 science education; Honors Internship.

Students will also want to see also the Honors College Student Handbook and the Departmental Honors Program Handbook (<http://www.towson.edu/honors/forms/>).

I. Thesis Option

The Honors Thesis is the most common form of Honors experience because it reflects the fact that scholarship in Biology is typically involves some form of research.

1. Select a faculty advisor and design, with the assistance of your advisor, an Honors project.
2. Contact the Biology Honors Coordinator. (Contact the Biology Department office to get the name of this individual).
3. Prepare Thesis proposal: This proposal should include a title page bearing the student's and faculty thesis advisor's names. Most Honors Thesis Proposals are five to six pages, plus a bibliography. This proposal can form the basis of a grant proposal to obtain college and/or university funding to support the research project. However, some modification may be needed to meet the grant proposal guidelines.
4. Select a Thesis committee: The thesis committee is composed of the faculty thesis advisor, a second faculty member chosen in consultation with the faculty thesis advisor and the Biology Honors Coordinator. Members of the committee are responsible for reading and responding to the thesis, evaluating the work, and attending the public presentation.
5. Prepare and submit an Honors Thesis Committee and Proposal Approval Form (Appendix A in the Departmental Honors Program Handbook – see link above) to the Honors College along with a copy of your Thesis proposal.
6. Successfully complete BIOL 498 and 499. Note that up to three credits of this course work may count towards the Biology major.
7. Prepare Honors Thesis following a standard format including a title page, approval sheet, and consecutively numbered pages through the references. The Departmental Honors Program Handbook provides samples of a title page and an approval sheet as well as the Honors Thesis format.
8. Post announcements for the oral presentation of your research (i.e., seminar) at least one week in advance.

9. Oral Presentation/Seminar: The seminar is a public presentation of the thesis project; it includes 20-30 minute synopsis of the work followed by a discussion of the work by the audience. This will be followed by a discussion in a closed meeting with the thesis committee.
10. A completed, signed copy of the thesis approval form (form can be found in the Departmental Honors Program Handbook or <http://www.towson.edu/honors/forms/index.asp>) must be submitted to the Honors College no later than two weeks before graduation.
11. An UNBOUND signed original and an additional signed copy of the thesis must be delivered to the Honors College Office by the last day of the final exam period. When the Honors College approves the thesis, “Departmental Honors” will appear on your diploma and final transcript.
12. A bound copy of the thesis should be delivered to the Biology Honors Coordinator by the last day of the final exam period.

II. K-12 Science Education

Students have the option of conducting research on how we educate students in Biology at the K-12 or undergraduate level. Like other students conducting research, students doing a teaching project will prepare a written thesis.

1. Select a faculty advisor in Science Education and design, with the assistance of your advisor, an Honors project.
2. Contact the Biology Honors Coordinator.
3. Prepare project proposal: This proposal should include a title page bearing your name and the faculty advisor. Most Honors project proposals are five to six pages, plus a bibliography.
7. Select Honors Project committee: The committee is composed of the faculty advisor, a second faculty member chosen in consultation with the faculty advisor and the Biology Honors Coordinator. Members of the committee are responsible for reading and responding to the student’s thesis, evaluating the work, and attending the public presentation.
4. Prepare and submit an Honors Project Committee and Proposal Approval form to the Honors College along with a copy of your project proposal.
5. Successfully complete BIOL 498 and 499. In this case BIOL 498, will be credit for conducting your research related to science education and BIOL 499 will be credit for writing the thesis based on your science education research. Note that up to 3 credits of this course work may count towards the Biology major.
6. Prepare Honors Project thesis following a standard format including a title page, approval sheet, and consecutively numbered pages through the references. The Departmental Honors Program Handbook provides samples of a title page and an approval sheet.
8. Post Announcements for the Oral Presentation of your project at least one week in advance.

9. Oral Presentation: The Honors Seminar is a public presentation of the project; 20-30 minute synopsis of the work followed by a discussion of the work by the audience. This will be followed by a discussion in a closed meeting with the project committee.
10. A completed, signed copy of the thesis approval form (form can be found in the Departmental Honors Program Handbook) must be submitted to the Honors College no later than two weeks before graduation.
11. An UNBOUND signed original and an additional signed copy of the thesis must be delivered to the Honors College Office by the last day of the final exam period. When the Honors College receives and approves the thesis, "Departmental Honors" will appear on your diploma and final transcript.
12. A bound copy of the thesis should be delivered to the Biology Honors Coordinator by the last day of the final exam period.

III. Internship/Independent Study/Study Abroad Options

In addition to the traditional Thesis project, the Honors College curriculum allows students the option of fulfilling requirements by some combination of independent study, internship experience, and Study Abroad. Students must complete a total of 6 pre-approved credits of course work in order to complete this requirement of the Honors College program. For example, and Honors Internship (HONR 493), associated with Directed Readings (BIOL 481), Please note that these credits will not count towards the Biology major. However, they will fulfill (if approved) the Honors College requirements and contribute the fulfillment of overall graduation requirements.

1. Choose a Biology faculty advisor whose interests are closest to your interests and career goal.
2. Discuss the characteristics of your proposed experience with your advisor.
3. For internships, meet with the departmental Internship Coordinator and contact the Career Center regarding available internships and expectations. There are procedures to develop your own internship if existing internships do not fit your interests. The Study Abroad office would be the appropriate place to start for an experience that includes study outside of the U. S. The Independent Study option requires a detailed outline of the topic that you plan to investigate.
4. Contact the Biology Honors Coordinator concerning your plans to fulfill the Honors College experience via one of these options.
5. Prepare and submit a proposal syllabus to the Honors College. The proposal should outline your learning goals for the experience and how it complements both your overall academic plan and your Honors experience. A template for the proposal syllabus may be found in the Appendix of the Honors College Student Handbook (<http://www.towson.edu/honors/forms/>). To enroll in an Honors Independent Study/ Honors Directed Reading/ Honors Internship, **students must submit a proposal syllabus for the course to the Honors College no later than the last day of the Change of Schedule period for the semester in which the student plans to enroll.** Students wishing to enroll in HONR 493 (Internship) must submit their syllabus to the Honors College for approval at least two weeks before they begin their internship. Students may be able to earn honors credit for a departmental Directed Readings (BIOL 481).

Students who are interested in receiving honors credit for Directed Readings must also submit a proposal syllabus for the course to the Honors College no later than the last day of the Change of Schedule period for the semester in which the student plans to enroll. Students may use the honors syllabus templates as a guide, and they should clearly state how the honors course differs from a traditional departmental Directed Readings.

6. Oral Presentation: The Honors Seminar is a public presentation of the experience or an overview of the independent study project. The seminar should be a 20-30 minute synopsis of the work, followed by a discussion of the work by the audience. Post Announcements for the Oral Presentation of your research at least one week in advance.

7. A signed original and an additional signed copy of the written report must be delivered to the Honors College by the last day of the final exam period. When received, “Departmental Honors” will appear on your diploma and final transcript. A copy of the report should be delivered to the Biology Honors Coordinator by the last day of the final exam period for a department copy.

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