

The Biology Major's Handbook

17th Edition

Fall 2016-Spring 2017

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 If you encounter material that is out-of-date, possibly incorrect, unclear, or downright confusing, please let us know.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 to the 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. Laura Gough (pronounced “Goff”).

The Biology Department Office is located in Smith Hall, Room 341, and can be reached by phone at 410-704-3043, or by e-mail at sgrue@towson.edu. The Biology Department has several staff members but the two people with whom students interact the most are the senior administrative assistant, Ms. Cindy Evans, and the administrative assistant, Ms. Sarah Grue.

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: <https://www.towson.edu/fcsm/departments/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

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 about Courses, Professors, Classroom Situations, Etc.

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 associate chair of the department, Dr. Brian Masters. Dr. Masters can be reached by e-mail at bmasters@towson.edu or 410-704-2035.

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Everyone participating in this course is expected to be respectful of each other without regard to race, class, linguistic background, religion, political beliefs, sex, gender identity or expression, sexual orientation, ethnicity, age, veteran's status, or physical ability and characteristics. If you feel these expectations have not been met, please speak with the instructor or the designated diversity liaison, Dr. Brian Masters, bmasters@towson.edu

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).

MB3 majors take basic courses in three areas: molecular biology, biochemistry, and bioinformatics. They then choose one of these three areas as a "track" in which to specialize. In addition, all MB3 majors are strongly encouraged 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. Nadim Alkharouf. Dr. Alkharouf can be found in the York Road Building (Bill Bateman's building), room 423, and can be reached by e-mail at MB3@towson.edu or by phone at 410-704-3149. The program's website is: <http://www.towson.edu/fcsm/departments/molecularbio/>.

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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 ENVIS 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. Chris Salice. Dr. Salice can be found in the Administration Bldg, Room 213 (or Smith Hall, Room 561) and can be reached by e-mail at csalice@towson.edu or by phone at 410-704-4920. The program's website is: <http://www.towson.edu/fcsm/departments/environsci/>.

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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 (Organismal Biology and Ecology concentration) 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 see the major's website at: <https://www.towson.edu/cla/departments/interdisciplinary/undergrad/interdisciplinary/animalbehavior/> and visit in person with the director of the Animal Behavior Program, Dr. Mark Bulmer. Dr. Bulmer can be found in Smith Hall, Room 261, and can be reached by e-mail at mbulmer@towson.edu or by phone at 410-704-4065.

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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 of 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://inside.towson.edu/generalcampus/tupolicies/documents/03-01.00%20Student%20Academic%20Integrity%20Policy.pdf>

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 “2019-2020” 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 were major changes in the required amount of coursework for students choosing this concentration. These changes substantially reduced what was an exceptionally heavy course load. 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 a 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.html>. 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 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 can be found at:

<http://inside.towson.edu/UniversityRelations/GenEds/GenEdRequirements.cfm>

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 that website.

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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/grades/prior.html> (Credit for Prior Learning Program, Office of the Registrar, Enrollment Services Bldg., Room 231; 410-704-2471).

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Transferring in Courses from Other Schools and the Minimum Amount of Coursework One Must Complete at Towson University

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, including Core and major courses. Biology majors must take a minimum of 19 Biology course credits at TU, with at least 10 of these credits coming from upper (300–400) level courses. “Biology courses” include BIOL courses as well as MBBB 301 & 315 and CHEM 351 & 356.

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 of how to transfer summer credits to TU, if you take summer coursework at a different institution.

A special note 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 131/131L and 132/132L. 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 221 and 222 at TU.

If you want to take *basic* chemistry (do NOT take Organic Chemistry at a community college) or 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.

There is also a second potential problem with taking *some* courses required for your major in summer. These include Chem 131/131 and BIOL 221/221L.

Say you were planning to take CHEM 131/131L at TU (or equivalent at a community college) over the summer and CHEM 132/132L at TU in the fall. When you register for fall classes in the spring, the registration system will not let you register for CHEM 132/132L if you have not enrolled in CHEM 131/131L. What to do? Before registering for fall courses, contact the Department of Chemistry office (Smith 541 - 410-704-3058) to get permission to register for the desired section of the chemistry course in the fall. Note that Chemistry will check before the fall semester starts to make sure that you completed the first course, say CHEM 131/131L, with a C or better, in the summer. Otherwise you will be disenrolled from CHEM 132/132L.

The same is true for Anatomy and Physiology I (BIOL 221/221L and 222/222L). If you wish to take just BIOL 221/221L over the summer and to take BIOL 222/222L 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 222/222L in fall. You must then also follow up with her when you have completed BIOL 221/221L and provide evidence that you have earned a C or better.

At present, you will NOT run into the same problems with Physics 211 and 212. Even if you have not yet had the first semester course (PHYS 211 or 241), you can still register for the second course, PHYS 212 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.

Note, however, that students are required to have departmental permission to take PHYS 211 and 212 in any semester. To get this permission, students need to send an email to the Physics, Astronomy and Geoscience Department – PAGS@towson.edu – and provide their name, their TU ID number, and a list of course sections that would fit their schedule, indicating their priority.

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/University Core 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 “Transfer Petition 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 obtained from: <http://www.towson.edu/registrar/forms.html>.
- 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 “Transfer Petition” 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 form may be obtained from <http://www.towson.edu/registrar/forms.html>.

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 131/131L and CHEM 132/132L 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 131/131L and 132/132L. 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. Students with a cumulative GPA of 3.25-3.39 may register for 20 credits. Those with a GPA of 3.5-4.0 may take 21 credits. Graduating seniors in their last semester must get permission from the Registrar’s Office to take more than 19 credits.

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 4 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/>.

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://inside.towson.edu/generalcampus/tupolicies/documents/03-01.00%20Student%20Academic%20Integrity%20Policy.pdf>. Here, infractions such as **cheating, plagiarism, fabrication/falsification, and self-plagiarism (multiple submission of the same 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, you must put quotation marks around this material and provide a citation to the source of the material.

There are, however, other forms of plagiarism that students often do not recognize. One form is 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.

There is also so-called “self-plagiarism” It is generally unacceptable to submit the same work for assignments in two classes. Be careful to avoid such multiple submissions, and if overlap seems unavoidable, consult with your instructor right away.

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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-D-F Grading Option (formerly known as the “Pass/Fail” option)

Students may elect to be graded on a Pass-D-F basis for up to **13** credits of coursework. *However, students may not elect the Pass-D-F grading option for courses that are required for their major or minor or a certificate, e.g., a teaching certificate.* The 13 credit rule applies to all students, even those students whose undergraduate catalog says the limit is 12.

If a student elects to take a course on a Pass-D-F 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-D-F Grading Option” refers just to courses in which students normally receive letter grades.

Changes to the Pass-D-F 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://www.towson.edu/registrar/calendars/index.html>. You *cannot* change to the Pass-D-F option online. Instead, you must complete a Course Schedule Change Form (Drop/Add) found at: <http://www.towson.edu/registrar/forms.html> 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).

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Auditing a Course

When one audits a course, one “sits in” on the course but does not get a letter grade. Rather, if one is “successful” in auditing a course, an “AU” appears on one’s transcript in place of a grade, next to the course name. It costs the same to audit a course as to take a course for a grade.

One can sign up to audit a course in the coming session during registration. The instructor’s permission is needed to do so, however. One can also switch from taking a course for a grade to auditing the course after the semester has started but, again, the instructor’s permission is needed to do so and the instructor is under no obligation to allow an audit. If permission *is* granted to change to an audit, this must be done by a specific date (the deadline is the same as the deadline for changing to the pass grading option – see above - or for withdrawing from a course – see below). To switch from taking a course for a grade to an audit, one must present a completed Change of Schedule Form with the instructor’s signature (and departmental stamp, if necessary) to the Registrar’s Customer Service Center, Enrollment Services Bldg, room 223, by the deadline.

The requirements for a successful audit are set by the instructor and the student should discuss such requirements before signing up to audit the class. In most cases, instructors will insist that the student attend every class session, including lecture and laboratory. The student may also be required to complete homework assignments, lab reports, etc. In other words, the student may have to do all the work for the course except take the exams. If the student fails to meet the instructor’s requirements for a successful audit, they will “fail” an audit and receive a grade of “AUX” on their transcript.

Before asking to audit a course, a student should discuss this option with both the instructor of the course and their academic advisor. In many cases, it will not make sense to pay “full price” to simply audit a course, as audits usually do not carry much if any weight with employers or professional schools or graduate schools (there can be exceptions, however). In addition, many students have trouble finding the motivation to go to class or do the required assignments when they are not being graded. A grade of AUX on a transcript looks particularly bad and is something to very much avoid.

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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).

One possible issue when considering withdrawing is that some courses, most notably the Human Anatomy and Physiology courses (BIOL 221 and 222), allow students a limited number of attempts at the course. See more information on this below.

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 that 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 financial aid

There are many different grants, scholarships and loans that TU students can get and each have their own set of requirements. Students who are thinking about dropping or withdrawing below 12 credits should carefully review the requirements outlined in the TU Award Guide (www.towson.edu/aidguide) and at <http://www.towson.edu/admissions/financialaid/guide/requirements/index.html>. Students with any questions about these requirements should contact the Financial Aid Office (Enrollment Services Bldg, Room 339; 410-704-4236; finaid@towson.edu) to see how their aid might 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 Marshall Hall, Suite 50. 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, getting a waiver is less likely under the following conditions:

- the student has already been granted a waiver in a previous semester (typically one gets one waiver)
- the student will drop below 9 active credits
- the student has a history of conduct/behavioral issues (e.g., alcohol violations)

If, for one or more of these reasons, a student feels like they may be denied a waiver, it is strongly recommended that they set up an appointment with Housing and Residence Life Office (Marshall Hall Suite 50) to discuss their situation.

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://www.towson.edu/registrar/calendars/index.html>. 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). The petition for *selective* late retroactive withdrawal, from some but not all courses, must be submitted prior to the start of the final exam period; *full* retroactive withdrawal, from all courses, can even be submitted well beyond the end of the relevant semester.

Medical and emergency withdrawals look exactly the same as other withdrawals on your transcript. Therefore, if you recognize a medical reason or emergency in time to withdraw on your own, there is no need to petition the Academic Standards Committee.

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 or other university during the summer and have the grade replace the grade at TU in the calculation of the GPA (grades from 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 Third Attempt at a Course petition found at: <http://www.towson.edu/registrar/forms.html>. 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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A Special Note on Repeating Human Anatomy and Physiology courses (BIOL 221 and BIOL 222)

Students are limited to **TWO** attempts in each of the courses. If a student registers for the course but later withdraws, this is still counted as an attempt.

Students may appeal for a third attempt. Students must provide a written appeal with supporting documentation directly to the course coordinator for these courses, Dr. Colleen Winters (cwinters@towson.edu). Students with documented health issues or family issues that have directly impacted their abilities in the course, or other issues beyond their control will be considered for a third attempt consistent with the Academic Standards Committee use of late/retroactive withdrawal exceptions.

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 are also subject to more stringent requirements for completing attempted courses and avoiding withdraws and repeated coursework. These requirements are outlined in the “Satisfactory Academic Progress Policy” at

<http://www.towson.edu/admissions/financialaid/guide/requirements/sap.html>”

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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Requesting a Transcript

Current students can request their official transcript through [Towson Online Services](#). Students simply go to Self Service and, under the heading *Academics*, click on the drop down and select *Transcript: Request*, to request an official transcript or select *Transcript: Unofficial Transcript* to view the unofficial transcript. For information on the forms (e.g., paper or electronic) and cost of transcripts, see:

<http://www.towson.edu/registrar/grades/transcript.html>

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/apply.html>.

Students approaching graduation can also make an appointment with the Transfer Student Advisor 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, students should contact the Biology Department Office by phone at 410-704-3043.

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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 using a Change of Address form at <http://www.towson.edu/registrar/forms.html>. That website also has a Change of Name form as well.

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COURSE REQUIREMENTS AND COURSE OPTIONS FOR THE BIOLOGY DEGREE

Foundation, Ancillary, Breadth, and Elective Courses

All Biology majors are required to take a set of foundation, ancillary, breadth, and elective courses.

Foundation 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 the [Quick Guide to the Biology Major Concentrations](#) document which is found at the following website:

<https://www.towson.edu/fcsm/departments/biology/resources/degreecompletion.html>.

Course checklists for each concentration are also available at this website and in the Biology Department Office.

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How to Declare a Concentration

One declares a concentration using an online Change of Major/Minor form, which is found at: <http://www.towson.edu/registrar/forms.html>

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.

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 the required course “concurrently,” i.e., during the same semester, which makes it a “co-requisite.” 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-D-F 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 Biology 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. See the [Anticipated Offerings of Biology Courses in Coming Semesters](#) document which is found at the following website: <https://www.towson.edu/fcsm/departments/biology/resources/degreecompletion.html>

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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A Special Note on Taking Physics Courses

Students must take either non-calculus based PHYS 211/212 or calculus-based PHYS 241/242 for the Biology degree. Students are required to have departmental permission to take PHYS 211 and 212 in any semester. To get this permission, students need to send an email to the Physics, Astronomy and Geoscience Department – PAGS@towson.edu – and provide their name, their TU ID number, and a list of course sections that would fit their schedule, indicating their priority.

No permission is required to take PHYS 241 or 242.

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. Please note that graduation with honors is distinct from the traditional Latin honors (e. g., magna cum laude) based only on class rank and cumulative grade point average.

There are two types of “graduation with honors” at Towson University: graduation with *University Honors* and graduation with *Departmental Honors*. Only students admitted to the Honors College graduate with university honors. However, *any* student can graduate with departmental honors, provided that they meet the requirements. Note: Students in the Honors College can graduate with both university and departmental honors but they must apply for the latter and 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. The types of projects available to students are described in [Appendix 5](#).

Students still interested in obtaining Department Honors should consult with the Biology Honors Coordinator, preferably by the end of their sophomore year. Currently the Biology Honors Coordinator is Dr. Erik Scully (Smith 261, 410-704-3012; escully@towson.edu).

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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. As already mentioned, students interested in animal behavior, which falls under the IDIS major (interdisciplinary), would typically take a second major in biology (or possibly psychology), as half the requirements for the Animal Behavior major fall in each of these other departments.

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. 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, found at: <http://www.towson.edu/registrar/forms.html>.

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 an advisor in that major. Students will want to visit advisors for both majors on a regular basis to ensure that they are taking the best set of courses and that they are on track to graduate on time.

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://www.towson.edu/registrar/forms.html>.

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THE BIOLOGY MINOR: COURSE REQUIREMENTS AND COURSE OPTIONS

To complete the Biology minor, students are required to take CHEM 131/131L and CHEM 132/132L- (General Chemistry I and 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 221-222-Human Anatomy and Physiology I, II, but additional coursework will then be necessary to attain the required total of 6 upper-level (300-400 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 221 and 222.

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TIME REQUIRED TO COMPLETE THE BACHELOR’S DEGREE

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

Statistics show that most Biology majors do *not* finish their degree four years! The majority of students take 4, 4 1/2, or 5 years or even longer to finish their B.S. degree. Unfortunately, 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.

You can change advisors if desired. See below.

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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 and/or 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 whose advice they would especially value
- 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 absolutely change advisors without fear of retribution of any kind. Students do NOT need the permission of their current advisor. In fact, the former advisor is not told a student has requested a change in advisors; the student simply disappears from their list of advisees.

To change your advisor, email the Co-Chair of the Biology Department's Advising Committee, Dr. Erik Silldorff at esilldorff@towson.edu. If you have a faculty member in mind, let Dr. Silldorff know who that person is and whether you have asked that person if they will take you on as an advisee.

If you do not have a particular new advisor in mind, let Dr. Silldorff know your concentration and your career interests so he can assign you to a proper advisor.

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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) must have completed **at least 12 hours of Biology course work**, including at least one course in addition to BIOL 201 and BIOL 202, or their equivalents, 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 members can 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. Matt Hemm (Smith Hall, Rm 483, mhemm@towson.edu, 410-704-2996).

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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 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 or send an e-mail to the Director at the address below. 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 at preprofessional@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 woman-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 advisors of WISP are Dr. Cindy Ghent (cghent@towson.edu) and Dr. Peko Tsuji (ptsuji@towson.edu). See also the WISP website, <https://www.towson.edu/fesm/diversity/womeninscience/> for more information.

The current faculty advisors of the student-run TU WIS Club are Dr. Beth Kautzman (kkautzman@towson.edu) and Dr. Peko Tsuji (ptsuji@towson.edu). See also the TU WIS Club website, <https://wp.towson.edu/wisc/>, for more information.

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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 if they have been offered FWS funds by reviewing their TU aid offers using TU's "Online Services," which are outlined at www.towson.edu/aidforms or by contacting the Financial Aid Office (Enrollment Services Bldg, Room 339; 410-704-4236; finaid@towson.edu). Students who were not offered FWS funds, but who did submit a FAFSA and did demonstrate financial need may appeal to the Financial Aid Office to request 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.towson.edu/careercenter/hire/index.html>. 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. 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: Dr. Rich Seigel, Smith 319A (410-704-3123)

Additional FWS positions may be available within the Molecular Biology, Biochemistry, and Bioinformatics program. You can contact the director of the program, Dr. Nadim Alkharouf. Dr. Alkharouf can be found in the York Road Building (Bill Bateman's building), room 423, and can be reached by e-mail at MB3@towson.edu or by phone at 410-704-3149.

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

<http://www.towson.edu/admissions/financialaid/programs/employment/workstudy.html>

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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 at:

<http://www.towson.edu/biology/student/employment.asp>. 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/>.

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.

For information how to apply for all available aid programs including grants, scholarships and loans, students should visit the TU Financial Aid Office web site at www.towson.edu/finaid.

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 credits of 300+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

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 www.towson.edu/scholarships or should contact the TU Financial Aid Office (Enrollment Services Bldg, Room 339; 410-704-4236).

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. Visit the www.towson.edu/scholarships for a variety of scholarship resources including TU's [Scholarship Seeker](#), and links to several [Private Scholarship](#) search sites.

Because no single web site will include links to all available scholarships. We also encourage students to do their own online searches using keyword phrases such as “undergraduate scholarships fellowships.” These are some of the resources we found:

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

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

<http://orise.orau.gov/science-education/internships-scholarships-fellowships/default.aspx>

<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 being done by various faculty members. You can do this by talking to your advisor or other Biology faculty but it will also be very helpful to look at faculty webpages on the Biology Department's website (you can start here:

<http://www.towson.edu/fcsm/departments/biology/facultystaff/index.html>). Make a prioritized list of those faculty whose research is of most interest to you.

2. Most faculty doing research will have published papers in scientific journals in the last several years. We strongly suggest that you obtain one or two papers published by the potential research mentor(s) at the top of your list. You can get those papers through the Cook Library website (start by clicking on "Journal List" on the left side of the library's main website). However, the easiest thing to do is send the faculty member an email asking for a PDF of the paper(s) that look most interesting to you.

Read those papers. You likely will not understand everything in each paper (and don't let that bother you!) but this still will have two big benefits. First, it will give you a better idea of what the faculty member does for research and will help you decide whether you want to work with them. Second, if and when you meet with the faculty member, having read their work will show a high level of interest in their research and make you that much more able to discuss research with the faculty member.

3. Contact faculty members whose research is of interest to you and arrange to meet them in person. Send an email with the following components:

- A statement that indicates that you are "interested in their research." But don't just say that. Be specific enough that the faculty member knows that you have actually looked closely at the research they do and have even read some of their scientific publications. For example, a faculty member's webpage may indicate that they "study the role of small proteins in bacterial cells." However, if you delve more deeply and read their publications, you will find that the research specifically investigates the role of small proteins in helping bacteria deal with various environmental stressors. When you write the professor, you can indicate that you are interested in his/her work on "the function of small proteins in bacterial cells" but especially "how small proteins help bacteria deal with different stressful environmental

conditions”... or something similar. This will tell the potential mentor that you have done more than just glance at the website and see their *general* area of research. It shows you have “done your homework” and are “willing to go the extra mile” to achieve your goals. This is exactly the type of student professors want in their research labs.

- A description of yourself, including where you are in your schooling (e.g., “first semester sophomore”), what science courses you have had (also list your grades and GPA if they are good!), and what you plan to do after graduation.
- A request to meet with them to talk about their research. Provide a complete list of days and times that you are free to come to their office to learn more.

Whatever you do, DO NOT simply send an email asking to do research with them without providing any other information as described above. Faculty members receive many requests from students for research opportunities and cannot take on every student who approaches them. Most faculty members will give a preference to students who express a well-informed and strong interest in their research.

If you do not hear back from the potential mentor within a week, feel free to email them again. Remember, if a faculty member does not respond immediately it is likely because they are very busy. If you do not hear back within a week of your second email, that’s not a good sign and you should approach other faculty members.

3. In your face-to-face meeting with each faculty member, find out what types of projects they are currently pursuing and whether or not they are accepting new undergraduate students for those projects. Be prepared to describe again what courses you have had, what your career goals are, and how much time per week you can commit to research. You may also ask to talk to the faculty member’s current research students to see what their experience has been like working with that faculty member.

4. Based on your “interviews” with various faculty, you should be able to decide with whom you would most like to do research. 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.

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, 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 or more of the professors who teach and/or do research on animal physiology. They may have contacts that either have positions or will know where positions are listed.

Second, you can, of course, search the internet using keywords like "undergraduate biology research internship opportunity" etc. Among other things, this type of search should turn up opportunities offered by specific institutions. Examples can be found at the following websites:

<http://www.murf.caltech.edu/>

<http://www.pennstatehershey.org/web/summerresearch/home>

<http://www.med.nyu.edu/sackler/summer-undergraduate-research-program-surp>

<http://www.sloankettering.edu/gerstner/html/54513.cfm>

<http://www.bcm.edu/smart/>

<http://gsbs.utmb.edu/surp/>

<http://www.pasteurfoundation.org/scientific-careers/summer-internship>

<http://www.colorado.edu/GraduateSchool/DiversityInitiative/>

<http://www.massgeneral.org/mao/education/internship.aspx?id=5>

<http://www.mayo.edu/mgs/surf.html>

<http://ssrp.stanford.edu/criteria.html>

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

Online searches can 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>), the Rochester Institute of Technology (<http://people.rit.edu/gtfsbi/Symp/calpha20011.htm>) and the American Society for Biochemistry and Molecular Biology (<http://www.asbmb.org/summerresearch/>).

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. *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/>).

Other government-based research positions are available through the Oak Ridge Institute for Science Education (ORISE) (<http://orise.orau.gov/science-education/internships-scholarships-fellowships/default.aspx>), 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; <https://www.training.nih.gov/programs/sip>). NIH places students in research laboratories throughout the country, including in Baltimore.

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/index.php/education/students/students/25-education/students/7827-asm-undergraduate-research-fellowship-asm-urf>.

Students interested in conducting research at the Smithsonian's National Museum of Natural History should investigate their Research Training Program: <http://naturalhistory.si.edu/NHRE/>

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/>. Still other opportunities are available through the United States Department of Agriculture (<http://www.dm.usda.gov/employ/sip/>) and Department of Homeland Security (<http://www.dhs.gov/homeland-security-careers/students>).

Other summer research opportunities for undergraduates 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 is described below. **Consent of instructor “teaching the course” – the *research supervisor* - is required to enroll in each course; you cannot simply “sign up.”**

BIOL 490 Independent Research (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 – see below).

Some details:

- Students can sign up for 1, 2, or 3 credits, depending on the extent and scope of the research project: 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 the 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 9 total credits earned, but each time the student enrolls they must be working with a different faculty member.
- Students do not get a traditional letter grade for this course. Rather, the course is graded “S/U” meaning students get either a grade of S (Satisfactory) or U (Unsatisfactory).
- 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 Independent Research (3 credits)

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. The project must be substantial enough that three credits are warranted. Students should spend an average of at least 12 hours a week on the research project or at least 168 hours on the project total. Unlike Biol 490, students can use Biol 491 as one of their “elective” course to count towards the Biology degree.

Some details:

- BIOL 491 can be repeated once for a total of 6 credits. However, they can use the course only one time to count as an elective course for their degree requirements.

Obtaining course credit for doing research off-campus

One 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 or 491 (see descriptions of latter two courses above). Be aware, however, that if you choose BIOL 490 or 493, the credits will not count towards the major. They will count as upper level credits required for graduation. If you choose Biol 491, those credits will count as elective credits towards the major.

Whatever you choose to do, 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 which TU course to sign up for and, in the case of Biol 490 and 493, how many credits 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 5](#). 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 hours 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 to do 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 (this can be waived in special circumstances).
- 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://www.towson.edu/careercenter/students/internships/>

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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; lwimmers@towson.edu). 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 the 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://profinterns.disneycareers.com/en/students-recent-grads/operations/sciences-horticulture-zoology/>

The Smithsonian Institution has a variety of internships, most in Maryland (<http://www.si.edu/ofg/intern.htm#inmnh>).

Pre-medical and pre-dental students may want to check out the Summer Health Professions Education Program offered at many universities around the country (<http://www.shpep.org/>).

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 of details must be worked out. You and your prospective 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 webpage (<http://www.towson.edu/careercenter/employers/>), 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. However, BIOL 493 is by permission only course. You can only enroll in the course by contacting the departmental Internship Coordinator (currently, Dr. Erik Scully, Smith Hall 261). You must be able to furnish proof that you have been accepted for an internship before enrolling in BIOL 493. The Biology Department and the University are not obligated to find you an internship because you wish to enroll in BIOL 493.

BIOL 493 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).

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.

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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 would be a course 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/mbcolleges.html> for a list of such programs).

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: <https://www.towson.edu/academicadvising/exchange/>.

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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.

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 or University Core 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/academics/international/abroad/scholarships.html>.

The Study Abroad Office, which is located on the 4th floor of the Psychology 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/academics/international/abroad/>. 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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INFORMATION ON CERTAIN CAREER OPTIONS FOR THE BIOLOGY MAJOR

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.

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.

An absolute wealth of information on medical schools, medical school requirements, and strategies for preparing for, and getting into, medical or dental school is found in documents located on this website: <https://www.towson.edu/fcsm/departments/biology/resources/degreecompletion.html>.

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 Pre-professional Program has an email contact list, which you should join as soon as you start TU by emailing Pre-professional@towson.edu and asking to be put on the list. This list notifies students of important information pertaining to MCAT/DAT scheduling, application deadlines, and interview protocols, as well as inviting students to meetings with guest speakers, such as the Dean of Admissions for medical or dental school, or alumni that are currently attending medical or dental schools.

All pre-medical/pre-dental students should also join the student-led Premedical and Predental Club by emailing tupreprofessional@gmail.com. This student-led group meets approximately once a month to discuss

pertinent issues, host relevant speakers, and organize or inform about community service or clinical volunteer opportunities.

There is also another student-led club to address the issues of minority students applying to med school, called **Minority Association of Pre-Medical Students (MAPS)**. Although the club was formed to address concerns of minority pre-medical students, they also welcome pre-dent students, as many of the same issues would apply to pre-dent students. See <https://involved.towson.edu/organization/TowsonMAPS> for more information.

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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. 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.

For much more information on this profession, see the Pre-PA Guidelines document on this website: <https://www.towson.edu/fcsm/departments/biology/resources/degreecompletion.html>.

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Veterinary Medicine

Students wanting to become veterinarians should 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 the GRE General Test (described in detail in the section on Graduate School below) and a few schools will accept the Medical College Admissions Test. 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.

Pre-veterinary students are urged to contact the Biology Department's Pre-Vet advisor, Dr. Jack Shepard (Smith Hall, Room 259; jsheward@towson.edu; 410-704-2394) for more information. Before doing so, see the Pre-Vet Guidelines document prepared by Dr. Shepard on this website: <https://www.towson.edu/fcsm/departments/biology/resources/degreecompletion.html>.

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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 two 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 318 General Microbiology (4 credits)
- CHEM 131+131L-General Chemistry I (4 credits) *and*
CHEM 132+132L-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) or ENGL 190
and another ENGL course
- 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: 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's teacher training program is called UTeach. For further information on the program and requirements, see: <http://www.towson.edu/uteach/>.

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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. ***It is extremely good idea to set up an appointment with the Career Center to look over your cover letter, resume, and other materials.*** They are the experts. 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 is a special kind of resume used in science and medicine. *Curriculum vitae* translates from Latin into "what I have done with my life"). A "CV" differs from a standard resume in that it provides more information and more details and, consequently, can stretch to several pages.

Detailed information on how to prepare a resume is provided to students in the Biol 204 – *Educational and Career Planning for the Biologist* course. For a copy of the materials from that course, please email Dr. Scott Johnson: sjohnson@towson.edu.

A detailed description of how to prepare a curriculum vitae is found below in [Appendix 2](#).

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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
 - * 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.
- Information on how to contact you to tell you that the letter is ready or has been sent

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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GRADUATE SCHOOL

What is Graduate School?

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

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

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

Why Do People Go to Graduate School?

- Some people attend graduate school to gain promotion or higher pay in their *current* profession, e.g., teachers.
- Some 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 conducting experiments designed by individuals that *do* have advanced degrees. If you are interested in obtaining higher-paying, more interesting, decision-making level positions in Biology, you often need graduate-school training.
- Some people attend graduate school to improve their “academic record” to give themselves a better chance of getting into, say, medical, dental, physician’s assistant, or pharmacy school. They take more courses to try and boost their GPA and they may engage in a small research project or even thesis research to get the “research experience” that so many professional schools want students to have.
- However, MOST people go to graduate school because they want to study and explore some particular area of Biology in more detail. In particular, they want to do their *own* research, discover new things about the natural world, and publish their results for others to see. In other words, they want to become true *scientists*.

Two Great Misconceptions About Graduate School

Many TU undergraduates do not even consider graduate school because they suffer from two misconceptions about graduate school. First, they mistakenly assume that “grad school” is just more of the same, i.e., *more* classes and *more* tests (but probably a lot harder). Yes, some coursework is involved in getting a graduate degree but the difference is that you take primarily courses in your specific area of interest. For example, a student may come to TU *generally* interested in molecular biology. After taking a number of undergraduate courses, the student discovers that he/she is particularly intrigued in how a particular human disease, like multiple sclerosis, works on a molecular basis. If this student heads off to grad school to study this topic in more detail, he/she may take graduate courses almost exclusively in the areas of advanced immunology, medical molecular biology, pharmacology, cancer biology, advanced virology and closely related fields.

These courses will often be taught by professors actively doing research in these areas. Moreover, the structure of graduate courses usually differs from that of undergraduate courses. Much more time is spent on the cutting-edge, *i.e.*, examining new and exciting discoveries. Many of your assignments will be to read primary literature articles, 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 thesis-type M.S. programs and especially Ph.D. programs is *conducting original research, involving bench-work experiments*. Under the guidance of a professor – a research mentor - 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 frequently published in scientific journals. *There is nothing quite like the thrill of making an original contribution of new information to one's favorite area of Biology.*

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

Further Information On Graduate School

TU faculty have prepared two *extensive* “guides” to graduate school that tell you more about what graduate school is like, how to identify a good graduate school, types of financial aid available, how to apply, how to interview and much, much more. One guide is for students generally interested in Organismal Biology and Ecology (including ecology, evolution, conservation biology, animal behavior, zoology, botany, etc.). The second guide is for students interested in cellular or molecular biology, anatomy and physiology, or biomedical research. There is a third, smaller guide for students going into secondary education.

Students in the Biol 204 – *Educational and Career Planning for the Biologist* course will have access to these guides for an assignment. ANY student can request the latest version of one of the guides from Dr. Scott Johnson: sjohnson@towson.edu.

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Appendix 1: Sample cover letter to send to prospective graduate supervisor

31 November 2021

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

Dear Dr. Winges,

I would like to introduce myself and inquire about applying to do graduate work under your supervision, starting in the fall of 2020.

I am currently an undergraduate at Towson University, near Baltimore, and will be graduating in May, 2019, with a B.S. in Biology. I have attached my CV and a list of science and math courses that I have taken, along with grades received. My overall GPA is 3.65, my GPA in Biology courses is 3.58, and my GPA in all science and math courses is 3.49. My scores on the GRE General Test were 550 on the Verbal section, 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 2020. 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 2: How to Prepare a Curriculum Vitae (CV)

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

In general, a CV should contain the following information:

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

Maria Q. Student

203 Learning Road
Baltimore, MD 21228

410-555-8309

Mstudel@students.towson.edu

Education

Program: B.S. Biology/Molecular Biology, Biochemistry & Bioinformatics

Degree expected: May 2021

Institution: Towson University

Overall GPA: 3.78 GPA in science/math courses: 3.58 GPA in biology courses: 3.73

Scholarships, Fellowships, Honors, and Awards

- Honorable Mention, Barnard Rubble Award; Best Undergraduate Researcher
Towson University – Department of Biological Sciences, 2020
- Elected to Beta Beta Beta Biological Honor Society, 2019
- CoSMiC Scholarship, Towson University – Department of Biological Sciences, 2018-2019
- Lions Clubs of Maryland University Scholarship, 2017

Employment

Position: Animal Caretaker, Veterinary Assistant

Dates: March 2020-present

Location: Cat Hospital at Towson

Research Experience

Position: Participant, NSF Research Experience for Undergraduates Program, Indiana University

Dates: Summer 2019

Project: DNA damage in response to excessive meat consumption

Supervisor: Dr. Wes T.R. Blotto

Duties/skills: DNA & RNA extraction, protein and PCR analysis

Position: Undergraduate Research Assistant, Towson University

Dates: September 2017-May 2018

Project: Mammalian DNA damage response pathways

Supervisor: Dr. Regina T. Peaciahr

Duties/skills: Biochemical and cell-based assays, including tissue culture

Research Funding

Undergraduate Research Grant, Fisher College of Science and Mathematics, Fall 2020, \$500

Sigma-Xi Scientific Research Society Grant-in-Aid-of- Research, Fall 2020, \$650

Presentations

Student, M.Q. and Peaciahr, R.T. “Effect of polyphenols in the UV light-induced damage in skin epithelial cells.” Experimental Biology meeting, Boston, NE, October 2020.

Publications

Peaciahr, R.T., Student, M.Q., and Smart, I. M. 2021. UV light-induced oxidative damage can be prevented with green tea polyphenols. *Journal of Biological Chemistry* (in press).

Membership in Professional Societies

American Association for Cancer Research, 2019- present
Beta Beta Beta Biological Honor Society, 2018-present
Sigma Xi Scientific Research Society, 2018- present

Extra-curricular Activities

Secretary, Beta Beta Beta Biological Honor Society, 2019-present
Volunteer, Habitat-for-Humanity of Baltimore, 2017-2018

References

Dr. Wes T.R. Blotto
Dept. of Biology
Indiana University
Bloomington, IN 33445
346-555-2373
wblotto@iu.edu

Dr. Michael Menten
Dept. of Biological Sciences
Towson University
Towson, MD 21252
410-555-4389
mmenten@towson.edu

Dr. Regina T. Peaciahr
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410-555-4388
rtpeaciahr@towson.edu

Appendix 3: Sample listing of courses/grades to send to prospective graduate supervisor or employer

SCIENCE AND MATH COURSES AND GRADES – Maria Q. Student

Biology

BIOL 201: Introduction to Cellular Biology & Genetics	B-
BIOL 202: Introduction to Ecology, Evolution and Behavior	B+
BIOL 204: Career Planning for the Biologist	S
BIOL 205: Biodiversity	A-
BIOL 309: Genetics	B+
BIOL 325: Animal Physiology	B
BIOL 389: Current Developments – Cancer Biology	A
BIOL 408: Cell Biology	A-
BIOL 409: Molecular Biology	B+
BIOL 410: Molecular Biology – Lab	A
BIOL 489: Directed Reading (Biology)	A
BIOL 490: Undergraduate Research	S
BIOL 491: Independent Research	A
BIOL 499: Undergraduate Thesis Project	Currently enrolled
MBBB 301: Introduction to Bioinformatics	A
MBBB 315: Genomics	B+
MBBB 493: Seminar in Bioethics	Currently enrolled

Chemistry

CHEM 131/131L: General Chemistry I	A – (lecture), A (laboratory)
CHEM 132: General Chemistry II	B+ (lecture), B+ (laboratory)
CHEM 210: Intro to Analytical Chemistry	B+
CHEM 331: Organic Chemistry I	B
CHEM 332: Organic Chemistry II	A

Physics

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

Mathematics & Statistics

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

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Appendix 4: 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	$3 \times 3.00 = 9.00$
Phys 211	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 5: Further Details on Obtaining Biology Departmental Honors

Students can pursue Departmental Honors, which appears on their transcript and diploma. To obtain such honors, student must do a major project, typically a research project, and present their results in a written “Honors Thesis.” Projects can involve basic research into any aspect of life on Earth. Projects can also be focused on how we educate students in Biology at the K-12 or undergraduate level (especially useful for students with the Secondary Education concentration).

Any student considering Departmental Honors should contact the Biology Honors Coordinator. Currently the Biology Honors Coordinator is Dr. Erik Scully (Smith 261, 410-704-3012; escully@towson.edu).

Approval of Departmental Honors is done by the Honors College, who submits the approval to the Registrar so that the honor appears on the student’s transcript. For this reason, students pursuing Departmental Honors have to submit paperwork and other material to the Honors College.

Here are the steps involved in obtaining Departmental Honors

1. Select a faculty advisor and design, with the assistance of your advisor, an Honors Thesis project. If your project involves education, then your advisor should be one of the faculty members who specializes in Science Education.
2. Contact the Biology Honors Coordinator if you have not done so to tell him/her what you are doing.
3. Prepare an Honors 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 an Honors 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 the “Honors Thesis Committee and Proposal Approval Form” (See Departmental Honors Program Handbook – (<https://www.towson.edu/honors/faculty/documents/departmental-honors-program-handbook.pdf>)). Submit this, along with a copy of your Honors Thesis proposal to the Honors College.
6. Successfully complete BIOL 491 and 499. Note that up to three of the six 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 (link above) 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 Honors College Handbook – see link above) 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.

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