The Biology Major's Handbook

23rd Edition

Spring 2022-2023

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

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Please direct questions, comments, and suggestions to: cwinters@towson.edu or bmayo@towson.edu

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THE DEPARTMENT OF BIOLOGICAL SCIENCES

Administration, Staff, and Faculty

The current chairperson of the Department of Biological Sciences is Dr. Peko Tsuji. The current assistant chairperson is Dr. Jack Shepard.

The Biology Department Office is located in the Science Complex, Room 4101, and can be reached by phone at 410-704-3042, or by e-mail at biolsci@towson.edu. Your call or email will be answered by the senior administrative assistant, Ms. Sarah Grue, or the administrative assistant, Ms. Brandi Mayo.

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 skilled part-time or "adjunct" faculty to assist in teaching courses.

Departmental Website

The Biology Department website: https://www.towson.edu/fcsm/departments/biology/.

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 the department webpage for upcoming seminar announcements.

If You Have Concerns about Courses, Professors, Classroom Situations, Grades, 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 do not feel that your concerns are being addressed, you can speak to your academic advisor and/or the assistant chair of the department, Dr. Jack Shepard. Dr. Shepard can be reached by e-mail at jshepard@towson.edu.

If you wish to appeal a grade that you have received in a class. The procedure to do so is found here: https://www.towson.edu/fcsm/resources/grade-appeals.html

Diversity Statement

Towson University values diversity and fosters a climate that is grounded in respect and inclusion, enriches the educational experience of students, supports positive classroom and workplace environments, promotes excellence, and cultivates the intellectual and personal growth of the entire university community. Should you feel that you are experiencing a negative environment related to diversity issues or cultural sensitivity, we

encourage you to contact the Department's Assistant Chair, [Dr. Jack Shepard; jshepard@towson.edu]. For more information go to https://www.towson.edu/fcsm/departments/biology/diversity.html

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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 salesperson, 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. 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 wanting more information about this major or wanting to discuss whether their career goals might be better served by this major are encouraged to contact the director of the MB3 program, Dr. Nadim Alkharouf. Dr. Alkharouf can be found in the York Road Building (7800 York Road), room 471, and can be reached by email at MB3@towson.edu or by phone at 410-704-3149. The program's website is: http://www.towson.edu/fcsm/departments/molecularbio/.

Environmental Science

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. Note: During the Fall 2022 semester, Dr. Salice is acting Dean of the Fisher College of Science and Mathematics. Contact Dr. Joel Moore (SC 2150B, email moore@towson.edu or call 410-704-4245) or Ms. Linda Morton (SC 5301A, email envs@towson.edu or call 410-704-4920). The program's website is: http://www.towson.edu/fcsm/departments/environsci/.

Animal Behavior

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 (SC 4150A). Dr. Bulmer 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 (https://www.towson.edu/academics/undergraduate/catalog.html) 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. If 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.

In addition to becoming familiar with the requirements for your chosen major, it would be wise to read the Code of Conduct, (https://www.towson.edu/studentaffairs/policies/documents/code_of_student_conduct.pdf) which describes student rights and responsibilities, prohibited conduct, and other key policies. Posted separately at https://www.towson.edu/about/administration/policies/03-01-00-student-academic-integritypolicy.html 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.)

Changing Your Catalog of Record

Yes. Students should speak with their academic advisor prior to submitting the form to determine the impact their catalog selection may have on their degree requirements. The procedure is described here https://catalog.towson.edu/undergraduate/academic-policies/catalog-selection/
The Catalog Selection Petition Form can be found at http://www.towson.edu/registrar/forms.html. This electronic form must be signed by the major department's chairperson prior to final approval by the Registrar's Office.

Course Requirements for a Bachelor's Degree

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 Core courses. By fulfilling the course requirements for the Biology major, students automatically complete the University Core mathematics requirement (Core #3), and science requirements (Cores #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.
https://www.towson.edu/admissions/undergrad/freshmen/credits/

The Credit for Prior Learning (CPL) Program offers an opportunity for Towson University students to receive college credit for abilities they may have acquired through life experience, personal study, and/or military course work by taking *challenge* tests in the area of their proficiency, presenting portfolios and providing documentation of military course work/experiences. Note, however, that no such exams are available for Biology courses. More information on getting credit for TU 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).

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

Courses taken at other colleges and universities may, if approved, transfer to TU and count towards TU degree requirements. Information on credit limits, coursework and how to gain approval for transferred coursework can be found: https://www.towson.edu/admissions/undergrad/transfer/credit/. Note that 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 (https://www.towson.edu/registrar/grades/standards.html).

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. Prior to enrolling in the course, it is best to verify that it will transfer to TU and count toward your degree credits. It is important financially and for progress in your degree to check this first. • Courses taken at Maryland Community Colleges can be checked on ARTSYS (https://artsys.usmd.edu/).

- Courses taken at other universities and colleges within or outside of Maryland can be checked with the Transfer Evaluation System (https://www.towson.edu/admissions/undergrad/transfer/credit/transferevaluation-system.html). For courses not listed in the system, an Individual Course Petition (https://www.towson.edu/admissions/undergrad/transfer/credit/course-petitions.html) can be submitted for review of the course. Directions for this process can be found on the link.

If the course(s) you plan to take is a prerequisite course for one that you plan to enroll in for the fall, for example CHEM131/L in the summer and CHEM132/L in the fall, the enrollment system will not allow you to enroll in CHEM132/L. In this situation, contact the home department for the course (in this example, Chemistry) to get permission to register for the desired sections of CHEM132/L in the fall.

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Course Load Limits

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. Students may take up to 4 credits during the January Minimester. Students may also take up to 7 credits in any one of the four summer sessions, and a maximum of 13 credits in all four summer sessions combined. Contact Records and Registration (recordsandregistration@towson.edu) to request an overload.

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.

Accessibility & Disability Services

Towson University is committed to providing equal access to its programs and services for all students. Accessibility & Disability Services (ADS), located in the Administration Bldg, Room 232 (410-704-2638) Visit their webpage for more information. https://www.towson.edu/accessibility-disability-services/

Attendance Policies

https://catalog.towson.edu/undergraduate/academic-policies/class-attendance-absence-policy/

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.

Cheating, Plagiarism, and Academic Integrity

All students should review TU's Student Academic Integrity Policy which can be found at: https://www.towson.edu/about/administration/policies/03-01-00-student-academic-integrity-policy.html Here,

infractions such as **cheating**, **plagiarism**, **fabrication/falsification**, and **self-plagiarism (multiple submission of the same assignments)** are all defined.

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 lettergrade basis (these do not count when calculating the GPA). Students must get an S grade in any such courses required for their major. https://www.towson.edu/registrar/grades/policies.html

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The Pass-D-F Grading Option (formerly known as the "Pass/Fail" option)

https://www.towson.edu/registrar/grades/grading-options.html

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.

Auditing a Course

Auditing a course is attending a course without receiving a letter grade in the course. The instructor must give permission to audit a course. Different courses and instructors will require a "contract" and require students to attend class meetings, participate in class discussions, complete assignments, etc. to successfully "complete" the course and receive an AU on their transcript. If these requirements are not met the student will receive an AUX. The cost of auditing the course is the same as taking the course for a grade.

The deadline is the same as withdrawing from a course during the semester. The date can be found on the academic calendar (http://www.towson.edu/registrar/calendars/index.html). Students should submit the online request to their instructor several days before the deadline if possible.

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 online through a student's Towson Online Services account. https://www.towson.edu/about/administration/policies/03-14-00withdrawal-policy.html

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* car insurance companies require that students have at least 12 *active* course credits to be eligible for certain discounts – if in doubt, check with your insurance company or your parents' insurance company if you are under their policy. 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

https://www.towson.edu/admissions/financialaid/guide/requirements/withdrawals.html

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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, because 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 *in person* 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 was granted a waiver in a previous semester (typically a student gets only one waiver)

- the student has a history of conduct/behavioral issues (e.g., alcohol violations)

If a student drops to 8 or fewer active credits, then they may not remain in their residence hall. Exceptions to this may *potentially* be granted but only if the student provided documentation of a medical reason for the reduced number of credits.

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 to discuss their situation (Marshall Hall Suite 50; 410-704-2516; housing@towson.edu).

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.

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 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.

Students wanting to withdraw from one or more courses after the official withdrawal deadline must submit a written appeal to the Academic Standards Committee (ASC). Students wanting to withdraw from one or more courses after the official withdrawal deadline must submit a written appeal to the Academic Standards Committee (ASC). Directions for preparing an appeal may be found: https://www.towson.edu/registrar/grades/documents/howtosubmitanappealtostandards.pdf. Requests must be submitted prior to the beginning of final exams for that semester.

Repeating a Course at TU or Elsewhere – General Policies
https://catalog.towson.edu/undergraduate/academic-policies/repeating-courses/

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Repeating Courses and Financial Aid
If a student repeats a course that they have already completed with a D, C, B, A, or PASS grade, aid regulations restrict the number of times that they can receive **federal aid** to repeat that course even if their major does not accept a C or D grade as a passing grade. Once they earn a "D" or better, they can only receive federal aid to repeat that course one more time. If they repeat it another time, they cannot receive any federal aid.

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.
https://catalog.towson.edu/undergraduate/academic-policies/grades-grading/

Appealing a Grade in a Course
A student who feels the grade they received in a Biology (BIOL) course is inaccurate and wish to appeal for a different grade should follow the steps provided here:
https://www.towson.edu/fcsm/resources/gradeappeals.html.

Satisfactory Academic Progress and Making the "Dean's List"
To remain in good "Academic Standing," a student must maintain a minimum cumulative GPA.
https://catalog.towson.edu/undergraduate/academic-policies/class-standing/
Making the Dean's list: https://catalog.towson.edu/undergraduate/academic-policies/deans-list/

Requesting a Transcript
Current students can request their official transcript through Towson Online Services. 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:
https://catalog.towson.edu/undergraduate/academic-policies/transcripts-academic-records/

Applying for Graduation

Students must apply for graduation several months before they expect to complete their graduation requirements and be given their degree. Deadlines for the application for graduation are Spring graduation - January 15th, Summer - July 4th, Fall - August 15th. Students should, however, check for any changes in these deadlines. Deadlines and instructions on how to apply for graduation online are at: https://www.towson.edu/registrar/graduation/

Taking Graduate Courses as an Undergraduate

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.

Changing Your Address and/or Your Name with the University

If you move, you can quickly and easily update your address online in Peoplesoft. Visit http://www.towson.edu/registrar/forms.html and scroll down to Records and Registration for links to change your address or name.

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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 Ecology, Evolution and Conservation. **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.

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
- Ecology, Evolution and Conservation (formerly Organismal Biology and Ecology)
- Secondary School Biology and General Science Teaching

Selection of a concentration is required by the end of the first 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.

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How to Declare a Concentration

Declaring a concentration is done online using the Change of Major/Minor form:
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.* 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.

Prerequisite Courses

Prerequisite courses are courses that you must take before enrolling in a course. Many courses above the 200level will have prerequisites. These courses cover skills and/or content required for the more advanced courses. Faculty teaching courses with prerequisites assume that students have learned and understand this prior knowledge and will move on with little or no review of the prior material.

Descriptions of each BIOL courses are found in the TU undergraduate catalog. Required "prereqs" for a course can be found at the end of the course description. For example, the end of the description of BIOL435 – Plant Ecology reads: "Prerequisites: BIOL206/206L and BIOL205. This means you must take and pass with a C or better, both BIOL206/206L – Introduction to Ecology and Evolution and BIOL205 – General Botany prior to taking Plant Ecology.

The online enrollment system will not allow a student to enroll in a course if they are not currently enrolled in or have completed a required prerequisite. Students who do not pass a prerequisite course will be withdrawn from a course that requires passing with a C or better.

Anticipated Two-year Sequence of Biology Courses

A list of Biology courses planned for the next two years (four semesters) "Anticipated Offerings of Biology Courses in Coming Semesters" document can be found:
https://www.towson.edu/fcsm/departments/biology/resources/degreecompletion.html

A Special Note on Taking Physics Courses

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.

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Independent Study and BIOL 481-Directed Readings in Biology

Students may want to explore an area of interest in much more detail than is found in the courses offered.by the department. For example, a student may want to learn more about the biology of HIV/AIDS or pursue a deeper understanding of the conservation of large cats. To do this, and get credit for it, students can enroll in BIOL 481 – Directed Readings in Biology. Students typically prepare a term paper that provides a major summary and synthesis of what they learned in the research.

Credits earned in BIOL481 cannot be used to fulfill elective course credit requirements for the biology major. Credits earned, however, will count towards the 120 total credits required for the B.S. degree.
Students must first find a faculty mentor who is willing to act as their mentor and supervise and grade their final term paper. Faculty are not required to accept students for BIOL481 therefore if you plan to take this course, you may need to ask several professors before getting a yes, especially if you are asking on short notice (i.e., the first week of classes). Students wishing to do a BIOL481 study should reach out to professors no less than one to two months prior to the start of classes.

Once a mentor is secured, the student and faculty member must develop an agreement on the topic to be studied, the nature and amount of literature to be read, the nature and length of the paper to be written, how the student will be graded, the number of credits awarded, and develop a schedule for meetings, updates, and deadlines for submission of drafts and the final paper.

BIOL481 – Directed Readings in Biology can be taken for 1-3 credits and can be repeated for a total of 3 credits. The number of credits corresponds with the scope of the project, i.e., the amount of literature reviewed and the number of pages in the final paper. Students must have completed at least 10 credits of Biology coursework prior to enrolling in BIOL481.

Departmental Honors

Graduating "with honors" can be extremely advantageous when applying for jobs and/or graduate and professional schools. Note that graduation with honors is different from the traditional Latin Honors (e.g., magna cum laude) based only on class rank and cumulative grade point average.
https://catalog.towson.edu/undergraduate/academic-policies/graduation-with-honors/

There are two types of "graduation with honors" at TU: 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 if 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 complete an independent research project and prepare an Honors Thesis proposal. Students must complete BIOL498 and BIOL499 in consecutive terms of their senior year. In addition, a minimum of 3 units must be taken from BIOL491 and/or BIOL481 in the junior year. The research thesis must be presented in an oral defense before the Honors Research Committee. An oral presentation open to the public is also required. Additional information can be found https://www.towson.edu/fcsm/departments/biology/undergrad/honors.html

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Double Majors and Minors

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 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 psychology), as half the requirements for the Animal Behavior major fall in each of these other departments.

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

Minoring allows a student to study a second subject without taking all the coursework for a complete major. Much like a second major, additional knowledge in another field can enhance career preparation and opportunities.

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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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 do not 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 a large number of courses, many of which have laboratories. If you started 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. Some students will stay an extra semester 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.
3. Students sometimes take an extra semester to take some interesting or useful 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.
4. 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.*

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GETTING ADVICE DURING YOUR SOPHOMORE, JUNIOR, AND SENIOR YEARS

Declaration of a Concentration and Assignment of a Departmental Advisor

https://www.towson.edu/fcsm/departments/biology/resources/advising.html

Advising

When you have declared a concentration within the biology major, usually at the end of your first year, you will be assigned an advisor based on your interests and concentration. Students are welcome to request a certain faculty member within the department as an advisor. Visit https://www.towson.edu/fcsm/departments/biology/resources/advising.html for more information.

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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 a faculty member with more expertise in this new area of interest is preferred
- 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 Biology Department's Professor Charlotte Saylor at csaylor@towson.edu. If you have a faculty member in mind, let Prof. Saylor 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 Prof. Saylor know your concentration and your career interests so she can assign you to a proper advisor.

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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. https://www.towson.edu/fcsm/departments/biology/studentorgs/honorsociety.html

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.
https://involved.towson.edu/organization/premedpredentclub

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 premed.predent@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.:

The co-directors of WISP are Dr. Peko Tsuji (ptsuji@towson.edu) and Dr. Cindy Ghent (cghent@towson.edu). See also the WISP website, https://www.towson.edu/fcsm/departments/stem/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, for more information.

MAPS: Minority Association of Premedical Students

https://involved.towson.edu/organization/towsonmaps

Pre-Physician Assistant (PA) Club

https://involved.towson.edu/organization/prepa

Pre-Vet Club

https://involved.towson.edu/organization/pre-vet

TU Dental Society

https://involved.towson.edu/organization/tudental

ASBMB: American Society for Biochemistry and Molecular Biology

https://involved.towson.edu/organization/tudental

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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 those who qualify for financial aid. It provides funding and allows students to earn paychecks by working within Towson

University departments. FWS benefits, eligibility requirements and application materials can be found at https://www.towson.edu/admissions/financialaid/programs/employment/workstudy.html

Employment Opportunities at TU
Handshake is Towson's online database that is managed by the Career Center; where you can apply for positions, post your resume and even register for career events. https://www.towson.edu/careercenter/hire/

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SCHOLARSHIPS, FELLOWSHIPS, AND AWARDS

The Office of Financial Aid is ready to assist students through the financial aid process. They provide information on various aid programs and applications https://www.towson.edu/admissions/financialaid/?utm_source=redirect&utm_content=finaid .

Department of Biological Sciences Scholarships and Awards
The Department of Biological Sciences awards several scholarships and awards a year. For more information on requirements, deadlines and to apply for an award, visit https://www.towson.edu/fcsm/departments/biology/scholarships.html.

Fisher College of Science and Mathematics Scholarships and Awards
The Jess Fisher Scholarship is also available to incoming first-year students choosing one of the majors housed within the Fisher College of Science and Mathematics.
https://www.towson.edu/fcsm/scholarships/fisher/fcsm.html

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.

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 there are plenty of free scholarship/fellowship search engines that will get you the same results. Many of these sites are illegitimate scams.

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OBTAINING HANDS-ON EXPERIENCE: RESEARCH AND INTERNSHIPS

Research

Why do research?

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 Biologist while they are still undergraduates. For many students, which 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!).

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 current faculty member by visiting: http://www.towson.edu/fcsm/departments/biology/facultystaff/index.html). Make a 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 and why. Be specific and mention what you learned from reading their papers.

- A description of yourself, including where you are in your schooling, what science courses you have completed and what you plan to do after graduation.

- A request to meet with them to talk about their research. Provide a list of days and times that you are available to meet.

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, you should email the next faculty member on your list.

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 decides not to take you on as a research student. Faculty must make a 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 not a reflection on your qualifications or abilities. Important note: Because of the time faculty must invest in students doing research in their lab yet still have their research progress, most if not all faculty will not take students in their final year/semester at TU. The student and the faculty member will benefit much more if a student begins doing research in their sophomore or junior year.

Off-campus research opportunities

Research off-campus provides opportunities to study topics that TU faculty may not study. There are many opportunities for off-campus research, especially during the summer. You will need to put ime and effort into finding such opportunities. Most are listed as "research assistantships," "research internships," or "research fellowships". Some might pay an hourly wage or stipend, and some may be volunteer, and you will not get paid for time, travel or living expenses.

Finding opportunities.

Ask TU faculty members in the field of interest if they know of any opportunities. For example, if you are interested in studying Animal Physiology, talk to the faculty that teach and/or do research in animal physiology.

Search the internet using keywords such as "undergraduate biology research internship opportunity," etc. Some examples include:

- http://www.med.nyu.edu/sackler/summer-undergraduate-research-program-surp
- http://www.sloankettering.edu/Gerstner/html/54513.cfm
- 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://www.amgenscholars.com/
- http://www.columbia.edu/cu/biology/ug/intern.html

There are usually a number of research assistant positions/opportunities available in the Baltimore/Washington area at medical schools, including Johns Hopkins University.

- https://www.niddk.nih.gov/research-funding/research-programs/diversity-programs/research-trainingopportunities-students/short-term-research-experience-underrepresented-persons-step-up
- https://www.kennedykrieger.org/professional-training/professional-training-programs/center-fordiversity/mchc-rise-up
- https://www.jhsph.edu/offices-and-services/office-of-student-life/diversity-summer-internship-programfor-undergraduates/index.html
- https://inbt.jhu.edu/education/undergraduate/nanobio-reu/
- https://www.hopkinsmedicine.org/johns_hopkins_bayview/education_training/summer_scholars_progr a m/pulmonary_critical_care_medicine_summer_internship.html

Internships may also be available in local private industries (e.g., MedImmune and Becton 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.

The U.S. government funds a large number of undergraduate research positions each year. *Particularly valuable and exciting* are the 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 found 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 http://www.nsf.gov/crssprgm/reu/list_result.cfm?unitid=5047

Other government opportunities may be found at:

- http://orise.orau.gov/science-education/internships-scholarships-fellowships/default.aspx
- https://www.training.nih.gov/programs/sip
- http://naturalhistory.si.edu/NHRE/
- http://www.dm.usda.gov/employ/sip

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Obtaining course credit for doing research on-campus

BIOL490 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. Students must have consent of their research mentor to enroll in this course.

- Students can sign up for 1, 2 or 3 credits depending on the extent and scope of the research project. Typically, 1 course credit is equivalent to 3-4 research hours / week
- This course is graded as Satisfactory (S) or Unsatisfactory (U)

- Credits DO NOT count towards requirements for the biology major, but they do count as upper-level credits.

BIOL491 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 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" courses to count towards the Biology degree.
- Can be repeated up to 6 total credits however only 3 of the credits can be counted as the elective course.

Obtaining course credit for doing research off-campus

Students can sign up for either BIOL 493 - Internship in Biology *or* BIOL 490 or 491. Note 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.

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.

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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?

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 be 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/

Finding an internship or creating your own internship

Pre-existing internships are listed at the Handshake website, https://www.towson.edu/careercenter/hire/, which is maintained by TU's Career Center. Students are also encouraged to visit with the Biology Internship Coordinator, Dr. Jay Nelson jnelson@towson.edu

Students 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/).

Custom internship experiences.

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 perspective internship supervisor need to develop a plan specifying what you will 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 a minimum of 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. The supervisor must complete and give you an Employer Agreement Form, which is available on this webpage.

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. Jay Nelson; jnelson@towson.edu). 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).

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

Taking Courses at Other Local Colleges and Universities

TU students can take courses not offered on campus at other local colleges and universities. Information on requirements and participating schools can be found at https://www.towson.edu/registrar/exchangeprograms/inter-institutional-registration-baltimore-exchange.html

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 courses are held at "field stations" run by various universities. A summary of most 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.

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

The National Student Exchange (NSE) allows students from TU to attend a different university for a semester. Program requirements, costs and a list of participating universities are available here https://www.towson.edu/academics/international/abroad/national-student-exchange.html
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/academics/international/abroad/nationalstudent-exchange.html Back to Table of Contents

Study Abroad Programs through Towson University

Students can choose from a multitude of study abroad and away programs. For information on destinations, costs and requirements visit https://www.towson.edu/academics/international/abroad/ .

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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. 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, or non-profit foundations.

Other jobs will have you spend some 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 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. More information about graduate school is provided below.

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Medicine and Dentistry

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 Advising

TU offers a Premedical/Predental Advising Program for students interested in attending medical and dental school. This program provides students with one-on-one advising, internship opportunities and even a committee letter to submit with your medical or dental school application (so long as you meet the program requirements). https://www.towson.edu/fcsm/departments/preprofessional/medicaldental/

Dr. Laura Martin is the program director and can be reached at premed.predent@towson.edu for more information.

Orientation sessions are offered at the beginning of each semester (Spring and Fall) and your attendance at one is a requirement for membership into the program. Be sure to keep an eye on the media screen in the Science Complex for the dates and times of the sessions.

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Physician Assistant

For 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

Requirements such as required coursework, GPA and entrance exam scores vary from school to school. It is recommended that you research schools that you want to apply to and review their specific requirements. The Association of American Veterinary Medical Colleges website contains valuable information ranging from applying to vet school, listings of vet schools and FAQs. https://www.aavmc.org/

Pre-veterinary students are urged to contact the Biology Department's Pre-Vet advisor, Prof. Christa Partain (SC 3101L; cpartain@towson.edu; 410-704-4167) for more information. Before doing so, see the see the PreVet Guidelines document on this website: https://www.towson.edu/fcsm/departments/biology/resources/degreecompletion.html.

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Pharmacy

https://www.towson.edu/fcsm/departments/chemistry/resources/prepharmacy.html Back to Table of Contents

Secondary Education

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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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 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.

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 area of Biology in more detail. 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*.

A Common and Critical Misconception 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, but the difference is that you take primarily courses in your specific area of interest. For example, a student may come to TU 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. 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 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.*

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 interested in Ecology, Evolution and Conservation (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 Professors Angela Cox or Cathy Wijnands: amcox@towson.edu or cwijnands@towson.edu .

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