Welcome Class of 2020!

We have prepared a series of short videos to help you learn about how to decide which course to take first, the placement/advisory test, Biology 2, Biology 11, Foundation Courses, majoring in biology, our foreign study program and doing research.

To view the videos, please go to the biology web page: [https://biology.dartmouth.edu/welcome](https://biology.dartmouth.edu/welcome)-class-2020

**Beginning Your Study in Biology at Dartmouth**
Prof. Tom Jack talks about how to decide which biology course to take first, including information about the Biology Advisory/Placement test.

**Biology 2 – Human Biology – offered in fall 2016**
Prof. Lee Witters talks about his non-majors course, Biology 2, that will be offered this fall.

**An Introduction to Biology 11**
Prof. Rob McClung talks about the principles and concepts that are covered in Biology 11 and gives an idea of typical BIOL 11 offerings (the offerings highlighted are from last year).

**Biology 11 – Fall offering: Major Events in the History of Life and the Human Genome**
Prof. Kevin Peterson gives an overview of the Biology 11 offering that he will teach in the fall of 2016.

**Biology 11 – Winter offering: Emerging Infectious Diseases: How Microbes Rule the World.**
Prof. Mary Lou Guerinot gives an overview of the Biology 11 offering that she and Prof. Rob McClung will teach in the winter of 2017.

**Biology 11 – Spring offering: Animal Minds**
Prof. Mark Laidre gives an overview of the Biology 11 offering that he and Prof. Tom Jack will teach in the spring of 2017.

**The Foundation Courses**
Prof. Natasha Grotz talks about the topics covered by the foundation courses, the role of these courses in the major and the schedule of offerings this year.

**Majoring in Biology at Dartmouth**
Prof. Sharon Bickel gives an overview of the structure of the major, including prerequisites, areas of concentration and introductory, intermediate and upper level courses.

**The Biology Foreign Study Program**
FSP faculty give a history and overview of the program that give students the opportunity to conduct original ecological research at field stations in Costa Rica and the Caribbean.

**Independent Research for Credit**
Maximilian Jentzsch ’15 talks about doing research for credit (BIOL 95/96/97).

**How Do I Find a Research Lab?**
Maximilian Jentzsch ’15 talks about tools for finding a research lab and how he found a lab.

*The Class of 1978 Life Sciences Center*
Faculty and their Courses for 2016-2017

Matt Ayres
Bio 16 – Ecology
Bio 55 – Ecological Research in the Tropics I

Brittny Calsbeek
Bio 7 – First Year Writing Seminar

Celia Chen
Bio 25 – Introduction to Marine Biology and Ecology
Bio 57 – Ecological Research on Coral Reefs

Michael Dietrich
Bio 36 – History of Genetics
Bio 48 – Evolutionary Medicine

Natasha Grotz
Bio 12 – Cell Structure and Function
Bio 45 – Molecular Biology
Bio 66 – Molecular Basis of Cancer

Mary Lou Guerinot
Bio 11 – Emerging Infectious Diseases
Bio 46 – Microbiology

Michael Hoppa
Bio 49 – Cellular and Molecular Neuroscience
Bio 74 – Advanced Neurobiology

Mark Laidre
Bio 11 – Animal Minds

Sharon Bickel
Bio 12 – Cell Structure and Function

Ryan Calsbeek
Bio 27 – Animal Behavior
Bio 60 – Evolutionary Ecology

Kathy Cottingham
Chair, Department of Biological Sciences
Bio 16 – Ecology

Patrick Dolph
Bio 13 – Gene Expression and Inheritance
Bio 69 – Cell Signaling

Erik Griffin
On sabbatical 2016-2017

Mary Lou Guerinot
Bio 11 – Emerging Infectious Diseases
Bio 46 – Microbiology

Bing He
Bio 12 – Cell Structure and Function

Tom Jack
Bio 11 – Animal Minds
Bio 13 – Gene Expression and Inheritance

Robert Maue
Bio 14 – Physiology
Bio 49 – Cellular and Molecular Neuroscience

http://biology.dartmouth.edu/
Rob McClung
Bio 11 – Emerging Infectious Diseases
Bio 76 – Advanced Genetics

Kevin Peterson
Bio 11 – Major Events in the History of Life and the Human Genome
Bio 28 – Macroevolution
Bio 63 – RNA: The Real Secret of Life

Roger Sloboda
Bio 12 – Cell Structure and Function
Bio 71 – Current Topics in Cell Biology

Hannah ter Hofstede
Bio 14 – Physiology
Bio 56 – Ecological Research in the Tropics II

Olga Zhaxybayeva
Bio 15 – Genetic Variation and Evolution
Bio 47 – Genomics: Data to Analysis

Mark McPeek
Bio 5 – Fundamentals of Applied Math for Sciences
Bio 58 – Advanced Community Ecology

Eric Schaller
Bio 40 – Biochemistry
Bio 99 – Senior Seminar in Biology

Elizabeth Smith
Associate Dean for the Sciences

Lee Witters
Bio 2 – Human Biology
Bio 37 – Endocrinology
Bio 78 – Molecular Mysteries of Human Biology

http://biology.dartmouth.edu/
**BIOLOGICAL SCIENCES**

**Introduction to the Biology Curriculum, Major and Minor**

Biological Sciences has a single major and a single minor. The major can be modified.

Within the major there are various areas of concentration a student can choose such as ecology, neurobiology, genetics, evolutionary ecology or human biology (pages 6 and 7 of this document list several possible areas of concentration).

There are multiple entry points into the Biology major. For many students, BIOL 11 is an appropriate starting point. BIOL 11 is offered fall, winter and spring terms in 2016-2017 with no prerequisites. BIOL 11 is designed to introduce students to the study of biology at the college level. Different offerings of BIOL 11 focus on different topics, and students should choose the offering that is most interesting to them. BIOL 11 does not have a laboratory component.

The foundation courses are numbered BIOL 12-16: BIOL 12 (Cell Structure and Function), BIOL 13 (Gene Expression and Inheritance), BIOL 14 (Physiology), BIOL 15 (Genetic Variation and Evolution) and BIOL 16 (Ecology). The biology major requires three of these five courses. Many students will take their first foundation course after taking BIOL 11. However, students with sufficient preparation in math and science may choose to enroll directly in a foundation course without first taking BIOL 11.

To aid students in deciding which Biology course provides the best starting point, we offer the Biology Placement/Advisory test, which is available to all members of the class of 2020 via Canvas. The result of the Biology Placement/Advisory Test is advisory, not binding: thus, the score does not appear on your placement records in Banner Student. If you are interested in studying Biology at Dartmouth, we strongly suggest that you take the Biology Placement/Advisory Test to help you decide which Biology course is most appropriate for you to begin studying Biology at Dartmouth.

The Biological Sciences department offers an FSP to Central America and the Caribbean in the winter term. Students who may want to participate in this FSP during their junior year should take BIOL 16 as soon as possible. For more information, please visit our FSP web page: [http://biology.dartmouth.edu/foreign-study-program](http://biology.dartmouth.edu/foreign-study-program).

**Non-Majors Courses**

Courses numbered BIOL 2 - BIOL 10 are non-major courses, have no lab, and do not count towards a Biology major or minor. However, BIOL 2 (Human Biology) may be an appropriate entry point for students with little science preparation; such students may consider taking BIOL 2 prior to BIOL 11.

**Other Information About Courses and Course Sequences**

- BIOL 11-16 are large classes often with 50 to 80 students. Students must realize that regular class attendance, steady work, and developed study skills are critical to success in these classes.
- The foundation courses (BIOL 12-16) involve problem-solving skills, including the use of high-school algebra to solve word problems about quantitative aspects of biology.
- The foundation courses are not sequenced and can be taken in any order (i.e. 12 does not have to be taken prior to 13).
- The foundation courses demand the mastery of large amounts of information. Students concerned about the transition to college may be advised to wait until they have developed their study skills before they enroll.
- Intermediate-level courses (numbered 20-49) can be taken once students have taken the appropriate foundation course as a prerequisite. Students may enroll in appropriate intermediate-level courses prior to completing all of their foundation courses.
How to choose your first Biology class at Dartmouth?

Biology 11 versus a Foundation Course

1. **Subject matter.** Choose a course that is of high intellectual interest to you. Nothing begets academic success like being genuinely interested in the subject matter. Read the course descriptions for Biology 11; each offering has a different intellectual theme customized by individual faculty to be timely and engaging. BIOL 11 generally spans a broader spectrum of the science of biology than individual foundation courses. The content of the foundation courses is designed to cover core knowledge within specific topic areas.

2. **Workload.** Both BIOL 11 and the foundation courses are rigorous and fast-moving and include technical readings and problem solving. The foundation courses also have a laboratory component, which substantially increases the contact hours and makes the foundation courses considerably more demanding than BIOL 11.

3. **Probability of scholastic success.** BIOL 11, by virtue of not having a laboratory component, permits students to spend more hours per week gaining a mastery of material covered during class sessions. BIOL 11 also consists almost entirely of first year students, which helps ease the transition to the more demanding foundation courses.

Biology 11 Offerings 2016 – 2017

**Fall 2016: Major Events in the History of Life and the Human Genome**
Over the course of the last 4.5 billion years, life has faced a number of challenges, and in response has evolved a number of remarkable innovations. These innovations are written in DNA, and thus molecular fossils for many of the major events in the history of life can be found within our very own genomes. This course will survey the human nuclear and mitochondrial genomes, using a gene or region from a chromosome as a “ticket” to a particularly important event or process in the history of life including the origin of life itself (Chromosome 14), the advent of protein synthesis (Chromosome 22), the invention of DNA (Chromosome 8), the rise of atmospheric oxygen (mitochondrion), the origin of species (Chromosome 2), the origin of animals and the rise of macroecology (Chromosome 12), and the origin of humans and human language (Chromosome 7). *Peterson.*

**Winter 2017: Emerging Infectious Diseases: How Microbes Rule the World**
Emerging infectious diseases, which have shaped the course of humanity and caused untold suffering and death, will continue to challenge society as long as humans and microbes co–exist. This course will explore why infectious diseases emerge and re–emerge. The viruses, bacteria and eukaryotes that cause these diseases continually evolve in response to their hosts. Dynamic interactions between rapidly evolving infectious agents and changes in the environment and in host behavior provide such agents with favorable new ecological niches. In addition, dramatic increases in the worldwide movement of people and goods drive the globalization of disease. *Guerinot and McClung.*

**Spring 2017: Animal Minds**
Darwin claimed that other species share the same “mental powers” as humans, only to different degrees. This course will examine the evidence for Darwin’s claim, focusing on the evolutionary, neural, and molecular basis of animal cognition. We will ask how and why organisms behave as they do, exploring the ways in which evolution has adapted organisms’ information gathering, perception, learning ability, memory, and decision making to both their physical and social world. Key examples will be drawn from navigation, tool-use, communication, and cultural imitation. An overarching emphasis will be placed on the active process of scientific discovery, especially how strong inference and multiple competing hypotheses enable scientists to make discoveries. *Jack and Laidre.*
Fall 2016 Course offerings for First-year Students
Biology 2 – Human Biology (Prof. Witters) (DOES NOT COUNT FOR MAJOR CREDIT)
Biology 5 – Fundamental Applied Mathematics for the Sciences
Biology 11 – Major Events in the History of Life and the Human Genome (Prof. Peterson)
Biology 12 – Cell Structure and Function (Prof. Grotz or Prof. Sloboda)
Biology 14 – Physiology (Prof. ter Hofstede)
Biology 16 – Ecology (Prof. Cottingham)

Winter 2017 BIOL 11 and Foundation Courses Offerings
Biology 11 – Emerging Infectious Diseases (Prof. Guerinot and Prof. McClung)
Biology 13 – Gene Expression and Inheritance (Prof. Dolph or Prof. Jack)
Biology 14 – Physiology (Prof. Maue)
Biology 15 – Genetic Variation and Evolution (Prof. Zhaxybayeva)

Spring 2017 BIOL 11 and Foundation Courses Offerings
Biology 11 – Animal Minds (Prof. Jack and Prof. Laidre)
Biology 12 – Cell Structure and Function (Prof. Bickel and Prof. He)
Biology 16 – Ecology (Prof. Ayres)

Information About the Biology Major and Minor

Requirements for the Biology Major
Prerequisites: CHEM 5 and CHEM 6 (or equivalent), and one quantitative course from among BIOL 29, COSC 1, COSC 5, ENGS 20, EARS 17, MATH 4, MATH 8 (or above) or MATH 10 (or equivalent). We are currently working on adding BIOL 5/MATH 5 to this list of approved quantitative courses. Students who elect to include BIOL 29 in their area of concentration (see below) must fulfill the quantitative prerequisite with one of the other courses listed above. Some upper-level biology courses such as BIOL 40 (Biochemistry) also require CHEM 51-52 (or equivalent). Therefore, students who are serious about pursuing a Biology Major are advised to begin their math and chemistry requirements early in their college careers.

Foundation Courses: For the major, students will complete three of the five Foundation courses (numbered BIOL 12-16).

Area of Concentration: Students will complete seven additional courses that emphasize a particular “area of concentration,” including two Biology courses numbered 50-97. In addition, to facilitate interdisciplinary learning, two of these seven courses may be advanced courses from other departments that are appropriate for a student’s chosen area of concentration.

Requirements for Biology Modified Major
Students who wish to complement their interest in the life sciences with several courses in one or more disciplines, may consider a modified major. For a modified major, the area of concentration consists of five Biology courses in addition to the three Foundation courses and four suitable advanced courses from another department or combination of departments. Students taking BIOL 11 as their first major course may count it as one of the five courses. Prerequisite and foundation course requirements remain the same. Courses outside the Biology Department may not be substituted for foundation courses or for the five additional Biology courses.

http://biology.dartmouth.edu/
Requirements for the Biology Major Modified with Math

Mathematics is the “Language of Science”. Students who are more quantitatively oriented may want to consider modifying their Biology major with Mathematics. To facilitate this, the Biological Sciences and Mathematics Departments have agreed on the following structure for a Biology modified with Mathematics major. In addition to the Biology courses in their area of concentration, students choosing this option will take four courses from among the offerings in Mathematics. Prerequisites and foundation course requirements for the Biology major remain the same. All students choosing this option must take MATH 22 (Linear Algebra with Applications) and MATH 23 (Differential Equations). The other two mathematics courses should be chosen in consultation with your Biology advisor depending on your area of concentration. Please consult the ORC for more details.

Requirements for the Biology Minor

The prerequisites for the Biology minor are CHEM 5 and CHEM 6 (or equivalent) and one quantitative course from among BIOL 29, COSC 1, COSC 5, ENGS 20, EARS 17, MATH 4, MATH 8 (or above) or MATH 10 (or equivalent). In addition, students will complete two foundation courses and four additional Biology courses (BIOL 11 or above). Students may choose to use BIOL 29 as a prerequisite or as one of the four additional Biology courses but not both. Students who elect to count BIOL 29 as one of the four additional courses must fulfill the quantitative prerequisite with one of the other courses listed above. Students do not need to develop an area of concentration for the minor, but they may do so if they wish. Courses outside the Biology Department may not be substituted for foundation courses or the four additional Biology courses.

Examples of Areas of Concentration:

**ANIMAL BEHAVIOR** (Calsbeek, Laidre, McPeek, ter Hofstede)

**BIOCHEMISTRY** (Bickel, Dolph, Schaller, Sloboda, Smith, Witters)

**CELL BIOLOGY** (Bickel, Dolph, Griffin, He, Hoppa, Schaller, Sloboda, Smith, Witters)

**DEVELOPMENT** (Griffin, Jack, Peterson)

**ECOLOGY** (Ayres, Calsbeek, Cottingham, Laidre, McPeek)

**EVOLUTIONARY ECOLOGY** (Calsbeek, Laidre, McPeek, ter Hofstede)

**GENETICS** (Bickel, Dolph, Griffin, Guerinot, He, Jack, McClung)

**GENOMICS, BIOINFORMATICS AND COMPUTATIONAL BIOLOGY** (Cottingham, McPeek, Zhaxybayeva)

**HUMAN BIOLOGY** (Dolph, Smith, Witters)

**MOLECULAR ECOLOGY** (Calsbeek, McPeek)

**MOLECULAR EVOLUTION** (Dietrich, McPeek, Peterson, Zhaxybayeva)

**NEUROBIOLOGY** (Dolph, Hoppa, Maue, Witters)

**PALEOBIOLGY** (Peterson)

**PHYSIOLOGY AND ORGANISMAL BIOLOGY** (Ayres, Calsbeek, Hoppa, Laidre, Maue, McPeek, ter Hofstede, Witters)

**PLANT BIOLOGY** (Ayres, Guerinot, Jack, McClung, Schaller)
Information for Pre-Health Students

Students who want to apply to medical school or other post-graduate health programs (veterinary medicine, dental, etc.) do not have to be Biology majors. Many pre-health students major in other sciences, humanities, and social sciences at Dartmouth and have had an excellent track record for post-graduate acceptances. Students do, however, have to master critical core concepts and competencies taught by the Biology department.

A student who wants to keep open the option of attending medical school immediately following graduation should take BIOL 12 and BIOL 13 by the end of their second year. BIOL 14 is also a good choice for students interested in health careers. In 2015-16, BIOL 12 is offered in the fall and spring terms, BIOL 13 is offered in the winter and summer terms, and BIOL 14 is offered in the fall and winter. Students pursuing health careers are also advised to begin math and general chemistry (CHEM 5-6 or equivalent) in their first year, and to complete the organic chemistry sequence (CHEM 51-52 or equivalent) in their second year. This is to allow students to take the MCAT by no later than early summer following their junior year, followed by submission of their application during the summer before their senior year. In planning for their pre-health science requirements, students should take into account whether two courses with laboratories in the same term might present extra challenges. All students should consult with a pre-health advisor when devising their curricular plan.

Note that students from Dartmouth are following a national trend and are tending to apply to medical school after they graduate (this necessitates at least one year off from school). This allows for more flexibility in scheduling courses required for medical school and often strengthens applications.

For more information on requirements for medical, dental, and veterinary school, please refer to Required Courses for Medical, Dental or Veterinary Schools:

THE DARTMOUTH OFF-CAMPUS PROGRAM IN TROPICAL BIOLOGY

http://biology.dartmouth.edu/foreign-studies-program

Overview
Dartmouth's Tropical Biology Program (Bio FSP) is an intensive, 10-week research-oriented program in ecological and evolutionary biology, offered in Central America and the Caribbean each winter quarter. The first 6-7 weeks are spent in Costa Rica at 4-5 field research stations, some of which are operated by the Organization for Tropical Studies (OTS), a consortium of Latin American and North American universities devoted to tropical research and education. These stations and other field sites provide access to lowland rain forest, dry seasonal deciduous forests, montane cloud forests, and high elevation paramo, as well as to tropical agricultural and forestry operations. At these sites, students learn to interpret the great variety and complexity of tropical habitats and their associated flora, fauna, and climatic features. The final third of the program is in the Cayman Islands, at the Little Cayman Research Center. There the focus is on marine biology, especially coral reef ecology. Students do research on sea grass meadows and plankton and fish communities. Habitats are shallow patch reefs and the fringing reef, from its crest to about 60 feet depth. We use small boats, snorkeling and SCUBA to access these habitats.

Program Format
The Tropical Biology Program exposes students to a diversity of tropical environments. They study theory, quantitative methods and research design, and apply them to projects in tropical biology. At the field sites, our daily schedule includes lectures, laboratories and field trips, as well as research projects by individuals or small groups. Students become familiar with the flora, fauna and functional complexity of tropical ecosystems. Applying the scientific method to these systems is a demanding, creative, and ultimately very satisfying experience. Students develop the ability to organize observations, formulate testable hypotheses and develop methods to test them quantitatively. They learn to work both independently and cooperatively, and to present seminars and write scientific papers. The development of students' scientific skills is demonstrated in the course proceedings "Dartmouth Studies in Tropical Biology," published annually, and available online as well as in Dana Biomedical Library and the Biology Department.

The tempo of the Program is fast, and the work intensive. Course participants, both students and faculty, are engaged in scheduled activities from dawn to dusk, and also in the evenings (generally 7-10 pm). Evenings are devoted to faculty lectures, student seminar presentations (on their research results), and student critiques of papers from the literature. Students are totally immersed in the course work during their time at the field stations, and become deeply involved in field studies. The field station setting allows for scheduling of class activities to fit biological rhythms, rather than academic conventions. As a result, we are able to take advantage of such activities as predawn field trips, late evening labs, and night dives on the coral reef.
Selection of Students

Most participants in the FSP are in their junior or senior year, majoring in biology. However, students in all majors are eligible to participate, as long as they have the prerequisites (see below). Selection of students is based on their motivation for in-depth learning in ecology, as demonstrated in their lab/field courses and research experience as well as academic performance. All applicants are interviewed by the faculty teaching in the program. The prerequisites for acceptance into the FSP are BIOL 16 (Ecology) and one additional course in ecology or evolutionary biology. BIOL 15, 22, 29 are recommended but not required. Knowledge of Spanish is beneficial but not required.

The size of the student group (15 students) is determined by accommodations at field stations and by the number that can be accommodated in a field research setting. One-on-one contact between faculty and students is essential in meeting our educational objectives. We often have more applicants apply than we can accept, so entry is competitive. Students not accepted for the winter of their junior year are encouraged to re-apply for their senior year.

Teaching Faculty and Graduate TAs

The program is taught by three Dartmouth biology faculty, who rotate over the term, each of whom stays with the group for approx. 4 weeks. The current Biology FSP Directors are Matt Ayres and Ryan Calsbeek. Faculty currently teaching in the program, listed with their research interests, are: Matt Ayres (plant-animal interactions, physiological and population ecology); Ryan Calsbeek (evolutionary ecology and animal behavior); Celia Chen (ecotoxicology, aquatic ecology); and Hannah ter Hofstede (bat ecology, animal communication, coevolution of predator-prey interactions).

The faculty are assisted by two Dartmouth graduate student teaching assistants (TAs), who make important contributions to the teaching, logistics, and social dynamics. The graduate students benefit by gaining valuable experience in research and teaching, and also provide an important link between the Costa Rica and Little Cayman sections of the program.

Finances

As is the case for most Dartmouth off-campus programs, the participating students pay tuition and room/meals costs that are the same as they would pay on campus. The only significant additional costs for this Program are (1) air travel to and from Costa Rica and Little Cayman and (2) equipment for snorkeling and SCUBA (SCUBA is optional).

Summary

The Dartmouth Tropical Biology Program encourages students to reach beyond their familiar surroundings and consider the broad organizing principles of environmental and evolutionary biology. For many students, the Tropical Biology Program is a capstone experience and highlight of their Dartmouth education, and one that helps them to make choices for further study and professional training. These quotes from recent student evaluations are fairly typical: "Best term ever", ".. one of the most amazing experiences I have ever had.", "...incredibly satisfying and rewarding", "The best experience of my academic career at Dartmouth."
Undergraduate Research in Biology

Biology students at Dartmouth are fortunate to have many research opportunities in the Department of Biological Sciences and the Geisel School of Medicine. Majors are strongly encouraged to do independent research and to seriously consider the research-based honors program. Undergraduate students have access to several funding opportunities at Dartmouth.

http://www.dartmouth.edu/~ugar/undergrad/programs.html

There are many programs to support undergraduate students interested in life sciences research!

Some of the Formal Opportunities
WISP (primarily 1st year women)
Sophomore Science Fellowships (sophomores)
Mellon Mays Undergraduate Fellowships (sophomores)
The Biology FSP is focused mostly on research (often junior year)
James O. Freedman Presidential Scholars Program (juniors)
Independent Study - Biology 95 (junior and senior majors and minors)**
Honors Research – Biology 97 (senior majors)**

**Independent and Honors research in a Dartmouth laboratory outside of the Biology Department is possible but requires a Biology Faculty Sponsor.

Other Possibilities
Work Study Program
Paid research intern
Volunteer

The best way to begin learning about the research interests of faculty is by spending some time online

Biology Department
http://biology.dartmouth.edu/people/faculty
Geisel School of Medicine Departments
http://geiselmed.dartmouth.edu/research/basic/

Most faculty LOVE to talk about their research! When you see something that looks interesting, contact the professor by email to meet and to find out more about undergraduate research opportunities.

Additional information about independent research available at:
http://biology.dartmouth.edu/undergraduate/research-opportunities