

# BIOLOGY MAJOR (B.S.)

<https://colsa.unh.edu/biological-sciences/program/bs/biology-major>

## Description

Biology is one of the most popular science majors since it provides a broad background in the biological sciences while allowing flexibility and specialization within the major. It integrates theoretical and practical (hands-on laboratory and field work) courses in different aspects of the biology of multicellular life. It encompasses the study of structural and functional relationships of living organisms at the molecular, cellular, and organismal level, the interactions of living systems with the environment and with each other, and the evolutionary relationships of life. Our goal is to create an environment for those with a scholarly interest in the biological sciences, and to extend their understanding, awareness, and appreciation of the diversity inherent in the biological sciences. Our major is aimed at promoting an excellent education in biological sciences by involving undergraduate students in a strong interaction with faculty both in the classroom and in research laboratories.

The biology major prepares students for post graduate degrees in the biological and medical fields, and for job opportunities in industry (environmental, biomedical, pharmaceutical, and biotechnological) and governmental research, and secondary school teaching. Completion of the four-year undergraduate program plus a fifth-year internship will be necessary for biology teaching certification. Students who plan to enter medical, dental, or related professional schools are advised to confer with their faculty adviser to work the requirements for these programs into their academic majors.

Core courses in the biology major are from departments that contribute to the biological sciences community at UNH. The core curriculum consists of introductory and upper-level science courses plus seven additional courses in the biological sciences; three of these must be selected from course lists in three broad categories.

While students are advised to declare the biology major as incoming first-year students to assure adequate program planning, transfer into this major at a later stage is also possible. Several of the other biological science majors share the same biology core curriculum. For the first to two years, it is quite easy to change to or from these other majors.

## Requirements

### Degree Requirements

**Minimum Credit Requirement:** 128 credits

**Minimum Residency Requirement:** 32 credits must be taken at UNH

**Minimum GPA:** 2.0 required for conferral\*

**Core Curriculum Required:** Discovery & Writing Program Requirements

**Foreign Language Requirement:** No

All Major, Option and Elective Requirements as indicated.

\*Major GPA requirements as indicated.

## Major Requirements

The biology courses in the core curriculum constitute an integrated sequence that train students in the basic skills and concepts of knowledge inherent to the biological sciences. The biology core allows a student to obtain a broad background in biology, and in the related physical sciences and math that provide a foundation for success in understanding biological principals.

To receive the B.S. degree in biology, students must complete 128 credit hours with at least a 2.0 cumulative grade-point average for completion of the degree. All UNH Discovery Program requirements, biology core curriculum requirements, plus seven additional courses from the biological sciences, and a capstone experience. A minimum grade of C- is required in all biological science courses that are counted toward the requirements for a degree in biology. Students who expect to compete successfully for post-baccalaureate programs should attain a cumulative GPA of 3.0 or higher by the end of the sophomore year and maintain it at that level.

Code	Title	Credits
<b>Core Curriculum Courses</b>		
BIOL 400	Professional Perspectives on Biology <sup>1</sup>	1
BIOL 412	Introductory Biology: Evolution, Biodiversity and Ecology	4
BIOL 411	Introductory Biology: Molecular and Cellular	4
BIOL 541W	Ecology	4
GEN 604	Principles of Genetics	4
ZOOL 690	Evolution	4
CHEM 403 & CHEM 404	General Chemistry I and General Chemistry II	8
CHEM 545 & CHEM 546	Organic Chemistry and Organic Chemistry Laboratory <sup>2</sup>	5
MATH 424B or BIOL 428 or BIOL 633 or BIOL 711 or BIOL 706	Calculus for Life Sciences Quantitative Biosciences Data Analysis for Life Science Experimental Design & Analysis Data Science with R for the Life Sciences	4
BIOL 528	Applied Biostatistics I	4
PHYS 401 & PHYS 402	Introduction to Physics I and Introduction to Physics II	8
BMCB 658A	General Biochemistry	3
BIOL 780	Capstone Companion Course	1
<b>Total Credits</b>		<b>54</b>

## Biology Electives

In addition to the biology core curriculum, students must complete seven biology elective courses. One course must be taken from each of the three categories/disciplines; the other four electives can be chosen from the category lists or can be any other biological sciences course with approval of the student's adviser. All courses must be 500-level or above. There must be one animal-identified course (A) and one plant/fungal/algae course (FP). One capstone experience is required of all seniors; see subsequent section on capstones for detailed requirements. Corequisite lecture and lab courses count as one course.

Code	Title	Credits
<b>Category 1: Form and Function (Morphology, Anatomy and Physiology)</b>		
ANSC 511	Animal Anatomy and Physiology I (A)	4
ANSC 512	Animal Anatomy and Physiology II (A)	4
ANSC 701	Physiology of Reproduction (A)	4
ANTH 660	Human Osteology (A)	4
BIOL 775	Plant Rx (FP)	3
BMS 507	Human Anatomy and Physiology I (A)	4
BMS 508	Human Anatomy and Physiology II (A)	4
BMS 702	Endocrinology (A)	4
BMS 718	Mammalian Physiology (A)	4

MEFB 628	Marine Invertebrate Evolution and Ecology (A)	5
MEFB 754	Anatomy and Function of Marine Vertebrates (SML, A)	4
MEFB 773	Physiology of Fishes (A)	4
ZOOL 518	Comparative Morphology and Biology of Vertebrates (A)	4
ZOOL 625	Principles of Animal Physiology (A, ZOOL 626 Lab optional)	3
ZOOL 777W	Neuroethology (A, C)	4
<b>Category 2: Genetics/Development (including molecular biology and bioinformatics)</b>		
ANSC 612	Genetics of Animals (A)	4
BMCB 605	Principles of Cell Biology	4
BMS 503 & BMS 504	General Microbiology and General Microbiology Laboratory	5
GEN 704	Microbial Genetics and Genomics	5
GEN 705	Population Genetics (GEN 725 lab optional)	3
GEN 706	Human Genetics (A)	4
GEN 711	Genomics and Bioinformatics	4
GEN 721	Comparative Genomics	4
GEN 771	Molecular Genetics	4
GEN 772	Evolutionary Genetics of Plants (FP)	4
ZOOL 529	Developmental Biology (A)	4
ZOOL 736	Genes and Behavior (A, C)	4
<b>Category 3: Evolution, Ecology and Biodiversity (including population biology)</b>		
BIOL 510	Mushrooms, Molds, and Mildews: Introduction to the Fungal Kingdom (FP)	4
BIOL 566	Systematic Botany (FP)	4
BIOL 704	Plant-Microbe Interactions (FP)	3
BIOL 720	Plant-Animal Interactions (FP, C)	4
BIOL 752	New England Mushrooms: a Field and Lab Exploration (FP)	4
GEN 715	Molecular Evolution	4
MEFB 503	Introduction to Marine Biology	4
MEFB 510	Field Ornithology (SML, A)	4
MEFB 530	Evolution and Marine Diversity (SML)	4
MEFB 625	Introduction to Marine Botany (FP)	5
MEFB 675	Marine Mammal Biology and Conservation	3
MEFB 674	Ecology and Marine Environment (SML)	4
MEFB 714	Field Animal Behavior (SML, A)	4
MEFB 717	Lake Ecology	4
MEFB 725	Marine Ecology	4
MEFB 747	Aquatic Plants in Restoration/Management (FP, C)	4
MEFB 772	Fisheries Biology: Conservation and Management (A)	4
NR 506	Forest Entomology (A)	4
NR 642	Introduction to Biogeography	4
NR 660	Ecology and Biogeography of New Zealand	5
NR 663	Applied Directed Research in New Zealand	4
NR 712	Mammalogy (A)	4
NR 713	Quantitative Ecology	4
ZOOL 542	Ornithology (A)	4
ZOOL 555	Introduction to Entomology (A)	4
ZOOL 566	Herpetology (A)	4
ZOOL 613W	Animal Behavior	5
ZOOL 690	Evolution	4
ZOOL 708	Stream Ecology (C)	4
ZOOL 710	Sharks and Bony Fishes (A)	4
ZOOL 726	Conservation Behavior (A)	4
ZOOL 733W	Behavioral Ecology	4
ZOOL 740	Acoustic Ecology	4
<b>Other Elective Options</b>		
BIOL 600	Field Experience <sup>3</sup>	1-4
BIOL 633	Data Analysis for Life Science	4
BIOL 695	Biology Teaching Practices <sup>3</sup>	1-4
BIOL 700	Current and Controversial Issues in Biology (C)	4
BIOL 706	Data Science with R for the Life Sciences	4
BIOL 711	Experimental Design & Analysis	4
BIOL 795	Independent Investigations in Biology <sup>3</sup>	1-4
BIOL 799H	Honors Senior Thesis	2-8
BMCB 753	Cell Culture	5
BMCB 760	Pharmacology	4
BMCB 763	Biochemistry of Cancer	4
BMS 602 & BMS 603	Pathogenic Microbiology and Pathogenic Microbiology Laboratory	5

BMS 655	Human and Animal Parasites (A)	3
BMS 703	Infectious Disease and Health	4
BMS 704	Pathologic Basis of Disease	4
BMS 705	Immunology (BMS 715 optional lab)	3
BMS 706 & BMS 708	Virology and Virology Laboratory	5
BMS 711	Toxicology	4
GEN 717	Molecular Microbiology	5
HMP 501	Epidemiology and Community Medicine	4
MEFB 590	Coastlines in Crisis	4
MEFB 741	Sharks: Biology and Conservation (A)	4
MEFB 755	Biological Oceanography (C)	3
NR 508	Communicating Science	4
NR 641	Wildlife Disease Ecology	4
NSB 727	Animal Communication (A, C)	4
PSYC 531	Psychobiology	4
PSYC 731	Brain and Behavior	4
PSYC 733	Drugs and Behavior	4
TECH 797	Undergraduate Ocean Research Project (A, C) <sup>4</sup>	2
ZOOL 610	Principles of Aquaculture	4

<sup>1</sup> BIOL 400 Professional Perspectives on Biology is required only for first-year biology majors.

<sup>2</sup> Students exploring pre-health professions should take a full year of Organic Chemistry (CHEM 651/CHEM 653 and CHEM 652/CHEM 654).

<sup>3</sup> A 600, 695, 795, or 799 experience may substitute for one elective with academic advisor approval, but only if taken for at least four credits. These four credits may be spread over multiple semesters if they are consecutive and with the same faculty mentor.

<sup>4</sup> This class requires enrollment in both fall and spring sections, 2 credits/semester for a total of 4 credits.

A 600, 695, 795, or 799 experience may substitute for one elective in any category with academic advisor approval, but only if taken for at least four credits. These four credits may be spread over multiple semesters if they are consecutive and with the same faculty mentor.

Note: It is strongly recommended that students participate in an exchange semester at another university, or in a field-oriented program or internship. There are many exchange opportunities available in which a full semester of credits toward the major may be earned. It is further recommended that students explore possibilities of one or more semesters of independent investigation (research projects). For details, students should contact their adviser. Financial support is available for most of these programs. In addition, students can explore the courses at the Shoals Marine Laboratory (SML), which provides an excellent setting for several "field-oriented" courses during the summer. Often there is financial support available for the SML programs. (See the SML website at <https://marine.unh.edu/SML> or the Cornell website at <http://www.shoalsmarinelaboratory.org> for details.)

## Capstone Experience

As part of the University of New Hampshire's Discovery Program requirements, all students must complete a capstone experience during their senior year (after earning at least 90 credits). **The capstone experience for students majoring in Biology consists of BOTH (1) an approved individual experience AND (2) the successful completion of the BIOL 780 Capstone Companion Course.** Students will not be approved for graduation until capstone certification has been granted.

### 1) The individual experience

The individual experience may be satisfied through various forms of experiential learning (e.g., Honors thesis, mentored research project,

internship) or a course denoted with a "(C)" in the courses listed above. The individual experience must fulfill **at least one** of the University's capstone criteria:

- synthesizes and applies disciplinary knowledge and skills
- fosters reflection on undergraduate learning and experience
- demonstrates emerging professional competencies
- applies, analyzes, and/or interprets research, data, or artistic expression
- explores areas of interest based on the integration of the prior learning

**Before beginning any capstone individual experience, students MUST SUBMIT A COMPLETED CAPSTONE APPROVAL FORM to their Program Coordinator.**

Students can obtain this form on the Department's Capstone page or from their Program Coordinator. Here they will describe their proposed individual experience and how it fulfills at least one of the University's capstone criteria listed above. If the student is selecting a "C" course for their individual experience, they should obtain the course syllabus from the instructor for information about the course's content and learning objectives.

## 2) Enrollment in BIOL 780

Students will also be required to enroll in BIOL 780 Capstone Companion Course (1 cr.) **during the semester of their individual experience.** BIOL 780 is offered every Fall and Spring semester.

- If the individual experience is a two-semester thesis, BIOL 780 should be taken during the second semester.
- If the individual experience occurs during the summer (e.g., internship), BIOL 780 should be taken during the Fall semester that immediately follows.
- Note: Because BIOL 780 is not offered during the summer, students cannot complete their individual experience during the summer *and graduate during that same September*. Summer experiences could only be used as individual capstone experiences if completed the summer before the student's senior year.

## Degree Plan

### Sample Degree Plan

*This sample degree plan serves as a general guide; students collaborate with their academic advisor to develop a personalized degree plan to meet their academic goals and program requirements.*

#### First Year

Fall		Credits
BIOL 412	Introductory Biology: Evolution, Biodiversity and Ecology	4
ENGL 401	First-Year Writing	4
CHEM 403	General Chemistry I	4
BIOL 400	Professional Perspectives on Biology	1
Discovery Course		4
<b>Credits</b>		<b>17</b>

#### Spring

BIOL 411	Introductory Biology: Molecular and Cellular	4
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CHEM 404	General Chemistry II	4
Discovery Course		4
Discovery Course or Major Elective		4
<b>Credits</b>		<b>16</b>

#### Second Year

##### Fall

BIOL 541W	Ecology	4
CHEM 545 & CHEM 546	Organic Chemistry and Organic Chemistry Laboratory <sup>1</sup>	5
Major Elective		4
Discovery Course		4

**Credits 17**

##### Spring

BIOL 528	Applied Biostatistics I	4
GEN 604	Principles of Genetics	4
Major Elective		4
Discovery Course		4

**Credits 16**

#### Third Year

##### Fall

PHYS 401	Introduction to Physics I	4
BMCB 658 & BMCB 659	General Biochemistry and General Biochemistry Lab	5
ZOOL 690	Evolution	4
Major Elective		4

**Credits 17**

##### Spring

PHYS 402	Introduction to Physics II	4
Discovery Course		4
Second Quant Course		4
Major Elective		4

**Credits 16**

#### Fourth Year

##### Fall

Major Elective		4
Major Elective		4
Capstone		4
General Electives		4

**Credits 16**

##### Spring

Major Elective		4
General Elective		4
General Elective		4

**Credits 12**

**Total Credits 127**

<sup>1</sup> Pre-professionals take one year of organic chemistry.

## Student Learning Outcomes

### Program Learning Outcomes

- Students demonstrate that they understand basic principles of biology. Demonstrate a fundamental understanding of the relationships between structure, function, and process at the level of molecular, cellular, and organismal levels. Describe the principles and mechanisms of organismal evolution and genetics as the central unifying and explanatory concepts of biology. Explain the relationship between organisms and their physical, chemical, and biological environments. Explain what biodiversity is, its value in ecosystems, and the need for its conservation.
- Students demonstrate that they can undertake scientifically valid methods of inquiry. Demonstrate proficiency in searching, reading, and understanding scientific literature. Apply the scientific process, including the framework of initiation, designing, and conducting experiments, and the appropriate analysis and discussion based on the data gathered. Exhibit technical skills in the use of appropriate laboratory and field techniques commonly used in biology.
- Students demonstrate that they can think critically and analytically. Demonstrate an ability to critically and objectively evaluate data, develop hypotheses, interpret and or design biological experiments and studies.
- Students demonstrate that they can communicate effectively. Communicate scientific material effectively in written and oral formats.
- Students practice science responsibly and ethically, and acknowledge the influence of cultural and historical biases in the sciences.