MARINE, ESTUARINE AND FRESHWATER BIOLOGY MAJOR (B.S.)

https://colsa.unh.edu/biological-sciences/program/bs/marine-estuarine-and-freshwater-biology

**Description**

The Major in Marine, Estuarine, and Freshwater Biology is intended to give students interested in the fields of marine and freshwater biology the background and direct hands-on experience needed to pursue productive careers, including potential advanced study. This strategically cross-disciplinary major builds on a broad set of science courses in high-impact areas of study for today's world, represented by a core curriculum in math, chemistry, physics, and biology. The core background is strengthened by a series of required and elective courses in a diverse range of aquatic sciences spanning watersheds to oceans, providing opportunities for study from organismal to ecosystem scales. Designed to provide a solid foundation of knowledge in freshwater, estuarine, and marine biology, the MEFB Major allows flexibility and encourages students to focus on particular areas of interest from molecular biology to ecosystem and policy studies. Students will have the opportunity to specialize in areas of their own interest, such as aquaculture and fisheries, animal behavior, ecological restoration, or management. While MEFB students must complete rigorous course requirements, our students are encouraged to tailor their elective courses within and across departments and colleges as needed to build their own, unique cross-disciplinary path.

The University of New Hampshire is uniquely located for the study of aquatic organisms and their habitats. We are centered between the Great Bay Estuary and the Gulf of Maine, with easy access to diverse marine environments as well as the freshwater habitats of New Hampshire's Lakes Region and the White Mountain National Forest. We boast three Marine Laboratories that provide exceptional opportunities for our students' research and educational needs, including Jackson Estuarine Laboratory (JEL), the Coastal Marine Lab (CML; part of the larger Judd Gregg Marine Research Center), and the Shoals Marine Laboratory (SML), as well as strong affiliations with the Great Bay National Estuarine Research Reserve. While JEL is located on Great Bay in Durham, CML is in nearby New Castle at the Seacoast, and SML is located seven miles off the coast. SML provides summer undergraduate programing with field-based marine courses that fulfill major electives, as well as internships and research opportunities for advanced study. In addition, UNH's campus maintains two fish aquaculture facilities, a world-class genomics laboratory, and the State Veterinary Diagnostic Laboratory, which provide hands-on opportunities for undergraduates. There is also an active diving program with courses at both beginner and advanced levels. A major strength of the MEFB program is the hands-on approach to learning combined with an emphasis on involving undergraduate students in mentored research opportunities.

**Off Campus Coursework and Study Abroad Opportunities**

It is strongly recommended that students consider participating in a summer, semester, or year-long study abroad program. UNH's Shoals Marine Laboratory (https://www.shoalsmarinelaboratory.org/), in conjunction with Cornell University, offers a host of marine biology-related college level courses that meet many degree requirements of the MEFB major over the summer on our island campus in the Isles of Shoals. SML offers both Merit and Need-based Scholarships, multi-course discounts, as well as competitive Research Internships offering summer stipends. UNH Global is the definitive resource for Study Abroad opportunities for undergraduates (https://www.unh.edu/global/education-abroad). UNH Global can provide information on programs of study, while students' academic advisors can assist in course selection options that provide equivalencies to requirements in MEFB so progress toward degree is not compromised. In addition, Ecoquest, run by the Department of Natural Resources, offers summer and semester programs of environmentally oriented courses in New Zealand (https://ecquest.unh.edu/). These are just some of the many opportunities available for MEFB students and we encourage you to explore more.

**Pre-health Professional Program**

MEFB majors who wish to pursue postgraduate degrees in the health care professions should visit the premed advising website (http://www.unh.edu/premed-advising).

**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**

A minimum grade of C- is required in all biological science courses that are counted toward the requirements for a degree in MEFB. 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.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BIOL 412</td>
<td>Introductory Biology: Evolution, Biodiversity and Ecology</td>
<td>4</td>
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<tr>
<td>BIOL 411</td>
<td>Introductory Biology Molecular and Cellular</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 541W</td>
<td>Introductory Biology: Evolution, Biodiversity and Ecology</td>
<td>4 or 0</td>
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<tr>
<td>BMS 503</td>
<td>General Microbiology</td>
<td>5</td>
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<tr>
<td>&amp; BMS 504</td>
<td>General Microbiology Laboratory</td>
<td>5</td>
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<tr>
<td>GEN 604</td>
<td>Principles of Genetics</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 403</td>
<td>General Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 404</td>
<td>General Chemistry II</td>
<td>4</td>
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<tr>
<td>CHEM 545 &amp; CHEM 546</td>
<td>Organic Chemistry</td>
<td>5</td>
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<tr>
<td>BMCB 668A</td>
<td>General Biochemistry</td>
<td>3</td>
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<tr>
<td>MATH 424B</td>
<td>Calculus for Life Sciences</td>
<td>4</td>
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<tr>
<td>or BIOL 633</td>
<td>Data Analysis for Life Science</td>
<td>4</td>
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<td>or BIOL 711</td>
<td>Experimental Design &amp; Analysis</td>
<td>4</td>
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<tr>
<td>BIOL 528</td>
<td>Applied Biostatistics I</td>
<td>4</td>
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MEFB Electives: Choose 3

1. Evolution, Systematics and Biodiversity
   - BIOL 566 Systematic Botany
   - BIOL 705 Data Science with R for the Life Sciences
   - GEN 713 Microbial Ecology and Evolution
   - MEFB 500 Coastal Habitat Field Research Methods (SML)
   - MEFB 510 Field Ornithology (SML)
   - MEFB 530 Evolution and Marine Diversity (SML)
   - MEFB 535 Marine Mammal Biology (SML)
   - MEFB 625 Introduction to Marine Botany
   - or MEFB 747 Aquatic Plants in Restoration/Management
   - MEFB 628 Marine Invertebrate Evolution and Ecology
   - or ZOOL 710 Sharks and Bony Fishes

2. Capstone: BIOL 780 Capstone Companion Course
   - MEFB Elective: Choose 1

3. MEFB 747 Aquatic Plants in Restoration/Management (C)
   - MEFB 750 Introductory Research in Marine Biology (SML)
   - MEFB 765 Biological Oceanography (C)
   - NR 703 Watershed Water Quality Management
   - NR 744 Biogeochemistry
   - ZOOL 708 Stream Ecology
   - ZOOL 739W Behavioral Ecology

4. Physiology, Behavior and Cell Biology
   - ANSC 701 Physiology of Reproduction
   - BIOL 790 Plant Physiology
   - BMCB 605 Principles of Cell Biology
   - BMS 715 Public Health: Food and Water borne Diseases
   - MEFB 504 Field Wildlife Forensics (SML)
   - MEFB 505 Marine Parasitology and Disease (SML)
   - MEFB 714 Field Animal Behavior (SML)
   - MEFB 773 Physiology of Fishes
   - ZOOL 625 Principles of Animal Physiology
   - ZOOL 626W and Animal Physiology Laboratory

5. ZOOL 739W Behavioral Ecology
   - ZOOL 790 Genes and Behavior (C)
   - ZOOL 777W Neuroethology
   - MARR 405 Introduction to Marine Mammal Science and Policy
   - MARR 705 Introduction to Marine Policy: Understanding US Ocean, Coastal and Great Lakes Policy
   - MEFB 505 Introduction to Applied Science Communication (SML)
   - MEFB 702 Sustainable Marine Fisheries
   - MEFB 747 Aquatic Plants in Restoration/Management (C)
   - MEFB 772 Fisheries Biology Conservation and Management
   - ZOOL 610 Principles of Aquaculture
   - Research and Special Projects

1. A single course cannot be used for both a core requirement and an elective (e.g., ZOOL 542 cannot be used to fulfill the animal survey requirement and as an elective).
2. Primary focus of the project must be Marine, Estuarine and/or Freshwater. 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.
3. This class requires enrollment in both fall and spring sections, 2 credits/semester for a total of 4 credits.

**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 MEFB 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 Capstone Companion Course

Students will also be required to enroll in BIOL 780 (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 August. Summer experiences could only be used as individual capstone experiences if completed the summer before the student’s senior year.

Student Learning Outcomes

- Show the ability to synthesize diverse sources of information and communicate it effectively.
- Demonstrate a broad understanding of the unique characteristics, as well as the similarities, governing freshwater, estuarine and marine systems.
- Have a broad understanding of biology from the molecular to the ecosystem with a particular appreciation for the abiotic and biotic factors relating to diverse aquatic ecosystems.
- Demonstrate the ability to describe basic principles of scientific inquiry and the importance of scientific study for understanding the natural world.
- Demonstrate the ability to design and experiment, collect data, analyze and graph it appropriately, and summarize the significant findings.