

# COLLEGE OF LIFE SCIENCES AND AGRICULTURE

[www.colsa.unh.edu/](http://www.colsa.unh.edu/)

Thomas E. Brady, Dean  
Kimberly J. Babbitt, Associate Dean

Department of Biological Sciences  
Department of Molecular, Cellular and Biological Sciences  
Department of Natural Resources and the Environment

## Bachelor of Science

### Animal Sciences

Bioscience and Technology  
Equine Sciences  
Preveterinary Medicine

### Biochemistry

### Biology

Ecology, Evolution, and Behavior  
General  
Marine and Freshwater  
Molecular, Cellular, and Developmental

### Community and Environmental Planning

### Dairy Management

### Environmental Conservation Studies

### Environmental Horticulture

### Environmental and Resource Economics

### Environmental Sciences\*

Ecosystems  
Hydrology  
Soil and Watershed Management

### International Affairs (Dual Major)

### Medical Laboratory Science

Clinical Chemistry  
Clinical Hematology  
Clinical Immunohematology  
Clinical Microbiology

### Microbiology

### Nutritional Sciences

### Plant Biology

### Tourism Planning and Development

### Wildlife Ecology

### Zoology

## Bachelor of Science in Forestry

### Forestry\*

**T**he objectives of the College of Life Sciences and Agriculture are to give students a fundamental education in the biological, natural, and social sciences and to introduce them to the arts and humanities. In addition, advanced technical and professional courses are offered to prepare students for graduate school or entry-level positions in areas concerned with improving the quality of life. Preparation can vary from fundamental studies of cancer cells to community-service planning, resource protection to genetic engineering, and molecular biology to biotechnology.

A blend of the basic and applied aspects of life sciences and agriculture, coupled with careful selection of supportive courses, ensures graduates the background and experiences necessary to be competitive in the job market. Potential employers include federal, state, and local governments; consulting firms; and industrial organizations. Graduates are employed as watershed, soil, and natural resource managers; associates in biomedical and agricultural research laboratories; marketing analysts and extension specialists; nutrition supervisors and environmental regulators; and information educators and communication experts.

Community governments employ graduates as service planners and land-use specialists, teachers in traditional education, public health technicians, and urban pest control specialists.

Positions are available in private and commercial organizations in production agriculture, food processing, landscaping, agribusiness, sales, and private planning. Graduates may also pursue entrepreneurial careers as greenhouse, nursery, farm, and natural resource managers; or as consultants, arborists, and environmental planners.

For those graduates with international aspirations, the Peace Corps and the Foreign Agriculture Service employ farm production experts, soil and water managers, market analysts, agricultural engineers, teachers, plant and animal breeders, and nutrition specialists.

Additionally, departments prepare students for advanced study in their chosen field of interest where graduate study is required for attaining their career goals.

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## Degrees

The college offers three undergraduate degrees: the bachelor of arts, the bachelor of science, and the bachelor of science in forestry. Some of the courses prescribed in these

degree programs partially fulfill the general education requirements. Students should see their advisers for specific information.

### Bachelor of Arts

The bachelor of arts degree is available in plant biology and zoology. Students must accumulate 128 credits, attain a 2.0 cumulative grade-point average, satisfy general education requirements, and complete a foreign language requirement (see University Academic Requirements for specific B.A. language requirements). Check individual departmental listings for specific major requirements and minimum acceptable grades in major courses.

### Bachelor of Science

The bachelor of science degree is available in all departments or programs except forestry. University requirements are the same as for the bachelor of arts degree, except that a foreign language is not required and minimum acceptable grades may differ in some programs. Check individual departmental or program listings for specific major requirements.

### Bachelor of Science in Forestry

The bachelor of science in forestry is a professional, designated degree available to students majoring in forestry.

### General Science Certification

Students majoring in animal sciences, biochemistry, biology, environmental conservation studies, environmental sciences, forestry, microbiology, plant biology, wildlife ecology, or zoology, may seek certification to teach science at the middle, junior, or high school level.

For further information, contact the coordinator of teacher education in the Department of Education.

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\*Designated degree (the name of the specialization is on the diploma, e.g., B.S. in Ecosystems).

### Advising System

A member of the faculty whose area of interest is closely related to the student's is appointed as an adviser to assist the undergraduate in planning his or her academic program. Further advising is also available in the dean's office, Rudman Hall.

### Undeclared Status

Students may select a major upon entering the college or may wait until registration for the sophomore year. Students who are uncertain about choosing a specific major may remain undeclared during their freshman year. In most cases they should take the following courses, after which they should be ready to declare a major:

#### Fall

LSA 400  
CHEM 403  
BIOL 411

General education requirement

An introductory course in any department in the college

#### Spring

CHEM 404  
BIOL 412  
MATH 424B

General education requirement

Undeclared freshmen should explore possible majors by taking courses in the areas or programs that interest them most. They should talk to faculty, students, and their adviser concerning requirements, job opportunities, etc., in the various programs and should be prepared to declare a major when they register for the first semester of the sophomore year.

### Combined Programs of Study

In addition to pursuing a single major, students may combine programs of study as follows (see University Academic Requirements for more information):

*Minors:* See University Academic Requirements, page 119.

*Second major:* See University Academic Requirements, page 19.

*Dual-degree programs:* See University Academic Requirements, page 18.

*Student-designed majors:* See Special University Programs, page 119.

*Other combined and interdisciplinary opportunities:* See Special University Programs, page 114.

### UNH-EcoQuest New Zealand Study Abroad Program

The Department of Natural Resources and the Environment offers highly motivated students the opportunity to study abroad through the UNH-EcoQuest New Zealand applied field studies program. Students engage in a unique multidisciplinary, research-oriented program and receive grade-point average credit for a semester abroad. Four fully integrated courses (NR 660, 661, 662, and 663 for 16 credit hours) focus on the ecological, resource management, and conservation and sustainability issues important to the natural environment, economy, and culture of New Zealand. Alternatively, students may participate in a two-course (NR 660, 662 for 8 credit hours) summer session. Contact Donna Dowal, (603) 862-2036.

### Interdisciplinary Programs

#### Agribusiness

The agribusiness minor is designed to provide students in disciplines other than environmental and resource economics training in the economics and management of agricultural and other natural resource business firms. This program prepares students to work for private companies, governmental agencies, or nonprofit, nongovernmental organizations. Students who are interested in operating their own businesses will also find this minor very useful. The courses in the agribusiness minor emphasize the applications of economic and business management principles.

#### Required

EREC 411, Environmental and Resource Economics Perspectives  
EREC 501, Agricultural and Natural Resource Product Marketing or MKTG 550, Survey of Marketing  
EREC 504, Business Management for Natural Resource Firms  
EREC 606, Land Economic Perspectives: Uses, Policies, and Taxes  
EREC 715, Linear Programming and Quantitative Models

For additional information, contact John M. Halstead, Environmental and Resource Economics Program coordinator, 310 Nesmith Hall, (603) 862-3914.

#### Animal Behavior Minor

The animal behavior minor is designed for students who are interested in learning more about the mechanisms underlying the behavior of many different types of animals, as well as the reasons why certain behaviors may have evolved. Students interested in the animal behavior minor must complete a total of

20 credits of coursework (approximately five courses), from the list of courses below. Students must receive a grade of C- or better in each of these courses and no more than eight major requirement credits can be counted toward the minor. If a student is interested in using a relevant course that is not included in the following list, they must seek permission from either Michelle Scott or Win Watson in the Department of Biological Sciences.

#### Required Courses:

ZOOL 713, Animal Behavior  
ZOOL 777, Neurobiology and Behavior

#### Elective Courses (must take three, and one must be a psychology course):

PSYC 512, Psychology of Primates  
PSYC 521, Behavior Analysis  
PSYC 531, Psychobiology  
PSYC 710, Visual Perception  
PSYC 731, Brain and Behavior  
PSYC 733, Drugs and Behavior  
PSYC 735, Neurobiology of Mood Disorders  
PSYC 737, Behavioral Medicine  
PSYC 741, Animal Cognition  
BCHM 702, Endocrinology  
ZOOL 714, Ecology of Animal Behavior (Shoals)  
ZOOL 733, Behavioral Ecology

#### Community Planning

Land use and its impact on the quality of life has emerged as a major policy issue in New Hampshire, as well as at the national and global levels. Planning is a multidisciplinary profession that requires people who understand the technical tools and social concepts required to guide the selection and implementation of alternative schemes compatible with long term environmental and economic objectives. Students may supplement their major and general education course requirements with specific courses that will enhance their ability to find employment that requires knowledge of planning concepts and tools used in the formulation and implementation of effective land and resource planning by government agencies, nonprofit organizations, and private business firms.

#### Required

*Group I-Theory and practice of planning (all courses required)*  
CD 415, Community Development Perspectives  
CD 614, Fundamentals of Planning (prereq: EREC 411)  
CD 777, Topics in Community Planning (prereq: CD 614)

#### *Group II-Tools and applications in planning (choose one)*

CD 672, New Hampshire Real Estate  
CIE 505, Surveying and Mapping (coreq: MATH 425)  
NR 757, Photo Interpretation and Photogrammetry  
NR 760, Geographic Information Systems in Natural Resources  
NR 609, Soils and Community Planning  
NR 703, Watershed Water Quality Management (prereq: NR 504 or permission)  
SOC 660, Urban Sociology

GEOG 590, Introductory Cartography

*Group III-Resource management theory (choose one)*

ECON 641, Public Economics (prereq: ECON 401, ECON 605, or permission)

EREC 572, Introduction to Natural Resource Economics

EREC 606, Land Economic Perspectives: Uses, Policies, and Taxes (prereq: EREC 411)

EREC 627, Community Economics (prereq: EREC 411 or equivalent)

EREC 756, Rural and Regional Economic Development

TOUR 767, Social Impact Assessment

*Group IV-Additional complementary electives (optional)*

CD 794, Community Planning Internship

GEOG 582, Economic Geography

GEOG 583, Urban Geography

For additional information, contact Kelly L. Cullen, Community and Environmental Planning Program coordinator, 303 Nesmith Hall.

## Genetics (GEN)

[genetics.unh.edu/](http://genetics.unh.edu/)

(For course descriptions, see page 194.)

The University does not offer a baccalaureate degree program in genetics (only master's and Ph.D. degrees). However, undergraduates can complete a minor in genetics or can pursue their interest in the context of any of the following B.S. degree programs: animal sciences, biochemistry, biology, microbiology, plant biology, or zoology. Students interested in preparing for graduate work in genetics at UNH or elsewhere should contact the chairperson of the genetics program for advice on courses early in their undergraduate careers.

Requirements: Completion of 20 credits from the courses listed below, with a grade of C- or better, is required for a minor in genetics. At least two courses should be selected from each of the categories. Four (or more) credits of GEN 795, Investigation in Genetics, may be counted as one course toward fulfillment of the minor. See page 19 for requirements for completion of a minor.

### Category 1

GEN 705, Population Genetics

GEN 715, Molecular Evolution

GEN 723, Quantitative Genetics

GEN 753, Cytogenetics

GEN 766, Environmental Genetics

GEN 772, Evolutionary Genetics of Plants

ZOOL 665, Conservation Genetics

### Category 2

BIOL 604, Principles of Genetics

GEN 706, Human Genetics

GEN 711, Genomics and Bioinformatics

GEN 754, Laboratory in Biochemistry and Molecular Biology of Nucleic Acids

GEN 771, Molecular Genetics

GEN 774/775, Plant Biotechnology and Genetic Engineering

GEN 782, Developmental Genetics

## Marine Biology

The minor is designed to provide a foundation in marine biology and related sciences to any UNH undergraduate student with the exception of students enrolled in the marine and freshwater biology option of the biology program. It is offered through the Department of Biological Sciences. The minor consists of 20 credits with grades of C- or better and no pass/fail courses. No more than eight major requirement credits may be used towards the minor. All courses in the program are selected in consultation with the minor adviser (contact Larry Harris, Department of Biological Sciences).

Students should declare their intention to minor in marine biology before the end of the junior year. During the final term, students should apply to the dean to have the minor shown on their transcript.

### Required

Five courses (20 credits); two of the five courses (eight credits) can count toward the major.

Introductory course in Marine Science (choose one):

ZOOL/PBIO 503, Introduction to Marine Biology

ESCI 501, Introduction to Oceanography

ZOOL 674, Field Marine Science

Four additional courses selected in consultation with the minor adviser.

In addition, students are encouraged to become involved in a research project, either by working in a professor's laboratory or by participating in the Undergraduate Ocean Research Project (TECH 797).

## Sustainable Living

Issues of sustainable living involve every aspect of life. Humans are part of, and dependent upon, healthy functioning ecosystems. Sustainable living requires learning to live with ecosystem limits. Students increase their knowledge and awareness of environmental issues and problems, gain an understanding of ecology, and develop thinking and communication skills in order to help solve complex problems and move humanity toward a more sustainable future.

### Required Courses

1. *Environmental Issues - One course below*

NR 415, Global Environmental Change

NR 435, Contemporary Conservation Issues and Environmental Awareness

NR 502, Forest Ecosystems and Environmental Change

NR 650, Principles of Conservation Biology

NR 720, International Environmental Politics and Policies for the 21st Century

NR 724, Resolving Environmental Conflicts

ECON 607, Ecological Economics

EREC 608, Environmental Economics for Non-economists

GEOG 673, Environmental Geography

2. *Ecology - One course below*

NR 433, Wildlife Ecology

BIOL 541, General Ecology

NR 527, Forest Ecology

NR 660, Ecology and Biogeography of New Zealand

ZOOL 474, Intro to Marine Sciences (Summers at Appledore Island)

ZOOL 503, Intro to Marine Biology

3. NR 784, Sustainable Living

4. NR 601, Environmental Conservation and Sustainable Living Internship

5. NR 785, Systems Thinking for Sustainable Living

For additional information, contact Robert Eckert, Department of Natural Resources and the Environment, (603) 862-2508.

## Water Resources Management

Students in Biology, Environmental Conservation Studies, Forestry, Plant Biology, Wildlife Ecology, Environmental Engineering, Environmental and Resource Economics, Community and Environmental Planning, and related fields should consider a minor in Water Resources Management. There is a strong demand among consulting firms, state and federal agencies, and not-for-profit organizations for persons with knowledge and experience relevant to water resource management.

### Required

1. NR 504, Freshwater Resources

2. NR 703, Watershed Water Quality Management

3. *Choose one of the following:*

EREC 676, Economics of Water Use and Quality Management

ESCI 705, Principles of Hydrology

NR 604, Watershed Hydrology

*Choose from the list below or from category three above for eight additional credits:*

NR 658, Introduction to Geographic Information Systems

NR 711, Wetland Ecology and Management

NR 716, Wetland Delineation

NR 719, Wetlands Restoration and Mitigation

NR 751, Aquatic Ecosystems

NR 760, Geographic Information Systems in Natural Resources

NR 542, Forestland Measurement and Mapping

ESCI 710, Groundwater Hydrology

ZOOL 708, Steam Ecology

ZOOL 717, Biology of Lakes

For additional information, contact William McDowell, Department of Natural Resources, (603) 862-2249.

## Wetland Ecology

Students in biology, environmental conservation studies, forestry, plant biology, environmental sciences, wildlife ecology, and related majors should consider obtaining a minor in wetland ecology. There is a strong demand among consulting firms, and state and federal agencies for employees with knowledge and experience relevant to wetland resource management.

### Required

NR 504, Freshwater Resources or NR 703, Watershed Water Quality Management  
 NR 711, Wetland Ecology and Management  
 NR 716, Wetland Delineation or NR 719, Wetlands Restoration and Mitigation, or ZOO 708, Stream Ecology

### Recommended

PBIO 566, Systematic Botany  
 PBIO 625, Introduction to Marine Botany  
 PBIO 721, Microscopic Algae  
 PBIO 722, Marine Phycology  
 PBIO 747, Aquatic Higher Plants  
 MICR 713, Microbial Ecology and Evolution  
 NR 527, Forest Ecology  
 NR 765, Community Ecology  
 NR 751, Aquatic Ecosystems  
 NR 425, Field Dendrology  
 NR 501, Introduction to Soil Sciences  
 NR 602, Natural Resources and Environmental Policy  
 NR 621, Field Description of Soils  
 NR 706, Soil Ecology  
 ZOO 725, Marine Ecology

For additional information, contact David Burdick, (603) 862-5129, or William McDowell, (603) 862-2249.

## Programs of Study

### Animal Sciences (ANSC)

[www.animalsci.unh.edu/](http://www.animalsci.unh.edu/)

(For course descriptions, see page 154. See also *Nutritional Sciences*, page 103, and *Medical Laboratory Science*, page 100.)

The undergraduate animal sciences program at UNH provides students with fundamental and applied education in nutrition, reproduction, genetics, physiology, pathology, cell biology, and large animal management. Courses are also offered in all areas of dairy and light horse production.

There are four major degree programs offered in the area of animal and nutritional sciences: a) animal sciences with options in equine sciences (equine industry and management, therapeutic riding, and equine science), bioscience and technology, and preveterinary medicine; b) dairy management; c) medical laboratory science with tracks in clinical

chemistry, hematology, immunohematology, histology, and microbiology; and d) nutritional sciences. Kendall Hall houses the New Hampshire Veterinary Diagnostic Lab; an electron microscopy facility; and nutrition, physiology, and cell culture labs, all of which provide opportunities for students interested in basic animal sciences. The equine program maintains a light horse center and offers courses in management, equine diseases, equine discipline, physical performance, and horsemanship specializing in dressage and combined training. Dairy facilities include housing for more than one hundred milking-age cows in the new \$1.6-million Fairchild Dairy Teaching and Research Center. Responding to a need by farmers for scientific research to support organic dairy efforts, UNH is the first land-grant university to have an organic dairy farm. It is a research center for organic production and management and an education center for organic dairy farmers, farmers considering the transition to organic, and students of sustainable agriculture. The organic dairy is housed at the Burley-Demeritt Farm. Miniature swine also are maintained at the Burley-Demeritt farm.

The animal sciences degree has three program options: 1) equine sciences, 2) bioscience and technology, and 3) preveterinary medicine. In addition to satisfying the specific requirements of the major and options, all animal sciences majors must complete the University general education requirements.

The UNH equine sciences option offers a unique and well-rounded program of study to students pursuing a career in the horse industry. The equine program's outstanding physical facilities are complemented by a strong, science-based curriculum taught by an experienced and talented faculty. Students graduating from the UNH equine program receive a B.S. in animal sciences with a concentration in equine sciences. The core curriculum of study provides students with a solid background in the biological and equine sciences. Students then choose one of three tracks for career specialization: I) equine industry and management, II) therapeutic riding, III) equine science.

Students in the bioscience and technology option often specialize in nutrition, reproduction, genetics, or cell biology. This curriculum prepares students for advanced training in graduate school programs or in various medical professions; entry-level positions in biomedical, biotechnical, pharmaceutical, and other scientific companies; or technical positions in many research and medical units.

The preveterinary medicine option is designed to meet the academic requirements of

most veterinary schools. Requirements may be met within three years, allowing students to apply to veterinary school during their senior year. However, most students finish their senior year, thus allowing more time for electives, concentration in areas of secondary interest, and completion of graduation requirements.

Employers in agriculture prefer to hire an agricultural graduate with extensive knowledge in a related field (e.g., computer science) rather than a graduate in one of these areas with no knowledge of agriculture. Hence, animal science students are encouraged to obtain training in a field that complements study in animal sciences. Such areas may include cell biology, biotechnical skills, communications, computer science, education, or business. This is generally accomplished by either taking a concentration of courses or obtaining a minor in a specialty area. Attainment of sufficient training in a specialty area enhances opportunity for employment. A careers course is offered to help students select and prepare for a particular career area.

Development of optional career goals is important for preveterinary students. Admission to schools of veterinary medicine is highly competitive. Therefore, students in this option are urged to prepare for alternative careers as they complete preveterinary requirements.

All animal sciences majors are required to complete ANSC 406; CHEM 403 and 404\*; and ENGL 501 (or ENGL 419, 502, or 503; or ANSC 543). In addition, the requirements in one of the three following options must also be completed:

### Bioscience and Technology Option

BIOL 411-412; PHYS 401-402; MATH 424B and BIOL 528 (or SOC 502 or PSYC 402); MICR 503 or BIOL 541; ANSC 511-512 or ZOO 518 and 625/626; CHEM 545 or 651-652; BIOL 604; BCHM 658/659 or 751-752; ANSC 750; and one 700-level ANSC course.

### Equine Sciences Option

#### Requirements for all Equine Sciences students

AAS 237, Equine Handling and Care Techniques  
 ANSC 404, Intro to Equine Sciences (waived for TSAS equine management graduates)  
 ANSC 406, Careers in Animal Science  
 ANSC 600, Field Experience (waived for TSAS equine management graduates)  
 ANSC 697, Equine Seminar (waived for TSAS equine management graduates)  
 BIOL 528, Applied Statistics  
 ENGL 501, Intro to Prose Writing (or ENGL 419 or 503 or ANSC 543)  
 EREC 411, Resource Economics Perspectives

\*Equine students exempt.

**TRACK I—EQUINE INDUSTRY AND MANAGEMENT****Core Courses**

AAS 228, Anatomy and Physiology of Domestic Animals  
 AAS 239, Fundamentals of Animal Health  
 ANSC 432, Animal Forages  
 AAS 235, Animal Nutrition  
 AAS 246, Animal Business Applications  
 ANSC 620/622, Equine Diseases  
 ANSC 625, Equine Sports Medicine and Lameness  
 ANSC 724, Reproductive Management and Artificial Insemination  
 BIOL 412, Principles of Biology II  
 EREC 504, Business Management for Natural Resource Firms

**Track Options (choose five of the following)\***

AAS 226, Equine Conformation and Lameness  
 AAS 247, Applied Equine Management  
 AAS 253, Equine Competition Management  
 ADMN 502, Financial Accounting  
 ANSC 420/444B, Horse in History  
 ANSC 507, Colt Training  
 ANSC 565, Principles of Horse Trials Management  
 ANSC 602/444, Animal Rights  
 ANSC 640, Principles of Riding Instruction  
 ANSC 641/642/643, Teaching Specialties  
 ANSC 701, Physiology of Reproduction  
 EREC 501, Agriculture and Natural Resource Product Marketing  
 RMP 554, Recreational Business Management  
 MGT 580, Introduction to Organizational Behavior  
 ZOOL 713, Animal Behavior

\*For classes less than three credits, two must be taken together to count as one requirement.

**Suggested electives**

AAS 234, Equipment and Facilities Management  
 AAS 278, Applied Animal Science Computer Applications

**TRACK II—THERAPEUTIC RIDING****Track Requirements**

AAS 226, Equine Conformation and Lameness  
 AAS 247, Applied Equine Management  
 AAS 252, Equine Health Management  
 or ANSC 620/622, Equine Diseases and Disease Clinic  
 ANSC 500, Methods of Therapeutic Riding  
 ANSC 795, Investigations  
 BIOL 412, Principles of Biology II  
 EREC 504, Business Management for Natural Resource Firms  
 or AAS 246, Animal Business Applications  
 ZOOL 507/508, Human Anatomy and Physiology

**Track Options (choose five of the following)**

ANSC 507, Colt Training  
 ANSC 640 & 643, Teaching Specialties  
 CSL 202, Introduction to Nonprofit Organizations  
 CSL 207, Introduction to Nonprofit Budgeting and Accounting Practices  
 CSL 208, Essentials of Fundraising for Community-Based Organizations  
 CSL 209, Essentials of Grant Writing for Community-Based Organizations  
 COMM 520, Survey of Communication Disorders  
 or COMM 533, Sign Language  
 HHS 740, Collaborative Services for Children with Special Needs

MGT 580, Introduction to Organizational Behavior  
 OT 510, Exploring Occupational Therapy and Occupation  
 OT 500, The Behavior and Development of Children  
 or FS 525, Human Development  
 RMP 501, Recreation Services for Individuals with Disabilities

**Suggested electives**

AAS 254, Animal Assisted Activities and Therapy  
 AAS 251, Human/Animal Bond  
 AAS 278, Applied Animal Science Computer Applications

**TRACK III—EQUINE SCIENCES****Track Requirements**

ANSC 511/512, Anatomy and Physiology  
 ANSC 609, Principles of Nutrition  
 ANSC 612, Genetics of Domestic Animals  
 ANSC 620, Equine Diseases  
 ANSC 622, Equine Disease Clinic  
 ANSC 625, Equine Sports Medicine and Lameness  
 ANSC 724, Reproductive Management and Artificial Insemination  
 or ANSC 701, Physiology of Reproduction  
 BIOL 411/412, Principles of Biology I and II  
 CHEM 403/404, General Chemistry

**Track Options (choose five of the following)**

AAS 226, Equine Conformation and Lameness  
 AAS 235, Animal Nutrition  
 AAS 239, Fundamentals of Animal Health  
 ANSC 432, Animal Forages  
 ANSC 701, Physiology of Reproduction  
 ANSC 704, Principles of Pathobiology  
 ANSC 718, Mammalian Physiology  
 ANSC 724, Reproductive Management and Artificial Insemination  
 ANSC 750, Nutritional Biochemistry  
 BCHM 658/659, General Biochemistry and General Biochemistry Lab  
 BIOL 604, Principles of Genetics  
 CHEM 545/546, Organic Chemistry and Organic Chemistry Lab  
 ZOOL 713, Animal Behavior

**Diploma program providing preparation for NARHA certification**

ANSC 404, Introductory Equine Science  
 or AAS 237, Equine Handling and Care Techniques  
 ANSC 402, Horsemanship  
 KIN 501, First Aid-Responding to Emergencies  
 ANSC 500, Methods of Therapeutic Riding  
 ANSC 795, Investigations  
 a seminar on teaching therapeutic riding

**Pre-veterinary Medicine Option**

BIOL 411-412; PHYS 401-402; MATH 424B; BIOL 528; MICR 503;  
 ANSC 511-512; BIOL 604; CHEM 651/652 and 653/654; BCHM  
 658/659; ANSC 750; and one 700-level ANSC course.

(For course requirements for the B.S. degree in Dairy Management, see *Dairy Management*, page 97.)

**General Science Certification**

(See *Department of Education and COLSA/ Degrees*, pages 35 and 89.)

**Biochemistry and Molecular Biology (BCHM)**

[www.biochemistry.unh.edu/](http://www.biochemistry.unh.edu/)

(For course descriptions, see page 163.)

The field of biochemistry and molecular biology encompasses a broad range of the molecular life sciences, from biophysics and biochemistry to applied biology and medicine. The B.S. in biochemistry is based on a solid foundation in biology, chemistry, physics and math, along with advanced courses in molecular biology, biochemistry, cell biology, and genetics. The combined B.S.-M.S. degree program allows outstanding students with well-defined career plans to augment their bachelor's degree program with an intensive research program and graduate-level course work leading to the master's degree.

The biochemistry and molecular biology program offers specialized training in the areas of molecular genetics, signal transduction, gene regulation, bioinformatics, molecular evolution, cancer biology, macromolecular interactions, glycobiology, lipid metabolism, endocrinology, genomics, and proteomics. Undergraduate students are encouraged to become involved in research projects sponsored by external granting agencies such as the National Institutes of Health, the National Science Foundation, and others.

Students interested in the biochemistry major should consult with a biochemistry faculty member as early as possible to ensure the most effective curricular planning.

For first-year students with a strong high school preparation in both chemistry and mathematics (including calculus), the following schedule is recommended:

**Fall**

BIOL 411, Principles of Biology I  
 CHEM 403, General Chemistry I  
 MATH 425, Calculus I  
 ENGL 401, First Year Writing

**Spring**

BIOL 412, Principles of Biology II  
 CHEM 404, General Chemistry II  
 MATH 426, Calculus II  
 General education course

For first-year students lacking a strong background in chemistry and mathematics, the following schedule is recommended:

**Fall**

BIOL 411, Principles of Biology I  
 CHEM 403, General Chemistry I  
 ENGL 401, First Year English  
 General education course

**Spring**

BIOL 412, Principles of Biology II  
 CHEM 404, General Chemistry II  
 MATH 424B, Calculus for Life Sciences  
 General education course

**Bachelor of Science in Biochemistry**

The bachelor's degree in biochemistry consists of a set of core requirements (Group I) and a set of required electives from several subject areas (Groups II-V):

**I. All of the following**

BIOL 411, 412, Principles of Biology I, II  
 CHEM 403, 404, General Chemistry I, II  
 MATH 425, 426, Calculus I, II,  
 or 424B, Calculus for Life Sciences and  
 BIOL 528, Applied Biostatistics I  
 MICR 503, General Microbiology  
 BIOL 604, Principles of Genetics  
 BIOL 605, Eukaryotic Cell and Developmental Biology  
 CHEM 547/549 and 548/550, Organic Chemistry,  
 or CHEM 651/653 and 652/654, Organic Chemistry,  
 or CHEM 545/546, Organic Chemistry, and BCHM 658/659,  
 General Biochemistry  
 PHYS 401, 402, Introduction to Physics I, II,  
 or PHYS 407, 408, General Physics I, II  
 BCHM 751-752, Principles of Biochemistry  
 BCHM 755, Laboratory in Biochemistry and Molecular Biology

**II. One of the following molecular biology courses**

BCHM 711, Genomics and Bioinformatics  
 BCHM 766, Environmental Genomics  
 BCHM 771, Molecular Genetics  
 BCHM 782, Developmental Genetics  
 BCHM 790, Current Topics in Biomedicine  
 GEN 715, Molecular Evolution

**III. One of the following biochemistry courses**

BCHM 702, Endocrinology  
 BCHM 750, Physical Biochemistry,  
 or CHEM 683, 684, Physical Chemistry I, II  
 BCHM 763, Biochemistry of Cancer  
 BHCM 790, Current Topics in Biomedicine  
 BCHM 794, Protein Structure and Function

**IV. One of the following laboratory techniques courses**

BCHM 754, Laboratory in Biochemistry and Molecular Biology  
 of Nucleic Acids  
 BCHM 799, Senior Thesis  
 BCHM 795, Investigations in Biochemistry and Molecular  
 Biology  
 ANSC 714, Research Methods in Endocrinology  
 ANSC 751, Cell Culture  
 CHEM 756, Advanced Organic Chemistry Laboratory  
 MICR 602, Pathogenic Microbiology  
 MICR 704, Genetics of Prokaryotic Microbes  
 MICR 705, Immunology  
 MICR 706/708, Virology and Virology Lab  
 MICR 717, Microbial Physiology  
 PBIO 753, Cytogenetics  
 PBIO 774/775, Plant Biotechnology and Genetic Engineering

**V. One additional course from groups II-IV**

The biochemistry curriculum provides most of the required and recommended courses for students seeking admission to professional schools in medicine, dentistry, veterinary medicine, and pharmacy. Students who major in biochemistry can also use their training in conjunction with advanced degrees in law and business.

Approximately 50 percent of the students who graduate with a major in biochemistry seek advanced degrees. Many biochemistry majors go on to attend graduate school in all areas of the life and biomedical sciences, especially graduate programs in genetics, molecular biology, biochemistry, cell biology, and chemistry. Recipients of an M.S. degree are more attractive to employers and often obtain better positions, greater salaries, and more responsibility and independence. A Ph.D. degree is eventually required for those who wish to direct research programs, be involved in state-of-the-art scientific research, become a professor in a college or university, or obtain an executive position in a science-related area of industry or government.

Students obtaining the B.S. in biochemistry enjoy excellent job prospects immediately upon graduation. There is currently a demand for skilled research technicians in biotechnology companies, pharmaceutical companies, government agencies, forensics, academic research laboratories, and hospitals. Students graduating in biochemistry have knowledge that is valuable in the fields of management, sales, marketing, regulatory affairs, technical writing, and scientific journalism. With additional courses in education, the B.S. in biochemistry also qualifies graduates to teach at the elementary, junior high, and high school levels.

***A combined Bachelor of Science and Master of Science in Biochemistry***

This is a five-year program leading to a combined bachelor and master's degree in biochemistry. It is designed for highly motivated and qualified students seeking additional training to further their career goals as a researcher in the life sciences.

***Admission Policy***

Admission to the combined degree program is highly competitive. Students wishing to pursue this option must have a grade-point average greater than 3.2 at the time of application. A thesis adviser must be identified during the junior year, and the approval of the adviser and department chairperson must be obtained. Prior to the first semester of the senior year, the student must formally apply to the Graduate School and receive early admission. The requirement for the Graduate Record Examinations is waived for combined degree applicants.

***Requirements***

Thirty credits of graduate level (800-900) coursework (including dual credit courses) must be completed. Six to eight credits must be taken during the senior year, and are applied to both the B.S. and M.S. requirements. All other requirements for the M.S. degree (see Graduate School catalog) must be followed,

including completion of preliminary exams, conducting a research project, and passing an oral examination based on the master's thesis project.

**Suggested Program**

Because of the intensive nature of the combined degree program, the thesis research project should be initiated as early as possible. A guidance committee should be established no later than the beginning of the fifth year to approve the student's proposed course of study. The following schedule is recommended:

**Junior year**

Identify thesis adviser and begin research project during the summer following junior year.

**Senior year**

Senior thesis (BCHM 799) during both semesters and the following summer, along with two dual-credit courses (800/900 level).

**Fall semester, fifth year**

Two 800/900 level courses (6-8 cr.)  
 BCHM 997 (1 cr.)  
 BCHM 899 (5 cr.)

**Spring semester and summer, fifth year**

One 800/900 level course (3-4 cr.)  
 BCHM 998 (1 cr.)  
 BCHM 899 (5 cr.)  
 Special topics (1-2 cr. as needed)  
 Research should be completed and the master's thesis defended during the summer.

**Support**

Students in the B.S./M.S. program are eligible for support through University Financial Aid. Additional support may be available from the student's adviser.

***General Science Certification***

(See *Department of Education and COLSA/Degrees*, pages 35 and 89.)

**Biology (BIOL)**

[www.biology.unh.edu/](http://www.biology.unh.edu/)

(For course descriptions, see page 164.)

The biology program is designed to provide a strong, broad background in biological sciences to students interested in education in the life sciences. The Biology program integrates theoretical and practical (hands-on laboratory and field work) courses in different aspects of the biology of animals, microbes, and plants. The curriculum is designed to reflect the diversity of the biological systems in nature. It encompasses the study of structural and functional relationships of living organisms at the molecular, cellular, and organismal level; the interactions of the living systems with the environment and with each other; and the evolutionary relationships of various forms of life. The goal is to create a facilitative environment for those with a scholarly interest in the biological sciences,

and to extend their understanding, awareness, and appreciation of the diversity of the biological sciences.

The program is aimed at promoting excellence in biological science education by involving undergraduate students in strong interaction with faculty both in the classroom and research laboratories, and encouraging the development of quality undergraduate programs in all aspects of biology.

The biology program prepares students for graduate work in the biological, medical and agricultural sciences, and for job opportunities in industry (biomedical, pharmaceutical, agrochemical, environmental, and biotechnological) and governmental research, secondary school teaching or a general education about living organisms. 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 build the requirements for these programs into their academic majors.

Courses in the biology program are selected from departments that constitute the biological sciences community at UNH. The flexibility of the curriculum allows students wide selection of courses in various departments. Students in the biology major take a common core curriculum involving introductory and upper level courses. They select one of four areas of concentration. These options are: 1) general biology; 2) ecology, evolution, and behavior biology; 3) marine and freshwater biology; and 4) molecular, cellular, and developmental biology.

While students are advised to declare the biology major as incoming first-year students to assure adequate program planning, transfer into the program at a later stage is also possible. Students who wish to concentrate in a specific area of biological sciences other than the options within the biology program should consider a major in animal sciences, biochemistry, microbiology, plant biology, or zoology. The biology core curriculum is followed by students in all of these programs. This makes changing majors a very simple process.

### **Biology Core Curriculum**

All biology and several of the biological sciences majors begin with the biology core curriculum. The biology courses in the core curriculum constitute an integrated sequence of courses imparting basic knowledge of biology in order to expose students to the breadth of knowledge inherent in the biological sciences. The biology core allows a student to

obtain a broad background in biology and related physical sciences and math. While it is recommended that the core curriculum be substantially completed in the first two years, students are encouraged to consult with their academic advisers to select one or more courses in their major during the sophomore year that may provide a gateway to the major. This may result in delaying one or more of the core courses in the junior year. By the end of the sophomore year, students are expected to have selected a departmental major or one of the four above-mentioned biology options leading to a B.S. degree.

### **Biology Core Curriculum Courses**

BIOL 400, Professional Perspectives on Biology<sup>1</sup>  
 BIOL 411 & 412, Principles of Biology I, II<sup>2</sup>  
 BIOL 541, General Ecology  
 MICR 503, General Microbiology  
 BIOL 604, Principles of Genetics  
 CHEM 403 & 404, General Chemistry  
 CHEM 545/546, Organic Chemistry and BCHM 658/659, General Biochemistry,  
 or CHEM 651/653 and CHEM 652/654, Organic Chemistry<sup>3</sup>  
 MATH 424B, Calculus for Life Sciences or 425, Calculus I  
 BIOL 528, Applied Biostatistics I, or MATH 426, Calculus II<sup>4</sup>  
 PHYS 401 and 402, Introduction to Physics  
 ENGL 501, Introduction to Creative Nonfiction, or equivalent<sup>3</sup>  
 EDUC 500, Exploring Teaching<sup>5</sup>

Typically, students take BIOL 400; BIOL 411 & 412; CHEM 403-404; and Calculus 424B in the first year, and then complete the remainder of their core requirements during the sophomore and junior years.

In addition to the core curriculum, the requirements for individual options are described separately.

### **Academic Requirements**

To receive the B.S. degree in biology, students must complete 128 credit hours with a 2.0 cumulative grade-point average (GPA). Courses must include all UNH general education requirements, biology core curriculum requirements, and the requirements for the selected option. A minimum grade of C- is required in all biological science courses that are counted towards the requirements for a degree in biology (all four options). The only exception is that a passing grade below a C- will be accepted in a student's first biology course (BIOL 411 or 412). 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.

Students should consult with their academic advisers during their freshman and sophomore years for assistance in determining the most appropriate option or major for their professional goals. Since biology core courses are required of all biological science majors, it is relatively easy to change majors within the biological sciences during this period.

*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. In addition, students should 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 Web site for details ([www.shoals.unh.edu](http://www.shoals.unh.edu)) or the Cornell Web site at [www.sml.cornell.edu](http://www.sml.cornell.edu)). 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 or the Biology program office. Financial support is available for most of these programs.

Premedical and other pre-health professional students should visit the premedical office in Hood House for additional information on requirements for specific professional schools. The following elective courses will be helpful in preparing for admission to post-baccalaureate programs in the health professions and for their required aptitude examinations: BCHM/ANSC 702, ZOOL 518, ZOOL 625/626, BIOL 605, BCHM 751/752, ANSC 511/512.

One 600, 795, or 796 experience totaling three or more credits or any two 795-796 experiences of two credits each can fulfill one course requirement in any category with adviser approval. A Petition for Academic Variance approved by the biology program director is required to count 795-796 experiences for more than one major required course. Students should check the UNH WEBCAT ([webcat.unh.edu](http://webcat.unh.edu)), the biology Web site ([biology.unh.edu](http://biology.unh.edu)), and the UNH online catalog for updates and current course offerings.

### **Biology Options**

In order to receive a B.S. in biology, a student may choose from one of the four biology options. These options are: 1) general biology; 2) ecology, evolution, and behavior biology; 3) marine and freshwater biology; and

<sup>1</sup>BIOL 400 is required only for first year biology majors.

<sup>2</sup>BIOL 411 and 412 are not sequential and may be taken in reverse order.

<sup>3</sup>CHEM 651/653 and 652/654 and ENGL 501 are required for premedical or affiliated professional programs.

<sup>4</sup>MATH 426, Calculus II can be substituted for Statistics, but we recommend Statistics.

<sup>5</sup>Required only for those preparing for teacher certification.

4) molecular, cellular, and developmental biology. A complete list of approved courses in each option is available from the student's adviser, the biology program office, and the biology program Web site at [biology.unh.edu](http://biology.unh.edu).

The general biology option within the biology major provides broad-based training in the biological sciences for students who prefer not to specialize at the undergraduate level. Students must choose eight courses in addition to the biology core curriculum courses as specified in the categories listed in the option requirements (see Web site [biology.unh.edu](http://biology.unh.edu)). Within the biology core, BIOL 528 is preferred to MATH 426; however, either is acceptable, and the sequence CHEM 545/546-BCHM 658/659 is preferred to CHEM 651/653-652/654, for all students in the option, except for those who are pre-health professionals. Corequisite lecture and lab courses count as one course. Courses listed in more than one category will satisfy requirements in only one category.

The marine and freshwater biology (MFB) option provides broad-based training in the aquatic biological sciences for students who prefer to take additional courses in the area of marine and freshwater biology. Students interested in aquaculture and fisheries may also choose this option by taking appropriate courses in consultation with their adviser. Students must choose eight courses in addition to the biology core curriculum courses to fulfill the requirements of this option. All students must take Biology of Lakes (P BIO/ZOOL 717) or Field Studies in Lake Biology (P BIO/ZOOL 719). For additional course requirements, students should visit the biology Web site at [biology.unh.edu](http://biology.unh.edu).

The molecular, cellular, and developmental biology (MCDB) option provides an opportunity for broad training in molecular, cellular, and developmental biology, and the biotechnology area for students who would like to achieve limited specialization in this field. Students interested in the interdisciplinary fields of genetics, genomics, and bioinformatics may also choose this option by taking appropriate courses in consultation with their adviser. This is in addition to broad-based training in the basic areas of biology and related physical sciences covered in the core curriculum. Students choose eight courses from the list of approved courses (available on the Web at [www.biology.unh.edu](http://www.biology.unh.edu)) in addition to biology core curriculum courses, in order to complete this option. The sequence CHEM 651/653-CHEM 652-654 is preferable to CHEM 545/546 and BCHM 658/659.

The ecology, evolution, and behavior (EEB) option within the biology program provides broad training in organismal and environmental biology, and provides an opportunity for limited specialization in the field of ecology, conservation, evolution, or behavior. Students must choose eight courses in addition to the biology core curriculum to complete this option. All students are required to take ZOOL 690. An additional seven courses should be selected as specified in the list of approved courses ([www.biology.unh.edu](http://www.biology.unh.edu)). Within the biology core, BIOL 528 is preferred to MATH 426; however, either is acceptable.

#### ***Prehealth Professional Program***

Students who wish to pursue postgraduate degrees in the health care professions should visit the premedical advising office in Room 102, Hood House. For more information, call (603) 862-2064 or visit the program's Web page at [www.unh.edu/premed-advising](http://www.unh.edu/premed-advising).

#### ***Biology Teacher Certification and General Science Certification***

Biology teacher certification for students preparing to teach high school biology may be obtained through the Department of Education's five-year, undergraduate-graduate degree program. Students are required to take EDUC 500 (preferably in the sophomore year), earn a bachelor's degree in one of the biological sciences, and complete a fifth year, which includes an internship and coursework leading to a master's degree in education. General science certification for students preparing to teach science in middle and junior high schools can be obtained through the Department of Education's general science certification program. For further information, see Education, or contact the Department of Education's teacher education coordinator.

#### ***Biology Minor***

A biology minor may be earned by completing the following requirements: 1) BIOL 411-412 or P BIO 412 and ZOOL 412; 2) one course from each of the three major organism groups: a) animals (ANSC or ZOOL courses), b) microbes (MICR courses), and c) plants (P BIO courses); 3) two additional biological science courses at the 600-700 level.

Students interested in a biology major or minor should contact the Biology Program Office, (603) 862-3205.

#### **Community and Environmental Planning (CD)**

[www.plan.unh.edu/](http://www.plan.unh.edu/)

*(For course descriptions, see page 173.)*

The community and environmental planning program prepares students for professional careers as local government administrators, town or regional land-use planners, and community facilitators and educators. It is an applied social science degree program that gives the student an understanding of the interrelated social, economic, political, environmental, and technical factors that influence a community and its residents. The curriculum takes an interdisciplinary approach and includes field experience and internships as vital components that complement classroom and independent research.

Students majoring in community and environmental planning are encouraged to concentrate in one of three areas: 1) community change and development, 2) community public administration, and 3) community and regional planning. These areas of specialty provide the necessary background and training to prepare graduates for entry-level positions with local municipalities and agencies throughout the nation. The program also provides a firm base for graduate study in a variety of areas such as regional planning, public administration, rural sociology, economic development, and law.

A minor in community and environmental planning provides opportunities for students in other areas to better understand the application of their knowledge to specific community issues. The minor complements majors in both technical fields and liberal arts.

Local municipalities in New England are turning to full-time professional administrators to assume responsibility for the day-to-day administration, management, and planning activities that were previously carried out by part-time town officials. Officials at the New Hampshire Municipal Association estimated that New Hampshire needs, each year, at least twenty-five new graduates in community and public administration to fill local government professional needs. In addition to professional administration or planning positions in local or regional government, employment opportunities are also available with public agencies and organizations at the state, national, and international levels.

Students interested in the challenges of community and environmental planning should consult with Kelly L.Cullen, program coordinator, Department of Natural Resources and the Environment, 303 Ne-smith Hall, (603) 862-4811.

**Required Courses**

CD 415, Community Development and Planning Perspectives, or CSL 201, Intro to CSL  
 CD 508, Applied Community Development  
 CD 614, Fundamentals of Planning  
 CD 777, Topics in Community Planning  
 CD 794, Community Planning Internship, or CD 793, Community Administration Internship  
 EREC 411, Environmental and Resource Economics Perspectives  
 EREC 525, Statistical Methods and Applications  
 EREC 606, Land Economic Perspectives: Uses, Policies, and Taxes  
 EREC 627, Community Economics  
 TOUR 700, Marketing Communications Research: Methodological Foundations  
 TOUR 705, Ecotourism: Managing for the Environment, or TOUR 767, Social Impact Assessment  
 MATH 420, Finite Mathematics  
 CSL 204, Managing Change and Conflict in Communities  
 CD 672, New Hampshire Real Estate  
 POLT 502, State and Local Government, or POLT 551, Global Urban Politics

**Dairy Management (ANSC)**

[www.dairy.unh.edu/](http://www.dairy.unh.edu/)

(See page 106 for the Department of Biological Sciences. For Animal Science [ANSC] courses, see page 154.)

The dairy management program is designed to provide students with solid training in areas important to the successful management of a dairy enterprise, for employment in related agribusinesses (e.g., pharmaceutical and feed industries), or for those wishing to pursue additional training leading to the M.S. or Ph.D. degree in dairy science or its related disciplines. Dairy management students receive training in areas such as nutrition, reproduction, diseases, genetics, lactation physiology, forages, agribusiness finance, personnel management, computer science, and public relations. In addition, junior and senior students enrolled in this program will be given complete responsibility for managing the UNH teaching herd with other students, acquiring actual management experience along with their basic subject matter training. The Fairchild Teaching and Research Center, a modern dairy facility, houses approximately one hundred milking cows plus a similar number of nonlactating animals. The Burley-Demeritt Organic Dairy Farm houses 45 milking cows and a similar number of nonlactating animals.

In addition to general education requirements, a typical dairy management student will take the following courses:

**First Year**

ANSC 408 (optional), 409, 410, 430; BIOL 411; CHEM 403-404; ENGL 401; EREC 411

**Second Year**

ANSC 432, 511, 512, 543, 650; CS 401; PBIO 421; EREC 504

**Summer Internship**

ANSC 600

**Third Year**

ANSC 609, 612, 530, 650, 701 and/or 715, 710

**Fourth Year**

ANSC 698, 708, 727, 728; MGT 580 or 713

Students interested in pursuing graduate studies take MATH 424B, CHEM 545-546, BCHM 658-659, and MICR 503 in lieu of PBIO 421 and CS 401.

**Environmental and Resource Economics (EREC)**

[www.envecon.unh.edu/](http://www.envecon.unh.edu/)

(For course descriptions, see page 190.)

This program offers training in environmental and resource economics, including public resource policy, resource management, natural resource and environmental economics, and community economics and finance. The curriculum emphasizes applied economics in the context of public policy. Training is also available in agricultural economics, including agribusiness, small business management, food marketing, agricultural policy, and world food supplies.

Students majoring in environmental and resource economics will normally concentrate in one of the following three areas: environmental and natural resource economics, agricultural economics, or community economics. In addition, students must satisfy general education requirements, which lead to a broad university education. Majors interested in the economic or business aspects of agriculture and natural resources will be expected to take courses in the biological sciences.

Students majoring in any of the social science, life science, and agriculture departments of the University may find it to their advantage to elect courses or a minor in environmental and resource economics or agribusiness. By doing so, their basic training can be supplemented in a specific area of interest, such as resource development and natural resource policy for social science majors, farm management and agricultural marketing for agricultural majors, and community economics and finance for students interested in local government and development.

**Required Courses**

All of the following:

ECON 401, Principles of Economics (Macro)  
 ECON 605, Intermediate Microeconomic Analysis  
 ECON 611, Intermediate Macroeconomic Analysis, or ECON 635, Money and Banking  
 EREC 411, Environmental and Resource Economics Perspectives

EREC 504, Business Management for Natural Resource Firms  
 EREC 525, Statistical Methods and Applications  
 MATH 420, Finite Mathematics, or MATH 424B, Calculus for Life Sciences  
 At least five of the following, of which two must be 700 level:  
 EREC 501, Agricultural and Natural Resource Product Marketing

EREC 572, Introduction to Natural Resource Economics  
 EREC 606, Land Economics Perspectives: Uses, Policies, and Taxes

EREC 627, Community Economics  
 EREC 633, Economics of Travel and Tourism  
 EREC 708, Environmental Economics  
 EREC 715, Linear Programming and Quantitative Models  
 EREC 756, Rural and Regional Economic Development  
 TOUR 700, Marketing Communications Research: Methodological Foundations

Students who major in environmental and resource economics are qualified for a wide variety of opportunities upon graduation. Private business, public institutions, and government agencies currently have a strong demand for specialists trained in natural resource development; land and water use policy; natural resource and small business management; agricultural, fisheries, and forestry marketing; and community development. In many cases, students may wish to improve their qualifications by pursuing more specialized graduate studies in one or more of the above areas.

**Departmental Honors**

Honors in environmental and resource economics will be awarded to students who complete 16 credits of honors courses in environmental and resource economics (including a minimum of four credits of a senior research project), and who maintain a minimum grade-point average of 3.2 in the major. Students interested in the environmental and resource economics honors program should contact the environmental and resource economics coordinator in Nesmith Hall for more information.

Students interested in a major or minor in environmental and resource economics should contact John M. Halstead, 310 Nesmith Hall, (603) 862-3914.

## Environmental Conservation Studies

[www.envconservation.unh.edu/](http://www.envconservation.unh.edu/)

(For Natural Resources [NR] courses, see page 227.)

The Environmental Conservation Studies (ECS) major gives students a broad, interdisciplinary background for developing their understanding of environmental and resource problems and what is needed to solve them. It also provides a solid foundation for the development of critical thinking skills. The program is designed to ensure that graduates possess broad-based integrated knowledge of how local and global ecological systems work as well as an understanding of the interdependency between people and the environment. Building on a solid natural science base, students discover how political, institutional, and economic systems relate to environmental quality and learn ways to sustainably manage human activities within the constraints of the Earth's ecological systems. Students acquire a set of basic skills and problem solving tools that enable them to tackle complex environmental conservation problems. Graduates will have gained hands-on practical experience integrating and applying their accumulated knowledge and skills in real world situations.

International education to support ECS students' educational goals is encouraged as a means to broaden their perspectives and knowledge, particularly through the UNH-Ecoquest New Zealand Field Studies Program. ECS students may also take advantage of a wide range of undergraduate research opportunities.

ECS students meet a set of 19 CORE requirements, through which they develop a foundation in natural resources, biology, ecology, chemistry, water quality management, soils, natural resources and environmental policy, economics, environmental ethics, and environmental law. They also acquire basic statistics, oral communication, writing and geographic information skills and develop their abilities to apply their knowledge and skills professionally through a practicum (internship) and a capstone course.

In addition to the CORE, each student chooses a 36 credit hour specialization, which may be selected from a range of natural resources and environmental policy and management course sequences that provide a specific focus as each student develops an area of academic competency and the skill sets to help meet her or his career goals. For example, students can choose specializations in the following subject areas: land and water resource policy and management; international environmental and natural resource policy and sustainable development; envi-

ronmental education, communication, public participation and leadership. Or a student may, in consultation with his or her adviser, design a specialization.

Students with strong interests in field-based natural resource management careers can choose a focus on a particular land or water natural resource system, such as forest resources, marine and coastal resources, watersheds or wetlands, or food production to build their expertise. Students with interests in environmental policy, politics, law and administration, or sustainable community development may want to gain additional background through selected courses in the social sciences. Those with interests in environmental education may want to obtain a teaching certificate or develop expertise in outdoor education or leadership. Others may want to pursue interests in environmental communication through courses in journalism or the visual or theater arts. Many undergraduates in ECS participate in faculty research or gain experience through UNH's undergraduate research opportunities programs. Students with particular interests in international environmental studies may want to participate in the dual major in International Affairs.

Students graduating with a B.S. degree in environmental conservation studies, with excellent academic records, are qualified for graduate work in environmental studies, environmental sciences, natural resources and environmental policy, resource management, conservation biology, environmental law, or environmental education and communication. ECS graduates work with private or nongovernmental conservation organizations; local, state or federal natural resources or planning agencies; industrial firms (e.g., waste management, compliance, land protection, watershed management, community planning, energy conservation, etc.); in primary and secondary education; field studies programs; journalism; and specialized environmental consulting firms. A number of graduates also choose to serve in the Peace Corps or with AmeriCorps prior to making more specific career path commitments.

### Degree Core Requirements

NR 400, Professional Perspectives in Natural Resources  
 NR 401, Introduction to Natural Resources  
 PBIO 412, Introductory Botany and ZOO 412, Biology of Animals,  
 or BIOL 411 and BIOL 412, Principles of Biology I and II  
 NR 504, Freshwater Resources  
 NR 501, Introduction to Soil Sciences  
 NR 602, Natural Resources and Environmental Policy  
 NR 658, Introduction to Geographic Information Systems  
 NR 718, Law of Natural Resources and Environment  
 NR 637, Practicum in Environmental Conservation (Internship)

NR 735, Land Conservation Principles and Practices,  
 or NR 663, Applied Directed Research in New Zealand  
 EREC 411, Environmental and Resource Economics Perspectives,  
 or ECON 402, Principles of Economics (Micro)

One introductory resource system course, as follows:

NR 415, Global Biological Change  
 NR 425, Field Dendrology  
 NR 433, Wildlife Ecology  
 NR 502, Forest Ecosystems and Environmental Change

One ecology elective:

BIOL 541, General Ecology  
 NR 527, Forest Ecology  
 NR 660, Ecology and Biogeography of New Zealand (only for UNH-EcoQuest NZ program students)  
 ZOO 503, Introduction to Marine Biology

One physical science (relevant to specialization):

CHEM 403, General Chemistry  
 ESCI 409, Environmental Geology  
 PHYS 401, Intro to Physics

One course in environmental ethics and values:

NR 701, Ecological Values and Ethics  
 NR 784, Sustainable Living  
 PHIL 755, Environmental Philosophy and Policy  
 HIST 618, American Environmental History  
 SOC 665, Environmental Sociology

One statistical skills course:

BIOL 528, PSYC 402, SOC 502 or equivalent

One communication skills course:

CMN 600, Public Speaking as a Civic Art  
 EDUC 710B, Micro-communications  
 THDA 520, Creative Drama (Children's Theater)  
 THDA 583, Introduction to Puppetry  
 THDA 622, Storytelling, Story Theater and Involvement Dramatics  
 THDA 624, Theater for Young Audiences

One writing skills course (beyond ENGL 401)

ENG 502, 503, 521, 621, or 623

### Specialization (36 credits required)

Students select one from the following listed specialization areas to develop their expertise in an area of interest. Alternatively, a student may, in consultation with the student's adviser, design a specialization area.

A. Land and Water Resource Policy and Management, International Environmental and Natural Resource Policy and Sustainable Development.

B. Environmental Education, Communication, Public Participation, and Leadership

*For each area of specialization students are required to select one listed course from each of 5 specified categories:*

Category 1: Ecology (a listed 600 or higher-level course)

Category 2: Economics (a listed 600 or higher-level course)

Category 3: Theory (from identified courses relevant to the specialization)

Category 4: Problem Solving Skills (from identified courses relevant to the specialization)

Category 5: Professional and/or Field Skills (from identified courses relevant to the specialization)

Students select four additional courses in their specialization to complete their 36 hour specialization. These four courses may be selected from any of the five categories. The majority of courses selected for the student's specialization should be at the 600 or 700 level. Special permission will be required to apply a 400 level course to fulfill a specialization requirement. Students must achieve a grade of C- or better for all courses they wish to be counted for their environmental conservation studies major. Students work closely with a faculty adviser to plan their program of study.

Students interested in the environmental conservation studies program may consult with program coordinator Robert Eckert, (603) 862-2508.

### **Environmental Conservation Studies Minor**

A minor in environmental conservation studies (five courses totaling at least 20 credits) is available to students outside of the environmental conservation studies major.

#### **Required Courses**

1. *Any one of the following:* PBIO 412; ZOO 412, BIOL 411, BIOL 412
2. NR 435, Contemporary Conservation Issues and Environmental Awareness,  
or NR 502, Forest Ecosystems and Environmental Change
3. *One course in ecology:* Possibilities include: NR 433, NR 425, NR 527, NR 660, BIOL 541
4. *One intermediate course in environmental policy, ecological or resource economics:*  
NR 724, Resolving Environmental Conflicts  
NR 731, Ecosystem-Based Governance: Policies and Management Strategies  
NR 662, Environmental Policy, Planning and Sustainability in New Zealand  
NR 718, Law of Natural Resources and Environment  
NR 720, International Environmental Politics and Policies for the 21st Century  
ECON 607, Ecological Economics  
EREC 606, 611, 627, or 676
5. *Choose one:*  
NR 504, Freshwater Resources  
NR 501, Introduction to Soil Sciences  
NR 661, Restoration Ecology and Ecosystem Management in New Zealand  
NR 785, Systems Thinking for Sustainable Living

Students interested in the environmental conservation studies minor should contact Mimi Larsen Becker, Department of Natural Resources and the Environment, (603) 862-3950.

### **Environmental Horticulture (DBS)**

[www.envhorticulture.unh.edu](http://www.envhorticulture.unh.edu)

(For Plant Biology [PBIO] courses, see page 238.)

This program offers a flexible curriculum for students interested in a multifaceted view of plant agriculture that also embraces issues of environmental stewardship, food safety, international development, and other topics of broad public concern. A degree in environmental horticulture will prepare students for careers managing greenhouses, nurseries, farms, and golf courses; in teaching; in consulting and applied research; in practicing journalism; in working for park and highway planning commissions; in working in sales or brokerage aspects of wholesale and retail marketing; and in finding employment in food- and feed-processing firms.

#### **Requirements**

Students are required to take the core courses, support courses, and 20 credits of approved elective courses.

#### **Core Courses**

|  | <b>Credits</b> |
|--|----------------|
| PBIO 412, Introductory Botany  | 4              |
| PBIO 421, Introductory Horticulture  | 4              |
| PBIO 501, Basic Biochemistry,<br>or BCHM 658/659, General Biochemistry   | 3              |
| PBIO 546, Plants, Soils, and Environment<br>or NR 501, Introduction to Soil Sciences<br>or HT 215, Soils and Land Use<br>and HT 217, Soils and Plant Nutrition | 4              |
| PBIO 547, Environmental Horticulture   | 4              |
| PBIO 572, Plant Propagation<br>or HT 204, Plant Propagation  | 4              |
| PBIO 566, Systematic Botany  | 4              |
| PBIO 600, Field Experience (Horticulture Related)  | 4              |
| PBIO 701, Plant Physiology   | 3              |
| PBIO 702, Plant Physiology Lab   | 2              |
| PBIO 612, Plant Genetics and Reproduction<br>or BIOL 604, Principles of Genetics   | 4              |
| PBIO 651, Plant Pathology  | 4              |
| PBIO 795W-02, Invest.: Insect Pest Management  | 4              |

#### **Electives**

A minimum of 20 credits (see department for list of electives applicable).

Students are offered some flexibility in selection of electives, although these electives should be related to horticulture and selected in consultation with an adviser.

#### **Support Courses Required from Other Programs**

|  |   |
|--|---|
| BIOL 528, Applied Biostatistics I                          | 4 |
| CHEM 403, General Chemistry I                              | 4 |
| CHEM 404, General Chemistry II                             | 4 |
| EREC 411, Environmental and Resource Economic Perspectives | 4 |

### **Environmental Sciences**

[www.envsci.unh.edu/](http://www.envsci.unh.edu/)

(For Natural Resources [NR] courses, see page 227.)

The College of Life Science and Agriculture (COLSA) and the College of Engineering and Physical Sciences (CEPS) jointly offer a bachelor of science degree in environmental sciences. Environmental sciences is an interdisciplinary field concerned with the interaction of biological, chemical, and physical processes that shape our natural environment. Students graduating with a degree in environmental sciences will have an understanding of these interacting processes, the ability to effectively communicate with both scientific and lay audiences, competency in field methods appropriate for entry-level environmental science positions, competency in the use and application of Geographic Information Systems (GIS), a basic understanding of environmental policy, and the ability to contribute to multidisciplinary teams. The University of New Hampshire is a recognized leader in environmental sciences research, and the environmental sciences program capitalizes on faculty expertise in this area. The program has 12 full-time faculty members, with major teaching and research emphases in the areas of biogeochemical cycling, environmental chemistry, ecosystem science, global change, hydrology, plant ecology, soil science, and water resource management.

Employment opportunities include: environmental consulting firms; educational facilities (e.g., science centers); environmental monitoring laboratories (e.g., water treatment plants; the Environmental Protection Agency); government agencies (e.g., the U.S. Geological Survey, Bureau of Land Management, Natural Resource Conservation Service), university and government research laboratories, and nongovernment environmental organizations. The environmental sciences program also constitutes an excellent preparation for graduate programs in several areas relating to the environment. Students should consult with their adviser early if their goals include further study.

#### **Requirements**

In addition to general education requirements, all students will take Introduction to Environmental Science (NR 403) and Professional Perspectives in Natural Resources (NR 400), plus one other elective introductory environmental science course. Foundation courses include two semesters of chemistry (CHEM 403, 404) and calculus (MATH 425, 426), one semester of geology (ESCI 401, 402, or 409), one semester of statistics (MATH 644 or BIOL 528), one semester of physics (PHYS 407), and one approved biology course. Core courses include Techniques in Environmental Sciences (ESCI 534); Introduction to GIS (NR 658), Fate and Transport in the Environment (ESCI 654); Natural

Resource and Environmental Policy (NR 602); and a capstone course sequence (NR791 and 792).

Students must complete an additional eight courses in one of the following options:

#### **Ecosystems**

NR 527, Forest Ecology,  
or BIOL 541, General Ecology  
NR 730, Terrestrial Ecosystems  
NR 765, Community Ecology  
NR 751, Aquatic Ecosystems  
four approved electives

#### **Hydrology**

PHYS 408, General Physics II  
ESCI 561, Landscape Evolution  
NR 501, Introduction to Soil Sciences, or ESCI 512, Principles of Mineralogy  
NR 604, Watershed Hydrology  
ESCI 705, Principles of Hydrology  
ESCI 710, Groundwater Hydrology  
two approved electives

#### **Soil and Watershed Management**

PHYS 408, General Physics II  
NR 501, Introduction to Soil Sciences  
NR 604, Watershed Hydrology  
NR 703, Watershed Water Quality Management  
NR 706, Soil Ecology,  
or NR 744, Biogeochemistry  
three approved electives

For a list of approved elective courses students may consult with the program coordinator, John D. Aber, (603) 862-3045.

#### **Forestry**

[forestry.unh.edu/](http://forestry.unh.edu/)

(For Natural Resources [NR] courses, see page 227.)

Climate change, carbon storage, biodiversity, and ecosystem integrity in the context of sustainable human use of forests and associated resources are important scientific and social issues. The forestry program at the University of New Hampshire prepares its graduates with the scientific and managerial knowledge and skills to address these environmental and resource management problems at local, regional, and global levels.

Forestry is the art and science of managing and understanding the natural and human dimensions of forests and forest use. Forestry education at UNH focuses on sustainable management of forests for biodiversity, productivity, and health, based on a multidisciplinary approach. The program's goal is to provide a sound professional preparation, a broad general education, and the flexibility to cultivate special abilities and interests, leading to a bachelor of science in forestry degree (B.S.F.) accredited by the Society of American Foresters (SAF). The SAF is recognized by the Council on Postsecondary Accreditation

and the U.S. Department of Education as the accrediting body for forestry in the United States. Students are encouraged to develop an area of concentration or to complete a minor in consultation with their academic adviser.

UNH forestry graduates manage forests to provide wildlife habitat and recreation opportunities, care for soil and water resources, protect and restore forest ecosystems, and assure a sustainable supply of forest products. They are employed by private industry, public agencies, public interest groups, education institutions, research organizations and consulting firms. Many students enter graduate school for advanced study in forest biology or management while others have found challenging international opportunities.

#### **Freshman Year**

BIOL 528, Applied Biostatistics I, or equivalent  
ENGL 401, First Year Writing  
MATH 424B, Calculus for Life Sciences,  
or MATH 420, Finite Mathematics  
NR 400, Professional Perspectives in Natural Resources  
NR 401, Introduction to Natural Resources  
NR 425, Field Dendrology  
NR 433, Wildlife Ecology  
NR 542, Forestland Measurement and Mapping  
PBIO 412, Introductory Botany  
General education elective 4, 5, 6, or 8

#### **Sophomore Year**

CHEM 403, General Chemistry  
EREC 411, Environmental and Resource Economics Perspectives,  
or ECON 402, Principles of Economics (Micro)  
NR 501, Introduction to Soil Sciences  
NR 504, Freshwater Resources  
NR 506, Forest Entomology  
NR 527, Forest Ecology  
NR 599, Work Experience  
Oral Communications Skills Course  
General education elective 4, 5, 6, or 8

#### **Junior Year**

NR 602, Natural Resources and Environmental Policy  
NR 643, Economics of Forestry  
NR 658, Introduction to Geographic Information Systems  
FORT 279, Forest Fire Control and Use  
NR 729, Silviculture  
NR 757, Photo Interpretation and Photogrammetry  
NR 782, Monitoring Forest Health,  
or PBIO 651, Plant Pathology  
General education elective 4, 5, 6, or 8

#### **Senior Year**

NR 745, Forest Management  
NR 749, Forest Inventory and Modeling  
RMP 711, Recreation Resource Management  
General education elective 4, 5, 6, or 8

Students interested in the Forestry program may consult with the program coordinator, Theodore Howard, (603) 862-2700.

#### **General Science Certification**

(See Department of Education and COLSA/ Degrees, pages 35 and 89.)

#### **Genetics Program (GEN)**

[www.genetics.unh.edu/](http://www.genetics.unh.edu/)

(For course descriptions, see page 194.)

There is no baccalaureate degree program in genetics (only master's and Ph.D. degrees). However, undergraduates can complete a minor in genetics or can pursue their interests within the context of any of the following B.S. degree programs: biology, animal sciences, biochemistry, microbiology, plant biology, or zoology. Students interested in preparing for graduate work in genetics at UNH or elsewhere should contact the chairperson of the genetics program early in their undergraduate careers for advice on courses.

#### **Requirements:**

Completion of 20 credits from the courses listed below, with a grade of C- or better, is required for a minor in genetics. At least two courses should be selected from each of the categories. Four (or more) credits of GEN 795, Investigation in Genetics, may be counted as one course toward fulfillment of the minor. See page 19 for requirements for a completion of a minor.

#### **Category 1:**

ZOOL 665, Conservation Genetics  
GEN 705, Population Genetics  
GEN 715, Molecular Evolution  
GEN 723, Quantitative Genetics  
GEN 753, Cytogenetics  
GEN 766, Environmental Genetics  
GEN 772, Evolutionary Genetics of Plants

#### **Category 2:**

BIOL 604, Principles of Genetics  
GEN 706, Human Genetics  
GEN 711, Genomics and Bioinformatics  
GEN 754, Laboratory in Biochemistry and Molecular Biology of Nucleic Acids  
GEN 771, Molecular Genetics  
GEN 774/775, Plant Biotechnology and Genetic Engineering  
GEN 782, Developmental Genetics

#### **International Affairs (dual major)**

(For course descriptions, see page 207.)

#### **Life Sciences and Agriculture (LSA)**

(For course descriptions, see page 214.)

#### **Medical Laboratory Science (MLS)**

[www.mls.unh.edu/](http://www.mls.unh.edu/)

(For course descriptions, see page 221.)

The medical laboratory science (MLS) program provides students with a quality education in the fundamentals of biomedical laboratory science and laboratory skills in addition to a broad-based university general education. The curriculum enables students to determine the presence, extent, or absence of human disease and to provide the valuable data needed to evaluate the effectiveness of

the treatment of human disease. The program also provides an excellent background for students intending to pursue careers in the medical field and upon completion of a clinical internship qualifies them to become certified medical technologists.

Baccalaureate degree holders in medical laboratory science are highly sought after by biotechnology companies and biomedical research facilities. Students who receive certification are highly sought after by hospitals and medical centers. Forensics, public health, education, and diagnostic product development, sales, and service are additional areas of employment for MLS graduates. Graduates of the program are also uniquely qualified to continue their post-baccalaureate education in a wide variety of professional programs including physician assistant programs, pathologists' assistant programs, and medical school. They are prepared for advanced studies in many other fields including biochemistry, microbiology, genetics, molecular biology, health management and policy, and business administration.

Students may pursue a Bachelors of Science degree in MLS by following a clinical, research, histology, or pre-professional track. Students obtain detailed curricula information in the Introduction to Medical Laboratory Science course (MLS 401) and in consultation with their academic advisers.

### ***MLS Clinical Track***

MLS majors following the clinical track will complete MLS required courses and a 24 -26 week clinical internship. Clinical internship positions are not guaranteed and are filled on established criteria published in the MLS Student Handbook, including professionalism, academic performance, interviews, references, and faculty recommendations.

Clinical students may become certified in all areas of the laboratory by completing courses in Advanced Clinical Microbiology (MLS 751), Advanced Hematology (MLS 752), Advanced Immunohematology (MLS 753), and Advanced Clinical Chemistry (MLS 754) during their internship. Upon successful completion of the clinical internship these students are awarded the B.S. degree and are eligible to take a national certification exam offered by the American Society of Clinical Pathologists (ASCP) or the National Certification Agency (NCA). Clinical students may choose to become certified in only one area of the clinical laboratory by completing either a Clinical Microbiology Internship (MLS 761), a Clinical Hematology Internship (MLS 762), a Clinical Immunohematology Internship (MLS 763), or a Clinical Chemistry Internship (MLS 764). Upon successful completion

of the clinical internship these students are awarded the B.S. degree and are eligible to take a national certification exam offered by the ASCP or NCA in their categorical specialty area.

### ***MLS Clinical Track—Academic Requirements and Essential Functions***

Students applying for a clinical internship must have obtained a grade of C or better and a 2.5 grade-point average (GPA) in all MLS designated courses. These student must also have achieved a minimum 2.5 cumulative GPA at the time of application for their clinical internship in April of their junior year. They must maintain that minimum until the internship begins. A personal interview at the clinical affiliate to evaluate a student's understanding of the profession, communication skills, maturity, self-confidence, and supervisory potential is required. Students must demonstrate these attributes to participate in the clinical courses.

The medical laboratory science clinical curriculum is accredited by the National Accrediting Agency for Clinical Laboratory Sciences (NAACLS). NAACLS requires students in this program to have the following essential functions: a sound intellect; good motor skills; eye-hand coordination and dexterity; effective communication skills; visual acuity to perform microscopic analyses, or read procedures, graphs, etc.; professional skills such as the ability to work independently, manage time efficiently, and comprehend, analyze and synthesize various materials, as well as have sound psychological health and stability. Additional information regarding the essential functions listed above may be obtained by contacting the MLS program director.

### ***MLS Histology Track***

MLS majors following the histology track will complete MLS required courses and additional histology courses where students learn to prepare, process and stain tissue from surgery and autopsies for microscopic analysis. Histotechnology professionals perform, develop, evaluate, correlate and assure accuracy and validity of laboratory testing and procedures; direct and supervise anatomic pathology laboratory resources and operations; and, collaborate in the diagnosis and treatment of patients. Upon successful completion of the MLS histology track students are awarded the B.S. degree. Students also have an opportunity to participate in an 18-week histology internship experience, and with an additional 34 weeks of work under a board-certified pathologist, they are eligible to take a national certification exam. His-

tologists have unlimited choice of practice settings. Hospitals, for-profit laboratories, public health facilities, and industry currently have positions for qualified histologists. Other opportunities are in industrial research, veterinary pathology, marine biology, and forensic pathology. Histology graduates also have the necessary educational experiences to pursue studies in a variety of graduate and professional programs such as pathologists' assistant programs.

### ***MLS Research Track***

MLS students following the research track will complete MLS required courses and additional courses that emphasize the theories and techniques required for the analysis of blood, cells, and tissues, and utilized in biomedical research. Upon successful completion of the MLS research curriculum students are awarded the B.S. degree. Graduates are well prepared for technically oriented jobs where their analytical, scientific, and technical skills are valuable and desired assets. They may be employed in industrial, research, or public health laboratories, as well as in forensic or pharmaceutical laboratories. Graduates are also well prepared for graduate studies in microbiology, biochemistry, genetics, molecular biology, and other science and non-science disciplines.

### ***MLS Pre-professional Track***

MLS majors following a pre-professional track will complete MLS required courses and additional courses required for admission to professional programs such as physician assistant programs, pathologists' assistant programs, or medical schools. Upon successful completion of the MLS pre-professional curriculum, students are awarded the B.S. degree. Since 70-80 percent of what medical professionals do is diagnose based on laboratory testing results, medical laboratory science program graduates are well prepared for continuing their medical education in professional programs.

### ***MLS Minor***

Students may obtain a minor in MLS by successfully completing three MLS-designated courses and additional approved courses for a minimum of 20 credits. Students interested in the MLS minor should consult the MLS program director.

### ***Required Core Courses***

BIOL 604, Principles of Genetics  
 CHEM 403 and 404, General Chemistry  
 CHEM 545/546, Organic Chemistry (pre-med students substitute CHEM 651/3 and 652/4 for CHEM 545/546)  
 ZOOL 507 and 508, Anatomy and Physiology  
 MLS 755, Molecular Diagnostics

MLS 640, Phlebotomy Theory  
 MLS 642/643, Basic Immunology/Serology Lab  
 MLS 644/645, Hematology/Clinical Hematology Lab  
 MLS 660/661, Body Fluids/Body Fluids Lab  
 BCHM 658/659, General Biochemistry  
 MICR 503, General Microbiology  
 MICR 602, Pathogenic Microbiology  
 BIOL 528, Applied Biostatistics, or other Statistics course  
 (PSYC 402 or SOC 502)  
 MLS 720/721, Mycology, Parasitology, and Virology/MPV Lab  
 MLS 610, Biomedical Laboratory Management

#### **Additional required course for Clinical Track**

MLS 641, Phlebotomy Clinical Internship

#### **Additional required course for Clinical, Research and Pre-professional Tracks**

MLS 658/659, Medical Biochemistry/Clinical Chemistry Lab

#### **Additional required courses for Clinical and Pre-professional Tracks (except Pre-pathologists' Assistant)**

MLS 656/657, Immunohematology and Transfusion Science/  
 Blood Banking Lab  
 MLS 750, Seminar

#### **Additional required courses for Histology Track and Pre-pathologists' Assistant**

ANSC 707/807, Routine Histological Techniques  
 ANSC 709/809, Special Histological Techniques  
 ANSC 623, Comparative Histology

#### **Additional required courses for Pre-professional Tracks**

BIOL 411, General Biology  
 BIOL 412, (Pre-med)  
 ANSC 704, Principles of Pathobiology  
 Additional English course  
 Algebra (Pre-physician assistants or pathologists' assistant only)  
 Calculus (Pre-med only)  
 Additional Psychology or Sociology course (Pre-physician assistants only)  
 Physics 401/402 (Pre-med only)

### **Microbiology (MICR)**

[www.microbiology.unh.edu/](http://www.microbiology.unh.edu/)

(For course descriptions, see page 222.)

Microbiology explores the world of organisms too small to be seen with the unaided eye. The primary emphasis of the microbiology program is on prokaryotes (bacteria and archaea) and viruses. The curriculum provides basic familiarity with microorganisms, their interactions with other life forms (including humans), and their roles in natural systems and processes.

Baccalaureate degree holders in microbiology secure positions in industry (food and beverage, pharmaceutical, bioproducts, etc.); in city, state, and federal agencies (public health, environmental quality, regulatory, etc.); or in universities or research institutes.

The microbiology major offers programs of study leading to the bachelor of science degree. Microbiology is widely recognized as being both a basic life science and a highly pragmatic applied science. The curriculum within the microbiology program is intended to accommodate the diverse needs of potential students. It provides solid training for individuals intending to enter the workforce or to pursue graduate education in the biological sciences, biomedicine, or biotechnology. It also provides for entry into professional programs such as dentistry, human medicine, or, with some little additional preparation, veterinary medicine. The curriculum is appropriate for students planning to enter the workforce immediately upon graduation as research technicians, applied scientists, or in sales or marketing positions in the life sciences or biotechnological industry. The curriculum is also appropriate for transfer students and those planning to pursue a degree in business, including the M.B.A., for careers in managing diagnostic laboratories or in hospital administration.

Individuals considering a major in microbiology are strongly encouraged to enroll in MICR 503 and organic chemistry in their sophomore year. Requirements of the biology core curriculum may be deferred until the subsequent year, if necessary. Other microbiology-related courses offered in the following programs may be taken with an adviser's permission: animal sciences, biochemistry and molecular biology, plant biology, civil engineering, zoology, or medical laboratory science. Courses in these areas are reviewed periodically by the microbiology faculty to ascertain their suitability for microbiology majors.

Special Problems in Microbiology (MICR 795) is available by permission and allows students the opportunity to conduct semi-independent research projects in conjunction with departmental faculty. Up to 4 credits of Problems in Microbiology may be applied to major requirements, although students may enroll for additional hours. Students must receive a minimum grade of C in major requirements (e.g., microbiology). A passing grade in major requirements taught outside the College of Life Sciences and Agriculture (e.g., chemistry, math, or physics) is acceptable.

Microbiology-related courses offered in the following programs may be taken with an adviser's permission: animal sciences, biochemistry and molecular biology, plant biology, civil engineering, zoology, or medical laboratory science. Courses in these areas are reviewed periodically by the microbiology faculty to ascertain their suitability for microbiology majors.

Students planning to attend graduate or postgraduate professional school or apply for certification as registered microbiologists through the American Society for Microbiology are strongly advised to take a course in quantitative analysis (CHEM 517-518).

Individuals considering a major in microbiology are strongly encouraged to enroll in MICR 503 and organic chemistry in their sophomore year. Requirements in the biology core curriculum may be deferred until the subsequent year, if necessary.

Students may obtain a minor in microbiology by successfully completing MICR 503 and four additional departmental courses in microbiology totaling a minimum of 20 credits at the 600 or 700 level. BCHM 658/659 may be substituted for one of these courses. Students must receive a minimum grade of C in major requirements taught in the College of Life Sciences and Agriculture (e.g., microbiology, biology, or biochemistry). BCHM 658/659 may be substituted for one of these courses. A maximum of 4 credits of Problems in Microbiology may be applied to the minor.

### **Microbiology Curriculum**

The microbiology Bachelor of Science degree is satisfied by students taking seven microbiology courses totaling a minimum of 28 credit hours with a grade of C or above. Students are required to take the microbiology core (five classes) and a minimum of two microbiology electives. Additionally, students must also satisfy the general biology core requirements, (see page 95).

#### **Microbiology Core**

MICR 503, General Microbiology  
 MICR 602, Pathogenic Microbiology  
 MICR 704, Genetics of Prokaryotic Microbes  
 MICR 717, Microbial Physiology  
 A microbial ecology course (this requirement may be fulfilled by taking either MICR 707, MICR 713, or NR 706)

#### **Electives**

MICR 711, Genomics and Bioinformatics  
 MICR 718, Ethics and Issues in Microbiology  
 MICR 751, Cell Culture  
 MICR 702, Infectious Disease and Health  
 MICR 706, Virology (and 708, Laboratory)  
 MICR 714, Public Health and Waterborne Diseases  
 MICR 705, Immunology  
 MICR 707, Marine Microbiology  
 MICR 713, Microbial Ecology & Evolution  
 NR 706, Soil Ecology  
 MICR 600, Field Experience  
 MICR 603, Bacteriology of Food (UNHM)  
 MLS 720/721, Mycology, Parasitology, and Virology  
 MICR 795, Problems in Microbiology

#### **Biology Core**

BIOL 411-412, Principles of Biology I and II  
 CHEM 403-404, General Chemistry

CHEM 651/653, Organic Chemistry,  
or CHEM 545/546 and BCHM 658/659, General Biochemistry,  
or BCHM 751-752, Principles of BCHM with BCHM 755 (lab)  
PHYS 401-402, Introduction to Physics I and II  
MATH, 424B, Calculus for Life Sciences,  
or MATH 425  
BIOL 528, or equivalent (statistics)  
BIOL 604, Principles of Genetics

1. MICR 795 can be taken for three or four credits over one or two semesters. Maximum of four credits can be applied as one of Microbiology required courses for the major or minor (although students may enroll for additional hours), and it must be a lab experience. Faculty permission is required.

2. MICR 600 Field Experience (must be three or four credits for meeting major requirements; maximum of four credits toward major). The following criteria must be met:

- student develops proposal;
- proposal is signed by supervisor sponsoring faculty;
- student is encouraged to present at conference;
- final report is accepted by sponsoring faculty;
- student cannot be paid by a company.

3. For students transferring into the microbiology major, the equivalent of two semesters of a laboratory biological science may be accepted with microbiology faculty approval.

4. Premedical and other pre-health students should take one year of organic chemistry.

### Natural Resources (NR)

[www.nre.unh.edu](http://www.nre.unh.edu)

(For course descriptions, see page 227.)

### Nutritional Sciences (NUTR)

[www.nutrition.unh.edu/](http://www.nutrition.unh.edu/)

(For course descriptions, see page 232.)

The science of nutrition is the study of nutrients in food and the body's handling of these nutrients. As an applied science, nutrition is based on biochemistry and physiology but can also include anthropology, economics, genetics, microbiology, pathology, and zoology. Consequently, the nutritionist often cooperates with workers in many different fields. The nutrition program at UNH is designed to permit specialized study in human and/or animal nutrition.

Three curricula are offered to meet the educational needs of students with differing professional aspirations.

#### Basic Science Curriculum

This curriculum provides students with a solid science background in biology, chemistry, physiology, nutrition, biochemistry, and physics. Upon graduation, students are well prepared for technically oriented jobs in science. This curriculum is also excellent preparation for students planning further education in graduate school or professional schools of medicine and dentistry. Students in

this curriculum are required to complete the biology core curriculum (see page 95 in biology description) and NUTR 400 and 750; ANSC 511/512 or ZOOL 507/508; MICR 503; BCHM 658/659; and 12 additional credits from recommended courses in nutrition.

#### Dietetics Curriculum

Approved by the American Dietetics Association (ADA), the dietetics curriculum prepares students to apply for a postgraduate dietetic internship. Completing this internship and passing the ADA examination are essential for becoming a registered dietitian (RD), and requisite for employment opportunities in clinical dietetics and community nutrition. Required courses for this curriculum are NUTR 400, 401, 476, 504, 510, 550, 650, 700, 720, 750, 773, 775, and 780; ZOOL 507/508; CHEM 403/404, and 545/546; ENGL 401; HMG 403; MICR 501 or 503; BCHM 658/659; SOC 400 or PSYC 401; HMP 401; HMP 710; and either PSYC 402, SOC 502, BIOL 528, or HHS 540.

#### Wellness Curriculum

The Wellness Track will provide students with a nutrition and wellness background that will prepare them for future employment opportunities in agencies and businesses that have an emphasis on health and wellness, such as the workplace, schools, fitness centers, non-profit organizations and the community. Upon graduation, students would be prepared for future study or certification in the health education field. Required courses for this curriculum are NUTR 400, 401, 476, 506, 510, 546, 650, 720, and 756; ZOOL 507/508; CHEM 403/404; ENGL 401; HMP 401 and 501; HMG 403; KIN 527, 527, 620 and 648; MICR 501; OT 513; SOC 400 or PSYC 401; PSYC 402 or SOC 502.

#### Plant Biology (PBIO)

[www.plant.unh.edu/](http://www.plant.unh.edu/)

(For course descriptions, see page 238.)

Plant biology is the study of plants at the population, organismal, cellular, and molecular level; and the investigation of the uses of plants for food, fiber, recreational, and ornamental purposes. Offerings in marine and freshwater plant biology also are provided and facilitated by the Jackson Estuarine Laboratory and two marine laboratories where the plant biology faculty maintains an active involvement in teaching and research.

#### General Science Certification

(See Department of Education and COLSA, pages 35 and 89.)

### B.S. in Plant Biology

This degree is for students intending to seek employment in agricultural, pharmaceutical, and biotechnology industries; to work in governmental agencies, environmental groups, and consulting firms; to teach secondary education; or to undertake graduate studies in preparation for advanced research and teaching positions. Students interested in university teaching and/or research, and governmental and industrial research, should plan to complete an advanced degree in the field.

Students are required to take the core courses, which include the biology core curriculum and five plant biology elective courses.

| Core Courses  | Credits |
|---|---------|
| BIOL 411, Principles of Biology I                     | 4       |
| BIOL 412, Principles of Biology II                    | 4       |
| CHEM 403, General Chemistry I                         | 4       |
| CHEM 404, General Chemistry II                        | 4       |
| MATH 424B, Calculus for Life Sciences                 | 4       |
| MICR 503, General Microbiology                        | 5       |
| BIOL 541, General Ecology                             | 4       |
| BIOL 528, Applied Biostatistics I                     | 4       |
| CHEM 545/546, Organic Chemistry and Laboratory        | 5       |
| BCHM 658/659, General Biochemistry and Laboratory     | 5       |
| PHYS 401, Introduction to Physics I                   | 4       |
| PHYS 402, Introduction to Physics II                  | 4       |
| BIOL 604, Principles of Genetics                      | 4       |
| PBIO 701/702, Plant Physiology and Laboratory         | 5       |
| PBIO 758, Plant Anatomy                               | 5       |
| PBIO 774, Plant Biotechnology and Genetic Engineering | 3       |
| PBIO 566, Systematic Botany                           |         |

#### Plant Biology Electives

Five additional courses must be selected from those listed under categories 1-5. No more than three courses from any one category can be used to fulfill the requirement. It is strongly recommended that students choose courses from as many of the categories as possible to obtain a broad background in plant biology. Core courses cannot be used to fulfill elective requirements. PBIO 795, Investigations in Plant Biology can be used once to fulfill one of the five electives, if taken for three or more credits. PBIO 796, Special Topics in Plant Biology can be used to fulfill elective requirements, if taken for three or more credits and pre-approved by adviser.

##### Category 1: Systematics, Ecology, and Evolution

PBIO 566, 625, 717, 719, 721, 722, 723, 747, 761; ZOOL 545; NR 713, 730, 765, 783

##### Category 2: Marine and Freshwater Plant Biology

PBIO 503, 625, 717, 719, 721, 722, 723, 725, 727, 732, 747

##### Category 3: Plant Structure and Physiology

PBIO 709, 713, 714/715, 727, 774/775

##### Category 4: Environmental Horticulture

NR 506; PBIO 546, 547, 565, 572, 650, 651, 652, 678, 679; ZOOL 745

##### Category 5: Plant Genetics, Cell Biology, and Biotechnology

BCHM 771; GEN 705; PBIO 751, 753, 754, 772, 775

**B.A. in Plant Biology**

The curriculum provides a broad background in the liberal arts and plant biology. Students may enter this program as first-year students or transfer into it from other liberal arts or science programs. This program is of particular interest to students who intend to utilize their plant biology training in public relations, teaching, or other related careers in combination with a liberal arts background. The program allows students to obtain minors in other fields such as English, history and philosophy of science, international affairs, education, art, etc., to create an interdisciplinary program, or to pursue a double major. Students must complete a minimum of 40 semester credits in the major, including B.A. degree core courses, upper level biology category electives, required general education requirements, and other B.A. requirements.

**Upper Level Plant Biology Category Electives**

12 credits minimum

Select courses from several of the five plant biology categories (see B.S. program). PBIO 758 and 774 are also recommended.

**Required General Education Courses**

Required: Group 3, CHEM 403-404, General Chemistry

Recommended: Group 2, BIOL 528, Applied Biostatistics I

Group 8, PHIL 424, Science, Technology, & Society; or HUMA 651, Humanities and Science: The Nature of Scientific Creativity

**Other B.A. Requirements**

Foreign language (equivalent to one year of college language)

**Requirements**

|  | <b>Credits</b> |
|--|----------------|
| PBIO 412, Introductory Botany*                                     | 4              |
| ZOOL 412, Biology of Animals                                       | 4              |
| PBIO 501, Basic Biochemistry                                       | 3              |
| or CHEM 545/546, Organic Chemistry and Laboratory                  | 5              |
| BIOL 541, General Ecology  | 4              |
| PBIO 566, Systematic Botany  | 4              |
| or PBIO 721, Microscopic Algae                                     | 4              |
| or PBIO 722, Marine Phycology                                      | 4              |
| BIOL 604, Principles of Genetics                                   | 4              |
| or PBIO 612, Plant Genetics and Reproduction                       | 4              |
| PBIO 701/702, Plant Physiology and Laboratory                      | 5              |
| *waived if previous credit received for BIOL 411-412 or equivalent |                |

**Minors**

The Department of Plant Biology offers two departmental minors: a minor in plant biology and a minor in environmental horticulture. These minors are available to all students and are designed to provide a flexible and broad selection of courses to complement any other major area of study.

**The requirements for the plant biology minor are:**

PBIO 412 or equivalent or BIOL 601, and a minimum of 16 credits from the following list of courses: PBIO 566, 625, 651, 668, 701/702, 709, 713, 714/715, 717, 719, 721, 722, 727, 751, 753, 754, 758, 761, 772, 774/775, 795 (maximum of four credits), 796, 799; BIOL 601

**The requirements for the environmental horticulture minor are:**

PBIO 421 and a minimum of 16 credits from the following list of courses: PBIO 405, 547, 565, 566, 572, 612, 650, 651, 652, 678, 679, 689, 701/702, 795, 796; BIOL 601

For advice on course selection, students should see the department chairperson.

**Departmental Honors**

Honors in plant biology or environmental horticulture will be awarded to students who complete 16 credits of honors courses in plant biology courses (including a minimum of four credits in a senior honors thesis project), and maintain a minimum grade-point average of 3.2 (overall average and in major coursework). Students wishing to apply to the departmental honors program should consult with the department chairperson.

**Tourism Planning and Development (TOUR)**

[www.tourism.unh.edu/](http://www.tourism.unh.edu/)

(For course descriptions, see page 256.)

Tourism creates immense economic activity, totaling more than \$4 trillion dollars of world spending. Tourism is also an integral part of New England's economy. Experience has shown that the public and private sectors of the tourism industry benefit substantially from proper planning. Those locations with the best planned and managed tourism developments are likely to be the most successful tourist destinations from the standpoint of providing both high-quality tourist experiences and bringing substantial economic benefits with minimal disruptions to the social and natural environment. In response to these needs, the Department of Natural Resources and the Environment offers a bachelor of science degree in tourism planning and development from regional and international perspectives.

The tourism planning and development curriculum provides students with the skills and knowledge necessary to plan, develop, and manage natural, cultural, and financial resources in an environmentally responsible manner. The program utilizes an interdisciplinary approach to provide students with a

strong liberal education supplemented by a broad professional understanding of tourism planning and its role in local, state, national, global economic, and social development. Students study both the social and environmental sciences in order to better understand the complexity of natural and social systems. The program emphasizes the practical application of planning and economic theory to the planning for the development of tourism resources.

**Curriculum Structure**

All majors must complete a core curriculum and choose one of two concentrations: international development or regional tourism planning.

**Core Courses**

The core curriculum is composed of the following courses:

TOUR 400, Introduction to Tourism

EREC 411, Environmental and Resource Economics Perspectives

EREC 501, Agriculture and Natural Resource Product Marketing

EREC 525, Statistical Methods and Applications

CD 614, Fundamentals of Planning

TOUR 615, Tourism Planning and Development

TOUR 633, Economics of Travel and Tourism

TOUR 560, Special Topics (8 credits)

TOUR 700, Marketing Communications Research:

Methodological Foundations

TOUR 705, Ecotourism: Managing for the Environment,

or TOUR 767, Social Impact Assessment, or CD 777, Topics in Community Planning

TOUR 794, Tourism Internship

TOUR 794 involves a 14-16 week, full-time, supervised (40 hrs.) internship, and enables students to meet and work in association with representatives from the public and private sectors of the tourism industry.

**International Tourism Development Concentration**

This concentration area prepares students to work in the dynamic and challenging environment of international tourism development. Depending on interests, language skills, and international experiences, students may expect to find employment in settings such as national tourism offices, international tourism organizations, national and foreign consults, and multinational tourism destination resorts. In addition to the required core courses, students who pursue the international tourism development concentration must complete the following requirements: TOUR 792, International Experience; two TOUR electives; competency in a foreign language (i.e., functional reading, writing, and speaking ability equivalent to the third-year second-semester level); and two additional electives that will enhance students' career opportunities in the international area.

### **Regional Tourism Planning Concentration**

This concentration area prepares students to obtain professional roles in planning in the public or private sectors of the tourism industry. Depending on interests and technical skills, students may expect to find employment in settings such as local and regional economic development organizations, chamber of commerce offices, convention and visitor bureaus, state and federal offices of tourism development, local and regional planning commissions, and resort communities. In addition to the required core courses, students who pursue the regional tourism planning concentration must complete the following requirements: TOUR 798, Independent Study in Tourism; two TOUR electives; and all the requirements for a minor in community planning.

### **Wildlife Ecology**

[www.wildlife.unh.edu/](http://www.wildlife.unh.edu/)

(For Natural Resources [NR] courses, see page 227.)

The wildlife curriculum is for students interested in the ecology, conservation, and management of wild animals. It is designed to provide a knowledge of wildlife species and their various forest, field, and wetland habitats. Students are prepared for employment with public and private agencies in wildlife conservation and management, or for continued study at the graduate level.

Fieldwork is carried out during the academic year on local and regional wildlife populations. Majors are assisted and encouraged to obtain summer employment related to wildlife and natural resources.

#### **Freshman Year**

BIOL 411, Principles of Biology I  
 BIOL 412, Principles of Biology II  
 ENGL 401, First Year Writing  
 MATH 424B, Calculus for Life Sciences,  
 or MATH 420, Finite Mathematics  
 NR 400, Professional Perspectives in Natural Resources  
 NR 401, Introduction to Natural Resources  
 NR 425, Field Dendrology  
 NR 433, Wildlife Ecology  
 Elective, physical science or general education elective

#### **Sophomore Year**

BIOL 528, Applied Biostatistics I  
 CHEM 403, General Chemistry  
 CHEM 404, General Chemistry  
 ENGL 501, Introduction to Creative Nonfiction,  
 or ENGL 502, Technical Writing,  
 or ENGL 503, Persuasive Writing  
 EREC 411, Environmental and Resource Economics  
 Perspectives  
 NR 527, Forest Ecology,  
 or BIOL 541, General Ecology

NR 655, Vertebrate Biology  
 NR 658, Introduction to Geographic Information Systems  
 ZOOL 542, Ornithology,  
 or ZOOL 712, Mammalogy,  
 or elective

#### **Junior Year**

NR 602, Natural Resources and Environmental Policy  
 NR 615, Wildlife Habitats  
 NR 737, Wildlife Population Dynamics  
 ZOOL 625, Principles of Animal Physiology  
 ZOOL 690, Evolution,  
 or ZOOL 665, Conservation Genetics  
 ZOOL 710, Ichthyology,  
 or ZOOL 713, Animal Behavior,  
 or ZOOL 733, Behavioral Ecology  
 Elective

#### **Senior Year**

NR 729, Silviculture or equivalent  
 NR 636, Wildlife Techniques  
 NR 738, Wildlife Policy and Management  
 Elective  
 Elective  
 Elective

Electives should be used to satisfy remaining general education requirements and the wildlife major requirements in the areas of communication skills and physical sciences (one course in each area-pertinent courses are listed in the detailed wildlife curricular guidelines available from the department).

Students interested in the wildlife ecology major may consult with the program coordinator, Peter Pekins, (603) 862-1017.

### **General Science Certification**

(See Department of Education and COLSA/ Degrees, pages 35 and 89.)

### **Zoology (ZOOL)**

[www.zoology.unh.edu/](http://www.zoology.unh.edu/)

(For course descriptions, see page 257.)

The Department of Biological Sciences has a primary responsibility for undergraduate and graduate instruction in fundamental aspects of animal biology, including the principles of form, function, development, and diversity produced by animal evolution. The teaching program provides a broad coverage of basic biological processes in invertebrate and vertebrate animals at the cellular, organismic, population, and community levels. Students receive background for a variety of professional positions in the public and private sector, and for graduate programs in the biological sciences including health-related fields. The department offers the bachelor of arts, bachelor of science, master of science, and doctor of philosophy degrees. Biological sciences faculty contribute significantly to the biology core curriculum, marine biology minor, animal behavior minor, genetics

program, University Honors Program, ocean projects, undergraduate research opportunity programs, and courses at the Shoals Marine Laboratory.

There is a strong teaching and research emphasis on ecological and physiological processes in aquatic animals or ecosystems. This focus is enhanced by the geographical location of the University and the availability of facilities for aquatic research. The University's location and facilities provide unique opportunities for the study of aquatic and terrestrial animals due to its access to the Seacoast and the lakes region of New Hampshire, the White Mountain National Forest, and the presence of two coastal marine laboratories, as well as estuarine and freshwater laboratories.

The zoology major builds from the common background of the biology core curriculum, with ample time for third- and fourth-year students to concentrate in specialized disciplines such as marine and freshwater biology, behavior, cell and developmental biology, ecology, evolution, fisheries, physiology, and neurobiology. Zoology majors must complete 32 credits from courses in the biological sciences approved by the department with a 2.0 average. Students must receive a minimum grade of C- in major requirements taught in the College of Life Sciences and Agriculture (e.g., zoology, microbiology, biology, biochemistry). A passing grade in major requirements taught outside the College of Life Sciences and Agriculture (e.g., chemistry, mathematics, physics) is acceptable. Minimum requirements for the B.S. in zoology are as follows: completion of the biology core courses and required courses in animal morphology, physiology and development, plus advanced electives in zoology and other biological sciences. The B.A. in zoology has a foreign language requirement in lieu of one advanced elective. B.A. students also have somewhat more flexibility when choosing courses from the biology core.

### **New England Regional Student Program**

The bachelor's degree in Zoology is one of the specialized curricula recognized by the New England Board of Higher Education and participates in the New England Regional Student Program. Under this program, students from the state of Massachusetts receive some preferential admission consideration and if admitted, pay the UNH in-state tuition rate plus 75 percent. Students who are interested in a zoology major should consult the department's undergraduate adviser or chair.

### **General Science Certification**

(See Department of Education and COLSA/ Degrees, pages 35 and 89.)

## Departments

### Department of Biological Sciences

**Majors:** Animal Science (Equine Sciences), Biology (General; Ecology, Evolution & Behavior; Marine and Freshwater), Dairy Management, Environmental Horticulture, Plant Biology, Zoology

**Chairperson:** Christopher D. Neefus

**Professors:** William E. Berndtson, John F. Burger, Donald S. Chandler, William A. Condon, Thomas M. Davis, Curtis V. Givan, James F. Haney, Larry Harris, William H. Howell, Leland S. Jahnke, James B. Loy, Arthur C. Mathieson, Subhash C. Minocha, Christopher D. Neefus, Charles G. Schwab, Michelle P. Scott, Robert L. Taylor, Jr., Winsor H. Watson

**Affiliate Professors:** Ann Bucklin

**Extension Professors:** Alan T. Eaton, Catherine A. Neil, Jeffrey T. Schloss, Cheryl A. Smith, Stanley R. Swier

**Research Professors:** Raymond E. Grizzle

**Associate Professors:** Alan L. Baker, Patricia D. Bedker, David L. Berlinsky, Jessica A. Bolker, Elizabeth P. Boulton, Peter S. Erickson, James E. Pollard, John M. Roberts, Anita S. Klein

**Affiliate Associate Professors:** James Byers, Pingguo He, Richard Langan

**Extension Associate Professors:** Rebecca C. Grube, Trent S. Schriefer

**Research Associate Professors:** Molly E. Lutcavage

**Affiliate Assistant Professors:** Michelle Dionne, Dwight Trueblood, Barry Wicklow

**Extension Assistant Professors:** Brian A. Krug, Kenneth J. La Valley, Michal Lunak

**Research Assistant Professors:** Gregg E. Moore

**Lecturers:** Christina Keim

### Department of Molecular, Cellular and Biomedical Sciences

**Majors:** Animal Sciences (Bioscience and Technology; Preveterinary Medicine), Biochemistry, Biology (Molecular, Cellular and Developmental), Medical Laboratory Science, Microbiology, Nutritional Sciences

**Chairperson:** Rick H. Cote

**Professors:** Gale B. Carey, Rick H. Cote, Joanne Curran-Celentano, Clyde L. Denis, Wayne R. Fagerberg, Thomas L. Foxall, Thomas M. Laue, Aaron B. Margolin, Thomas G. Pistole, Frank G. Rodgers, Anthony R. Tagliaferro, W. Kelley Thomas, Louis S. Tisa, Paul C. Tsang, Charles W. Walker

**Affiliate Professors:** John A. McCracken, Ron Rompalla, Stacia A. Sower, Martin R. Stokes, Stuart A. Tobet

**Clinical Professors:** Richard A. French

**Extension Professors:** Deborah Luppold, Catherine A. Violette

**Research Professors:** Michael P. Lesser, Vernon N. Reinhold

**Associate Professors:** Dennis J. Bobilya, John J. Collins, Eleanne S. Dowd, Estelle M. Hrabak, Colette Janson-Sand, Andrew P. Laudano, David H. Townson

**Affiliate Associate Professors:** Arthur F. Stucchi

**Clinical Associate Professors:** Mary Katherine Lockwood, Ruth A. Reilly

**Assistant Professors:** Feixia Chu, Vaughn S. Cooper, Deena J. Small, Cheryl A. Whistler

**Affiliate Assistant Professors:** Bo. R. Rueda, John A. Ryan, John S. Sava, Nathan L. Smith, James A. Sulikowski, Gary B. Smejkal, Ellen Whittemore

**Clinical Assistant Professors:** Joanne D. Burke, Barry J. Corriveau, Adele J. Marone, Alice D. Roudabush, Inga F. Sidor, Elise R. Sullivan

**Research Assistant Professors:** Kevin M. Culligan, Jennifer A. Durant, Dennis E. Mathews

**Lecturers:** Joyce R. Stone, Jesse S. Morrell

### Department of Natural Resources and the Environment

**Majors:** Community and Environmental Planning, Environmental Conservation Studies, Environmental and Resource Economics, Environmental Sciences (Ecosystems; Soil and Watershed Management) Forestry, Tourism Planning and Development, Wildlife Ecology

**Chairperson:** John M. Halstead

**Professors:** John D. Aber, John E. Carroll, Russell G. Congalton, Mark J. Ducey, Robert T. Eckert, Lyndon E. Goodridge, John M. Halstead, Theodore E. Howard, Bruce E. Lindsay, John A. Litvaitis, Marianne K. Litvaitis, William W. Mautz, William H. McDowell, Peter J. Pekins, Barrett N. Rock, Andrew A. Rosenberg, James T. Taylor

**Affiliate Professors:** Christopher Eagar, Jeffrey E. Gove, Jeffrey S. Kahl, William B. Leak, Rakesh Minocha, Lawrence J. Prelli

**Extension Professors:** Karen P. Bennett, Julia M. Peterson, Michael R. Sciabarrasi, Sarah S. Smith

**Research Professors:** Fredrick T. Short

**Associate Professors:** Mimi L. Becker, Kelly L. Cullen, Serita D. Frey, George C. Hurtt, Paul C. Johnson, Thomas D. Lee, Alberto B. Manalo, Douglas E. Morris, Scott V. Ollinger, Robert A. Robertson

**Affiliate Associate Professors:** Linda S. Heath, Peter A. Maddison

**Extension Associate Professors:** Charles A. French

**Research Associate Professors:** David M. Burdick, Stephen H. Jones

**Affiliate Assistant Professors:** Matthew Baber, Ria Brejaart, John L. Campbell, Richard A. Hallett, Joel N. Hartter, Erik A. Hobbie, Mary E. Martin, Bruce S. Wildblood-Crawford, Mariko Yamasaki

**Extension Assistant Professors:** Matthew D. Tarr

**Research Assistant Professors:** Adrienne I. Kovach

**Lecturers:** Mary A. Robertson