UNDERGRADUATE PROGRAMS

Biology encompasses the scientific study of life. The structure and function of organisms are studied at the molecular, cellular, organismal, population and ecosystems levels. The Department of Biology prepares students for careers in a variety of biological fields including the health sciences, natural resource management, biotechnology, veterinary medicine, education, and environmental sciences.

The Department of Biology offers undergraduate programs leading to a Bachelor of Science (BS) and a Bachelor of Arts in Education (BAE) for Biology. All students are expected to work closely with their faculty advisor to determine their curriculum. The BS degree is designed for students who require a broad background in biology, along with specialized training that will prepare them for specific careers. The program is based upon a core curriculum to provide the common background. Students are required to earn a minimum grade in the introductory sequence (BIOL 171, BIOL 172, BIOL 173, BIOL 270) to ensure a solid foundation for upper division courses. Coursework for specific careers is based on selection of elective courses tailored to career choice. Degree options or advising guides to different career options including pre-medicine, pre-dentistry, pre-physical therapy, pre-physician assistant, pre-optometry, pre-medical technology, pre-pharmacy, pre-veterinary medicine, wildlife biology, fisheries biology, and botany. Range science courses are available. The BAE degree prepares students for teaching biology in secondary education. More information on degree programs can be found at the Department of Biology website: wwwbiology.ewu.edu.

Students in the Department of Biology have varied opportunities to do biology. At the introductory level, students learn the basics of how to design, conduct, and present research projects. During their final year, the senior capstone course highlights a research project. Many upper-division elective courses in biology also incorporate research projects. In addition, undergraduate students can participate in faculty research. In coordination with the Program in Environmental Science, the Department of Biology offers an Environmental Science major with an emphasis in Environmental Biology. This major includes a core curriculum that provides students with a broad exposure to biology, chemistry, geology, statistics, and geographic information systems. More focused courses in biology provide students with expertise in their emphasis area. Motivated students have the opportunity to obtain a double major in both Environmental Science and Biology. Refer to Environmental Science section of catalog for more information.

The Department of Biology offers minors in biology, health sciences, biology/secondary, and general science/add-on endorsements. The Department of Biology is located in a building that houses laboratories designed for instruction and research in most aspects of biology. The department maintains its own aquarium rooms, cell culture facilities, greenhouse and herbarium.

In addition to on-campus facilities, the department operates the Turnbull Laboratory for Ecological Studies on the Turnbull National Wildlife Refuge about four miles from campus. These facilities provide opportunities for research in plant and animal physiology, ecology, fisheries and wildlife biology.

Major Requirements for Biology

Upon declaring biology as a major each student should meet with an advisor as soon as possible. Students should plan to complete BIOL 171, BIOL 172, BIOL 173 and BIOL 270; CHEM 151, CHEM 152, CHEM 153 and the university English and departmental mathematics requirements in the first two years of study. Required 300-level coursework should be completed by the end of the third year. Capstone and advanced elective courses are ordinarily taken in the senior year. A minimum of 50 credits of upper biology courses are required. Only 5 credits of BIOL 399 or BIOL 499 Directed Study in Biology and 5 credits of BIOL 395 or BIOL 495 Internship will be allowed toward the electives. The following biology courses will not fulfill elective requirements: BIOL 100 Introduction to Biology (5); BIOL 232, BIOL 233, BIOL 234 Human Anatomy and Physiology for Non-Biology Majors (5, 5, 5); BIOL 235 Elementary Medical Microbiology (5); BIOL 390 Biology Teaching Methods (1).

Those students planning graduate study are encouraged to take courses in physics, organic chemistry, calculus, statistics and a directed study (research) course in biology.

Required courses in the following programs of study may have prerequisites. Reference the course description section for clarification.

BACHELOR OF ARTS IN EDUCATION (BAE)

Note: See Education, for prerequisites, core requirements and additional SLOs.

BAE students must complete the Secondary Education Core (43 credits)

Student Learning Outcomes—students will:

• create a community of diverse learners who construct meaning from their science experiences and possess a disposition for further exploration and learning;
• organize a safe and effective learning environment;
• interrelate and interpret important concepts, ideas and applications in the field of biology; and conduct scientific investigations;
• develop strategies for teaching that organic evolution is a unifying theme;
• construct and use effective assessment strategies to determine the backgrounds and achievements of learners and facilitate their intellectual, social and personal development;
• engage students both in studies of various methods of scientific inquiry and in active learning through scientific inquiry.

BIOLOGY/SECONDARY MAJOR

This major satisfies the endorsement requirements for grades 5–12.

Note: BAE students must complete both the courses below and the secondary education core courses.

Required Biology Courses (55–56 credits)

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>BIOL 171 Biology I</td>
<td>5</td>
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<tr>
<td>BIOL 172 Biology II</td>
<td>5</td>
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<tr>
<td>BIOL 173 Biology III</td>
<td>5</td>
</tr>
<tr>
<td>BIOL 270 Biological Investigation</td>
<td>5</td>
</tr>
<tr>
<td>BIOL 301 Microbiology</td>
<td>5</td>
</tr>
<tr>
<td>BIOL 302 Botany</td>
<td>5</td>
</tr>
<tr>
<td>BIOL 310 Fundamentals of Genetics</td>
<td>5</td>
</tr>
<tr>
<td>BIOL 340 Biology and Society</td>
<td>2</td>
</tr>
<tr>
<td>BIOL 423 Evolution</td>
<td>5</td>
</tr>
<tr>
<td>BIOL 440 Ecology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 441 Ecology Lab</td>
<td>2</td>
</tr>
</tbody>
</table>

Choose one of the following (5 credits)

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 303 Invertebrate Zoology</td>
<td>5</td>
</tr>
<tr>
<td>BIOL 304 Vertebrate Zoology</td>
<td>5</td>
</tr>
</tbody>
</table>

Choose one of the following (4–5 credits)

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 334 Human Anatomy and Physiology III</td>
<td>5</td>
</tr>
<tr>
<td>BIOL 351 Principles of Animal Physiology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 352 Principles of Plant Physiology</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 353 Principles of Microbial Physiology</td>
<td>4</td>
</tr>
</tbody>
</table>

Required supporting courses (17 credits)

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 390 Biology Teaching Methods</td>
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</tr>
<tr>
<td>CHEM 151 General Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 152 General Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 153 General Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>SCED 390 Secondary Science Teaching Methods</td>
<td>1</td>
</tr>
</tbody>
</table>

Choose one of the following (5 credits)

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 380 Data Analysis for Biologists</td>
<td>5</td>
</tr>
<tr>
<td>MATH 142 Precalculus II</td>
<td>5</td>
</tr>
<tr>
<td>MATH 380 Probability and Statistics</td>
<td>5</td>
</tr>
</tbody>
</table>

Minimum credits for above major 120 credits

Note: the above option requires more than 12 quarters to complete at 15 credits per quarter.
BACHELOR OF SCIENCE IN BIOLOGY (BS)

Student Learning Outcomes—students will:

• demonstrate knowledge of evolution, diversity of life, and form and function of living organisms;
• interpret observations through the creation, testing, analysis of hypotheses;
• design laboratory or field experiments;
• inspect data and apply basic statistics to their analysis and communication.

• Write reports and prepare and deliver oral reports that:
  1. demonstrate ability to use scientific journals, periodicals, and electronic media to access current biological information;
  2. demonstrate ability to evaluate journal articles from the primary literature.

BIOLOGY MAJOR

Required Biology courses (28 credits)
BIOL 171 Biology I (5)
BIOL 172 Biology II (5)
BIOL 173 Biology III (5)
BIOL 270 Biological Investigation (3)
BIOL 310 Fundamentals of Genetics (5)
BIOL 490 Department Senior Capstone (5)

Choose one of the following (5 credits)
BIOL 301 Microbiology (5)
BIOL 302 Botany (5)
BIOL 303 Invertebrate Zoology (5)
BIOL 304 Vertebrate Zoology (5)

Choose one of the following (4–5 credits)
BIOL 423 Evolution (5)
BIOL 440 Ecology (4)

Choose one of the following (5 credits)
BIOL 436 Cell Biology (5)
BIOL 438 Molecular Biology (5)

Choose one of the following (4–5 credits)
BIOL 334 Human Anatomy and Physiology III for Biology Majors (5)
BIOL 351 Principles of Animal Physiology (4)
BIOL 352 Principles of Plant Physiology (4)
BIOL 353 Principles of Microbial Physiology (4)

Required Supporting Courses (20 credits)
BIOL 380 Data Analysis for Biologists (5)
or MATH 161 Calculus I (5)
or MATH 380 Elementary Probability and Statistics (5)
CHEM 151 General Chemistry (5)
CHEM 152 General Chemistry (5)
CHEM 153 General Chemistry (5)

Electives (36 credits)
Students 2007–Spring 2013, 25 of 40 electives must be Biology; Fall 2013, 21 of 36 electives must be Biology.

Minimum total credits for above major 102 credits

BIOLOGY MAJOR WITH BIOTECHNOLOGY OPTION

Required Biology courses (52 credits)
BIOL 171 Biology I (5)
BIOL 172 Biology II (5)
BIOL 173 Biology III (5)
BIOL 270 Biological Investigation (3)
BIOL 301 Microbiology (5)
BIOL 310 Fundamentals of Genetics (5)
BIOL 436 Cell Biology (5)
BIOL 438 Molecular Biology (5)
BIOL 485 Molecular Biotechnology (5)
BIOL 488 Molecular Biotechnology Lab (2)
BIOL 489 Topics in Molecular Biotechnology (2)
BIOL 490A Molecular Biotechnology Senior Capstone (5)

Choose from the following electives (10 credits)
BIOL 302 Botany (5)
BIOL 304 Vertebrate Zoology (5)
BIOL 420 Epidemiology (5)
BIOL 421 Medical Bacteriology (5)
BIOL 430 Immunology (5)
BIOL 432 Virology (5)
BIOL 460 Hematology (5)
BIOL 477 Embryology (5)
CHEM 481 Intermediary Metabolism (5)
CSCD 409 Scientific Programming (4)
MATH 162 Calculus II (5)

Required Supporting Courses (62 credits)
CHEM 151 General Chemistry (5)
CHEM 152 General Chemistry (5)
CHEM 153 General Chemistry (5)
CHEM 304 Quantitative Analysis (6)
CHEM 351 Organic Chemistry (4)
CHEM 352 Organic Chemistry (4)
CHEM 372 Organic Chemistry Lab I (3)
CHEM 480 Biochemistry (5)
CHEM 304 Quantitative Analysis (6)
CHEM 351 Organic Chemistry (4)
CHEM 352 Organic Chemistry (4)
CHEM 372 Organic Chemistry Lab I (3)
CHEM 304 Quantitative Analysis (6)
CHEM 351 Organic Chemistry (4)
CHEM 352 Organic Chemistry (4)
CHEM 372 Organic Chemistry Lab I (3)
CHEM 304 Quantitative Analysis (6)
CHEM 351 Organic Chemistry (4)
CHEM 352 Organic Chemistry (4)
CHEM 372 Organic Chemistry Lab I (3)

Total credits for above major 124 credits
BIOLOGY MAJOR WITH PRE-MEDICINE/ PRE-DENTISTRY OPTION

This curriculum is recommended for students planning a career in medicine or dentistry. The schedule of classes is designed to prepare students for the aptitude examination (MCAT, DAT) which is taken during a student’s junior or early senior year. Students interested in other health care professions (e.g., physical therapy, physician’s assistant) need to see a department advisor to plan a curriculum.

Required Biology courses (28 credits)
BIOL 171 Biology I (5)
BIOL 172 Biology II (5)
BIOL 173 Biology III (5)
BIOL 270 Biological Investigation (3)
BIOL 310 Fundamentals of Genetics (5)
BIOL 490 Department Senior Capstone (5)

Choose one of the following (5 credits)
BIOL 301 Microbiology (5)
BIOL 302 Botany (5)
BIOL 303 Invertebrate Zoology (5)
BIOL 304 Vertebrate Zoology (5)

Choose one of the following (4–5 credits)
BIOL 334 Human Anatomy and Physiology III for Biology Majors (5)
BIOL 351 Principles of Animal Physiology (4)
BIOL 352 Principles of Plant Physiology (4)
BIOL 353 Principles of Microbial Physiology (4)

Required supporting courses (61 credits)
BIOL 380 Data Analysis for Biologists (5)
or MATH 161 Calculus I (5)
or MATH 380 Elementary Probability and Statistics (5)
CHEM 151 General Chemistry (5)
CHEM 152 General Chemistry (5)
CHEM 153 General Chemistry (5)
CHEM 351 Organic Chemistry (4)
CHEM 352 Organic Chemistry (4)
CHEM 353 Organic Chemistry (3)
CHEM 372 Organic Chemistry Laboratory I (3)
CHEM 471 Pre-Med, Dent, Vet and Pharm Preparation (1)
CHEM 480 Biochemistry (5)
CHEM 481 Intermediate Metabolism (5)
PHYS 121 Descriptive Astronomy (5)
PHYS 131 Introductory Physics I (4)
PHYS 132 Introductory Physics II (4)
PHYS 133 Introductory Physics III (4)
PHYS 161 Mechanics Laboratory (1)
PHYS 162 Heat and Optics Laboratory I (1)
PHYS 163 Instrumentation Laboratory I (1)

Electives—choose two from the following (9–10 credits)
BIOL 301 Microbiology (5)
BIOL 304 Vertebrate Zoology (5)
BIOL 310 Fundamentals of Genetics (5)
BIOL 334 Human Anatomy and Physiology I for Biology Majors (5)
BIOL 333 Human Anatomy and Physiology II for Biology Majors (5)
BIOL 334 Human Anatomy and Physiology III for Biology Majors (5)
BIOL 411 Field Botany (5)
BIOL 420 Epidemiology (5)
BIOL 421 Medical Microbiology (5)
BIOL 423 Evolution (5)
BIOL 430 Immunology (5)
BIOL 432 Virology (5)
BIOL 433 Biology of Cancer (5)
BIOL 436 Cell Biology (5)
BIOL 438 Molecular Biology (5)
BIOL 440 Ecology (4)
BIOL 460 Hematology (5)
BIOL 473 Neurobiology (5)
BIOL 476 Muscle Physiology (5)
BIOL 477 Embryology (5)
TCOM 205 Introduction to Technical Communication (5)

Minimum total credits for above major 112 credits

BIOLOGY MINOR

This minor does not meet the endorsement requirement for teachers.

Required Biology courses (18 credits)
BIOL 171 Biology I (5)
BIOL 172 Biology II (5)
BIOL 173 Biology III (5)
BIOL 270 Biological Investigation (3)
BIOL 310 Fundamentals of Genetics (5)
BIOL 340 Biology and Society (2)
BIOL 423 Evolution (5)
BIOL 440 Ecology (4)
BIOL 441 Ecology Lab (2)

Choose one of the following (5 credits)
BIOL 301 Microbiology (5)
BIOL 302 Botany (5)
BIOL 303 Invertebrate Zoology (5)
BIOL 304 Vertebrate Zoology (5)

Required supporting courses (7 credits)
BIOL 380 Data Analysis for Biologists (5)
or MATH 141 Precalculus I (5)
or MATH 380 Elementary Probability and Statistics (5)
BIOL 390 Biology Teaching Methods (1)
SCE D 390 Secondary Science Teaching Methods (1)

Total credits for above minor 31 credits

BIOLOGY/SECONDARY MINOR

This minor satisfies the endorsement for grades 5–12.

Required Biology courses (36 credits)
BIOL 171 Biology I (5)
BIOL 172 Biology II (5)
BIOL 173 Biology III (5)
BIOL 270 Biological Investigation (3)
BIOL 310 Fundamentals of Genetics (5)
BIOL 340 Biology and Society (2)
BIOL 423 Evolution (5)
BIOL 440 Ecology (4)
BIOL 441 Ecology Lab (2)

Choose one of the following (5 credits)
BIOL 301 Microbiology (5)
BIOL 302 Botany (5)
BIOL 303 Invertebrate Zoology (5)
BIOL 304 Vertebrate Zoology (5)

Required supporting courses (7 credits)
BIOL 380 Data Analysis for Biologists (5)
or MATH 141 Precalculus I (5)
or MATH 380 Elementary Probability and Statistics (5)
BIOL 390 Biology Teaching Methods (1)
SCE D 390 Secondary Science Teaching Methods (1)

Total credits for above minor 48 credits

Course Requirements for Teacher Certification/Add-on Endorsements

GENERAL SCIENCE/ADD-ON ENDORSEMENT

(For students who currently possess a Washington State Teaching Certificate.) This add-on satisfies the General Science endorsement and allows teachers to teach any science grades 5–12.

To improve their marketability as science teachers, students may wish to complete this option in addition to their BAE in Biology, Chemistry, Earth and Space Science or Physics.

Required courses
BIOL 171 Biology I (5)
BIOL 172 Biology II (5)
BIOL 173 Biology III (5)
BIOL 390 Biology Teaching Methods (1)
CHEM 151 General Chemistry (5)
CHEM 152 General Chemistry (5)
CHEM 153 General Chemistry (5)
CHEM 390 Chemistry Methods for the Secondary School (1)
GEOG 314 Weather and Climate (5)
GEO L 120 Physical Geology—The Solid Earth (5)
GEO L 121 Physical Geology—Surficial Processes (5)
GEO L/ GEO G 390 Earth Science Teaching Methods (1)
PHYS 121 Descriptive Astronomy (5)
PHYS 131 Introductory Physics I (4)
PHYS 132 Introductory Physics II (4)
PHYS 161 Mechanics Lab (1)
PHYS 162 Heat and Optics Lab (1)
PHYS 390 Physics Teaching Methods (1)
SCE D 390 Secondary Science Teaching Methods (1)

Total credits for above add-on endorsement 65 credits
GRADUATE PROGRAM

Rebecca L. Brown, Admissions Coordinator 509.359.2528
Camille F. McNeely, Graduate Service Appointment Coordinator 509.359.7049
David Daberkow, Candidacy Coordinator 509.359.2259
biologymasters@ewu.edu

Eastern Washington University Department of Biology offers a Master of Science in Biology. The Master of Science in Biology program provides a demanding and rewarding experience in biology, leading to competent scholarship and research capability. The department emphasizes research as a basic component of graduate study. A variety of research specialties are available within the department, including limnology, stream ecology, riparian ecology, fisheries biology, embryology, exercise physiology, neurobiology, wildlife biology, animal physiology, mycology, plant ecology, microbiology and immunology. More information on faculty research interests may be obtained by writing the appropriate graduate program advisor or accessing our website at www.biology.ewu.edu. Graduates of the biology program either continue in PhD programs, or are employed in various biological fields with federal, state and local agencies, environmental consulting firms, public and private schools or private industry.

The Master of Science in Biology curriculum includes core courses in Biological Research Methods; Graduate Seminar; Current Topics in Ecology/Evolution, Physiology, Cell/Molecular Biology, and Growth of Biological Thought; elective courses in advanced topics; and research thesis.

In addition, an interdisciplinary master’s program is available that can incorporate biology. The Department of Biology is housed in a remodeled and well-equipped facility. The department administers the nearby Turnbull Laboratory for Ecological Studies on the Turnbull National Wildlife Refuge.

Graduate service appointments, with resident and non-resident tuition waivers, are available on a competitive basis to qualified graduate students. Nonresident students who do not qualify for a graduate service appointment can apply for nonresident tuition scholarship waivers. Other financial support is possible through work-study programs, hourly employment by the department or faculty research grants. All applicants are encouraged to submit an application for federal student aid which, for incoming students, must be received by the EWU Financial Aid Office by February 15 for support in the following academic year. Applications are available through the EWU Financial Aid Office.

Entrance Requirements and Preparation
To be admitted to the Master of Science in Biology program, applicants must first meet all requirements for admission to the Graduate School as outlined elsewhere in this catalog. Prospective MS applicants must hold a four-year baccalaureate degree in biology or related natural science from an accredited college or university. Preparation often includes the equivalent of two quarters of organic chemistry and one quarter of statistics or calculus. Students who have deficiencies for admission or deficiencies as determined by their graduate committee may be allowed to make up deficient coursework while enrolled in graduate school. Admission to the program will be considered when applicants have:
1) completed all admission requirements for the Eastern Washington University Graduate Studies Office, 2) submitted scores from the general GRE test, 3) provided a completed supplemental application to the Department of Biology and two evaluation/recommendation forms and 4) identified an appropriate faculty research advisor willing to serve as the major professor.

Graduate students wishing to be considered for a graduate service appointment must have their completed application, including a graduate fellowship application, to the Department of Biology by February 20. Applicants not seeking teaching fellowships must have their completed application to the Department of Biology by April 1, October 15 and January 15 for admission in the fall, winter and spring quarters, respectively.

Candidacy
To be admitted to candidacy, graduate students in the Master of Science in Biology program must have:
• completed 15 credit hours (at least 10 at the 500 level) but not more than one half of the total minimum credits required for the degree;
• removed all deficiencies regarding entrance requirements (deficient coursework cannot be counted toward a degree);
• met with their graduate committee to determine an appropriate course curriculum;
• had their research proposal approved by their internal graduate committee and presented their proposal to the Department of Biology;
• submitted the completed application form with research advisor’s and second committee member’s signatures to the appropriate biology graduate candidacy coordinator;
• had their candidacy approved by the Department of Biology faculty.

MASTER OF SCIENCE IN BIOLOGY

Student Learning Outcomes—students will:

• write a research proposal that demonstrates the ability to determine the veracity and value of published information;
• conduct research project, analyze data, and write thesis;
• present completed research in an open forum seminar with question/answer session.

Graduate Core (10 credits)
BIOL 500 Research Seminar (1, 1)
BIOL 510 Biological Research Methods I (4)
BIOL 511 Biological Research Methods II (4)

Choose three of the following (6 credits)
Note: additional current topics may be taken for elective credits.
BIOL 512 Current Topics in Physiology (2)
BIOL 513 Current Topics in Cell and Molecular Biology (2)
BIOL 514 Current Topics in Ecology/Evolution (2)
BIOL 515 Growth of Biological Thought (2)

Electives (16 credits)
To be determined in consultation with student’s graduate committee. All 400 and 500 level courses may be used as electives; if a course is stacked as a 400- or 500-level course, students must enroll at the 500-level.

Thesis (14 credits)
To be determined in consultation with student’s graduate committee. All Master’s of Science in Biology students are required to conduct original research toward their Master’s thesis.
BIOL 600 Thesis Research (14 credits)

Minimum total credits for above master’s degree 46 credits

Teaching
All Master’s of Science students in biology are required to either teach at least one quarter as a paid teaching assignment or arrange a teaching experience in consultation with their graduate committee. Students who do not have a paid teaching assignment may arrange to receive BIOL 595 credit for the development and execution of this teaching experience.

Final Comprehensive Examination
The final comprehensive examination for the Master’s of Science in biology consists of a research seminar and an oral defense of the master’s thesis presented to the department. Immediately following the student’s seminar, an oral examination is administered by the student’s committee, which is composed of two or three departmental faculty members and a faculty member appointed by the Graduate Studies Office. The focus of the examination is the student’s thesis and general biology knowledge.
**Biology Courses**

**Terms offered:** If no terms are indicated, check with the department or EagleNET.

**Course fees will be required on many biology courses.** Some of the following courses are stacked as 400- and 500-level courses. Biology graduate students enrolled in stacked courses must enroll at the graduate (500) level.

**BIO 100 Introduction to Biology**
Prerequisite: completion of pre-university basic skills in mathematics requirement.
Satisfies: GECR for natural sciences, biology.

**BIO 115 Investigating Biology**
Prerequisite: completion of pre-university basic skills in mathematics requirement.
Satisfies: GECR for natural science, biology.

**BIO 171 Biology I (5)**
Note: course fee.
Prerequisite: Concurrent enrollment in MATH 141 or completion of MATH 141 with ≥2.0.
Students must receive ≥1.7 to enroll in BIO 172 and ≥2.0 to enroll in BIO 270.

**BIO 172 Biology II (5)**
Note: course fee.
Prerequisite: ≥1.7 in BIO 171 and ≥2.0 in MATH 141.
Satisfies: 2nd Natural Sciences biology GECR if BIO 171 and BIO 270 are complete or BIO 172 and BIO 270 are complete.

Introduction to biology, covering evolution, the diversity of life and interactions among organisms and their environment.

**BIO 173 Biology III (5)**
Note: course fee.
Prerequisite: ≥2.0 in BIO 172.

This course is an introduction to biology, covering the structure and function of plants and animals, with emphasis on developing plants and vertebrates.

**BIO 232 Human Anatomy and Physiology**
Prerequisite: one course in college chemistry.
Satisfies: a GECR for natural sciences, biology.

First of a three-quarter sequence concerned with the structure and function of the human organism. Chemistry, cells, histology, integumentary system, skeletal system, excitable tissues and muscular system will be completely and thoroughly covered. Laboratory included that utilizes human cadavers, models, multimedia and other technologies.

**BIO 233 Human Anatomy and Physiology**
Prerequisite: BIO 232.
Satisfies: a GECR for natural sciences, biology.

Second of a three-quarter sequence concerned with the structure and function of the human organism. Nervous system, autonomic nervous system, special senses, endocrine system, cardiovascular system, lymphatic system and immunity will be completely and thoroughly covered. Laboratory included that utilizes human cadavers, models, multimedia and other technologies.

**BIO 234 Human Anatomy and Physiology**
Prerequisite: BIO 233.
Satisfies: a GECR for natural sciences, biology.

Third of a three-quarter sequence concerned with the structure and function of the human organism. Respiratory system, digestive system, nutrition and metabolism, urinary system, and reproductive system will be completely and thoroughly covered. Laboratory included that utilizes human cadavers, models, multimedia and other technologies.

**BIO 235 Elementary Medical Microbiology**
Prerequisite: completion of or concurrent enrollment in both BIO 234 and CHEM 163.

This course will discuss micro-organisms and animal parasites, with chief emphasis on those which affect human health. A laboratory is included.

**BIO 270 Biological Investigation**
Note: the completion of BIOL 171 and BIO 270 satisfies a GECR for natural sciences, biology, the completion of BIOL 171, BIO 172 and BIO 270 satisfies a second GECR for natural sciences, biology.
Prerequisite: ≥2.0 in BIO 171 or BIO 172.
Experimental design and performance, including data collection and analysis, scientific writing and use of the biological literature.

**BIO 299 Special Studies Biology**
Prerequisite: permission of the instructor, department chair and college dean.

An opportunity for students to explore problems of special interest.

**BIO 300 History of Biology**
Examines the development of biological ideas in the Western world from early times to the present.

**BIO 301 Microbiology**
Prerequisite: ≥1.5 in BIO 171, ≥2.0 in BIO 270, CHEM 153.

This course covers morphology, physiology, taxonomy and ecology of the microorganisms, emphasizing prokaryotes, fungi and the viruses. A laboratory is included.

**BIO 302 Botany**
Prerequisite: ≥2.0 in BIO 172, BIO 173, BIO 270; completion of or concurrent enrollment in CHEM 151.

This course examines the structure, function and phylogenetic relationships in the plant kingdom. A laboratory is included.

**BIO 303 Invertebrate Zoology**
Prerequisite: ≥2.0 in BIO 172, BIO 173, BIO 270; completion of or concurrent enrollment in CHEM 151.

This course examines structure, function and phylogenetic relationships of the invertebrate phyla. A laboratory is included.

**BIO 304 Vertebrate Zoology**
Prerequisite: ≥2.0 in BIO 172, BIO 173, BIO 270; completion of or concurrent enrollment in CHEM 151.

This course examines structure, function and phylogenetic relationships of the vertebrates. A laboratory is included.

**BIO 306 Natural Vegetation Ecology of North America**
Prerequisite: ≥1.7 in BIO 171, ≥2.0 in BIO 172 and BIO 173, CHEM 153.

This course provides comprehensive coverage of the major topical areas of genetics: classical, molecular and evolutionary.

**BIO 310 Fundamentals of Genetics**
Prerequisite: ≥1.5 in BIO 171 and ≥2.0 in BIO 172 and BIO 173, CHEM 153.

This course covers the genetic concepts that underpin molecular and cellular biology, molecular and developmental biology, and neurobiology. Topics include the molecular basis of heredity, genetic variation and evolution, the regulation of gene expression and the nature of DNA damage and repair. Special emphasis on molecular biological techniques and modern research methods.

**BIO 312 Fundamentals of Soil Science**
Prerequisite: CHEM 13.

An introduction to the scientific study of soils, emphasizing the relationship of soils to the environment including their formation, their properties and their relationship to organismic life. The course emphasizes the causes and effect of soil management on the environment and its resources.

**BIO 318 Biology of Women**
Cross-listed: WAST 318.

This course will focus on the biological and anatomical roots of humans’ relation with the environment.

**BIO 320 The Human Prospect**
Prerequisite: CHEM 130.
Satisfies: international studies university graduation requirement.

Explores the biological and morphological roots of humans’ relation with the environment.

**BIO 324 Entomology**
Prerequisite: ≥2.0 in BIO 172, BIO 173, CHEM 151.

This course is a study of insect biology. A laboratory is included.

**BIO 332 Human Anatomy and Physiology**
Prerequisite: CHEM 153 with a grade ≥2.5; or instructor permission.

This is a three-quarter sequence covering the structure and function of the human body. Intended for students with significant background in biology and chemistry who are pursuing health care careers. A laboratory is included each quarter.

**BIO 333 Human Anatomy and Physiology**
Prerequisite: CHEM 153.

See description listed under BIO 332.

**BIO 334 Human Anatomy and Physiology**
Prerequisite: CHEM 153.

See description listed under BIO 332.

**BIO 338 Discovering Women in Science**
Prerequisite: either BIO 100 or ≥2.17 in BIO 171 or one of them taken concurrently.

This course will discuss biological, social, ethical and economic implications of current advances in the biological sciences.

**BIO 339 Biology of Aging**
Prerequisite: ≥2.5; or instructor permission.

This course will discuss the aging of biological organisms, viewed from the molecular level through regulating gene expression, horizontal gene transfer and cell-cell communication.

**BIO 352 Principles of Animal Physiology**
Prerequisite: CHEM, BIOL 173.

An integrative understanding of the physiological systems of vertebrates, analyzing physiological processes from the cellular level upwards, integrating in organismal function. This course reinforces concepts from biology, physics, chemistry and mathematics.

**BIO 352 Principles of Plant Physiology**
Prerequisite: CHEM, BIOL 173.

This course addresses mechanisms by which plants obtain nutrients from the soil and atmosphere, convert light energy to chemical energy, and coordinate responses to shifting environmental conditions in roots, leaves and reproductive structures.

**BIO 353 Principles of Microbial Physiology**
Prerequisite: CHEM, BIOL 173.

This course explores the physiology of unicellular microbes. It includes topics on microbial replication and how microbes adapt to their environment through regulating gene expression, horizontal gene transfer and cell-cell communication.
BIOL 380 Data Analysis for Biologists (5)  
Prerequisites: ≥ 2.0 in BIOL 172, BIOL 175, BIOL 270, completion or concurrent enrollment in CHEM 151 and a ≥ 2.0 in MATH 141.  
Satisfies: mathematics proficiency.  
Students gain the knowledge and skills required to conduct and interpret data analysis and statistics commonly applied in Biology. Key concepts of statistical analysis such as populations and samples, uncertainty, statistical significance values, hypothesis testing, Type I & Type II errors, statistical methods and R programming language are covered.

BIOL 390 Biology Teaching Methods (1)  
Prerequisites: ≥ 2.1 in BIOL 171, ≥ 2.0 in BIOL 172, BIOL 173 and BIOL 270, co-requisite: SCED 330.  
This course is designed for individuals seeking endorsement to teach junior or senior high school biology or general science. Various types of biology programs, organization of lesson materials, techniques and laboratory safety are included in the course.

BIOL 395 Internship/Co-op Fieldwork (1–15)  
Prerequisite: permission of the instructor, department chair or college dean; only 5 credits will be allowed toward the electives.

BIOL 405 Limnology (5)  
Prerequisites: any one of BIOL 301, BIOL 302, BIOL 303, BIOL 304 or concurrent enrollment.  
This course includes the general study of the physical, chemical, and biological features of lakes and streams. A laboratory is included.

BIOL 409 Mycology (5)  
Prerequisite: any one of BIOL 301, BIOL 302, BIOL 303, BIOL 304 or concurrent enrollment.  
This course includes discussion of the structure, physiology, ecology and taxonomy of microfungi and mushrooms with an emphasis on fungi of the Northwest. A laboratory is included.

BIOL 411 Field Botany (5)  
Prerequisites: junior standing or permission of instructor.  
The goal of this course is to gain an appreciation of natural history and the unique array of plants found in our region. This will be a practical, hands-on, field-based course where students learn how to identify plants.

BIOL 420 Epidemiology (5)  
Prerequisite: BIOL 301.  
This course is a study of the factors which determine the frequencies and distributions of communicable diseases among humans.

BIOL 421 Medical Bacteriology (5)  
Prerequisites: BIOL 300.  
This course addresses microbial agents of human disease, with an emphasis on bacteria.

BIOL 423 Evolution (5)  
Prerequisites: BIOL 310 plus any one of BIOL 301, BIOL 302, BIOL 303, BIOL 304.  
This course is a study of diversity and speciation in biological systems.

BIOL 430 Immunology (5)  
Prerequisite: any one of BIOL 301, BIOL 303, BIOL 304 or permission of the instructor. BIOL 460 is recommended.  
This course covers the immune reactions of animals with principal emphasis on those associated with infectious diseases.

BIOL 432 Virology (5)  
Prerequisite: any one of BIOL 301, BIOL 303, BIOL 304 or permission of the instructor. BIOL 460 is recommended.  
This course covers the molecular biology of microbial, animal and plant viruses and their host-virus relationships. Those viruses associated with human and animal diseases are emphasized.

BIOL 435 Biology of Cancer (5)  
Prerequisites: ≥ 2.0 in BIOL 173 or BIOL 234, CHEM 153 or CHEM 163.  
A general study of human neoplasms.

BIOL 436 Cell Biology (5)  
Prerequisites: ≥ 1.7 in BIOL 171, ≥ 2.0 in BIOL 172, BIOL 175, BIOL 270, CHEM 153.  
This course is a comprehensive study of cell biology from a structural and functional perspective.

BIOL 438 Molecular Biology (5)  
Prerequisites: BIOL 310 and one of BIOL 301, BIOL 302, BIOL 305 or BIOL 308.  
This course includes study of gene structure, organization, function and regulation. Equal emphasis is given to the molecular processes and genetic phenomena of both prokaryotic and eukaryotic cells.

BIOL 440 Ecology (4)  
Prerequisites: MATH 161 or MATH 380 and ≥ 2.0 in BIOL 172, BIOL 173 or BIOL 270; or permission of the instructor.  
This course involves the study of factors which determine the distribution and abundance of organisms.

BIOL 441 Ecology Lab (2)  
Prerequisite: current or prior enrollment in BIOL 440.  
A field and laboratory course which emphasizes testing ecological hypotheses.

BIOL 442 Conservation Biology (4)  
Prerequisites: ≥ 1.7 in BIOL 171, ≥ 2.0 in BIOL 172, BIOL 173, BIOL 270 or permission of the instructor; BIOL 440 recommended.  
Conservation biology is an interdisciplinary discipline that has arisen in response to the current unprecedented rates of extinction and draws on a wide range of basic sciences and applied fields to address the problems of ecological diversity. This course introduces students to the discipline of conservation biology, familiarizes students with literature in conservation biology and provides students with a forum for discussion of some major topics in conservation biology.

BIOL 443 Wildlife Management (4)  
Prerequisites: ≥ 1.7 in BIOL 171, ≥ 2.0 in BIOL 172, BIOL 173 and BIOL 270 or permission of the instructor; BIOL 440 recommended.  
This course examines the historical and political development of wildlife management, the ecological principles that underpin management decisions, primary approaches to management and current management issues.

BIOL 444 Field Ecology (4)  
Prerequisite: BIOL 423 or BIOL 440 or permission of the instructor.  
In this course students conduct observational and/or experimental field studies designed to answer contemporary ecological questions. The course emphasizes hypothesis testing, study design, field techniques, data analysis and written and oral study presentation. May emphasize aquatic ecology, terrestrial ecology or both may be emphasized.

BIOL 445 Stream Ecology (5)  
Prerequisite: one of: BIOL 301, BIOL 302, BIOL 303; BIOL 304; or permission of instructor.  
This course covers the diverse ecological functions of streams and their roles in global processes. The primary focus is on ecosystem function. Stream organisms and their communities are also covered. Course activities include field work, laboratory techniques, data analysis and professional methods for measuring rates of stream ecosystem processes and investigating stream communities.

BIOL 446 Riparian Ecology (5) alt  
Prerequisites: ≥ 1.7 in BIOL 171, ≥ 2.0 in BIOL 172, BIOL 173, BIOL 175 and BIOL 270 or permission of instructor.  
This course will focus on riparian areas (riparia), which experience intermittent flooding by water moving within a catchment. Riparia form the interface between terrestrial and aquatic habitats and perform critical ecosystem functions. This class will address riparian physical processes, biotic adaptations, human impacts, conservation, restoration and management.

BIOL 450 Mammalogy (5) alt  
Prerequisite: BIOL 304 or permission of the instructor.  
This course covers the classifications, life histories and ecology of mammals. A laboratory is included.

BIOL 454 Ornithology (5) alt  
Prerequisite: BIOL 304 or permission of the instructor.  
Natural history and taxonomy of birds.

BIOL 460 Hematology (5)  
Prerequisites: BIOL 310 plus one of BIOL 301, BIOL 303 or BIOL 304; or permission of the instructor.  
This course discusses the morphology and hemostasis of the normal and abnormal human hemotological system. A laboratory is included.

BIOL 462 Ichthyology (5)  
Prerequisites: ≥ 2.0 in BIOL 172, BIOL 173, BIOL 270 or permission of the instructor.  
This course is a systematic and ecological study of fishes with emphasis on the freshwater fishes of the U.S. A laboratory is included.

BIOL 463 Fisheries Biology and Management (4)  
Prerequisites: ≥ 2.0 in BIOL 172, BIOL 173, BIOL 270 or permission of the instructor.  
This course covers the development of the biological basis of fisheries management and the role of fish populations as sources of food and recreation for humans.

BIOL 470 Biological Illustration (5)  
Prerequisites: ≥ 2.0 in BIOL 172, BIOL 73, BIOL 270 or permission of the instructor.  
The emphasis in this course is developing the various techniques commonly used in rendering biological illustrations that are suitable for publication.

BIOL 471 Pre-Med, Dent, Vet and Pharm Preparation (1–2)  
Prerequisite: junior standing or permission of the instructor.  
Prepares students for their interviews for medical, dental, veterinary or pharmacy school and for professional activities. Discusses medical ethics and presents students with a wide range of dilemmas associated with the medical field and has students work toward resolutions.

BIOL 473 Neurobiology (5)  
Prerequisites: ≥ 2.0 in BIOL 172, BIOL 173, BIOL 270, CHEM 153 or permission from the instructor. PHYS 133 or PHYS 153 is recommended.  
This course introduces students to the principles of neurobiology. Emphasis is placed on human neuroscience but examples from a wide range of invertebrates and vertebrates are used to best illustrate neurobiological principles, concepts, and mechanisms. The course also includes a laboratory component focusing on neuroanatomy.

BIOL 476 Muscle Physiology (3)  
Prerequisite: BIOL 332 or permission of the instructor.  
This course examines the structure, function and regulation of muscle tissue with emphasis on skeletal muscle.

BIOL 477 Embryology (5)  
Prerequisites: BIOL 301.  
This course examines the dynamics, physical features and mechanisms of early organismic development from both the classical embryology and modern genetic perspective. Emphasis is placed on mammalian embryology. Also discussed are state-of-art technologies currently in use in medical and veterinary practice and in research.
BIOL 479 Clinical Laboratory Theory and Practicum I (6)  
Prerequisite: admission to Professional Training at Sacred Heart Medical Center.  
BIOL 479 is a clinical laboratory science course, which will begin at the affiliate hospital in the latter part of the second year of a student’s junior year. It includes lecture and laboratory instruction in clinical immunohematology, clinical chemistry, phlebotomy, clinical hematology, clinical microscopy and urinalysis, clinical body fluids, transfusion techniques and clinical microbiology.

BIOL 480 Clinical Laboratory Theory and Practicum II (12)  
Prerequisite: BIOL 479.  
BIOL 480 is the second course in clinical laboratory science at the affiliate hospital. Students will review basic and advanced information in immunohematology, clinical chemistry, clinical hematology, clinical microbiology, clinical immunology, medical mycology and phlebotomy techniques. Students will perform patient laboratory testing under the guidance of trained professionals.

BIOL 481 Freshwater Invertebrate Zoology (5)  
Prerequisites: ≥2.0 in BIOL 172, BIOL 173, BIOL 270 are required, BIOL 405 or BIOL 440 is recommended.  
This is a field course stressing the collection, preservation, and identification of fresh water invertebrates. A laboratory is included.

BIOL 482 Clinical Laboratory Theory and Practicum III (12)  
Prerequisite: BIOL 480.  
BIOL 482 is the third course in clinical laboratory science at the affiliate hospital. Students continue to study advanced clinical immunohematology, clinical chemistry, clinical microbiology and clinical hematology. During this course, students will perform actual patient laboratory testing under the guidance of trained professionals.

BIOL 483 Clinical Laboratory Theory and Practicum IV (12)  
Prerequisite: BIOL 482.  
BIOL 483 is the fourth course in clinical laboratory science at the affiliate hospital. Students will learn financial and quality management of clinical laboratory, ethics and professional behavior. Students will continue their training in advanced diagnostics in clinical microbiology, clinical chemistry, hematology and immunohematology. During this course, students will perform actual patient laboratory testing under the guidance of trained professionals.

BIOL 485 Molecular Biotechnology (5)  
Prerequisites: BIOL 301, BIOL 310, CHEM 480.  
A study of the concepts, experiments and industrial applications of fermentation theory, recombinant DNA protocols, plasmids and cloning, DNA, RNA and protein sequencing and synthesis, monoclonal antibodies and cell fusion, solid support enzyme technology, bioenergy reactions, biomass and secondary metabolite production and biodegradation.

BIOL 488 Molecular Biotechnology Laboratory (2)  
Prerequisite: BIOL 485 or concurrent enrollment.  
Experiments include basic analytical and separatory techniques, analytical and preparative fermentations, restriction analysis of viral DNA, RNA labelling and sequencing, tissue fractionation and lectin affinity chromatography, DNA cloning, screening and blot analysis, mammalian cell culture and fusion, immunohemoanalysis and in vitro translation.

BIOL 489 Topics in Molecular Biotechnology (2)  
Prerequisite: BIOL 485, BIOL 489.  
Readings and discussion of research and issues in molecular biotechnology.

BIOL 490 Department Senior Capstone (5)  
Prerequisites: senior standing (1.5 credits), BIOL 310, and any one of BIOL 301, BIOL 302, BIOL 303 or BIOL 304.  
Satisfies: graduation requirement.  
Integrated Studies in Form and Function, Integrated Studies in Microbial and Molecular Biology or Integrated Studies in Ecology and Evolutionary Biology. See the major or professional advisor for the appropriate section number. A laboratory is included.

BIOL 490A Capstone in Biotechnology (5)  
Prerequisites: senior standing, BIOL 485, BIOL 488, BIOL 490.  
Satisfies: senior capstone university graduation requirement.  
This capstone course is specific to the Biotechnology Option. Integration of lecture and laboratory experience to culminate in research project. See your major department. A laboratory is included.

BIOL 491 Senior Thesis (20)  
Prerequisite: BIOL 483  
BIOL 491 is Senior Thesis in clinical laboratory science at the affiliate hospital. Students will have lectures in ethics and professional behavior, management information and participate individually in small clinical laboratory experience and continue their training of advanced diagnostic work in clinical microbiology, clinical chemistry, clinical hematology and immunohematology. During this course, students will perform actual patient laboratory testing under the guidance of trained professionals. An individual senior project integrating practical and theoretical topics will be the culmination of this course.

BIOL 495 Professional Internship (1–15)  
Note: only 5 credits will be allowed toward the elective.  
Prerequisite: permission of the instructor, department chair and college dean.

BIOL 496 Experimental Courses and Research Courses (1–5)  

BIOL 497 Workshops, Short Courses, Conferences (1–5)  

BIOL 498 Seminar (1–2)  
Prerequisite: advanced standing in departmental program.

BIOL 499 Directed Study (1–5)  
Prerequisite: permission of the instructor, department chair and college dean.

BIOL 500 Research Seminar (1)  
Note: must be repeated for at least 2 credits.  
Prerequisite: admission to graduate program in biology.

Students develop and present seminars on their research to an audience of peers and faculty.

BIOL 501 Seminar Programming (1)  
Notes: graded Pass/No Credit; students shall be enrolled in BIOL 501 during all quarters of residency when not enrolled in BIOL 500.  
Prerequisite: admission to graduate program in biology or permission of the instructor.

Students learn to host a scientific meeting by developing and distributing a scientific meeting program, making all necessary logistical arrangements for the meeting and conducting the meeting itself. The product produced is the Department of Biology’s Graduate Student Symposium.

BIOL 505 Limnology (5)  
Prerequisite: admission to graduate program.

An in-depth study of the physical, chemical and biological features of lakes and streams incorporating independent field work and/or synthesis of primary literature.

BIOL 509 Mycology (5)  
Prerequisite: admission to graduate program or permission of the instructor.  
Structure, physiology, ecology and taxonomy of microfungi and mushrooms, with an emphasis on fungi from the Northwest and on the design and implementation of independent mycological experiments.

BIOL 510 Biological Research Methods I (4)  
Prerequisite: admission to the biology master’s program or permission of the instructor.  
Methods of biological research, including scientific writing and presentation, utilization of scientific literature and a brief introduction to experimental design and data analysis.

BIOL 511 Biological Research Methods II (4)  
Prerequisite: BIOL 510.  
This course will explore implications of observational and experimental study design and expose students to quantitative hypothesis tests appropriate for the biological sciences.

BIOL 512 Current Topics in Physiology (2)  
Note: may be repeated for credit.  
Prerequisite: admission to the biology master’s program or permission of the instructor.  
Current readings in a specialized area of physiology, including functional aspects of animals, plants or micro-organisms or functions common to two or more groups of organisms.

BIOL 513 Current Topics in Cell and Molecular Biology (2)  
Note: may be repeated for credit.  
Prerequisite: admission to the biology master’s program or permission of the instructor.  
This course will explore implications of current research developments across the molecular and cell biology disciplines. Topics will build on research expertise of faculty as well as current literature. These areas include environmental and medical microbiology, recombinant DNA, immuno-pathology, embryo physiology.

BIOL 514 Current Topics in Ecology/Evolution (2)  
Prerequisite: admission to the biology master’s program or permission of the instructor.  
Current readings on selected topics of ecology and evolution. Topics will depend upon interests of instructor and students. Possible topics include: evolution of mating systems, aquatic ecology, community ecology, microevolutionary processes, population dynamics, evolution of life history strategies.

BIOL 515 Growth of Biological Thought (2)  
Prerequisite: admission to the biology master’s program or permission of the instructor.  
This course will include readings on topics such as changing biological paradigms, philosophies and ethical behavior of biologists in their historic as well as current context. Topics will be developed in relation to antecedent discoveries, available technology, political events and social climate.

BIOL 519 Review of Literature (1)  
Presentations by faculty and graduate students of current biological research papers.

BIOL 520 Epidemiology (5)  
Prerequisite: admission to graduate program or permission of the instructor.  
A study of the factors which determine the frequencies and distributions of the communicable diseases among humans with an emphasis on independent synthesis of current literature.

BIOL 521 Medical Bacteriology (5)  
Prerequisite: BIOL 301.  
The microbial agents of human disease, with an emphasis on bacteria.
BIOL 530 Immunology (5)
Prerequisite: admission to graduate program or permission of the instructor.

Immune reactions of animals with principal emphasis on those associated with infectious diseases. Students will conduct primary literature review.

BIOL 532 Virology (5)
Prerequisite: admission to graduate program or permission of the instructor.

The molecular biology of microbial, animal and plant viruses, especially those viruses associated with human and animal diseases and their host-parasite relationships with an emphasis on synthesis of primary literature.

BIOL 535 Biology of Cancer (5)
Prerequisite: admission to graduate program or permission of the instructor.

An advanced study of human neoplasms through synthesis of current literature.

BIOL 536 Cell Biology (5)
Prerequisite: admission to graduate program or permission of the instructor.

A comprehensive study of cellular biology from a structural and functional perspective incorporating independent laboratory and/or synthesis of primary literature.

BIOL 539 Special Topics (1–5)

BIOL 542 Conservation Biology (4) alt
Prerequisite: admission to graduate program or permission of the instructor.

Conservation biology is a synthetic discipline that has arisen in response to the current unprecedented rates of extinction and draws on a wide range of basic sciences and applied fields to address the problem of loss of biological diversity. This course examines the discipline of conservation biology, familiarizes students with literature in conservation biology and provides students with a forum for discussion of some major topics in conservation biology. Students incorporate independent field work and/or synthesis of primary literature.

BIOL 543 Wildlife Management (4)
Prerequisite: admission to graduate program or permission of the instructor.

An examination of the historical and political development of wildlife management, the ecological principles that underpin management decisions, primary approaches and current management issues incorporating independent field work and/or synthesis of primary literature.

BIOL 546 Riparian Ecology (5)
Prerequisite: admission to the Biology Master’s Program or permission of the instructor.

This course will focus on riparian areas (riparia), areas which experience intermittent flooding by water moving within a catchment. Riparia form the interface between terrestrial and aquatic habitats and perform critical ecosystem functions. This class will address riparian physical processes, biotic adaptations, human impacts, conservation, restoration and management.

BIOL 550 Mammalogy (5)
Prerequisite: admission to graduate program or permission of the instructor.

The classifications, life histories and ecology of mammals with an emphasis on independent field or literature review studies.

BIOL 554 Ornithology (5)
Prerequisite: admission to graduate program or permission of the instructor.

Natural history and taxonomy of birds with an emphasis on independent field or literature review studies.

BIOL 560 Hematology (5)
Prerequisite: admission to graduate program or permission of the instructor.

An in-depth study of the morphology and hemostasis of the normal and abnormal human hematological system incorporating primary literature review and seminar preparation.

BIOL 562 Ichthyology (5)
Prerequisite: admission to graduate program or permission of the instructor.

An in-depth systematic and ecological study of fishes, especially the freshwater fishes of the U.S., incorporating review of primary literature and independent field research.

BIOL 563 Fisheries Biology and Management (4)
Prerequisite: admission to graduate program or permission of the instructor.

Development of the biological basis of fisheries management and the role of fish population as sources of food and recreation for humans. Synthesis of this information by developing a comprehensive management plan for a particular species or body of water.

BIOL 567 Conservation Biology (5)
Prerequisites: admission to the MS Biology Program or permission of instructor.

This course introduces students to the principles of neurobiology. Emphasis is placed on human neuroscience but examples from a wide range of invertebrates and vertebrates are used to best illustrate neurobiological principles, concepts, and mechanisms. The course also includes a laboratory component focusing on neuroanatomy.

BIOL 577 Muscle Physiology (3)
Prerequisite: BIOL 233 or BIOL 436 or BIOL 490.

The structure, function and regulation of muscle tissue, with an emphasis on skeletal muscle.

BIOL 581 Freshwater Invertebrate Zoology (5)
Prerequisite: admission to graduate program or permission of the instructor.

A field course incorporating techniques used in the collection, preservation and identification of freshwater invertebrates into independent field research.

BIOL 585 Molecular Biotechnology I (5)
Prerequisite: admission to graduate program or permission of the instructor.

An in-depth examination of animal and plant cell culture and microbial fermentation from the perspective of physiology and biochemical engineering.

BIOL 588 Molecular Biotechnology Laboratory (2)
Prerequisite: admission to graduate program or permission of the instructor.

Advanced quantitative procedures in recombinant DNA and monoclonal antibodies.

BIOL 589 Molecular Biotechnology Laboratory (2)
Prerequisite: admission to graduate program or permission of the instructor.

Advanced quantitative procedures in recombinant DNA and monoclonal antibodies.

BIOL 596 Experimental Course (1–5)
BIOL 597 Workshops (1–5)
Note: only one workshop course for up to 3 credits may be used to fulfill graduate degree requirements.

BIOL 598 Seminar (1–5)
BIOL 599 Independent Study (1–5)
Prerequisites: permission of the instructor, department chair and college dean.