

# BIOLOGY

## Department of Biology

Website: <https://www.washburn.edu/academics/college-schools/arts-sciences/departments/biology/index.html> (<https://www.washburn.edu/academics/college-schools/arts-sciences/departments/biology/>)

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## Faculty

Professor John Mullican, PhD, Chair  
 Professor and Associate Dean Matthew Arterburn, PhD  
 Professor Rodrigo Mercader, PhD  
 Professor Takrima Sadikot, PhD  
 Associate Professor Susan Bjerke, PhD  
 Associate Professor Jason Emry, PhD  
 Associate Professor Andrew Herbig, PhD  
 Associate Professor Benjamin Reed, PhD  
 Associate Professor Paul Wagner, PhD  
 Associate Professor Tracy Wagner, PhD  
 Assistant Professor Joan Klages, PhD  
 Senior Lecturer Kellis Bayless, PhD  
 Senior Lecturer Duane Hinton, PhD  
 Senior Lecturer Erica Jackson, PhD  
 Lecturer Heather Pfannenstiel, MS  
 Administrative Specialist Rogshana Mahua  
 Laboratory Supervisor Kaylyn Hobelman  
 Karlyle Woods Caretaker Danny Walters

## Mission

The Washburn Biology Department consists of a team of student-centered educators that provides all students with a strong foundation in the life sciences, promotes critical thinking through teaching and research opportunities, and encourages engagement with the community.

## Description of the Discipline

Biology is an integrative discipline that emerges from all areas of the natural sciences and builds upon those foundations. In the spirit of our discipline the Biology Department is committed to providing students with a strong foundation in the life sciences that culminates in specialized experiences designed to prepare students not only for diverse career opportunities available in the biological sciences, but also to be life-long learners. Fundamental to our students' development is the acquisition of a broad knowledge base, the ability to integrate and apply this knowledge, and the ability to communicate observations and analyses. Through close interaction with our faculty in the classroom and in research environments the Biology Department fosters students' innate desire for discovery and helps them develop the skills and modes of thinking that will empower their contributions to an ever-expanding understanding of the natural world.

Faculty members professionally engage in their sub-disciplines through scholarly work and service, enabling them to contribute to the evolution of their disciplines and engaging them as active members of the greater scientific community abreast of the dynamic nature of their fields. This engagement functions to meet changing student needs within the Biology Department, Allied Health, pre-Nursing and other programs and serves as resources of life science knowledge and awareness of biological issues for the community at large. We strive to establish and

maintain the highest standards of curricular innovation, academic rigor, technical skill, modern physical facilities, and personalized mentorship, in support of our primary goal: providing a high-quality learning experience for all students that we engage.

## Description of Programs

The courses in biology are designed to meet the needs of at least four groups of students: those interested in biology as a subject necessary to their general education, those in nursing, kinesiology, and the various allied health programs, those planning to teach biology or general science, and those preparing for graduate work or for professional careers in biology, environmental biology, forensic biology, molecular biology and biotechnology, or other related fields.

## Student Learning Outcomes

Student Learning Outcomes for each major are listed in their respective major descriptions.

## Information Common to all Majors within the Biology Department

All Majors within the Biology Department must be officially declared before taking upper division BI courses; however, it is recommended that the major be declared as early as possible after matriculation to Washburn University in order to be eligible for Biology scholarships, and to be assigned an appropriate advisor. Non-Biology majors must be officially declared in an appropriate major before taking upper division BI courses. The declaration of major is done online by either the Chair or an appropriate advisor within the department, after an advising session with the student. Each semester all majors must meet with a department advisor to plan the appropriate course work for the next semester and to receive a registration PIN.

## Natural Science Concentration

All Bachelor of Science degrees include a required 30-hour natural science concentration, which includes courses chosen from departments in the Natural Sciences and Mathematics Division, other than the student's major department. At least 15 of these hours must be in one department. The 30 hours must be approved by the student's major department chairperson.

Natural Sciences Concentration courses for BS degrees offered by the Department of Biology are limited to these courses:

- CH 151 Fundamentals of Chemistry I or above,
- PS 261 College Physics I or above,
- MA 116 College Algebra or above, or
- CM 105 Introduction to Computer Science or above.

## Departmental Honors

Students are eligible to receive departmental honors upon graduation if they fulfill the following minimum requirements:

- A grade point average of 3.5 in the major, including a 3.5 in upper division work in the major.
- Successful completion of BI 395 Research in Biology.
- Service to the Department, or to the community relevant to their respective department major.
- The recommendation of the Department.

## Programs

- Biology, BA and BS (<https://catalog.washburn.edu/undergraduate/college-arts-sciences/biology/biology-ba-bs/>)
- Environmental Biology, BA and BS (<https://catalog.washburn.edu/undergraduate/college-arts-sciences/biology/environmental-biology-ba-bs/>)
- Forensic Biology, BS (<https://catalog.washburn.edu/undergraduate/college-arts-sciences/biology/forensic-biology-bs/>)
- Molecular Biology and Biotechnology, BS (<https://catalog.washburn.edu/undergraduate/college-arts-sciences/biology/molecular-biology-biotechnology-bs/>)
- Biology Major with Secondary Education Specialization, BS (<https://catalog.washburn.edu/undergraduate/college-arts-sciences/biology/biology-major-secondary-education-specialization-bs/>)
- Biology Secondary Education, BEd (<https://catalog.washburn.edu/undergraduate/college-arts-sciences/biology/biology-secondary-education-bed/>)
- Biology, Minor (<https://catalog.washburn.edu/undergraduate/college-arts-sciences/biology/biology-minor/>)

## Course Offerings

All course descriptions listed below assume either a 16-week fall or spring semester. Courses that are offered in the summer and/or online will be held at different times than what is listed below, but will be equivalent in terms of class and laboratory time.

### BI 100 Human Biology (3)

This course is an introduction to fundamental life processes in humans. Topics will include the structure and function of biomolecules, chemical reactions and enzymes, and the structure, function, and energy transformations of cells. Cell division, the central dogma, and introductory genetics are introduced as is a general survey of human organ systems. This course is primarily for majors in nursing, allied health, and kinesiology. Not applicable toward credit for biology major requirements. Three hours of lecture per week. Prerequisite: None.

Course Attributes:

- Gen Ed AY 2024-2025: Natural and Physical Sciences
- Gen Ed AY 2024-2025: Scientific Reasoning and Literacy
- Gen Ed Pre-AY 2024-2025: Natural Science
- USLO: Critical and Creative Thinking

### BI 101 Human Biology Laboratory (2)

This lab course complements the BI 100 lecture course. Laboratory exercises will provide hands-on applications to understand human biology concepts. Not applicable toward credit for biology major requirements. Three hours of laboratory per week. Prerequisite: A grade of "C" or better in BI 100, or concurrent enrollment.

Course Attributes:

- Gen Ed AY 2024-2025: Natural and Physical Sciences
- Gen Ed AY 2024-2025: Scientific Reasoning and Literacy
- Gen Ed Pre-AY 2024-2025: Natural Science
- USLO: Quantitative and Scientific Reasoning and Literacy

### BI 106 Everyday Biology (5)

An integrated lecture and laboratory course designed for people pursuing degrees outside the natural or health sciences and who are interested in understanding basic biological concepts and their applications in everyday life. Topics include scientific inquiry, health, nutrition, natural resources, ecosystems, and biotechnology. Laboratory exercises apply biological concepts towards investigating pertinent questions. This course requires no previous science or mathematics background and cannot count towards Biology Department degree programs. Fulfills the general education requirement of a natural science course with lab. Course consists of three hours of lecture and three hours of laboratory exercises per week. Prerequisites: None.

Course Attributes:

- Gen Ed AY 2024-2025: Natural and Physical Sciences
- Gen Ed AY 2024-2025: Scientific Reasoning and Literacy
- USLO: Quantitative and Scientific Reasoning and Literacy

### BI 140 Introduction to Forensic Biology (3)

An introduction to the collection, processing and testing of biological evidence during forensic investigations. Topics include: the use of biological samples in crime scene investigation, molecular biology techniques used to detect biological samples and evaluating the strength of DNA profiling. Three hours of lecture per week. Prerequisites: None.

Course Attributes:

- Gen Ed AY 2024-2025: Scientific Reasoning and Literacy
- Gen Ed Pre-AY 2024-2025: Natural Science
- USLO: Quantitative and Scientific Reasoning and Literacy

### BI 150 Evolution (3)

The course is designed for non-science majors who want a basic explanation of evolution, how it works, and why it matters. The course will include discussion of simple genetics, origins of life, mechanisms of evolution, and the applied value of evolution. Three hours of lecture per week. Prerequisite: None.

Course Attributes:

- Gen Ed AY 2024-2025: Scientific Reasoning and Literacy
- Gen Ed Pre-AY 2024-2025: Natural Science
- USLO: Quantitative and Scientific Reasoning and Literacy

### BI 155 Sexually Transmitted Disease (1)

An overview of diseases, which rely on sexual interactions for transmission, e.g., AIDS, syphilis, herpes, and others. The history, epidemiology, clinical nature, treatment and prevention of these diseases are discussed. Two hours of lecture per week for an 8-week course. Prerequisite: None.

### BI 180 Special Topics/Biology (1-3)

Selected topics of general interest. Not applicable toward credit for biology major requirements. Prerequisite: None.

Course Attributes:

- Gen Ed AY 2024-2025: Natural and Physical Sciences
- Gen Ed Pre-AY 2024-2025: Natural Science
- USLO: Critical and Creative Thinking

**BI 192 General Cellular Biology (5)**

The organization and activities of organisms at the cellular level. Analysis of the chemical, genetic, and microscopic properties shared by all cells. This is the beginning biology course for the student who wishes to major in biology. Four hours of lecture and three hours of laboratory per week. Prerequisites: None.

Course Attributes:

- Gen Ed AY 2024-2025: Natural and Physical Sciences
- Gen Ed AY 2024-2025: Scientific Reasoning and Literacy
- Gen Ed Pre-AY 2024-2025: Natural Science
- USLO: Critical and Creative Thinking

**BI 194 General Organismal Biology (5)**

An introduction to the basic principles of organismal biology with an emphasis on plants and animals. Topics covered will include general ecology and evolution, anatomy and physiology, and organismal diversity. Four hours of lecture and three hours of laboratory per week. Prerequisite: A grade of "C" or better in BI 102 or BI 192.

**BI 202 Biology of Behavior (3)**

Biological aspects of human & animal behavior, including sociobiology, ethology, behavioral genetics & evolution, heredity vs. environment, male-female differences, & the neurological & hormonal basis of behavior. Three hours of lecture per week. Prerequisites: None.

Course Attributes:

- Gen Ed AY 2024-2025: Scientific Reasoning and Literacy
- Gen Ed Pre-AY 2024-2025: Natural Science
- USLO: Quantitative and Scientific Reasoning and Literacy

**BI 203 Human Impact on the Environment (3)**

The structure and function of a natural environment and the impact of humans on that environment. Topics include population and food, various pollution problems, energy problems, and possible solutions. Three hours of lecture per week. Prerequisite: None.

Course Attributes:

- Gen Ed AY 2024-2025: Inclusion and Belonging
- Gen Ed Pre-AY 2024-2025: Natural Science
- USLO: Global Citizenship, Ethics and Diversity

**BI 206 Introductory Microbiology (4)**

The basic characteristics of microbes and an analysis of their effects on humans. Emphasis on human medical microbiology. Basic microbiological techniques, with an emphasis on those used in medicine. Developed primarily for students majoring in nursing. Not applicable toward credit for biology major requirements. Three hours of lecture and one three-hour laboratory per week. Prerequisites: A grade of "C" or better in BI 100 and BI 101 or BI 102 or BI 192.

**BI 230 Introduction to Human Physiology (3)**

This human physiology course is designed for those needing a basic background in physiology principles without the additional functional knowledge that is obtained in the laboratory setting. The emphasis of this course will include learning basic relationships and necessary language to be able to understand the terminology that may be used in fields that are in the periphery of physiology. Three hours of lecture per week. Prerequisite: A grade of "C" or better in BI 100 or BI 102 or BI 192.

**BI 234 Introduction to Biotechnology (3)**

The purpose of this course is to introduce and explore the scientific basis of a broad range of topics in the emerging areas of biotechnology involving microbes, plants, animals, and medicine to understand the impact of biotechnology on society. Additional topics include: history, development, current operations, future advances, industry structure, and career opportunities within the biotechnology industry. Three hours of lecture per week. Prerequisite: A grade of "C" or better in BI 102 or BI 192.

**BI 250 Introduction to Human Anatomy (3)**

The structure of the human body, with emphasis on skeletal and muscular systems. Three hours of lectures per week. Prerequisite: A grade of "C" or better in BI 100 or BI 102 or BI 192.

**BI 255 Human Physiology (4)**

The basic functions of human organ systems. Three hours of lecture and one three-hour laboratory period per week. Prerequisites: A grade of "C" or better in BI 100 and BI 101 or BI 102 or BI 192.

**BI 260 Biology of Aging (3)**

Mechanisms of aging processes with special reference to human gerontology. Unfavorable progressive changes in molecules, cells, systems, and organisms will be examined. Three hours of lecture per week. Prerequisites: None.

Course Attributes:

- Gen Ed AY 2024-2025: Inclusion and Belonging
- Gen Ed Pre-AY 2024-2025: Natural Science
- USLO: Critical and Creative Thinking

**BI 275 Human Anatomy (4)**

Designed primarily for students majoring in biology, nursing or physical therapy. Lectures survey the organ systems with emphasis on skeletal, muscular, nervous, circulatory and reproductive systems. Laboratory exercises include both animal and human cadaver dissection. Two hours of lecture and two two-hour laboratory periods per week. Prerequisites: A grade of "C" or better in BI 100 and BI 101 or BI 102 or BI 192. NOTE: Pregnant women should consult with physician and instructor prior to enrollment due to specimen preservatives used in this course.

**BI 280 Special Topics/Biology (1-3)**

Selected topics of general interest. Prerequisite: One or more general biology course(s).

**BI 300 Field Biology (3)**

Identification and study of plants and animals in the field, including their ecology. One hour of lecture and three hours of laboratory per week. Prerequisite: A grade of "C" or better in BI 103 or BI 194.

**BI 301 General Microbiology (4)**

Characteristics of microorganisms with major emphasis on bacteria and viruses. Principle roles of microorganisms in our environment. Laboratory introduces basic techniques used in microbiological studies. Three lectures and one three-hour laboratory period a week. Prerequisites: BI 103 or BI 194 with a grade of C or better, and CH 151.

**BI 302 Entomology (4)**

Designed to cover the general biology of insects with a focus on their ecology, importance to humans and the environment, and their identification and taxonomy. Field trips will be an integral part of this course. Three hours of lecture and one three-hour laboratory period per week. Prerequisites: A grade of "C" or better in BI 103 or BI 194.

**BI 303 Invertebrate Zoology (4)**

The invertebrate groups with emphasis on basic zoological principles. Field trips are an integral part of this course. Three lectures and one three-hour laboratory period a week. Prerequisite: BI 103 or BI 194 with a grade of C or better.

**BI 305 Parasitology (4)**

This course will explore the various protozoan, helminth, and arthropod parasites of humans. Three hours of lecture and one three-hour laboratory period per week. Prerequisite: A grade of "C" or better in BI 103 or BI 194.

**BI 310 Ecology (4)**

Examines the interactions between organisms, their environment, and their evolution; major topics include global ecology, physical ecology, community ecology, species interactions, and biodiversity. Three lectures and one three-hour laboratory period a week. Prerequisite: BI 103 or BI 194 with a grade of C or better.

**BI 311 Field Ecology (3)**

Introduction to experimental and observational studies in field ecology; stressing experimental design, data collection, analysis, and interpretation and presentation of results. The course will emphasize fieldwork and student led projects. The course will also use field and computer exercises designed to familiarize students with research and analysis tools in ecology. One hour of lecture and one three-hour laboratory per week. Prerequisites: A grade of "C" or better in BI 310, or consent of instructor.

**BI 312 Behavioral Ecology (4)**

An advanced approach to the study of animal behavior, with a focus on how animals interact with one another and how those interactions influence their evolutionary fitness. Topics will include foraging, movement and space-use, parental care, behavioral types, and predator-prey interactions. Three hours of lecture and one three-hour lab per week. Prerequisites: A grade of "C" or better in BI 103 or BI 194, or consent of instructor.

**BI 314 Statistics for Biologists (3)**

A course designed as an overview of statistical procedures common in biological research emphasizing their biological relevance and interpretation. Lectures will cover data presentation, parameter estimation, hypothesis testing, goodness of fit, analysis of variance, regression, and a brief introduction to modern methods of analysis. Labs will cover the practical implementation of statistical analyses using the statistical package R. Two hours of lecture and two hours of laboratory per week. Prerequisite: Grades of "C" or better in BI 102 or BI 192 and MA 116. Recommended: MA 140 with a grade of C or better.

**BI 315 Vertebrate Zoology (4)**

A taxonomic approach to the study of vertebrate animals, with a focus on phylogeny, evolution, comparative anatomy, ecology, and behavior. Laboratory experiences will mostly entail fieldwork or field trips and focus on the ecology and behavior of different vertebrate taxa. Three hours of lecture and one three-hour laboratory period per week with several optional weekend field trips. Students will be expected to drive and/or carpool to field sites each week during their assigned laboratory time. Prerequisites: A grade of "C" or better in BI 103 or BI 194.

**BI 319 Biology for STEM Educators (3)**

An exploration of the core concepts and principles that unite the major disciplines of the Biological Sciences. The impacts that each of these concepts have on society will be discussed. Special emphasis will be placed on developing lessons and models that effectively communicate complex ideas to a range of ages, and in a variety of classroom, museum, and clinical settings. Three hours of lecture per week. Prerequisite: A grade of "C" or better in either BI 100 and BI 101 or BI 106 or BI 102 or BI 192, and Junior standing.

**BI 322 Advanced General Botany (4)**

A survey of the anatomy, physiology, and diversity of plants. Evolutionary development, ecology, and applied botany will be discussed. The laboratory will include both field-based and laboratory-based experiments. Three lectures and one three-hour laboratory period a week. Prerequisite: A grade of "C" or better in BI 103 or BI 194.

**BI 324 Systematic Botany (3)**

Exploration of the flowering plants of Kansas and their habitats. Major principles of systematics are covered. Two three-hour class periods per week, and nearly all periods are devoted to field trips to local areas of interest. Prerequisite: BI 103 or BI 194 with a grade of C or better.

**BI 325 Microbiology of Human Disease (5)**

Basic principles involved in pathogenesis of human disease, host resistance, and epidemiology. Characteristics and laboratory diagnosis of major bacterial pathogens. Three hours of lecture and two two-hour laboratory periods per week. Prerequisite: A grade of "C" or better in BI 301.

**BI 328 Plant Anatomy and Physiology (3)**

Examines the anatomy and physiology of the stems, roots, leaves and reproductive organs of plants, from the molecular to the organismal levels. Prerequisite: BI 103 or BI 194 with a grade of C or better.

**BI 330 Animal Physiology (4)**

A comparative study of the basic physiological processes occurring throughout the animal kingdom. Three lectures and one three-hour laboratory period a week. Prerequisites: BI 103 or BI 194 with a grade of C or better, and CH 152.

**BI 333 General Genetics (4)**

A course designed to cover basic genetic principles, including Mendelian genetics, cytogenetics, population genetics and an introduction to molecular genetics. Laboratory experiments will be used to illustrate the genetic principles covered in lecture. Three hours of lecture and one three-hour laboratory period per week. Prerequisites: BI 103 or BI 194 with a grade of C or better, and CH 151.

**BI 340 Evolutionary Biology (3)**

A course designed to cover the fundamental aspects of evolutionary biology from classical Darwinian evolution to modern analyses of evolutionary theory. Specific topics covered include the history and development of evolutionary thought, population genetics, cooperation and conflict, phylogenetics, and patterns and tempo of diversification. The course will also include a discussion of the relevance of evolution to societal issues. Three hours of lectures per week. Prerequisite: A grade of "C" or better in BI 103 or BI 194, or consent of instructor.

**BI 343 Human Genetics (3)**

This course explores classical and molecular mechanisms of inheritance in individuals, families, and populations. Topics include genetics of behavior, outcomes of gene and chromosomal mutations, cancer genetics, genetic counseling, personalized genomics, and issues and applications of current gene and reproductive technologies. Three hours of lecture per week. Prerequisites: A grade of "C" or better in BI 333, or consent of instructor.

**BI 353 Molecular Genetics (3)**

The molecular basis of genetic systems including chromosomal and extrachromosomal elements. Topics include manipulation of DNA, molecular techniques, cloning, methods for the study of gene expression, mutability of DNA, plasmid systems, prokaryotic and eukaryotic genomes, and practical aspects of biotechnology. Three hours of lecture per week. Prerequisite: A grade of "C" or better in BI 301 or BI 333.

**BI 354 Molecular Biology Laboratory (3)**

A laboratory course designed to introduce the student to modern molecular biology techniques, including recombinant DNA technology (gene cloning), DNA sequence analysis, PCR, Southern hybridization, bioinformatics, and more. This course is designed to mimic a real-world research experience. Two periods totaling 5 hours per week to include one hour for lecture/discussion. Prerequisite: A grade of "C" or better in BI 301 or BI 333 or BI 353 or consent of instructor.

**BI 355 Developmental Biology (5)**

Topics in modern developmental biology will be covered in lecture and through readings so as to gain a working knowledge of the analyses of developmental processes such as fertilization, embryonic cleavage, cell determination and cell differentiation in selected species. Emphasis will be on experiments that reveal how these processes are controlled at the molecular and cellular levels. Three hours of lecture and two two-hour laboratory periods per week. Prerequisite: A grade of "C" or better in BI 333.

**BI 357 Histology (4)**

Microscopic examination of fundamental tissues and vertebrate organs. Two hours of lecture and two two-hour laboratory periods per week. Prerequisite: A grade of "C" or better in BI 103 or BI 194.

**BI 360 Human Cadaver Dissection (3)**

This course is intended to give students who aspire to go to medical school, dental school or post graduate human anatomy programs a chance to gain experience dissecting and learning human cadaveric anatomy. This is a five week summer course that covers the dissection of the entire human cadaver. Focus of dissection is primarily on muscle and joint anatomy, but includes thoracic and abdominopelvic organs along with vascular dissection and identification. Student evaluation is based on participation and dissection skills. Prerequisites: BI 103 or BI 194 with a grade of C or better, or BI 275, and instructor consent.

**BI 362 Immunology (3)**

Molecular and cell biology of specific and nonspecific immune responses in mammals, with special emphasis on human immune systems. Reviews experimental support for current immunological theories. Roles of immunology in human health and disease. Three hours of lectures per week. Prerequisite: Grades of "C" or better in BI 301 and (BI 333 or BI 353 or CH 350).

**BI 363 Immunology Laboratory (2)**

Laboratory course designed to introduce students to current clinical & research procedures in immunology. Includes techniques utilized in biological & biochemical research as well as medical applications. Four hours of laboratory per week. Prerequisite: A grade of "C" or better in BI 362, or concurrent enrollment.

**BI 370 Virology (3)**

The structure and properties of animal viruses. Molecular aspects of virus replication and the role of viruses in disease states. Three hours of lecture per week. Prerequisite: A grade of "C" or better in BI 301.

**BI 380 Special Topics/Biology (1-3)**

A consideration of various emerging or advanced specialty areas in biology, offered according to student and staff availability. Prerequisites: BI 103 or BI 194 with a grade of C or better, and consent of instructor (Additional prerequisites might be needed depending upon particular topic).

**BI 389 Biology Literature Review (2)**

Students will learn to critically read and analyze primary biology literature in at least four of the five core biology disciplines: cell biology, botany, zoology, microbiology and genetics. It is designed for students who have not yet taken Biology Seminar (BI 390). Students will orally present the data from these papers to the class and complete a series of worksheets on the content of the literature. Students will also learn the basics of a thorough, scientific literature search online and the mechanics of writing a scientific abstract. Two hours of lecture per week. Prerequisite: A grade of "C" or better in BI 103 or BI 194, and one other biology core course, and consent of instructor.

**BI 390 Biology Seminar (1)**

Organization and oral presentations of the results of current research in the biological sciences. Utilization of recent journal literature, abstracting techniques, and oral communication of scientific data will be emphasized. One semester is required of all majors. Up to three credit hours may be applied toward meeting departmental or university graduation requirements. Prerequisites: 15 hours of BI and Jr. standing.

**BI 395 Research in Biology (1-3)**

This course is the capstone course in the Biology degree, and open only to declared majors at Washburn University. Independent, undergraduate research on some special problem in biology, the field to be chosen by the student in conference with the instructor. Open only to students, from any discipline, with at least fifteen hours of credit derived from core majors' courses in Biology. At least one semester is required of every Biology major. A maximum of six credit hours of research may be taken by any student, and no more than 3 credits in one semester. Prerequisite: Consent of instructor.

**BI 420 Forensic Molecular Biology (4)**

This course will thoroughly cover the theory behind the molecular biology used in forensic DNA analysis as well as the practical considerations pertaining to the forensic lab environment. Through simulated examples of real-life sample types, students will learn and gain experience with techniques and equipment currently used in the forensic biology field. Three lectures and one three-hour laboratory period per week. Prerequisites: A grade of C or better in BI 333, CH 340, and CH 342 or consent of instructor.

**BI 440 Biotechnology Internship (3)**

Experience and training in an approved biotechnology or related industry laboratory, or academic research laboratory. Prerequisites: 27 credit hours of biology, 15 credit hours of chemistry, and Instructor approval.

**BI 448 Zoo Internship (3)**

Field experience and training at an AZA accredited Zoo. Students can specialize in either an education, animal, or horticulture tract. Prerequisite: A grade of "C" or better in BI 102 or BI 192 and BI 103 or BI 194, Junior Standing, and consent of instructor.