

Biology Department (BIO)

College of Science and Health
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www.uwlax.edu/academics/department/biology (<https://www.uwlax.edu/academics/department/biology/>)

The Department of Biology strongly supports undergraduate and graduate programs in biological sciences. Undergraduate students pursuing a major in biology complete foundation course work including introductory biology, organismal biology, cell biology, genetics, and ecology. Because chemistry is foundational to life, biology majors complete at least three semesters of chemistry, including organic chemistry. Each student may plan their own electives and specialize in one of several sub-disciplines within biology, field studies and/or laboratory studies. Some elective courses require off-campus trips to field stations in northern Wisconsin. Other courses make use of several unique ecological habitats close to campus, such as the Mississippi River and the La Crosse River Marsh. In addition, modern laboratory facilities in the new Prairie Springs Science Center and use of high tech research equipment prepare students for careers in biotechnology. Biology faculty have been award winning, with the department receiving the **Regents Teaching Excellence Award** for the best Universities of Wisconsin department in 2013 and individual faculty winning national and university awards for teaching and research.

Biology students develop a curriculum around specific career goals. Each student meets individually with their faculty adviser each semester. The sub-discipline diversity of the faculty in the department provides a wide array of content expertise and both classroom and non-classroom opportunities for student learning. The Department of Biology also values interdisciplinary programs, hosting the nutrition minor and with significant involvement in the neuroscience minor and environmental studies minor.

High impact experiential learning is highly valued by the biology program and provides students opportunity to participate in both individualized and unique learning experiences. The Department of Biology has established a number of partnerships with local, state, and regional environmental and aquatic science research centers, biotechnology firms, public health entities, and allied health care institutions. These partnerships provide undergraduate and graduate students with the opportunity to interact with professionals in health and medical sciences, river studies, aquatic toxicology, fisheries biology, watershed studies, food science, and seed genetics to name a few. These opportunities are in the forms of undergraduate research, course-embedded research, internships, and job shadowing. Many of these experiences receive funding from the university and some result in summer jobs, part-time employment for students during the academic year and/or employment upon graduation.

Graduates of the programs in biology have traditionally been very competitive in the job markets and for entrance into graduate and other professional programs. The first destination reports of the past few years reveal 98% of biology majors reported a career outcome within a

year of graduation, with around half attending graduate or professional school, and the rest employed. A few graduates each year report taking volunteer or military positions.

General education writing emphasis

This department incorporates a significant amount of writing through the required courses instead of identifying particular courses as writing emphasis courses. Students who complete a major in this department will fulfill the general education writing emphasis requirement (<http://catalog.uwlax.edu/undergraduate/generaleducation/#generaleducationrequirementstext>).

2024-25 Faculty/Staff

The following is the department's faculty and staff as of the publication date of this catalog. This list will not be updated again until the next catalog is published in July.

Professor

Scott Cooper
 Tisha King-Heiden
 Barrett Klein
 Jennifer Klein
 Sumei Liu
 Jennifer Miskowski
 Todd Osmundson
 Gregory Sandland
 Eric Strauss
 Meredith Thomsen

Associate Professor

Sierra Colavito
 Anita Davelos
 Anne Galbraith
 Anton (Tony) Sanderfoot
 David Schumann
 Christine Schwartz
 Bradley Seebach
 Jaclyn Wisinski
 Alder Yu

Assistant Professor

Douglas Brusich
 Cord Brundage

Arthur Gruppe II

Jessica Judson

Jaspreet Kaur

Markus Mika

Adam Schneider

Ross Vander Vorste

Mary Zimmerman

Teaching Professor

Faye Ellis

Renee Redman

Associate Teaching Professor

Lee Baines

Lisa Kobs

Kristin Greany

Assistant Teaching Professor

Jason Freund

William (Bill) Haviland

Rebecca Werren

Intro Biology Coordinator

Teresa Mika

Laboratory Supervisor

Franklin Greene

Elisabeth Paluch

Administrative Support

Lynne Smith

Majors

- Biology major - BA (<http://catalog.uwlax.edu/undergraduate/biology/biology-ba/>)
- Biology major - BS (<http://catalog.uwlax.edu/undergraduate/biology/biology-bs/>)
- Biology major: aquatic science concentration - BA (<http://catalog.uwlax.edu/undergraduate/biology/aquatic-science-ba/>)
- Biology major: aquatic science concentration - BS (<http://catalog.uwlax.edu/undergraduate/biology/aquatic-science-bs/>)
- Biology major: biomedical science concentration - BA (<http://catalog.uwlax.edu/undergraduate/biology/biomedical-science-ba/>)
- Biology major: biomedical science concentration - BS (<http://catalog.uwlax.edu/undergraduate/biology/biomedical-science-bs/>)

- Biology major: environmental science concentration - BA (<http://catalog.uwlax.edu/undergraduate/biology/environmental-science-ba/>)
- Biology major: environmental science concentration - BS (<http://catalog.uwlax.edu/undergraduate/biology/environmental-science-bs/>)
- Biology major: molecular genetics and cell biology concentration - BA (<http://catalog.uwlax.edu/undergraduate/biology/molecular-genetics-and-cell-biology-ba/>)
- Biology major: molecular genetics and cell biology concentration - BS (<http://catalog.uwlax.edu/undergraduate/biology/molecular-genetics-and-cell-biology-bs/>)
- Biology major: plant and fungal biology concentration - BA (<http://catalog.uwlax.edu/undergraduate/biology/plant-and-fungal-ba/>)
- Biology major: plant and fungal biology concentration - BS (<http://catalog.uwlax.edu/undergraduate/biology/plant-and-fungal-bs/>)

Teacher education program

- Biology major: science education (grades 4-12) concentration - BS (<http://catalog.uwlax.edu/undergraduate/biology/education/>)

Dual degree program

- Dual degree program in biology and physical therapy (<http://catalog.uwlax.edu/undergraduate/biology/dual-degree-program-in-biology-physical-therapy/>)

Minors

- Biology minor (<http://catalog.uwlax.edu/undergraduate/biology/biologyminor/>)

Courses

+BIO 100 Cr.4

Biology for the Informed Citizen

This course develops an understanding of what science is and utilizes biology as a framework for investigating the importance of science in our everyday lives. Topics include evolution, ecology, human impact on the environment, cell biology, and genetics as it relates to human reproduction. This course is designed as a general education course for non-science or non-allied health majors. Not applicable to the major or minor in biology. Prerequisite: Students with credit in BIO 103 or BIO 105 cannot earn credit in BIO 100. Offered Fall, Spring, Summer.

+BIO 102 Cr.3

Contemporary Issues in Biological Sciences

An intra-disciplinary approach to investigating current issues within the biological sciences. Specific topics under the general categories of health, medicine, environment, genetics, and industrial technology will be identified, described and characterized. The science underlying the issue will be explored and the potential impact (past and future) of applied scientific advances within the respective disciplines will be examined in depth. Not applicable to a major or minor in biology. Offered Occasionally.

+BIO 105 Cr.4

General Biology

An introduction to biology including topics in ecology, population biology, nutrient cycling, food webs, cell structure and function, metabolism, photosynthesis, reproduction, genetics, molecular biology and evolution. This course provides a strong foundation for further science courses, and is designed for science majors, allied health majors and students with an interest in science. Lect. 3, Lab. 2. Offered Fall, Spring.

BIO 202 Cr.2

Introduction to Biological Data Analysis and Interpretation

This course is an introduction to the common techniques used by biologists to efficiently and effectively process, interpret, and communicate ideas and information generated in the biological sciences. Students will learn the techniques in a hands-on approach using biological databases. Topics covered in this course will include basic laboratory and field notebook production and use; the use, analysis and interpretation of databases, graphs, tables, charts, and other visual aids used in scientific papers; techniques for digital microscopic image production and analysis. Prerequisite: BIO 105. Offered Summer, Winter.

BIO 203 Cr.4

Organismal Biology

A survey of the diverse form and function of prokaryotes, protists, fungi, plants and animals. Basic ecology, natural history, evolution, biogeography and importance of organisms to humans will be emphasized. Lect. 3, Lab 3. Prerequisite: BIO 105 with a grade of "C" or better. If both BIO 210 and BIO 304 have been completed, BIO 203 cannot be taken for credit. Offered Fall, Spring.

BIO 210 Cr.3

Animal Biology

Animal biology is a phylogenetic survey of the animal-like protists and animal kingdom beginning with single celled organisms and ending with vertebrates. Innovation of form and function of each major animal group will be discussed along with their taxonomy, ecology, natural history, distribution, medical and economic importance to humans and natural ecosystems. Lect. 2, Lab 2. Prerequisite: BIO 203. Offered Fall.

BIO 212 Cr.3

Biology of Health and Disease

The health of humans and other biological systems is explored from the cell to the community level. Homeostatic mechanisms that maintain health will be discussed starting at molecular and progressing to organismal mechanisms. Causes of disease and disruptions in health are examined with emphasis on prevention, diagnosis and treatment modalities in individuals and populations. Credits earned will not count towards biology major or minor requirements. Prerequisite: grade of "C" or better in BIO 100 or BIO 105. Offered Spring, Summer.

BIO 260 Cr.1-3

Special Topics in Biology

Topics in biology of interest to selected groups. Topics will be offered with a specific title. May be staffed by resident faculty or visiting lecturers. Other departments may be invited to participate. Repeatable for credit - maximum six. Prerequisite: BIO 105. Offered Occasionally.

BIO 289 Cr.1

Introduction to Scientific Research

This course is a directed independent study project or research assistance experience within the discipline, but outside that offered through regularly scheduled courses, under the direction of the supervising faculty member. Repeatable for credit - maximum four. Departmental option for pass/fail or letter grade. Consent of instructor. Pass/Fail grading. Offered Fall, Spring, Summer.

BIO 299 Cr.1

Biology Tutor Training Practicum

This course is designed to offer training and supervision for biology tutors. The course will include an overview of best tutoring practices and how to best serve different client populations. Students will develop a reflective tutoring practice based on reading and course discussions. Content specific training will be done throughout the semester at appropriate times. It is strongly encouraged that the student take the course during the first semester of employment at a biology tutor. Failure to complete the course during the first year of employment will result in termination of employment as a tutor. Students who repeat the course will engage more deeply with the content. Repeatable for credit - maximum three. Prerequisite: BIO 105. Consent of instructor. Pass/Fail grading. Offered Fall, Spring.

BIO 302 Cr.2

Introductory Plant Identification

Introduction to the identification of trees, shrubs, and other herbaceous plants of both local native and cultivated species. Field trips required. Lect. 1, Lab 2. Prerequisite: BIO 203 or BIO 304. Offered Fall - Odd Numbered Years.

BIO 303 Cr.4

Vertebrate Form and Function

Anatomy and physiology of the vertebrates with the rat as the basic study animal. Lect. 2, Lab 4. Prerequisite: BIO 105. Offered Occasionally.

BIO 304 Cr.3

Plant Biology

Plant Biology is a phylogenetic survey of the plant-like protists and organisms in the plant kingdom beginning with single celled organisms and ending with flowering plants. Innovation of form and function of each major plant group will be discussed along with their anatomy, morphology, taxonomy, ecology, natural history, distribution, medical and economic importance to humans and natural ecosystems. Lect. 2, Lab 2. Prerequisite: BIO 203. Offered Spring.

BIO 306 Cr.4

Genetics

A comprehensive study of the basic principles of heredity, including Mendelian and Molecular Genetics. Lect. 3, Lab 2. Prerequisite: BIO 105 and a second biology course applicable to the major. Offered Fall, Spring.

BIO 307 Cr.3

Ecology

A study of interactions that determine the distribution and abundance of living organisms. The basic principles of ecology are presented in order to develop an understanding of the nature of these interactions at the individual, population and community levels of biological organization. Prerequisite: BIO 203. Offered Fall, Spring.

BIO 312 Cr.4

Human Anatomy and Physiology I

A comprehensive study of general anatomical and physiological principles of cells, body fluid compartments, the skeletal, muscular, and nervous systems and the special senses. Required elements of the laboratory portion of the course include computer simulations, microscopy, mammal organ dissections and study of cadaver projections. Students who have completed this course, or are currently enrolled, may not register for this course again until after freshmen registration (unless they have instructor/department consent). Lect. 3, Lab 2. Prerequisite: grade "C" or better in BIO 105 & CHM 103. Students who have completed this course, or are currently enrolled, may not register for this course again until after freshmen registration (unless they have instructor/department consent). Offered Fall, Spring, Summer.

BIO 313 Cr.4

Human Anatomy and Physiology II

A comprehensive study of the cardiovascular, respiratory, digestive, urinary, reproductive and endocrine systems. Required elements of the laboratory portion of this course include computer simulations, microscopy, mammal organ dissections and study of cadaver prosections. Lect. 3, Lab 2. Prerequisite: earn a "C" or better in BIO 105, CHM 103, and BIO 312. Students who have completed this course, or who are currently enrolled, may not register for this course again until after freshmen registration (unless they have instructor/department consent). Offered Fall, Spring, Summer.

BIO 315 Cr.4

Cell Biology

A comprehensive overview of cell structure and function, including the nature of biomolecules, cellular metabolism and its regulation, the dynamics of membranes and the cytoskeleton, the execution and control of the cell cycle, cell interactions, and cell signaling. Lect. 3, Lab 3. Prerequisite: BIO 105; one additional semester of biology; and a minimum of three semesters of chemistry through organic chemistry. Offered Fall, Spring.

BIO 321 Cr.4

Ornithology

This course covers evolution, anatomy, physiology, ecology, and conservation of birds. It includes field identification with emphasis on Wisconsin forms. There will be a required weekend field trip on either the last weekend in April or the first weekend in May, dependent on the semester and final exam schedule. Lect. 3, Lab 3. Prerequisite: BIO 203 or BIO 210 or BIO 303. Offered Spring.

BIO 330 Cr.3

Economic Botany

Plants provide humans with food, feed, fuel, fiber, pharmaceuticals, and other economically important products. This course provides an introduction to domesticated plant varieties and wild plant species and their value in human and domestic animal nutrition, and as energy sources, manufactured materials and drugs. Ethnobotanical interests in wild plant species will also be discussed. Prerequisite: BIO 203 or BIO 304. Offered Alternate Years.

BIO 333 Cr.3

Radiation Biology

Applications and effects of nuclear radiation on biological systems. Lect. 2, Lab 2. Prerequisite: BIO 105; one additional course in biology; CHM 103. Offered Spring.

BIO 337 Cr.3

Plant Physiology

An introduction to plant water relations, mineral nutrition, respiration, photosynthesis, growth, and development with emphasis on the physiology of seed plants. Prerequisite: BIO 203 or BIO 304. Offered Spring.

BIO 341 Cr.3

Limnology

This course includes fundamentals of aquatic ecology, with special reference to community ecology. Taxonomy, stratification and succession of organisms to be investigated. Energy traffic through aquatic ecosystems will also be investigated. Field trips required. Lect. 2, Lab 3. Prerequisite: BIO 105; one additional biology course; one semester of chemistry. Offered Fall.

BIO/CHM/PHY 356 Cr.2

Curriculum and Assessment in Math and Science

Students are introduced to state and national content standards and related theories on teaching and learning. They will apply this knowledge to develop a curricular framework. Topics will include: Learning outcomes, student misconceptions, balanced assessment, and lesson planning in the content areas. Prerequisite: declared math or science education major/minor; admission to teacher education. (Cross-listed with BIO/CHM/PHY; may only earn credit in one department.) Offered Fall.

BIO 365 Cr.3

Scientific Visualization

The ability to powerfully and effectively convey biological concepts and subjects can depend on the clarity, accuracy, and aesthetics of visualizing subject matter. We will learn skills of the scientific illustrator working in biology and produce a series of graphics with the intent to use in oral presentations, posters, publications, and portfolios. This course is designed to challenge scientist, graphic designer, and artist working specifically in the realm of biology. We will explore topics in biology, because depicting a subject accurately means knowing one's subject intimately. Visualization techniques will include pen and ink and other traditional illustration techniques, digital image creation and manipulation, macrophotography, microscope use, intro to 3D visualization, thermography, etc. Lab 4. Prerequisite: BIO 100 or BIO 105; BIO 203 or ART 262. Offered Fall - Even Numbered Years.

BIO 390 Cr.2

Latin and Greek Roots in Scientific Terminology

Most scientific terminology comes to us as derived from Latin and Greek words. This course provides a solid background in scientific vocabulary by learning root words, prefixes and suffixes, as well as combinations of two or more root words and prefixes. Does not apply toward biology major or most concentrations. Prerequisite: BIO 105. Offered Fall.

BIO 401/501 Cr.4

Comparative Vertebrate Anatomy

Comparative anatomy is fundamental for investigating vertebrate function and evolutionary biology. The course integrates anatomy, evolution, and development of the chordate body, system-by-system and across the group's diversity from flying and running vertebrates to sea squirts and lampreys. Labs will raise insight and skill through comprehensive, respectful dissection of minks, dogfish sharks, lampreys, and representative organ specimens. One lab period per week is dedicated to a main dissection and exploration of anatomy. The next lab period integrates lecture, dissection refinement, and collaborative reinforcement of learning. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Lect. 2, Lab 4. Prerequisite: BIO 203 or BIO 210; junior, senior, or graduate standing. Offered Spring.

BIO 404/504 Cr.3

Plant Taxonomy

Collection, identification, classification, and evolution of the vascular plants with emphasis on local flora. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Lect. 1, Lab 4. Prerequisite: BIO 203 or BIO 304; junior standing. Offered Spring - Odd Numbered Years.

BIO 405/505 Cr.2

Aquatic and Wetland Vascular Plants

Identification and collection of vascular plants of aquatic and marsh habitats with emphasis on adaptive morphology and ecology of local species. Field trips required. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Lect. 1, Lab 2. Prerequisite: BIO 203 or BIO 304; junior standing. Offered Fall - Even Numbered Years.

BIO 406/506 Cr.4

Parasitology

A survey of the major groups of animal parasites with regard to their taxonomy, morphology, life histories, host-parasite relationships, and economic importance. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Lect. 2, Lab 4. Prerequisite: BIO 203 or BIO 210 or BIO 303; junior standing. Offered Fall.

BIO 408/508 Cr.4

Developmental Biology

An exploration of the cellular and molecular mechanisms that underlie embryonic development in several model organisms. Topics include fertilization, regulation of gene expression, cell fate determination, stem cells, early pattern formation, morphogenesis of tissues/organs, and limb formation. The course primarily focuses on animal models with an emphasis on evolutionarily conserved processes, structures, and molecular pathways. Technological advances and relevance to human development and disease are highlighted throughout. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Lect. 2, Lab. 4. Prerequisite: BIO 203 or BIO 210 or BIO 303; BIO 306 or MIC 416; BIO 315; junior standing. Offered Spring.

BIO 410 Cr.1

Human Cadaver Dissection

This supervised cadaver dissection course uses a regional anatomy approach and is designed to improve students' competency in human gross anatomy. Students will prepare a human cadaver prosection for use in undergraduate anatomy and physiology laboratories. In addition to dissections, students will use computer-based learning projects and literature reviews to enhance their understanding of human anatomy and the historical and current role of cadavers in society. Prerequisite: BIO 312, BIO 313, and BIO 479 (must have been a TA for BIO 312 or BIO 313). Consent of instructor. Offered Summer.

BIO 412/512 Cr.4

Mycology

A survey of all the major groups of fungi of the fungal kingdom (and relatives) in terms of systematics, anatomy, morphology, ecology, physiology, genetics, evolutionary relationships, and human and plant pathology. Laboratory includes microscopic and macroscopic study of the fungi, as well as making a collection of cultures and of fungal reproductive structures (including mushrooms) from selected groups. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Lect. 2, Lab 4. Prerequisite: BIO 203 or BIO 304 or MIC 230 (Both the microbiology course and one of the biology courses are strongly recommended); junior standing. Offered Fall.

BIO 413/513 Cr.3

Medical Mycology

A study of the increasing number of medically important fungi, including the yeasts, molds, other fungi, and actinomycetes that are pathogenic to humans and other animals. Emphasis is on laboratory techniques for isolation and identification of pathogenic fungi. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Lect. 2, Lab 2. Prerequisite: BIO 203 or MIC 230; junior standing. Offered Spring.

BIO 414/514 Cr.3

Freshwater Invertebrate Zoology

Introduces the ecology and taxonomy of the metazoan, non-parasitic freshwater invertebrates. An extensive course designed to provide a foundation for taxonomic knowledge, and basic understanding of the biology and ecology of freshwater invertebrates for advanced students in aquatic and environmental sciences. Lectures will focus on ecology; labs on taxonomy and quantitative skills. A student reference collection and field trips will be required. Lect. 2, Lab. 2. Prerequisite: BIO 203 or BIO 210 or BIO 341; junior standing. Offered Occasionally.

BIO 415 Cr.3

Neuroethology

Neuroethology is the study of the neural basis of natural animal behaviors. This course will integrate animal behavior, physiology, comparative anatomy, and neuroscience. Course topics will include the study of a variety of animal species with unique behaviors such as echolocation in bats and cetaceans, social communication in songbirds, jamming avoidance in electric fish, or auditory mapping in owl predation. Prerequisite: BIO 105; CHM 103; NEU 200 or BIO 203 or BIO 312. Offered Fall.

BIO 419/519 Cr.3

Quantitative Methods in Ecology

An introduction to field and laboratory procedures used by ecologists to describe and analyze the interactions between organisms and their environments. The course will emphasize quantitative techniques, including the use of computer technology, for collecting, recording and interpreting ecological data. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Lect. 2, Lab 2. Prerequisite: BIO 307 or BIO 341; STAT 145 or MTH 265 or equivalent experience with statistics; junior standing. Offered Fall.

BIO 421/521 Cr.3

Comparative Vertebrate Endocrinology

A comprehensive study of the production, regulation, structure, molecular to whole-body actions, metabolism, and excretion of biochemical signaling molecules across vertebrates with a focus on amphibians, fish, birds, and mammals. Hormone and neurotransmitter pathways will be examined with relationship to evolutionary and environmental influences using lecture, review of primary literature, and case studies. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Credit toward the biology major can only be received for this class or BIO 424, not both. Prerequisite: BIO 313 or BIO 458; junior standing. Offered Spring.

BIO 422/522 Cr.3

Ichthyology

A study of the taxonomy, anatomy, physiology, and ecology of fish, with emphasis on the fresh water fishes. Lect. 2, Lab. 2. Prerequisite: BIO 203 or BIO 210 or BIO 303; junior standing. Offered Fall - Odd Numbered Years.

BIO 424/524 Cr.3

Human Endocrinology

A comprehensive study of the production, regulation, structure, molecular to whole body actions, metabolism, and excretion of biochemical signaling molecules in humans. The classical and more recently recognized neurotransmitter and hormone pathways and clinical and pharmacology considerations of each will be explored using lectures, primary literature, and case studies. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Credit toward the biology major can only be received for this class or BIO 421, not both. Prerequisite: BIO 313 or BIO 458; junior standing. Offered Fall.

BIO 428/528 Cr.3

Advanced Nutrition for the Health Professions

A comprehensive study of nutrition-related diseases and nutrition assessment, evaluation, and management in clinical settings that people working in healthcare may encounter. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Prerequisite: BIO 313 or NUT 200; junior standing. Offered Fall, Spring.

BIO 429/529 Cr.3

Evolution

Consideration of the principles and the record of organic evolution of plants and animals. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Prerequisite: BIO 306; junior standing. Offered Fall, Spring.

BIO 432/532 Cr.2

Biology of Cancer

A survey of the current knowledge of cancer biology. The course will include lectures on a wide range of cancer topics, including: characteristics of cancer cells, carcinogenesis, cancer genes, tumor classification, invasion, metastasis, inheritance, immunology, drug development, treatment, and prevention. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Prerequisite: BIO 303 or BIO 313; BIO 306 or MIC 416; junior standing. Offered Fall, Spring.

BIO 435/535 Cr.3

Molecular Biology

A study of molecular biology with an emphasis on eukaryotic systems. The course will focus on the molecular aspects controlling biological processes. The impact of recombinant DNA technology on biotechnology and medicine will also be examined. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Prerequisite: BIO 306 and BIO 315, or MIC 416 and three semesters of college chemistry including organic chemistry; junior standing. Biochemistry strongly recommended. BIO 436 is an optional laboratory which can be taken concurrently. Offered Fall, Spring.

BIO 436/536 Cr.1

Molecular Biology Laboratory

A study of molecular biology with an emphasis on eukaryotic systems. Laboratory emphasis is on recombinant DNA technology, current techniques used to express recombinant proteins in eukaryotic cells, computer based DNA analysis, macromolecular modeling using computers, and quantitative assay techniques. This lab is optional for those enrolled in BIO 435. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Lab 3. Prerequisite: taken concurrently with BIO 435; junior standing. Offered Fall, Spring.

BIO 437/537 Cr.3

Plant Growth and Development

Discussion of experiments and analysis of research data obtained from the living plant. Prerequisite: BIO 203 or BIO 304; junior standing. Offered Occasionally.

BIO 439/539 Cr.3

Plant Anatomy

A detailed examination of plant structure and development as revealed with the light and electron microscopes. Primarily seed plants will be examined. Structure and development will be studied as a means by which plants cope with their ecology, evolution and function. Lect. 2, Lab. 2. Prerequisite: BIO 203 or BIO 304; junior standing. Offered Occasionally.

BIO/MIC 440/540 Cr.2

Bioinformatics

In this course, students will use computers to study and compare the sequence of nucleotides in DNA or RNA, or the amino acids in a protein. Computers are also used to examine the three dimensional structure of protein. Being able to manipulate and study this information is the basis for the current revolution in biotechnology. Topics include evolution, taxonomy, genomics and understanding disease. This course provides students an opportunity to explore the relationships between biology, microbiology, chemistry and computer science. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Lect. 1, Lab 2. Prerequisite: BIO 306 or MIC 416; junior standing. (Cross-listed with BIO/MIC, may only earn credit in one department.) Offered Spring, Winter.

BIO 441/541 Cr.3

Environmental Toxicology

The study of the lethal and sublethal effects of chemical contaminants on ecosystems and humans. Topics covered include environmental legislation, chemical distribution and fate in the environment, methods of toxicity testing, assessment of exposure and risk, effects of chemical contaminants on humans, and fish and wildlife populations, communities and ecosystems, and toxicity of specific chemical groups. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Prerequisite: BIO 307 or BIO 341; CHM 104; junior standing. Offered Spring - Odd Numbered Years.

BIO/MIC 442/542 Cr.3

Plant Microbe Interactions

This course explores in depth various ways that plants interact with microbes in the environment, at the macroscopic, cellular, and molecular levels. Case studies include both parasitic and mutualistic (symbiotic) interactions. Microbes include fungi, bacteria, nematodes, and viruses. Includes plant pathology and studies of the beneficial relationships between plants and microbes. Inquiry based labs are integrated into the lecture and discussion sessions. This course is taught largely at an undergraduate level. Graduate students have additional course requirements/expectations. Lect. 2, Lab 2. Prerequisite: BIO 203 or MIC 230; junior standing. (Cross-listed with BIO/MIC, may only earn credit in one department.) Offered Fall - Odd Numbered Years.

BIO 443/543 Cr.3

Molecular Mechanism of Disease and Drug Action

A survey of the leading non-infectious and non-cancerous diseases in the industrialized world. This course will explore the molecular mechanisms of disease, clinical symptomatology, and pharmacological treatment. Students will be expected to conduct thorough research on a given disease and present their results in a poster session. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Prerequisite: BIO 306, BIO 313; CHM 300 or CHM 304; junior standing. Offered Spring.

BIO 444/544 Cr.4

Entomology

Insects and their close relatives are ubiquitous, affecting humans' lives in profound ways. We will investigate the anatomy, behavior, evolution, and ecology of insects, as well as how insects impact human culture. Discussions, presentations, illustrations, field research, curation of specimens, and other activities offer opportunities for students to apply insect research knowledge and skills. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Lect. 3, Lab 2. Prerequisite: BIO 203; junior standing. Offered Fall - Odd Numbered Years.

BIO 446 Cr.3

Animal Behavior

We will explore factors that help to explain how and why animals behave as they do. Example topics include social behavior, learning, symbiotic relationships, sensory systems, communication, mating systems, defense, and parental care. Emphasis will be placed on non-human animals. Discussions, presentations, illustrations, and other activities offer opportunities for students to apply behavioral research knowledge and skills. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Prerequisite: BIO 105; BIO 203 or PSY 331 or NEU 200; junior standing. Offered Annually.

BIO 447/547 Cr.3

Standard Methods/Quality Assurance Water Analyses

This course will instruct students on the use of standard methods for analyses of selected biological, chemical, and physical constituents commonly included in water quality analyses. Quality assurance procedures, including Good Laboratory Practice Standards (GLPS) will be integrated into all activities. Materials covered include: principles of methods used; evaluation of precision, bias, and contamination; proper reporting and interpretation of results; and environmental sources and significance of constituents analyzed. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Lect. 1, Lab 4. Prerequisite: BIO 203 or BIO 210 or BIO 303 or BIO 304; three semesters of college chemistry; junior standing. BIO 341 recommended. Offered Spring.

BIO 449/549 Cr.3

Advanced Microscopy and Biological Imaging

Principles and techniques used in modern microscopy and biological image analysis. Emphasis will be on student projects to become proficient at confocal, fluorescence, and scanning electron microscopy. Students will also learn specimen preparation, digital imaging, and image processing and analysis for biological applications. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Lect. 2, Lab 2. Prerequisite: BIO 315 or MIC 230; junior standing. Offered Fall - Even Numbered Years.

BIO 450 Cr.1-3

Internship in Biology

An academically relevant field experience in government, industry, business, or community agencies. Students must have their internships approved and be advised by the department. Students must be on their internship worksite during the semester for which they are registered for academic credit. Credits earned will count only toward university electives and not toward the completion of any major or minor unless listed. Repeatable for credit - maximum eight. Pass/Fail grading. Offered Fall, Spring, Summer.

BIO/CHM/MTH/PHY 451 Cr.2

Curriculum and Content in Science and Mathematics

This is a methods course for science education and mathematics education majors that focuses on how content knowledge and pedagogical content knowledge are used to inform instruction. The course will focus on exploration of state and national standards, academic language, and methods of assessment. Prerequisite: EDS 203, EDS 206; concurrent enrollment in the department's section of BIO/CHM/MTH/PHY 454 or BIO/CHM/MTH/PHY 455; admission to teacher education. (Cross-listed with BIO/CHM/MTH/PHY; may only earn credit in one department.) Consent of instructor. Offered Spring.

BIO/CHM/PHY 452 Cr.2

The Learner and Learning in Science

This is a methods course for science education majors that focuses on learning theories, equitable practices, and culturally relevant pedagogy. The course draws on recommendations from state and national standards. Prerequisite: EDS 203, EDS 206; concurrent enrollment in the department's section of BIO/CHM/MTH/PHY 454 or BIO/CHM/MTH/PHY 455; admission to teacher education. (Cross-listed with BIO/CHM/MTH/PHY; may only earn credit in one department.) Consent of instructor. Offered Fall.

BIO/CHM/PHY 454 Cr.2

Field Experience I in Science Education

This course is the first field experience in a school environment. Candidates plan and teach lessons within the designated grade range of 4-12. Candidates are introduced to classroom management and conflict resolution. A multi-day, consistent schedule in the middle or high school field experience classroom is established by the course instructor in consultation with the teacher candidate and cooperating teacher. Prerequisite: EDS 203, EDS 206; concurrent enrollment in the department's section of BIO/CHM/PHY 451 or BIO/CHM/PHY 452; admission to teacher education. (Cross-listed with BIO/CHM/PHY; may only earn credit in one department.) Consent of instructor. Offered Fall, Spring.

BIO/CHM/PHY 455 Cr.2

Field Experience II in Science Education

This course is the second field experience in a school environment. Candidates plan and teach lessons within the designated grade range of 4-12. Candidates are introduced to classroom management and conflict resolution. A multi-day, consistent schedule in the middle or high school field experience classroom is established by the course instructor in consultation with the teacher candidate and cooperating teacher. Prerequisite: EDS 203, EDS 206; concurrent enrollment in the department's section of BIO/CHM/PHY 451 or BIO/CHM/PHY 452; admission to teacher education. (Cross-listed with BIO/CHM/PHY; may only earn credit in one department.) Consent of instructor. Offered Fall, Spring.

BIO 456/556 Cr.4

Plant Ecology

Conservation biology, ecological restoration, and predicting the effects of climate change all require an understanding of plant ecology. This course is focused on the interactions among plants, other organisms, and the environment. We will work across the individual, population, and community levels, and emphasize an exploratory approach to plant ecology. Class activities will include lectures, the discussion of ecological journal articles, and carrying out student-designed experiments. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Lect. 2, Lab 3. Prerequisite: BIO 307 or BIO 341; junior standing. Offered Fall - Even Numbered Years.

BIO 458/558 Cr.4

Comparative Animal Physiology

This course has both a lecture and a laboratory component. It aims to provide a thorough understanding of animal physiology from a comparative perspective. Emphasis will be placed on the basic physiological principles by which animals perform their life sustaining functions. Lectures will focus on vertebral animals, but will span both invertebrate and vertebrate models to illustrate how largely divergent groups have evolved different (or similar) mechanisms to cope with environmental challenges. The laboratory component will provide an active learning environment and hands-on experience in physiological experimentation. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Lect. 3, Lab 2. Prerequisite: BIO 203 or BIO 210 or BIO 401; junior standing. Offered Fall.

BIO 460/560 Cr.1-4

Symposium in Biology

Studies in biology of interest to specific groups. Varying topics will be offered at intervals with a specific title assigned to each. May be staffed by resident faculty or visiting lecturers. Other departments may be invited to participate. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Repeatable for credit - maximum 16. Variable offerings - check registration schedules. Prerequisite: four semesters of biology; junior standing. Offered Occasionally.

BIO 464/564 Cr.3

Stream and Watershed Ecology

An introduction to key concepts and theory pertinent to understanding and managing fluvial ecosystems (rivers and streams) and their watersheds. The course emphasizes rivers as large-scale physical and biological systems. Course work includes a comparative case study of distinctive types of temperate, tropical, and polar rivers. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Prerequisite: BIO 307 or BIO 341; junior standing. Offered Spring.

BIO 465/565 Cr.3

Neurophysiology

An examination of the nervous system beginning at the cellular level and working up to neuronal systems. Topics covered include the ionic basis of membrane potentials, synaptic communication, organization of functional circuits of neurons, and systems within the brain and/or spinal cord which control learning and memory, vision and motor function. Exploration of these fundamental neurophysiology topics from the basis for understanding a variety of student-selected topics which will be covered later in the semester. Late-semester topics often include higher-order aspects of brain function or challenges to the nervous system, such as the repair of brain or spinal cord injury, degenerative disease states, dyslexia, or consciousness. BIO 467 is an optional laboratory course which can be taken concurrently. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Prerequisite: BIO 105, CHM 103, and either BIO 312 or NEU 200; junior standing. Offered Annually.

BIO 466/566 Cr.3

Human Molecular Genetics

A study of the basic principles of heredity in humans. Focus will be on modern molecular techniques used in isolating human disease genes and modes of inheritance of human traits and disorders. Ethical issues in human genetics will also be discussed. This course is taught largely at a graduate level. Prerequisite: BIO 306; junior standing. Offered Fall.

BIO 467/567 Cr.2

Neurobiology Laboratory Techniques

An introduction to common laboratory techniques in neurobiology, including electrophysiology with invertebrate preparations, mammalian neuronal cell culture, and computational modeling. Students will receive training in techniques while performing classical experiments, then design their own novel experiments and carry them out. Prerequisite: BIO 312; BIO 465 or concurrent enrollment; junior standing. Offered Spring - Odd Numbered Years.

BIO 468/568 Cr.1

Human Molecular Genetics Lab

A study of the techniques used in doing research in human molecular genetics with a focus on commonly used model organisms in the study of human genetic disorders. Laboratory emphasis is on phenotype analysis, library screening, DNA microarray analysis, gene mapping, and bioinformatics. This course is taught largely at a graduate level. This lab is optional for those enrolled in BIO 466/566. Lab 3. Prerequisite: BIO 306; BIO 466 concurrently; junior standing. Offered Fall.

BIO 473/573 Cr.3

Marine Biology

Marine biology is an interdisciplinary field that includes elements of geology, physics, chemistry and biology. Students will gain an introduction to how biological organisms deal with varying physical, geological and chemical conditions found in marine ecosystems. Emphasis will be placed on current conservation concerns and marine invertebrate diversity. Prerequisite: BIO 203; CHM 103; junior standing. Offered Spring - Odd Numbered Years.

BIO 476/576 Cr.3

Ecosystem Ecology

Ecosystems include the living and non-living components of an environmental system and have emergent properties that can only be understood by examining the system as a whole. This course will examine advanced ecological topics centered around the structure and function of aquatic and terrestrial ecosystems. Topics covered will include the development of the ecosystem concept, ecosystem succession, production/decomposition, energy transfer in food webs, and nutrient cycling. The course will consist of classroom lectures, problem sets, and reading/discussion of relevant literature. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Prerequisite: BIO 307; one semester of chemistry; junior standing. Offered Spring - Even Numbered Years.

BIO 479 Cr.1

Biology Teaching Assistant

An opportunity to assist in the preparation and/or instruction of a biology course. Working with a faculty members, students may be expected to assist in the development and preparation of course materials, course instruction and student assessment. Repeatable for credit - maximum two. Departmental option for pass/fail or letter grade. Consent of instructor. Pass/Fail grading. Offered Fall, Spring, Summer.

BIO 483/583 Cr.3

Cell Signaling

Cell signaling controls the inner workings of organisms, allowing them to survive, reproduce, develop, respond, and adapt. Course topics will include how cells perceive changes in the environment by receptors, how they transmit the signal from receptors to other signaling molecules, and how signaling results in a cellular response. The course will integrate cell biology, genetics, and biochemistry. It will also complement several biology topics such as biology of cancer, developmental biology, molecular biology, and endocrinology. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Prerequisite: CHM 325, CHM 417, or both BIO 306 and BIO 315 (BIO 315 may be taken concurrently); junior standing. Offered Annually.

BIO 488 Cr.3

Mammalogy

A study of the diversity and biology of mammals. The evolutionary history of mammals provides the basis for a survey of modern mammalian groups, including their phylogenetic relationships, ecology, adaptations, and complex behaviors. Specimens of Wisconsin species will supplement the lectures. Prerequisite: BIO 105; BIO 203 or BIO 210; junior standing. Offered Fall.

BIO 489 Cr.1

Independent Study in Biology

A directed reading project or job shadowing experience within the discipline but outside that offered through regularly scheduled courses. Under the direction of the supervising faculty member (and in coordination with mentoring professional for job shadowing experience). A written report is an expected outcome. Repeatable for credit - maximum two. Consent of instructor. Offered Fall, Spring, Summer.

BIO 490/590 Cr.1-3

Current Topics in Biology Education

Biological researchers produce new discoveries almost daily. The purpose of this course is to train K-12 pre-service and in-service teachers in the current technologies and theories used in biology and to demonstrate the current approaches to teaching these materials. This course is taught largely at an undergraduate level. Graduate students will have additional course requirements/expectations. Repeatable for credit under different topics. Not applicable to a major or minor in biology, except for teacher certification major. Departmental option for pass/fail grading. Prerequisite: junior standing. Pass/Fail grading. Offered Occasionally.

BIO 491 Cr.1

Capstone Seminar in Biology

A seminar-style course designed for students to review and discuss basic concepts necessary for a career in the biological sciences and to assess their major in biology. This course will cover basic concepts of resume and cover letter writing, quantitative skills, computer literacy and current topics in biology. Students are expected to actively participate in an assessment of their major, and participate in discussions on major issues and developments in the biological sciences. Students will present a seminar on a contemporary biological topic incorporating primary literature. Prerequisite: senior standing. Offered Fall, Spring.

BIO 495 Cr.1-3

Service Learning in Biology

Students will plan, implement, and reflect on community service projects that will allow them to apply, enhance, and share what they have learned in a specific area of focus (such as aquatic science, nutrition, etc.) in cooperation with one or more community partners. The student's university advisor(s) and the participating community partner(s) will provide constructive evaluation of the project and student reflections throughout the experience. The student will provide formal written and oral communications to the advising faculty and community partner(s) regarding the outcomes of the service project. Repeatable for credit - maximum three. Prerequisite: junior standing. Offered Fall, Spring, Summer.

BIO 499 Cr.1-3

Independent Research

Individual research projects. Open to advanced students. Students may enroll for 1-3 credits per semester for a maximum of six credits. A maximum of two credits can be applied to the major in biology. Prerequisite: four semesters of biology and the completion of a consent form signed by the project director. Consent of instructor. Offered Fall, Spring, Summer.