Biology

Chair
- Diane C. Slusarski

Undergraduate major: biology (B.A., B.S.)
Undergraduate minor: biology
Graduate degrees: M.S. in integrated biology; Ph.D. in integrated biology
Faculty: https://biology.uiowa.edu/people/faculty
Website: https://biology.uiowa.edu/

The Department of Biology offers undergraduate and graduate programs that prepare students for careers in a wide variety of fields such as health science or biological research, technology, and education. It also offers several courses that undergraduate students in all majors may use to satisfy the GE CLAS Core Natural Sciences requirement and other courses on topics of general interest for undergraduate non-biology majors, including a First-Year Seminar course, BIOL:1000 First-Year Seminar, designed for entering students. The department also administers the interdisciplinary Biomedical Sciences major and the Neuroscience major, both leading to a Bachelor of Science degree.

Programs

Undergraduate Programs of Study

Majors
- Major in Biology (Bachelor of Arts)
- Major in Biology (Bachelor of Science)

Minor
- Minor in Biology

Graduate Programs of Study

Majors
- Master of Science in Integrated Biology
- Doctor of Philosophy in Integrated Biology

Facilities

The department is housed in two contiguous buildings, with modern facilities and equipment for state-of-the-art research.

Facilities include the Keck Dynamic Image Analysis Facility, which couples sophisticated state-of-the-art microscopy and computerized motion analysis to permit three-dimensional real-time analysis of cell movement in vitro and in situ. The Roy J. Carver Center for Genomics houses the department’s DNA sequencing, oligo synthesis, quantitative PCR, functional genomics/microarray facilities, and informatics facilities. The Roy J. Carver Center for Imaging is a microscopy and imaging facility; its confocal microscope is available for teaching and research.

A large greenhouse is used in plant research and education. The department also houses animal-care facilities suitable for mice, rats, rabbits, Xenopus laevis, and zebra fish. These facilities are managed by the University’s animal care unit, which is accredited by the Association for Assessment and Accreditation of Laboratory Animal Care. A central University facility provides assistance in the preparation of transgenic mice.

The department is home to the Developmental Studies Hybridoma Bank, which is affiliated with the National Institutes of Health. The hybridoma bank collects and distributes monoclonal antibodies that originate in laboratories all over the world. Its collection now contains more than 3,500 monoclonal antibodies that are distributed to users internationally for a modest fee.

In addition to department facilities, the University offers a genomic sequencing service, a DNA oligonucleotide synthesis and enzyme lab, oligopeptide synthesis and sequencing equipment, and mass- and NMR spectroscopy facilities. The Center for Biocatalysis and Bioprocessing is available for growing large amounts of microorganisms (e.g., 100 liters) for use in protein isolation.

Iowa Lakeside Laboratory

The Iowa Lakeside Laboratory is a field station run cooperatively by the University of Iowa, Iowa State University, and the University of Northern Iowa. Located on West Lake Okoboji, in northwestern Iowa, the laboratory affords excellent conditions for summer study in field biology, limnology, phycology, aquatic ecology, pollination biology, and plant taxonomy. It offers a wide variety of summer courses at the undergraduate and graduate levels. Students should check with their advisors to determine whether specific courses may be counted toward requirements for graduation. See Iowa Lakeside Laboratory (University College) in the Catalog or visit the Lakeside Laboratory website.

Courses

Many courses include laboratory, discussion, and/or field components.


Biology Courses

BIOL:1000 First-Year Seminar 1 s.h.
Small discussion class taught by a faculty member; topics chosen by instructor; may include outside activities (e.g., films, lectures, performances, readings, visits to research facilities, field trips). Requirements: first- or second-semester standing.
BIOL:1060 Big Ideas: Origins of the Universe, Earth, and Life  3 s.h.
Fundamental questions (How old is the universe? What is the nature of life? How has life evolved on Earth? What are our human origins? Are there other habitable planets in the universe?) that revolve around understanding origins from different perspectives (i.e., astronomy, physics, geoscience, biology, chemistry, anthropology); work with faculty from several departments to investigate these questions; inquiry-based activities to build success in critical thinking, teamwork, effective written and oral communication; origin of the universe, biochemistry of life, and origin of life on Earth; first of a two-part sequence. Recommendations: first-year or sophomore standing. GE: Natural Sciences without Lab. Same as ASTR:1060, EES:1060.

BIOL:1061 Big Ideas: Evolution of Life on Earth and the Search for Life in the Universe  4 s.h.
How has life evolved on Earth? What are our human origins? Are there other habitable planets in the universe? These fundamental questions revolve around understanding the origins of life from different perspectives—astronomy and physics, geoscience, biology, chemistry, and anthropology; students will work together with faculty from across four different departments to investigate these questions using inquiry-based activities to build success in critical thinking, teamwork, and effective written and oral communication; second half of the origins sequence (though either course also may be taken alone). GE: Natural Sciences with Lab. Same as ANTH:1061, ASTR:1061, EES:1061.

BIOL:1140 Human Biology  4 s.h.
Molecular and cellular basis of human life; integration of humans and the biosphere through photosynthesis, respiration; structure, function of human tissues, organs, organ systems; reproduction, genetics, impact of molecular biology and genetic engineering; lecture, laboratory. GE: Natural Sciences with Lab.

BIOL:1141 Introductory Animal Biology  4 s.h.
Fundamental principles: cells and macromolecules, energy metabolism, organismic physiology, genetics, development, ecology, and evolution. Requirements: one year of high school chemistry. Recommendations: CHEM:1070. GE: Natural Sciences with Lab.

BIOL:1251 How the Brain Works (and Why it Doesn't)  3-4 s.h.
Introductory survey of neuroscience; structure and function of the brain; nature of consciousness; brain function in mental illness and degenerative disorders; genes and the mind; perception, sensation, memory, and emotions. Requirements: non-biology major. GE: Natural Sciences without Lab.

BIOL:1260 Plants and Human Affairs  2-3 s.h.
How plants are useful to people: food, clothing, shelter, medicines, psychoactive agents; plants' social, economic, ecological significance. GE: Natural Sciences without Lab.

BIOL:1261 Introduction to Botany  4 s.h.
Biology of plant life; emphasis on structure, function, reproduction, inheritance, diversity, evolution. Requirements: one year of high school chemistry. GE: Natural Sciences with Lab.

BIOL:1295 Career Preparation and Life Design for Biology Majors  1 s.h.
Exploration of career paths, employers, graduate programs; preparation for life after college; development of practical skills in job searching, writing, interviewing, and networking; for students who are unsure what they can do after graduation with a bachelor's degree in biology. Requirements: junior or senior standing.

BIOL:1311 Human Genetics in the Twenty-First Century  3 s.h.
Organization and inheritance of human genes and genomes; genetic basis of simple and complex traits; genetic aspects of cancer; paleogenomics and tracing human migrations with DNA. GE: Natural Sciences without Lab. Same as ANTH:1310.

BIOL:1370 Understanding Evolution  3 s.h.
Evolution and diversity of living things, their patterns on Earth, their organization in ecological systems; dynamics of evolutionary processes. GE: Natural Sciences without Lab.

BIOL:1411 Foundations of Biology  4 s.h.
Unifying concepts of living systems; emphasis on common properties and processes; chemical and cellular basis of life, genetics, and evolution. Prerequisites: CHEM:1110 with a minimum grade of C- or CHEM:1070 with a minimum grade of A-. GE: Natural Sciences with Lab.

BIOL:1412 Diversity of Form and Function  4 s.h.
Underlying unifying concepts of life; emphasis on diversity of living systems; the tree of life, cellular evolution, prokaryotic and eukaryotic diversity, plant and animal form and function; interactions among diverse forms of life and their environment. Prerequisites: BIOL:1411 with a minimum grade of C-. GE: Natural Sciences with Lab.

BIOL:1808 Ways of Knowing Science  1 s.h.
Science as a powerful way of knowing based on experimentation and observation of natural world; introduction to subdisciplines of scientific research; scope and methods of scientific research; questions that scientific research seek answers for; methods that scientists use to obtain answers to their questions; how science affects us personally and how it affects the rest of society; research seminars, discussion, and exploration.

BIOL:2120 Good Genes Gone Bad: Genetic Disorders of Notable Celebrities  3 s.h.
Introduction to a wide range of genetic disorders affecting notable celebrities; relevant genetic pathways in easy-to-understand language; exploration of mechanisms of disease and treatments.

BIOL:2211 Genes, Genomes, and the Human Condition  3 s.h.
Organization, expression, and evolution of genes in context of genomes; focus on human genome; distribution and transmission of variation in human population. Prerequisites: BIOL:1411. Recommendations: BIOL:1412.

BIOL:2254 Endocrinology  3 s.h.
Production and effect of hormonal chemical messengers of secretory glands; emphasis on cell signaling in vertebrate systems; actions of hormones in regulating growth, physiology, and reproduction; organ to molecular levels. Prerequisites: BIOL:1411 and (BIOL:1412 or HHP:3500 or PSY:2701). Recommendations: CHEM:2210.
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<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
<th>Credits</th>
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<tr>
<td>BIOL:2346</td>
<td>Vertebrate Zoology</td>
<td>4 s.h.</td>
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<td></td>
<td>Vertebrate diversity, success in relation to evolutionary history,</td>
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<td></td>
<td>and adaptive radiation of fish, amphibians, reptiles, birds,</td>
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<td>mammals; physiological, morphological, behavioral, life history</td>
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<td>adaptations; vertebrate zoogeography, systematic, patterns of</td>
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<td>reproduction, social systems. Prerequisites: BIOL:1411 and BIOL:1412.</td>
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<td>BIOL:2374</td>
<td>Biogeography</td>
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<td>Introduction to processes that lead to the patterns of plant and</td>
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<td>animal distributions we see across the globe; processes of focus</td>
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<td>include plate tectons, climate, and human-ecological interactions;</td>
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<td>species management and conservation in relationship to climate and</td>
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<td>change in human patterns of environment. Prerequisites: BIOL:1141 or</td>
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<td>BIOL:1370 or BIOL:1261 or GEOG:1020 or BIOL:1412. Same as GEOG:2374.</td>
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<td>BIOL:2512</td>
<td>Fundamental Genetics</td>
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<td>Nature, function of genetic material: classical, molecular,</td>
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<td>developmental aspects. Prerequisites: BIOL:1411 with a minimum</td>
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<td>grade of C- and (BIOL:1412 with a minimum grade of C- or PSY:2701</td>
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<td>with a minimum grade of C-) and CHEM:1120. Corequisites: CHEM:2210,</td>
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<td>if not taken as a prerequisite.</td>
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<td>BIOL:2603</td>
<td>Mechanisms of Aging</td>
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<td>Evolutionary theories of aging, cellular and genetic basis of</td>
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<td>aging and repair, disruption of homeostasis in aging; focus on</td>
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<td>studies of biological and environmental causes of age-related</td>
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<td>diseases. Prerequisites: BIOL:1411 and (BIOL:1412 or HHP:3500 or</td>
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<td>PSY:2701).</td>
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<td>BIOL:2673</td>
<td>Ecology</td>
<td>3 s.h.</td>
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<td>Adaptations of organisms to their physical and biological</td>
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<td>environments; organism-environment interactions; population</td>
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<td>biology; interactions between species; ecology of communities,</td>
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<td>ecosystems; human impact on ecosystems. Prerequisites: BIOL:1411 and</td>
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<td>BIOL:1412. Recommendations: a basic statistics or calculus course.</td>
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<td>Same as ENVS:2673.</td>
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<td>BIOL:2723</td>
<td>Cell Biology</td>
<td>3 s.h.</td>
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<td>Structures of cells and organelles in relation to their functions</td>
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<td>at molecular, cellular levels; emphasis on higher eukaryotic cells.</td>
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<td>Prerequisites: BIOL:1411 and (BIOL:1412 or HHP:3500 or PSY:2701)</td>
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<td>and CHEM:1120.</td>
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<td>BIOL:2753</td>
<td>Introduction to Neurobiology</td>
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<td></td>
<td>Techniques of molecular biology, genomics, neuropharmacology, and</td>
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<td>functional brain imaging applied to understanding how the brain</td>
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<td>works. Prerequisites: (BIOL:1412 or HHP:3500) and BIOL:1411.</td>
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<td>BIOL:3172</td>
<td>Evolution</td>
<td>4 s.h.</td>
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<td>Nature, evidence, analysis, implications, molecular/genetic basis;</td>
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<td>historical record, phylogeny, speciation, adaptation, investigative</td>
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<td>methods. Prerequisites: BIOL:2512 with a minimum grade of C- and</td>
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<td>(STAT:2010 or STAT:3510 or MATH:1550 or MATH:1850).</td>
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<td>BIOL:3233</td>
<td>Introduction to Developmental Biology</td>
<td>3 s.h.</td>
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<td>Fundamental mechanisms in differentiation, organogenesis,</td>
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<td>morphogenesis; and pattern formation; mechanistic approach at</td>
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<td>molecular, cellular, tissue levels of organizations. Prerequisites:</td>
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<td>BIOL:1411 and CHEM:1120 and (BIOL:1412 with a minimum grade of</td>
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<td>C- or HHP:3500 with a minimum grade of C-). Recommendations: BIOL:2512.</td>
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<tr>
<td>BIOL:3244</td>
<td>Animal Behavior</td>
<td>3,5 s.h.</td>
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BIOL:3676 Evolution Lab 4 s.h.
Methods of sampling and describing variation in natural populations; application of molecular genetic, bioinformatic, and computational techniques to describe genetic variation through sequence analysis; use of controlled laboratory experiments and computer simulations to illustrate evolutionary principles. Prerequisites: BIOL:2512 or BIOL:2211. Corequisites: BIOL:3172 or BIOL:3373, if not taken as a prerequisite. Recommendations: grade of C or higher in BIOL:3172.

BIOL:3713 Molecular Genetics 4 s.h.
Mechanism, regulation of RNA, DNA, protein biosynthesis, with emphasis on methods of genetic analysis; application of modern recombinant DNA techniques to basic problems. Prerequisites: BIOL:2512 or BIOL:3310.

BIOL:3716 Genetics and Biotechnology Lab 4 s.h.
Expansion of genetic concepts introduced in BIOL:2512; introduction to genetic/molecular techniques currently used in genetic analysis and biotechnology. Prerequisites: BIOL:1411. Corequisites: BIOL:2512 or BIOL:2211, if not taken as a prerequisite. Requirements: grade of C or higher in BIOL:2512.

BIOL:3736 Developmental Biology Lab 4 s.h.
Experimental manipulation of embryos to examine mechanisms of early development, including gametogenesis and fertilization, cleavage, gastrulation, pattern formation and organogenesis; in vivo imaging of development, methods to visualize gene expression and independent research; model organisms including sea urchin, fish, frog, chick, mouse. Prerequisites: BIOL:3233.

BIOL:3743 Basic Biology of Human Disease 2 s.h.
Basic problems of infectious disease; selected viral, bacterial, and fungal pathogens, with emphasis on fungal pathogenesis; DNA fingerprinting; epidemiological study of disease dynamics. Prerequisites: BIOL:2512.

BIOL:3753 Developmental Neurobiology 3 s.h.
Neural induction and nervous system patterning; neurogenesis, axon and dendrite outgrowth and targeting; synapse formation, specificity, refinement; mechanisms of neuronal cell death; myelination; neural stem cells; introduction to cellular, molecular, and genetic techniques in studies of neural development. Prerequisites: BIOL:2753 with a minimum grade of C- or BIOL:3253 with a minimum grade of C-. Corequisites: BIOL:3253, if not taken as a prerequisite.

BIOL:3898 Teaching Internship in Biology 2 s.h.
Training in teaching the laboratory component of a large general education biology course; weekly session with instructor, shadowing and assisting a graduate teaching assistant in a lab section, leading laboratory exercises. Prerequisites: BIOL:1411 with a minimum grade of B and BIOL:1412 with a minimum grade of B. Requirements: junior or senior standing.

BIOL:3994 Introduction to Research 2-3 s.h.
Conduct independent scientific research related to the field of biology.

BIOL:4213 Bioinformatics 4 s.h.
Overview of bioinformatics topics, including access to sequence data, pairwise and multiple sequence alignment algorithms, molecular phylogeny, microarray data analysis, protein analysis, proteomics and protein structure analysis; emphasis on each topic includes biological motivation, computational approach (practical and theoretical), and interpretation of output. Prerequisites: BIOL:3120 or MIRC:3170 or BIOL:2512. Recommendations: grade of B+ or higher in BIOL:2512 or BIOL:3120, or graduate standing. Same as GENE:4213, IGPI:4213.

BIOL:4314 Introduction to Synthetic Biology in the Lab 4 s.h.
Introduction to theory and practice of large-scale design goals of synthetic biology in which various types of DNA instructions, known from decades of research and discovery on specific biological systems, are taken out of context and used to execute various novel tasks designed to solve real-world problems; basic laboratory instruction in standardized construction techniques for stringing together off-the-shelf DNA components that are then introduced into organisms capable of executing the instructional set; controlled experiments to investigate the degree of variability exhibited by engineered genetic constructs. Prerequisites: BIOL:1411. Same as BME:4314.

BIOL:4316 Summer Practicum in Genomics 2 s.h.
Major areas of genomics, including sequence similarity searching, whole genome comparisons, phylogenetic analysis, and regulatory informatics; computer workshop experience in application of bioinformatics tools. Prerequisites: BIOL:4213 or BIOL:3314.

BIOL:4333 Genes and Development 3 s.h.
Mechanisms by which genes control development of multicellular animals; methodology of scientific research applied to developmental genetics. Prerequisites: BIOL:2512 with a minimum grade of C-. Recommendations: BIOL:3233.

BIOL:4353 Neurophysiology: Cells and Systems 3-4 s.h.
Physiological properties of nerve cells, nervous systems; axonal conduction, synaptic transmission, sensory transduction, integrative processes, higher functions. Prerequisites: (BIOL:2753 or BIOL:3253) and (MATH:1460 or MATH:1380 or MATH:1550 or MATH:1850) and ((PHYS:1511 and PHYS:1512) or (PHYS:1611 and PHYS:1612)). Same as NSCI:4353.

BIOL:4373 Molecular Evolution: Genes, Genomes, and Organisms 3 s.h.
Theory underlying phylogenetic analysis with application of these methods to molecular data sets; analysis of multigene data, organellar, and nuclear genome sequences to reconstruct the history of cells. Prerequisites: BIOL:3172 with a minimum grade of C-. Same as IGPI:4373.

BIOL:4897 Teaching Internship in Biology 2-3 s.h.
Training and practical experiences in the teaching of biology; includes a weekly training session with a Ph.D. instructor or course supervisor, active assistance of the primary instructor in one or more class meetings each week, and/or providing constructive written feedback on laboratory or classroom exercises; additional experiences may include leading a training session, co-teaching or lead-teaching one or more lab or classroom exercises, and assisting with the development of classroom activities or resources; specific experiences will vary depending on the course and supervisor needs. Prerequisites: BIOL:1411 with a minimum grade of B and BIOL:1412 with a minimum grade of B. Requirements: third- or fourth-year standing and interview with instructor.
BIOL:4898 Communicating Research 1 s.h.
Independent, investigative research experience; research process and communication—establishing goals and expectations with a mentor, developing and framing a research hypothesis or question, communicating results in written and oral form to scientist and nonscientist audiences; supportive learning environment to share research experiences and develop identities as scientists, learn skills to become effective independent researchers and science communicators. Corequisites: BIOL:3994 or BIOL:4999.

BIOL:4995 Honors Research in Neuroscience arr.
Students conduct independent scientific research related to the field of neuroscience. Requirements: honors standing in neuroscience, UG g.p.a. of at least 3.33, and neuroscience g.p.a. of at least 3.33. Same as PSY:4995.

BIOL:4998 Honors Seminar in Biology 2 s.h.
Prerequisites: BIOL:1411 and BIOL:1412. Requirements: honors standing.

BIOL:4999 Honors Research in Biology arr.
Students conduct independent scientific research related to the field of biology. Requirements: honors standing in biology, UG g.p.a. of at least 3.33, and biology g.p.a. of at least 3.33.

BIOL:5117 Topics in Molecular Genetics 1-2 s.h.
Prerequisites: BIOL:2512 with a minimum grade of B-.

BIOL:5199 Critical Readings in Biology arr.

BIOL:5211 Genes, Genomes, and the Human Condition Graduate Lecture 3 s.h.
Organization, expression, and evolution of genes in context of genomes; focus on human genome; distribution and transmission of variation in human population. Recommendations: BIOL:1411 highly recommended. Same as IGPI:5211.

BIOL:5218 Microscopy for Biomedical Research arr.
Basic microscopy methods for research including optics, preparation, and analysis of biomedical specimens; light, fluorescence, confocal, transmitting electron, scanning electron, atomic force microscopes, elemental analysis; immunohistochemistry and stereology techniques; individualized laboratory instruction. Prerequisites: BIOL:2723. Same as ACB:5218, MICR:5218.

BIOL:5286 Monoclonal Antibody Technologies 2 s.h.
Provides knowledge of screening and characterization methods for monoclonal antibodies, a powerful tool in molecular cytology, immunohistochemistry, and studies of gene regulation; methods include screening for monoclonal antibodies (mAbs), fluorescence-activated cell sorting (FACS) analysis, enzyme-linked immunosorbent assay (ELISA), Southern blot hybridization, cytochemistry, histochemistry, and induced polarization (IP).

BIOL:5320 Computational Genomics 3 s.h.
Introduction to computational methods used in genome analysis and functional genomics; biological sequence analysis, sequence database search, microarray data analysis, biological network analysis; in-depth coverage of principal genome science challenges and recent solutions. Prerequisites: (BIOS:4120 or STAT:3510) and BME:5320 and (CS:5110 or ENGR:1300). Same as BME:5330, ECE:5220, GENE:5173, IGPI:5330.

BIOL:5412 Fundamental Genetics - Graduate Lecture 3 s.h.

BIOL:5512 Fundamental Genetics - Graduate Discussion 1 s.h.
Critical evaluation of classic genetics papers. Requirements: biology graduate standing.

BIOL:5653 Fundamental Neurobiology 3 s.h.
Neurobiology from molecular/cellular to systems levels, including cell biology of the neuron; membrane electrophysiology; synaptic transmission and plasticity, functional neuroanatomy, peripheral and CNS sensory systems, peripheral and CNS motor systems, autonomic systems, emotion, memory, sleep, language, attention and cognition, neuronal development. Same as NSCI:5653, PSY:5203.

BIOL:5658 Fundamental Neurobiology Discussion 1 s.h.
Discussion of selected papers, including classics from neurobiology literature; coordinated with BIOL:5653 lecture material. Same as NSCI:5658, PSY:5204.

BIOL:5753 Developmental Neuroscience 1 s.h.
Neural induction and nervous system patterning; neurogenesis, axon, and dendrite outgrowth and targeting; synapse formation, specificity, refinement; mechanisms of neuronal cell death; myelination; neural stem cells; introduction to cellular, molecular, and genetic techniques in studies of neural development. Prerequisites: BIOL:5653. Same as NSCI:5753.

BIOL:6188 Seminar: Writing in Natural Sciences 2 s.h.
Writing and critiquing skills in the natural sciences.

BIOL:6199 Research: Biology arr.

BIOL:6265 Neuroscience Seminar 0-1 s.h.
Research presentations. Same as ACB:6265, MPB:6265, NSCI:6265, PSY:6265.

Analysis and presentation of primary research on central biological questions utilizing a full array of model and non-model organisms and analytical approaches; development of effective skills in public speaking, presentation, and scientific writing.

BIOL:6899 Independent Study in Biology arr.

BIOL:7270 Principles of Scholarly Integrity 1 s.h.
Training in responsible conduct of research; student/mentor responsibilities; authorship and reviewing; plagiarism/falsification/fabrication of data; intellectual property; conflict of interest; fiscal, institutional, societal; treatment of human and animal subjects; data handling. Requirements: enrollment in graduate psychology or biology program. Same as PSY:7270.

BIOL:7604 Principles of Scholarly Integrity 0 s.h.
Training in responsible conduct of research and scholarly activities; student/mentor responsibilities; authorship; plagiarism/falsification/fabrication of data; intellectual property; conflict of interest; fiscal, institutional, societal; treatment of human and animal subjects; data handling. Requirements: postdoctoral standing in psychology or biology. Same as PSY:7604.