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.

The following courses are not open to graduate students and do not provide credit toward a biology major:

- BIOL:1000 First-Year Seminar
- BIOL:1060 Big Ideas: Origins of the Universe, Earth, and Life
- BIOL:1061 Big Ideas: Evolution of Life on Earth and the Search for Life in the Universe
- BIOL:1140 Human Biology
- BIOL:1141 Introductory Animal Biology
- BIOL:1251 How the Brain Works (and Why it Doesn't)
- BIOL:1260 Plants and Human Affairs
- BIOL:1261 Introduction to Botany
- BIOL:1311 Human Genetics in the Twenty-First Century
- BIOL:1370 Understanding Evolution
- BIOL:2211 Genes, Genomes, and the Human Condition

**Biology Courses**

**BIOL:1000 First-Year Seminar**

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.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits (s.h.)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL:1060</td>
<td>Big Ideas: Origins of the Universe, Earth, and Life</td>
<td>3 s.h.</td>
<td>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.</td>
</tr>
<tr>
<td>BIOL:1061</td>
<td>Big Ideas: Evolution of Life on Earth and the Search for Life in the Universe</td>
<td>4 s.h.</td>
<td>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 may be taken alone). GE: Natural Sciences with Lab. Same as ANTH:1061, ASTR:1061, EES:1061.</td>
</tr>
<tr>
<td>BIOL:1140</td>
<td>Human Biology</td>
<td>4 s.h.</td>
<td>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.</td>
</tr>
<tr>
<td>BIOL:1251</td>
<td>How the Brain Works (and Why it Doesn't)</td>
<td>3-4 s.h.</td>
<td>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.</td>
</tr>
<tr>
<td>BIOL:1260</td>
<td>Plants and Human Affairs</td>
<td>2-3 s.h.</td>
<td>How plants are useful to people: food, clothing, shelter, medicines, psychoactive agents; plants' social, economic, ecological significance. GE: Natural Sciences without Lab.</td>
</tr>
<tr>
<td>BIOL:1261</td>
<td>Introduction to Botany</td>
<td>4 s.h.</td>
<td>Biology of plant life; emphasis on structure, function, reproduction, inheritance, diversity, evolution. Requirements: one year of high school chemistry. GE: Natural Sciences with Lab.</td>
</tr>
<tr>
<td>BIOL:1295</td>
<td>Career Preparation and Life Design for Biology Majors</td>
<td>1 s.h.</td>
<td>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.</td>
</tr>
<tr>
<td>BIOL:1311</td>
<td>Human Genetics in the Twenty-First Century</td>
<td>3 s.h.</td>
<td>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.</td>
</tr>
<tr>
<td>BIOL:1370</td>
<td>Understanding Evolution</td>
<td>3 s.h.</td>
<td>Evolution and diversity of living things, their patterns on Earth, their organization in ecological systems; dynamics of evolutionary processes. GE: Natural Sciences without Lab.</td>
</tr>
<tr>
<td>BIOL:1411</td>
<td>Foundations of Biology</td>
<td>4 s.h.</td>
<td>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.</td>
</tr>
<tr>
<td>BIOL:1412</td>
<td>Diversity of Form and Function</td>
<td>4 s.h.</td>
<td>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.</td>
</tr>
<tr>
<td>BIOL:1808</td>
<td>Ways of Knowing Science</td>
<td>1 s.h.</td>
<td>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.</td>
</tr>
<tr>
<td>BIOL:2120</td>
<td>Good Genes Gone Bad: Genetic Disorders of Notable Celebrities</td>
<td>3 s.h.</td>
<td>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.</td>
</tr>
<tr>
<td>BIOL:2211</td>
<td>Genes, Genomes, and the Human Condition</td>
<td>3 s.h.</td>
<td>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.</td>
</tr>
<tr>
<td>BIOL:2254</td>
<td>Endocrinology</td>
<td>3 s.h.</td>
<td>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.</td>
</tr>
</tbody>
</table>
BIOL:2346 Vertebrate Zoology 4 s.h.
Vertebrate diversity, success in relation to evolutionary history, and adaptive radiation of fish, amphibians, reptiles, birds, mammals; physiological, morphological, behavioral, life history adaptations; vertebrate zoogeography, systematics, patterns of reproduction, social systems. Prerequisites: BIOL:1411 and BIOL:1412.

BIOL:2374 Biogeography 3 s.h.
Introduction to processes that lead to the patterns of plant and animal distributions we see across the globe; processes of focus include plate tectonics, climate, and human-ecological interactions; species management and conservation in relationship to climate and change in human patterns of environment. Prerequisites: BIOL:1141 or BIOL:1370 or BIOL:1261 or GEOG:1020 or BIOL:1412. Same as GEOG:2374.

BIOL:2512 Fundamental Genetics 4 s.h.
Nature, function of genetic material: classical, molecular, developmental aspects. Prerequisites: BIOL:1411 with a minimum grade of C- and (BIOL:1412 with a minimum grade of C- or PSY:2701 with a minimum grade of C-) and CHEM:1120. Corequisites: CHEM:2210, if not taken as a prerequisite.

BIOL:2603 Mechanisms of Aging 3 s.h.
Evolutionary theories of aging, cellular and genetic basis of aging and repair, disruption of homeostasis in aging; focus on studies of biological and environmental causes of age-related diseases. Prerequisites: BIOL:1411 and (BIOL:1412 or HHP:3500 or PSY:2701).

BIOL:2673 Ecology 3 s.h.
Adaptations of organisms to their physical and biological environments; organism-environment interactions; population biology; interactions between species; ecology of communities, ecosystems; human impact on ecosystems. Prerequisites: BIOL:1411 and BIOL:1412. Recommendations: a basic statistics or calculus course. Same as ENVS:2673.

BIOL:2723 Cell Biology 3 s.h.
Structures of cells and organelles in relation to their functions at molecular, cellular levels; emphasis on studies of eukaryotic cells. Prerequisites: BIOL:1411 and (BIOL:1412 or HHP:3500 or PSY:2701) and CHEM:1120.

BIOL:2753 Introduction to Neurobiology 3 s.h.
Techniques of molecular biology, genomics, neuropharmacology, and functional brain imaging applied to understanding how the brain works. Prerequisites: (BIOL:1412 or HHP:3500) and BIOL:1411.

BIOL:3172 Evolution 4 s.h.
Nature, evidence, analysis, implications, molecular/genetic basis; historical record, phylogeny, speciation, adaptation, investigative methods. Prerequisites: BIOL:2512 with a minimum grade of C- and (STAT:2010 or STAT:3510 or MATH:1550 or MATH:1850 or MATH:1460).

BIOL:3233 Introduction to Developmental Biology 3 s.h.
Fundamental mechanisms in differentiation, organogenesis, morphogenesis; and pattern formation; mechanistic approach at molecular, cellular, tissue levels of organizations. Prerequisites: BIOL:1411 and CHEM:1120 and (BIOL:1412 with a minimum grade of C- or HHP:3500 with a minimum grade of C-). Recommendations: BIOL:2512.

BIOL:3244 Animal Behavior 3,5 s.h.
Genetics, sensory physiology, migration, development of behavior, circadian rhythms, foraging strategies, aggression, sexual and parental behavior, group selection, social behavior. Prerequisites: BIOL:1411 and (BIOL:1412 or PSY:2701).

BIOL:3253 Neurobiology 4 s.h.
Neurobiology from molecular/cellular to systems levels including cell biology of the neuron; membrane electrophysiology; synaptic transmission and plasticity, functional neuroanatomy, sensory, motor and autonomic systems, emotion, memory, sleep, language, attention and cognition, neuronal development. Prerequisites: BIOL:2753 or (PSY:2701 and BIOL:3343). Recommendations: BIOL:2723 and BIOL:3110 and PHYS:1512.

BIOL:3314 Genomics 3 s.h.
Major areas of genomics, including DNA and protein sequence analysis, structural diversity of whole genomes, microarray applications, proteomics; computer workshop experience in applying bioinformatics tools. Prerequisites: BIOL:2512 or BIOL:3120. Same as IGPI:3314.

BIOL:3334 Animal Physiology 3 s.h.
Principles of cellular and systems physiology; emphasis on quantitative and experimental aspects. Prerequisites: BIOL:1411 and CHEM:1110 and CHEM:1120 and (MATH:1380 or MATH:1460 or MATH:1550 or MATH:1850). Recommendations: (PHYS:1511 and PHYS:1512) or (PHYS:1611 and PHYS:1612).

BIOL:3363 Plant Developmental Biology 3 s.h.
Developmental processes throughout life cycle of vascular plants; current knowledge of mechanisms, control; emphasis on molecular and genetic approaches to studying development. Prerequisites: BIOL:2512.

BIOL:3373 Human Population Genetics and Variation 3 s.h.
Principles of evolutionary change of genes and genomes applied to human populations and to comparisons between humans and their closest primate relatives; emphasis on consequences of mutation, natural selection, and demographic changes. Prerequisites: BIOL:2512 with a minimum grade of C- or BIOL:2211 with a minimum grade of C-.

BIOL:3383 Introduction to Systems Biology 3 s.h.
Concepts and skills used to develop computer models that provide insight into the operation of cellular processes like metabolic pathways and genetic circuits. Prerequisites: BIOL:1412 and (MATH:1460 or MATH:1550 or MATH:1850).

BIOL:3626 Cell Biology Laboratory 4 s.h.
Conceptual understanding and technical skills in fluorescence microscopy and digital imaging, mammalian cell culture, tissue fractionation, centrifugation, electrophoresis, and expression of recombinant proteins. Prerequisites: BIOL:2723.

BIOL:3655 Neurogenetics Laboratory 4 s.h.
Emphasis on project-oriented training to develop fundamental hands-on experimental manipulations and techniques, problem-solving skills, and data analysis methodology; students utilize modern genetic, behavioral, and electrophysiological methods to explore how gene and environment influence nervous system function and behavioral expression using genetic model organisms. Prerequisites: BIOL:2512 or BIOL:2211. Recommendations: BIOL:2753 or PSY:2701.

BIOL:3656 Neurobiology Laboratory 4 s.h.
Principles and practice of neurobiology research, including microscopy and imaging, cellular and molecular neurobiology, and electrophysiology. Prerequisites: (BIOL:1411 and PSY:2701) or BIOL:2753.
BIOL:3663 Plant Response to the Environment 3 s.h.
Mechanisms of plant responses to environmental factors (biotic and abiotic) at organ and molecular levels. Prerequisites: BIOL:2512 or BIOL:2723 or BIOL:3716 or BIOC:3120.

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 BIOC:3120.

BIOL:3716 Genetics and Biotechnology Lab 4 s.h.

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:2512 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: BIOC:3120 or MICR:3170 or BIOL:2512. Recommendations: grade of B+ or higher in BIOL:2512 or BIOC: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:2512 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: BIOC:3120.

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.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
<th>Type</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL:4898</td>
<td>Communicating Research</td>
<td>1 s.h.</td>
<td></td>
</tr>
<tr>
<td>BIOL:4899</td>
<td>Honors Research in Neuroscience</td>
<td>arr.</td>
<td></td>
</tr>
<tr>
<td>BIOL:4998</td>
<td>Honors Seminar in Biology</td>
<td>2 s.h.</td>
<td></td>
</tr>
<tr>
<td>BIOL:4999</td>
<td>Honors Research in Biology</td>
<td>arr.</td>
<td></td>
</tr>
<tr>
<td>BIOL:5117</td>
<td>Topics in Molecular Genetics</td>
<td>1-2 s.h.</td>
<td></td>
</tr>
<tr>
<td>BIOL:5199</td>
<td>Critical Readings in Biology</td>
<td>arr.</td>
<td></td>
</tr>
<tr>
<td>BIOL:5211</td>
<td>Genes, Genomes, and the Human Condition Graduate Lecture</td>
<td>3 s.h.</td>
<td></td>
</tr>
<tr>
<td>BIOL:5218</td>
<td>Microscopy for Biomedical Research</td>
<td>arr.</td>
<td></td>
</tr>
<tr>
<td>BIOL:5286</td>
<td>Monoclonal Antibody Technologies</td>
<td>2 s.h.</td>
<td></td>
</tr>
<tr>
<td>BIOL:5320</td>
<td>Computational Genomics</td>
<td>3 s.h.</td>
<td></td>
</tr>
<tr>
<td>BIOL:5412</td>
<td>Fundamental Genetics - Graduate Lecture</td>
<td>3 s.h.</td>
<td></td>
</tr>
<tr>
<td>BIOL:5512</td>
<td>Fundamental Genetics - Graduate Discussion</td>
<td>1 s.h.</td>
<td></td>
</tr>
<tr>
<td>BIOL:5653</td>
<td>Fundamental Neurobiology</td>
<td>3 s.h.</td>
<td></td>
</tr>
<tr>
<td>BIOL:5658</td>
<td>Fundamental Neurobiology Discussion</td>
<td>1 s.h.</td>
<td></td>
</tr>
<tr>
<td>BIOL:5753</td>
<td>Developmental Neuroscience</td>
<td>1 s.h.</td>
<td></td>
</tr>
<tr>
<td>BIOL:6188</td>
<td>Seminar: Writing in Natural Sciences</td>
<td>2 s.h.</td>
<td></td>
</tr>
<tr>
<td>BIOL:6199</td>
<td>Research: Biology</td>
<td>arr.</td>
<td></td>
</tr>
<tr>
<td>BIOL:6265</td>
<td>Neuroscience Seminar</td>
<td>0-1 s.h.</td>
<td></td>
</tr>
<tr>
<td>BIOL:6899</td>
<td>Independent Study in Biology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIOL:7270</td>
<td>Principles of Scholarly Integrity</td>
<td>1 s.h.</td>
<td></td>
</tr>
<tr>
<td>BIOL:7604</td>
<td>Principles of Scholarly Integrity</td>
<td>0 s.h.</td>
<td></td>
</tr>
</tbody>
</table>

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.

Biology graduate standing.

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.

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

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.

Writing and critiquing skills in the natural sciences.

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.

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.

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.