## Biology

**Chair**
- Tina L. Tootle

**Undergraduate major:** biology (BA, BS)

**Undergraduate minor:** biology

**Graduate degrees:** MS in integrated biology; PhD in integrated biology

**Faculty:** [Website](https://biology.uiowa.edu/people/faculty)

**Website:** [https://biology.uiowa.edu/](https://biology.uiowa.edu/)

### Biology 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:1060 Big Ideas: Origins of the Universe, Earth, and Life; BIOL:1140 Human Biology: Nonmajors; BIOL:1141 Human Biology: Health Professions; BIOL:1251 How the Brain Works (and Why It Doesn't); BIOL:1260 Plants and Human Affairs; BIOL:1261 Introduction to Botany; BIOL:1370 Understanding Evolution; and BIOL:2211 Genes, Genomes, and the Human Condition.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BIOL:1000</td>
<td>First-Year Seminar</td>
<td>1 s.h.</td>
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<tr>
<td>BIOL:1060</td>
<td>Big Ideas: Origins of the Universe, Earth, and Life</td>
<td>3 s.h.</td>
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<tr>
<td>BIOL:1140</td>
<td>Human Biology: Nonmajors</td>
<td>4 s.h.</td>
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<tr>
<td>BIOL:1141</td>
<td>Human Biology: Health Professions</td>
<td>4 s.h.</td>
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<tr>
<td>BIOL:1251</td>
<td>How the Brain Works (and Why It Doesn’t)</td>
<td>3-4 s.h.</td>
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<tr>
<td>BIOL:1260</td>
<td>Plants and Human Affairs</td>
<td>2-3 s.h.</td>
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<tr>
<td>BIOL:1261</td>
<td>Introduction to Botany</td>
<td>4 s.h.</td>
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<tr>
<td>BIOL:1295</td>
<td>Career Preparation and Life Design for Biology Majors</td>
<td>1 s.h.</td>
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<tr>
<td>BIOL:1370</td>
<td>Understanding Evolution</td>
<td>3 s.h.</td>
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<tr>
<td>BIOL:1411</td>
<td>Foundations of Biology</td>
<td>4 s.h.</td>
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<tr>
<td>BIOL:1412</td>
<td>Diversity of Form and Function</td>
<td>4 s.h.</td>
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<tr>
<td>BIOL:1808</td>
<td>Ways of Knowing Science</td>
<td>1 s.h.</td>
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<tr>
<td>BIOL:2120</td>
<td>Good Genes Gone Bad: Genetic Disorders of Notable Celebrities</td>
<td>3 s.h.</td>
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<tr>
<td>BIOL:2211</td>
<td>Genes, Genomes, and the Human Condition</td>
<td>3 s.h.</td>
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- BIOL:1060 Big Ideas: Origins of the Universe, Earth, and Life
  - Prerequisites: BIOL:1411 with a minimum grade of C- or CHEM:1070 with a minimum grade of A-. GE: Natural Sciences with Lab.
- BIOL:1140 Human Biology: Nonmajors
  - Prerequisites: BIOL:1412. GE: Natural Sciences without Lab.
- BIOL:1141 Human Biology: Health Professions
  - 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. GE: Natural Sciences without Lab.
- BIOL:1295 Career Preparation and Life Design for Biology Majors
  - 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:1370 Understanding Evolution
  - 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
  - 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
  - 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- or CHEM:1070 with a minimum grade of A-. GE: Natural Sciences with Lab.
- BIOL:1808 Ways of Knowing Science
  - 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
  - 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. GE: Natural Sciences without Lab.
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<tr>
<td>BIOL:2246</td>
<td>Entomology Lab</td>
<td>4 s.h.</td>
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<tr>
<td>BIOL:2254</td>
<td>Endocrinology</td>
<td>3 s.h.</td>
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<tr>
<td>BIOL:2374</td>
<td>Biogeography</td>
<td>3 s.h.</td>
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<tr>
<td>BIOL:2512</td>
<td>Fundamental Genetics</td>
<td>4 s.h.</td>
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<tr>
<td>BIOL:2663</td>
<td>Plant Response to the Environment</td>
<td>3 s.h.</td>
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<tr>
<td>BIOL:2673</td>
<td>Ecology</td>
<td>3 s.h.</td>
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<tr>
<td>BIOL:2723</td>
<td>Cell Biology</td>
<td>3 s.h.</td>
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<tr>
<td>BIOL:2753</td>
<td>Introduction to Neurobiology</td>
<td>3 s.h.</td>
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<tr>
<td>BIOL:3172</td>
<td>Evolution</td>
<td>4 s.h.</td>
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<tr>
<td>BIOL:3212</td>
<td>Bioinformatics for Beginners</td>
<td>3 s.h.</td>
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<td>BIOL:3223</td>
<td>Introduction to Developmental Biology</td>
<td>3 s.h.</td>
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<tr>
<td>BIOL:3244</td>
<td>Animal Behavior</td>
<td>3 s.h.</td>
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<tr>
<td>BIOL:3253</td>
<td>Neurobiology I</td>
<td>4 s.h.</td>
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<tr>
<td>BIOL:3254</td>
<td>Neurobiology II</td>
<td>4 s.h.</td>
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<tr>
<td>BIOL:3314</td>
<td>Genomics</td>
<td>3 s.h.</td>
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<tr>
<td>BIOL:3343</td>
<td>Animal Physiology</td>
<td>3 s.h.</td>
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<td>BIOL:3363</td>
<td>Plant Developmental Biology</td>
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Insects are the most species-rich and diverse of all animals; introduction to insect biology; emphasis on evolution, diversity, ecology, and morphology with some additional focus on physiology and behavior; students work in lab and field settings; memorization of entomological terms required; hands-on learning including how to employ various tools, techniques, and approaches used by professional entomologists, insect collecting and preservation, DNA extraction and sequencing, and analysis of evolutionary and ecological data. Prerequisites: BIOL:1412.

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.

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.


Mechanisms of plant responses to environmental factors (biotic and abiotic) at organismal and molecular levels. Prerequisites: BIOL:1411 and BIOL:1412.

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. Recommendations: a basic statistics or calculus course. Same as ENVS:2673.

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

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.

Nature, evidence, analysis, implications, molecular/genetic basis; historical record, phylogeny, speciation, adaptation, investigative methods. Prerequisites: BIOL:1412 with a minimum grade of C- and BIOL:2512 with a minimum grade of C- and (STAT:2010 or STAT:3510 or MATH:1550 or MATH:1850 or MATH:1460).

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:2512 or BIOL:2211 or BMB:3120 or MICR:3170. Same as IGPI:3212.

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.

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).

Behavioral aspects of vertebrate and invertebrate animals under pressure of different genetic background, aggression and competition for a mate, food or security, social behavior. Prerequisites: BIOL:1411 and (BIOL:1412 or PSY:2701).

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; focus on systems and developmental neurobiology; first in a two-semester sequence. Prerequisites: BIOL:1411 and (PSY:2701 or BIOL:2753).

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; focus on molecular/cellular neurobiology and neurophysiology; second in a two-semester sequence. Prerequisites: BIOL:3253 and (PHYS:1512 or PHYS:1612).

Major areas of genomics including genome sequencing, assembly, and annotation; evolutionary genomics, metagenomics, functional genomics, and computational genomics; synthetic biology and genome engineering. Prerequisites: BIOL:1412 and (BIOL:2211 or BIOL:2512 or BIOL:2723 or MICR:3170). Same as IGPI:3314.

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

Developmental processes throughout life cycle of vascular plants; current knowledge of mechanisms, control; emphasis on molecular and genetic approaches to studying development. Prerequisites: BIOL:1412 and 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:3603 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). Recommendations: BIOL:2723.

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: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 organismal and molecular levels. Prerequisites: BIOL:1412 and (BIOL:2512 or BIOL:2723 or BIOL:3716 or BMB: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 BMB:3120 or BMB:3110.

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:3994 Introduction to Research 1-3 s.h.
Independent scientific research related to the field of biology.

BIOL:3999 Independent Research in Neuroscience 2-3 s.h.
Independent scientific research related to the field of neuroscience. Same as PSY:3999.

BIOL:4213 Bioinformatics 2,4 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 and proof, (statistical and theoretical), and interpretation of output. Prerequisites: BMB:3120 or MICR:3170 or BIOL:2512 or BMB:3110. Recommendations: grade of B-plus or higher in BIOL:2512 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: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:1412 with a minimum grade of C- and BIOL:2512 with a minimum grade of C-. Recommendations: BIOL:3233.

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, organelar, and nuclear genome sequences to reconstruct the history of cells. Prerequisites: BIOL:3172 with a minimum grade of C-. Same as IGPI:4373.

BIOL:4386 Introduction to Scientific Computing for Biologists 3 s.h.
In modern biological research, computational tools are no longer a luxury but a necessity; introduction to a set of computational tools and best practices in data analysis to prepare for data-intensive research in the field of biomedical sciences; topics include reproducibility in computational projects, version control, command-line interface, remote computing, and general and statistical programming. Prerequisites: BIOL:2512 or BMB:3110 or BMB:3120 or MICR:3170. Recommendations: CS:2110.
BIOL:4897 Teaching Internship in Biology 1-3 s.h.
Training and practical experiences in the teaching of biology; includes a weekly training session with a PhD 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 2 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. Requirements: concurrent enrollment in BIOL:4999 or BIOL:3994 or HONR:3994 or URES:3994; or working in a research laboratory as a volunteer or paid research assistant for the semester enrolled.

BIOL:4995 Honors Research in Neuroscience arr.
Independent scientific research related to the field of neuroscience. Requirements: honors standing in neuroscience, UI GPA of at least 3.33, and neuroscience GPA of at least 3.33. Same as PSY:4995.

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

BIOL:4999 Honors Research in Biology arr.
Independent scientific research related to the field of biology. Requirements: honors standing in biology, UI GPA of at least 3.33, and biology GPA of at least 3.33.

BIOL:5110 Practicum: College Teaching for Biology Teaching Assistants 2 s.h.
Practical pedagogical concerns including how to structure a course, devise learning outcomes, development of syllabus and calendar of assignments, evaluation of student work, and creation of a student-centered classroom with collaborative learning experiences; for biology TAs teaching in introductory courses BIOL:1411 and BIOL:1412.

BIOL:5172 Evolution - Graduate Lecture 3 s.h.

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; immunochemistry and stereology techniques; individualized laboratory instruction. Prerequisites: BIOL:2723. Same as ACB:5218, MICR:5218.

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

BIOL:5472 Foundations of Evolutionary Theory 3 s.h.
Advanced study of the underpinnings of modern evolutionary theory through readings, lectures, and discussions. Topics begin with pre-Darwinian conceptions of evolution and the transformative idea of evolution by natural selection. From there, topics may include the modern synthesis of genetics with evolution, evolutionary development, the evolution of sex, and/or evolutionary genomics. For all topics, there is a dual focus both on reinforcing conceptual knowledge of evolutionary topics and learning the important history of the field.

BIOL:5512 Readings in Genetics 2 s.h.
Critical evaluation of classic genetics papers. Requirements: biology graduate standing.

BIOL:5653 Fundamental Neurobiology I 3 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; focus on systems and developmental neurobiology; first in a two-semester sequence. Same as NSCI:5653, PSY:5203.

BIOL:5654 Fundamental Neurobiology II 3 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; focus on molecular-cellular neurobiology and neurophysiology; second in a two-semester sequence. Prerequisites: BIOL:5653 or NSCI:5653 or PSY:5203. Same as NSCI:5654, PSY:5205.

BIOL:5658 Fundamental Neurobiology I Discussion 2 s.h.
Discussion of selected papers, including classics from neurobiology literature; coordinated with BIOL:5653 lecture material. Same as NSCI:5658, PSY:5204.

BIOL:5659 Fundamental Neurobiology II Discussion 2 s.h.
Discussion of selected papers, including classics from neurobiology literature; coordinated with BIOL:5654 lecture material. Same as NSCI:5659, PSY:5206.

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.