

# Biology

## Chair

Tina L. Tootle

**Undergraduate majors:** biology (BA, BS); biomedical sciences (BS); neuroscience (BS)

**Undergraduate minor:** biology

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

**Faculty:** <https://biology.uiowa.edu/people/faculty>

**Website:** <https://biology.uiowa.edu/>

## Courses

### 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:1261 Introduction to Botany; BIOL:1370 Understanding Evolution.

#### **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.

Origin of the universe, the biochemistry of life, and the origin of life on Earth; for non-science majors. Recommendations: first-year or sophomore standing. GE: Natural Sciences without Lab. Same as ASTR:1060, SEES:1060.

#### **BIOL:1140 Human Biology: Nonmajors** 4 s.h.

Overview of molecular and cellular basis of human life; structure, function of human tissues, organs, organ systems; evolution, reproduction, genetics, impact of molecular biology and genetic engineering; integration of humans and the biosphere; lecture, laboratory. GE: Natural Sciences with Lab.

#### **BIOL:1141 Human Biology: Health Professions** 4 s.h.

Molecular and cellular basis of human life; structure, function of human tissues, organs, organ systems; evolution, reproduction, genetics, impact of molecular biology and genetic engineering; integration of humans and the biosphere; lecture, laboratory. 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: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: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:1120 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. GE: Natural Sciences without Lab.

#### **BIOL:2246 Entomology Lab** 4 s.h.

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.

#### **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:2400 or HHP:3500 or PSY:2701). Recommendations: CHEM:2210.

#### **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: SEES:1020 or BIOL:1412 or BIOL:1261 or BIOL:1370 or BIOL:1141. Same as SEES: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 CHEM:1110. Recommendations: CHEM:2210.
- BIOL:2663 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:1411 and BIOL:1412.
- 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. Recommendations: a basic statistics or calculus course. Same as SEES:2673.
- BIOL:2723 Cell Biology** 3 s.h.  
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:2400 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:2400 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: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).
- BIOL:3212 Bioinformatics for Beginners** 3 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:2512 or BMB:3120 or MICR:3170. Same as IGPI:3212.
- 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:2400 with a minimum grade of C- or HHP:3500 with a minimum grade of C-). Recommendations: BIOL:2512.
- BIOL:3244 Animal Behavior** 3 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 HHP:2400 or PSY:2701).
- BIOL:3245 Animal Behavior Laboratory** 4 s.h.  
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 or HHP:2400).
- BIOL:3253 Neurobiology I** 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; focus on systems and developmental neurobiology; first in a two-semester sequence. Prerequisites: BIOL:1411 and (PSY:2701 or BIOL:2753).
- BIOL:3254 Neurobiology II** 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; focus on molecular/cellular neurobiology and neurophysiology; second in a two-semester sequence. Prerequisites: BIOL:3253 and (PHYS:1512 or PHYS:1612).
- BIOL:3314 Genomics** 3 s.h.  
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:2512 or BIOL:2723 or MICR:3170). Same as IGPI:3314.
- BIOL:3343 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: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:1412.
- 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-.
- 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:2400 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 or BIOL:4123.

- 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. 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.  
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, if not taken as a prerequisite. Recommendations: 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: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:4123 Cell Biology of the Nervous System** 3 s.h.  
Cell biology of each participant in the nervous system. Topics include how failures in cell function lead to neurological conditions such as Alzheimer's disease or Amyotrophic Lateral Sclerosis. Enhance critical thinking skills while building foundational knowledge of cell biology. Prerequisites: BIOL:1411 and (BIOL:1412 or HHP:2400 or HHP:3500 or PSY:2701).
- 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 approach (practical 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: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:4355 Neuroimmunology** 3 s.h.  
Interactions of neuroscience and immunology during development, homeostasis, injury, and disease. Prerequisites: BIOL:3253.
- 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: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** 1-2 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: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.  
Nature, evidence, analysis, implications, molecular/genetic basis; historical record, phylogeny, speciation, adaptation, investigative methods.
- BIOL:5199 Critical Readings in Biology** arr.
- BIOL:5312 Critical Analysis of Biological Research: Concepts, Methods, and Interpretation** 2 s.h.  
Develop fundamental skills in reading, summarizing, critiquing, and extrapolating from the primary literature; gain facility in reading and understanding topics in various disciplines across the field of biology.
- BIOL:5412 Fundamental Genetics: Graduate Lecture** 3 s.h.  
Nature and function of genetic material; classical, molecular, and developmental aspects. Corequisites: BIOL:5512.
- 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:5713 Molecular Genetics for Graduate Students** 4 s.h.  
Mechanism, regulation of ribonucleic acid (RNA), DNA, protein biosynthesis, with emphasis on methods of genetic analysis; application of modern recombinant DNA techniques to basic problems.
- 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.
- BIOL:6298 Concepts, Models, and Systems in Biology (COSMOS) Seminar I** 1 s.h.  
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:6299 Concepts, Models, and Systems in Biology (COSMOS) Seminar II** 2 s.h.  
Presentation of primary research and conceptual frameworks surrounding central biological questions across biological disciplines, drawing from a wide range of concepts and analytical approaches; development of effective skills in public speaking, presentation, and analysis of scientific literature.
- 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.