Biology

The Master of Arts in Biology program helps students update and deepen their knowledge of the biomedical sciences, prepare for employment in related fields, and advance their professional standing — while obtaining a graduate science degree on a part-time basis through evening, weekend, and online courses.

Designed to be adaptable to each individual's unique background and goals, the program provides a flexible curriculum and close individual advising for each student. Students include science and health professionals, teachers, technicians, and individuals in biology-related businesses.

Students in this program have the option of choosing a concentration in neurobiology for deeper, more focused study.

Contact: Ian Duncan
Phone: 314-935-6719
Email: duncan@wustl.edu
Website: http://ucollege.wustl.edu/programs/graduate/masters-biology

Degree Requirements

Master of Arts in Biology

Students seeking the Master of Arts in Biology must satisfactorily complete 30 units of graduate courses in the biological sciences, including a required capstone experience (http://ucollege.wustl.edu/programs/graduate/masters-biology/final-project) of either:

1. a 3-unit capstone course or
2. a 6-unit master's thesis.

Students have considerable freedom in selecting courses that match their own interests. Students must have completed a minimum of 24 units in order to be eligible for a capstone experience. Students with appropriate backgrounds, interests, and academic qualifications may, with authorization, write a master's thesis based on original library or laboratory research.

All students admitted to the Master of Arts in Biology are required to take at least 50 percent of the 30 units of courses required (i.e., 15 units) to complete the degree on the Washington University campus.

Optional Concentration for the AM in Biology

The optional concentration requires 12 units of courses as specified below. University College students who are admitted to the AM in Biology may select the optional concentration noted below.

Neurobiology — the study of the structure and function of the nervous system; helps prepare students for careers in biomedical fields, including research and clinical practice in medicine, neuroscience, and cognitive science.

Required:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>Bio 435</td>
<td>Neurobiology</td>
<td>3</td>
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Electives: Choose three

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>Bio 436</td>
<td>The Neural Basis of Behavior</td>
<td>3</td>
</tr>
<tr>
<td>Bio 4721</td>
<td>The Biology of Membranes</td>
<td>3</td>
</tr>
<tr>
<td>Bio 478</td>
<td>Neuroscience: Sensory Systems</td>
<td>3</td>
</tr>
<tr>
<td>Bio 4780</td>
<td>Genes, Brains and Behavior</td>
<td>3</td>
</tr>
<tr>
<td>Bio 485</td>
<td>Synaptic Function and Plasticity in the Nervous System</td>
<td>3</td>
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Credit Transfer

A maximum of 6 credits of related and comparable graduate-level courses may be transferred from another university or from a related graduate program at Washington University with the approval of the program director. These must be graduate-level units not used to fulfill undergraduate degree requirements. Transfer credit may be granted only for authorized courses for which the student received a grade of B or higher.

Please note that the AM in Biology degree is a terminal graduate degree awarded on the basis of completion of courses rather than research. Except in rare cases, it is not intended as preparation for a PhD degree. No more than 6 of the 30 credits may be earned in research courses. Those interested in graduate research or in earning a PhD should apply to the PhD programs offered by Washington University's Division of Biology and Biomedical Sciences (http://dbbs.wustl.edu).

Courses


U29 Bio 500 Independent Study

An independent research project under the supervision of a member of the Biology faculty. Open only to students admitted to the graduate program in Biology. Approved proposal must be presented at the time of registration. For more information, contact the assistant dean for Graduate Programs at 314-935-6700. Credit variable, maximum 3 units.

U29 Bio 5012 Human Anatomy and Development

Study of the human body primarily by dissection; extensive use of X-rays and CT scans. Emphasis on functional and clinical aspects of anatomy. Prerequisite: This course is restricted to first year medical students. Same as L48 Anthro 502 and M05 Neurosci 501A. Same as L41 Biol 501
U29 Bio 5061 Cell Biology
Eukaryotic cell structure and function viewed from the perspective of modern cell biology. Lectures cover such topics as membrane transport, endocytosis and secretion, intracellular trafficking, hormones and signal transduction, extracellular matrix and tissue formation, cytokinase and motility, cell cycle, apoptosis, and the cellular basis of disease. Prerequisite: Bio 2970.
Same as L41 Biol 334
Credit 3 units. A&S IQ: NSM Arch: NSM BU: SCI

U29 Bio 509 Chemistry for Biology Teachers
A strong connection exists between biology and chemistry. It is important to study the properties and interactions of chemicals within living organisms. This on-line course will emphasize those areas of contemporary biology that involve complex molecular structures and interactions that require knowledge of chemical and biochemical principles including bonding and molecular structure in important biological molecules, chemical reactions for biological processes such as respiration and photosynthesis and cellular energy conversions. The course will consist of online tutorials with animations, facilitated online discussions and the use of hands-on materials. Students will develop their knowledge by utilizing technological tools such as online molecular databases and molecular visualization software. The goal of the course is for teachers to explore topics with a global societal impact, such as pharmaceutical development, bioenergy sources, nutrition, the role of biomolecules in diseases and genetic testing.
Credit 3 units. UColl: OLI

U29 Bio 521 Program Capstone I
This is a 1.5-credit course intended as an extension of the three 2-credit content courses completed in year one of the MS degree program in biology. The course will include applications of advanced-level life science content to the teachers’ local biological setting. The course will also include applications of new content to teachers’ classroom setting. The instructional format will be project-based and delivered using an online learning environment. Students will be expected to conduct action research on a topic relevant to life science learning in their classrooms. Admission in the course is contingent upon admission in the graduate program. Online, for Summer Institute Teachers only.
Credit 1.5 units. UColl: OLI

U29 Bio 523 Plants and People
This course provides a rigorous introduction to plant sciences and biotechnology, including basic plant biology, photosynthesis, energy capture, and agriculture. The course will also cover such applied topics as genetically modified plants, conservation, plant-derived medicines, and food and nutrition in the developing world. Closed registration — for participants in the NSF Institute Master’s in Biology program or by permission of the associate director of the Institute for School Partnership.
Credit 2 units.

U29 Bio 527 Molecular Biology of Plant-Pathogen Interactions
This course will focus on the molecular interactions between plant pathogens and their hosts. The genetics and molecular dissection of plant defense pathways and pathogen virulence strategies will be explored. The molecular and biochemical interactions between plant pathogens and their hosts will be emphasized.
Credit 3 units.

U29 Bio 5285 Fundamentals of Mammalian Genetics
This course aims to provide both biologists and those with mathematical backgrounds with a basis in mammalian genetics. The course will include the following modules: nucleic acid biochemistry; gene and chromosome organization; introduction to human genetics; mutations and DNA repair; cancer genetics; genomic methodologies; biochemical genetics; murine genetics; epigenetics; neurodegenerative diseases; mitochondrial disorders; pharmacogenetics; introduction to human population genetics; applications of modern human genetics; introduction to web-based informatics tools for molecular genetics. One of the required courses in the Quantitative Human Statistical Genetics Graduate program.
Same as L41 Biol 5285
Credit 3 units.

U29 Bio 529 Case Studies in Biology
A prerequisite to critical scientific thinking is seeking reliable knowledge. Many people are fooled by pseudoscientific claims in the popular press. Case study learning humanizes the study of biology and makes science relevant to current events. This course will use an online format to present biology-based case studies that will prompt teachers to make critical assessments of scientific information. Course methods will model and scaffold the development of both teachers’ and students’ skills in group learning, critical thinking, and research techniques. This is a course for NSF Institute fellows only.
Credit 3 units.

U29 Bio 5319 Molecular Foundations of Medicine
This course will cover fundamental aspects of biochemistry and cell biology from a medical perspective. The course begins with a treatment of protein structure and the function of proteins in the cytoskeleton and cell motility. The principles of enzyme kinetics and regulation are then discussed, and basic pathways for the synthesis and metabolism of carbohydrates and lipids are introduced. This leads in to a discussion of membrane structure and the function cellular organelles in biological processes including energy production, protein degradation, and protein trafficking. Prerequisite: two semesters of organic chemistry.
Course director approval is required. Please note: This course is given on the medical school schedule, so it begins eight days before the graduate school schedule.
Same as L41 Biol 5319
Credit 3 units.

U29 Bio 5322 Anatomy and Physiology
On-line course; for MS in Biology Teachers only.
Credit 3 units. UColl: OLI

U29 Bio 552 Human Genetics and Cytogenetics
Human or medical genetics is one of the most rapidly advancing fields of science and is now integral to all aspects of biomedical science. This course provides a genetic perspective on the function of the human body in health and disease. Beginning with a study of chromosomes and the disorders that result from their aberrations, the course presents the theoretical background
necessary for a deeper understanding of the emerging impact of human genetics on biology. Topics include chromosomal basis of heredity, autosomal and sex chromosomal abnormalities, and cancer genetics. Students will be introduced to the specific molecular and cytogenetic techniques that have revolutionized the study of human genetics.

Credit 3 units.

**U29 Bio 563 Bio Applications of Biology to Global Health Issues**
Knowledge of biological processes can contribute to the health of individuals and ecological systems. This course will explore the linkages between biological concepts in the high school curriculum and contemporary problems confronting the health of the human population. For example, the course will address biological concepts relating to issues such as: antibiotic resistant bacteria, avian flu virus, SARS, HIV, among others. This is a course for NSF Institute fellows only. This course is fully online.

Credit 3 units.

**U29 Bio 577 Program Capstone I**
This is a 3-credit course intended as an extension of the three 2-credit courses completed in year one of the MS degree program in biology. The course will include applications of advanced-level life science content to the teachers’ local biological setting. The course will also include applications of new content to teachers’ classroom setting. The instructional format will be project-based and delivered using an online learning environment. Students will be expected to conduct action research on a topic relevant to life science learning in their classrooms. Admission in the course is contingent upon admission in the graduate program. Online course.

Credit 3 units.

**U29 Bio 5771 Program Capstone II**
This is a 1.5-credit course intended as an extension of the three 2-credit content courses completed in year two of the MS degree program in biology. The course will include 1) applications of advanced-level life science content to the teachers’ local biological setting, 2) applications of new content to teachers’ classroom setting, and 3) implementation of a leadership project at the teachers’ local setting. The instructional format will be project-based and delivered using an online learning environment. Students will be expected to conduct research on the implementation of their leadership plan. Admission in the course is contingent upon admission in the graduate program. For Summer Institute Teachers only.

Credit 1.5 units. UColl: OLI

**U29 Bio 579 Laboratory Investigations in Model Organisms**
Many of the biological functions and structures in organisms are similar. However, specific structures/functions are more visible in some organisms than others. Because of this it is often easier to study a particular organism as a model of biological processes. Information gained through study of a model organism can then be generalized to other organisms. The purpose of this course is to introduce biology teachers to these organisms and to have them learn how to culture and care for them. Second, we will design and conduct experiments using these organisms with an end goal of designing classroom investigations the teachers can use with their students. This is an online course. Admission to this course is open to those teachers in the NSF-funded teacher institute.

Credit 3 units.

**U29 Bio 580 MA Capstone: Topics in the Biological Dimensions of Climate Change**
Life and climate are intimately related. Today, human activities have stressed this relationship, posing serious risks for the near future. Accurately forecasting these risks relies on understanding how life and climate have changed together during Earth’s history. This course provides an interdisciplinary investigation of Earth’s major developments starting with the climatic conditions for life’s origins. We will proceed chronologically through a series of topics covering metabolism, development, physiology, biogeography, and human origins along with their climatological causes and effects. For each topic, we discuss related physical, chemical, ecological, and evolutionary principles based on readings from both primary and popular scientific sources. The course culminates in a comprehensive biological evaluation of contemporary proposals to mitigate or adapt to human-caused climate change. At the conclusion of the course, students should be able to effectively discuss biological aspects of climate change and their implications for society.

Credit 3 units.

**U29 Bio 5925 Matter and Energy Transformations**
Using the processes of photosynthesis and respiration as fundamental models, this course will examine energy transformations occurring within organisms and between communities of organisms and their abiotic environment. Topics will include the observations and measurement of energy transformation in living organisms and abiotic fuel cells; the effect of burning fossil fuels on the health of local environments and global warming; and, the effect of alternative fuel options on global environment and health. This is a course for NSF-Summer Institute fellows only.

Credit 3 units.