Biology

Degrees Offered

- Master of Science
- Doctor of Philosophy

Nature of the Program

The Department of Biology’s graduate program is dedicated to scholarship in academics and research. The objectives of the program are to empower students through the following:

1. Recognize important biological problems
2. Design, execute, and analyze experiments aimed at solving important problems
3. Communicate their findings in oral and written form
4. Foster an awareness of the social and political issues of the day related to biology
5. Create a desire to continue independent study after graduation

The Department of Biology offers graduate courses and research that lead to M.S. and Ph.D. degrees in biology. The focal areas of research in the graduate program are: plant sciences, biochemistry and molecular biology, bioinformatics, genetics, genomics and evolutionary biology, cell and developmental biology, ecology, forensic biology, neuroanatomy and neurophysiology and behavioral neurobiology.

FACULTY

CHAIRPERSON

- Jennifer Hawkins - Ph.D. (Iowa State University)

ASSOCIATE CHAIR

- Andrew Dacks - Ph.D. (University of Arizona)
  Associate Chair for Graduate Studies
- Dana Huebert Lima - Ph.D. (University of Wisconsin-Madison)
  Associate Chair for Undergraduate Advising, Recruitment, and Retention
- Stephanie Young - Ph.D. (West Virginia University)
  Associate Chair for Undergraduate Studies

PROFESSORS

- Ashok Bidwai - Ph.D. (Utah State University)
  Biochemical and molecular genetic analysis of protein kinases
- Kevin C. Daly - Ph.D. (University of Arizona)
  Sensory motor integration and behavior
- William Peterjohn - Ph.D. (Duke University)
- Rita V.M. Rio - Ph.D. (Yale University)
  Evolution of symbiosis
  - Richard B. Thomas - Ph.D. (Clemson University)
  Physiological plant ecology, global environmental change

ASSOCIATE PROFESSOR

- Edward Brzostek - Ph.D. (Boston University)
  Forest ecology, ecosystem modeling
- Andrew M. Dacks - Ph.D. (University of Arizona)
  Neural basis of behavior states, nervous system evolution
- Sarah M. Farris - Ph.D. (University of Illinois)
  Nervous system evolution and development, entomology
- Jennifer Gallagher - Ph.D. (Yale University)
  Yeast genetics, stress response, systems biology
- Jennifer Hawkins - Ph.D. (Iowa State University)
  Plant comparative genomics, Molecular evolution.
• Gary Marsat - Ph.D. (McGill University)
  Sensory processing of communication signals, systems neuroscience, computational neuroscience

ASSISTANT PROFESSOR
• Loren Albert - Ph.D. (University of Arizona)
  Plant ecophysiology and near-surface remote sensing
• Craig Barrett - PhD The Ohio State University
  Plant evolutionary biology
• Sadie Bergeron - Ph.D. (University of Massachusetts - Amherst)
  Developmental neuroscience
• Timothy Driscoll - Ph.D. (Virginia Tech)
  Bioinformatics, microbial metagenomics
• Eric Horstick - Ph.D. (University of Michigan)
  Developmental genetics, neuroscience, behavioral genetics

SERVICE PROFESSOR
• Donna Ford-Werntz - Ph.D. (Washington University, St. Louis)
  Plant systematics

SERVICE ASSOCIATE PROFESSOR
• Zachariah Fowler - Ph.D (West Virginia University)
  Forest ecology

Admissions

THE M.S. AND PH.D. IN BIOLOGY

The Biology program admits students directly to either the master's or doctoral degree programs. In addition to WVU's general admission requirements (http://catalog.wvu.edu/graduate/graduateeducationatwestvirginiauniversity/#classificationtext), applicants for graduate studies in biology must have a bachelor's degree, and should possess an adequate background in science and mathematics.

Admission into the Biology program is competitive with decisions based, in part, on materials contained in an applicant's curriculum vitae and statement of purpose. Applicants must submit a current curriculum vitae or resume (no more than two pages) that lists work experience, research experience, volunteer activities, internships, academic degrees and honors, and other accomplishments you feel the admissions committee should take into account in reviewing your application. The statement of purpose should be a thoughtful essay (no more than two pages) that: demonstrates a strong interest in scientific research; describes what the applicant hopes to gain from the Biology program; explains why WVU offers the best opportunity for achieving the applicant’s future professional goals; and addresses the match between the stated research interests and those of specific faculty in our department who may serve as their academic mentors. Information regarding faculty and their research interest can be found here (https://biology.wvu.edu/faculty-and-staff/).

Applicants should identify and are encouraged to contact at least one or more member(s) of our faculty who could act as their prospective advisor. Information regarding faculty and their research interests can be found here (https://biology.wvu.edu/faculty-and-staff/).

Acceptance into the Ph.D. or the M.S. program is by vote of the Graduate Committee of the Department of Biology. This committee ensures that all entrance requirements are met or that provisions have been made to remedy the deficiencies. It also ensures that the facilities and personnel needed to successfully complete the degree are adequate. If after reviewing all the application materials there is no faculty member willing to serve as the applicant's academic advisor, then the potential student will not be accepted into the program. Therefore, we recommend that applicants identify a member of our faculty who can provide them with the research training they seek and communicate with them directly to determine if they are taking any new students and whether they might be interested in serving as the applicant’s advisor.

List of Admission Requirements:
• See the steps to apply for admissions and access the application here (https://graduateadmissions.wvu.edu/how-to-apply/)
• Applicants must submit transcripts from all institutions attended
• Three letters of recommendation, written by people (typically faculty) in a position to evaluate your academic strengths and abilities
• Curriculum Vitae
• Statement of purpose
• GRE Scores are not required for the application or admission to the WVU Biology graduate programs, but will be considered if they are provided
International Applicants:
• See the steps to apply for admissions and access the application here (https://graduateadmissions.wvu.edu/how-to-apply/)
• International applications should view additional requirements here (http://catalog.wvu.edu/graduate/graduateeducationatwestvirginiauniversity/#internationaltext) and here (https://graduateadmissions.wvu.edu/information-for/international-students/)
• Language proficiency is required in order to hold a graduate teaching assistantship. See here (https://elli.wvu.edu/testing-resources/english-proficiency-gtas/).

Application Deadlines:
• The Biology graduate programs admit students to the Fall, Spring, or Summer terms
• The priority review deadline for all application materials is January 1st for Summer or Fall admission
• The priority review deadline for all application materials is October 1st for Spring admission
• All applications received by the deadlines will be considered for financial support in the form of a graduate teaching assistantship (GTA).
• Application materials submitted after the deadlines may be considered on a space-available basis and may also be considered for financial support in the form of a graduate teaching assistantship (GTA).
• Exceptional Ph.D. applicants may be nominated by the Biology program for competitive University Fellowships. Applicants who wish to be considered should submit a completed application no later than December 1st. Qualified applicants will be notified if they are nominated. More information on WVU fellowships can be found here (https://graduateeducation.wvu.edu/fellowships/).

Certain application requirements may be waived based on a preliminary review of an application by the program.

Admission Requirements 2023-2024
The Admission Requirements above will be the same for the 2023-2024 Academic Year.

M.S. and Ph.D. Major Code: 1436

For specific information on the following program, please see the link to the right:
• Biology, M.S.

For specific information on the following program, please see the link to the right:
• Biology, Ph.D.

Degree Progress
MASTER’S BENCHMARKS
• Progress toward completion: Year 1: Formation of an Advisory Committee and complete the Program of Study. Year 2: submit written Thesis and perform an oral defense. At the beginning of each academic year, students are evaluated by the department to insure timely progress in their degree programs.
• Additional Requirements: Students must have a program of study formulated and approved by an Advisory Committee at the end of the second semester of entering the M.S. program. The program of study outlines the coursework to be taken in support of the proposed research. The advisory committee ensures that all of the Department of Biology, Eberly College of Arts and Sciences, and University requirements are met during the course of the student’s program of study.

DOCTORAL BENCHMARKS
At the beginning of each academic year, students are evaluated by the department to insure timely progress in their degree programs. Students must adhere to the following timeline:
• Year 1: Form a committee and present the program of study.
• Year 2: Complete the Comprehensive and Proposal exams.
• Year 3: Conduct dissertation research.
• Year 4: Submit Written Dissertation and present Oral Dissertation Defense.

COURSES
BIOL 548. Introduction to Cellular and Molecular Neuroscience. 3 Hours.
PR: Consent. An advanced course that synthesizes topics such as gene regulation, cell signaling and neural network structure into a comprehensive picture of the cellular basis of nervous system function.
**Biology**

**BIOL 550. Phylogenetics and Comparative Biology. 3 Hours.**
PR: This course requires the equivalent of one semester of coursework in evolutionary biology (BIOL 320, GEOL 331, BIOL 461, BIOL 464, BIOL 420, or BIOL 455), ecology (BIOL 321, BIOL 448, BIOL 456, BIOL 457, BIOL 462, BIOL 463), and/or statistical analysis (BIOL 430). This course is an in-depth exploration of the philosophy, theory, methods, and applications of phylogenetic analysis, which is the basis for all comparative biology. Topics covered include character homology assessment, phylogenetic reconstruction, divergence time estimation, trait evolution, and recent advances in phylogenomics.

**BIOL 576. Computational Neuroscience. 4 Hours.**
PR: Consent. This course focuses on the tools and concepts used to probe and characterize the dynamics of neurons, neural networks and neural coding mechanisms. Lectures introducing concepts and discussion sessions of the current research literature complement computer laboratories where the student learns programing skills, analytical tools and neural modeling methods used in computational neuroscience research.

**BIOL 577. Central Nervous System Evolution and Development. 3 Hours.**
PR: BIOL 219 and BIOL 348 or equivalent. Origin and evolution of the animal nervous system, focusing on developmental and genetic mechanisms underlying structural modifications that serve as the basis for the evolution of behavioral repertoires.

**BIOL 579. Principles of Systems Neuroscience. 3 Hours.**
PR: BIOL 348 or Consent. Fundamental principles of nervous system organization with an emphasis on interactions between neurons and the consequences for behavior. There will be a focus on recent advances in our understanding of each organizational principle.

**BIOL 591. Advanced Topics. 1-6 Hours.**
PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.

**BIOL 593. Special Topics. 6 Hours.**
A study of contemporary topics selected from recent developments in the field.

**BIOL 611. Epigenetics. 3 Hours.**
Explores the molecular mechanisms, phenotypic phenomena and current application of epigenetics and the study of how genetic information is regulated and maintained. Students may not earn credit for both BIOL 415 and BIOL 611.

**BIOL 615. Microbial Symbiosis. 3 Hours.**
Molecular techniques used towards identifying the composition, structure and functions of microbial communities in various ecological contexts will be discussed. An understanding of the significance of microbial symbioses towards ecological and health processes will be developed. (Also listed as BIOL 456.)

**BIOL 620. Genomics. 3 Hours.**
PR: BIOL 219 or consent. Advanced elective examining biology and evolution on a genome-wide scale. Topics include fields of study and methods of DNA sequence acquisition and annotation, including exploration of the human genome and its contribution to disease discovery.

**BIOL 651. Evolution of Infectious Diseases. 3 Hours.**
The application of phylogenetics, microbiology, immunology, and epidemiology towards comprehending the evolution of infectious diseases. Students will develop a fundamental understanding of the significance of evolution and ecology towards infectious disease emergence and control.

**BIOL 658. Systems Biology. 3 Hours.**
PR: Consent. Systems Biology is an approach to understanding the dynamics of biological processes by integrating and assessing changes in and across networks. Technologies driving this approach include genome-wide sequencing of DNA and RNA, measurements of genome-protein interactions, and measurement of proteome levels and post-translational protein modifications.

**BIOL 681. Research Project Development. 1 Hour.**
This course provides graduate students with guidance on the creation and presentation of their Program of Study, which is the first benchmark to be met for a graduate degree in Biology at WVU. The program of study details the background and broad goals of a thesis research project and is used to determine personalized course load.

**BIOL 690. Teaching Practicum. 1-3 Hours.**
PR: Consent. Supervised practice in college teaching of biology. Note: This course is intended to insure that graduate assistants are adequately prepared and supervised when they are given college teaching responsibility. It also provides a mechanism for students not on assistantships to gain teaching experience. (Grading will be S/U.)

**BIOL 691. Advanced Topics. 1-6 Hours.**
PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.

**BIOL 692. Directed Study. 1-6 Hours.**
Directed study, reading, and/or research.

**BIOL 693. Special Topics. 1-6 Hours.**
A study of contemporary topics selected from recent developments in the field.

**BIOL 695. Independent Study. 1-9 Hours.**
Faculty supervised study of topics not available through regular course offerings.
BIOL 697. Research. 1-9 Hours.
PR: Consent. Research activities leading to thesis, problem report, research paper or equivalent scholarly project, or a dissertation. (Grading may be S/U.).

BIOL 698. Thesis or Dissertation. 1-6 Hours.
PR: Consent. This is an optional course for programs that wish to provide formal supervision during the writing of student reports (698), or dissertations (798). Grading is normal.

BIOL 715. Extracellular Matrix in Cell Signaling. 3 Hours.
The course emphasizes the fundamental role that the extracellular matrix plays in the process of morphogenesis, differentiation, development and maintenance of the differentiated state.

BIOL 737. Developmental Biology. 3 Hours.
PR: BIOL 336 or equiv., organic chemistry or biochemistry, or consent. The molecular and cellular basis of differentiation and morphogenesis. (Offered in fall of odd years.).

BIOL 752. Physiological Plant Ecology. 3 Hours.
PR: BIOL 350 and consent. Advanced studies on the interactions between plants and their environment focusing on whole-plant carbon exchange, water relations, and nutrient uptake, with reference to specific biomes.

BIOL 753. Water and Nutrient Relations of Plants. 3 Hours.
PR: BIOL 350 and consent. Advanced studies on water and nutrient acquisition, use, and transformation in plants with focus on plant-soil interactions, symbiotic associations, and acclimation and adaption mechanisms operating in plants.

BIOL 761. Ecosystem Dynamics. 3 Hours.
PR: Consent. A survey of our current understanding of the biogeochemistry that occurs at and near the surface of the Earth. Emphasis is placed on the biogeochemical cycles of carbon, nitrogen, phosphorus, and sulfur. The origin and dynamics of the atmosphere, lithosphere and hydrosphere are also considered. (Offered in even-numbered years).

BIOL 762. Plant Population Biology. 3 Hours.
PR: Graduate status or undergraduate status with the completion of BIOL 221 and the instructor's permit. Plant population biology examines the interplay of ecological theory and the real world of experimental ecology of natural populations using a case study approach. Each student will research a current topic in greater depth.

BIOL 790. Teaching Practicum. 1-3 Hours.
PR: Consent. Supervised practice in college teaching of biology. Note: This course is intended to insure that graduate assistants are adequately prepared and supervised when they are given college teaching responsibility. It will also present a mechanism for students not on assistantships to gain teaching experience. (Grading will be S/U.).

BIOL 791. Advanced Topics. 1-6 Hours.
PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.

BIOL 792. Directed Study. 1-6 Hours.
Directed study, reading, and/or research.

BIOL 793. Special Topics. 1-6 Hours.
A study of contemporary topics selected from recent developments in the field.

BIOL 794. Seminar. 1-6 Hours.
Special seminars arranged for advanced graduate students.

BIOL 795. Independent Study. 1-9 Hours.
Faculty supervised study of topics not available through regular course offerings.

BIOL 796. Graduate Seminar. 1-3 Hours.
PR: Consent. Each graduate student will present at least one seminar to the assembled faculty and graduate student body of his or her program.

BIOL 797. Research. 1-9 Hours.
PR: Consent. Research activities leading to thesis, problem report, research paper, or equivalent scholarly project, or a dissertation. (Grading may be S/U.).

BIOL 930. Professional Development. 1-6 Hours.
Professional development courses provide skill renewal or enhancement in a professional field or content area (e.g., education, community health, geology.) These tuition-waived continuing education courses are graded on a pass or fail grading scale and do not apply as graduate credit toward a degree program.