

BIOLOGY

biology.as.miami.edu

Dept. Code: BIL

Degree Programs

Application for Admission

Applications are due December 1.

In applying for admission, applicants must select either the *Master's* or the *Ph.D.* track.

Students with an appropriate B.S. degree or B.A. may seek direct entry to either the M.S. track or the Ph.D. track.

Applicants who were admitted on the Master's track, but wish to change to a Ph.D. track without completing the Master's may apply for admission to the Ph.D. program before the end of their second semester. Letters of support from three UM Biology faculty, including a major advisor, should be added to the applicant's file. The file must be current. Such applicants will be judged by the same criteria that are applied to other Ph.D. applicants.

Applicants to the Ph.D. track who were admitted on the Master's track and wish to complete the M.S. degree, should follow the same procedures as all other applicants, but they must include letters of support from three UM Biology faculty. Such applicants will be judged by the same criteria that are applied to other Ph.D. applicants.

Applicants must:

1. Apply online (<https://www.applyweb.com/miamigrd/>) at the UM Graduate School. Application fee of \$85.
2. Send hardcopies of the following to the Coordinator of Graduate Studies in Biology, Department of Biology, 1301 Memorial Drive, Coral Gables, FL 33146 USA.
 - a. Originals of all undergraduate and graduate official transcripts (photocopies are not accepted)
 - b. International applicants whose native language is not English must additionally submit the TOEFL (Test of English as a Foreign Language) official scores (photocopies of scores are not accepted)
3. Send digital copies of the following to the Coordinator of Graduate Studies in Biology (bio.gradcoord@miami.edu)
 - a. A cover letter that identifies interests, suggests possible research projects, states career goals and identifies a UM Biology faculty sponsor
 - b. Copies of any research papers (e.g., publications, manuscripts, senior reports, etc.)
4. Letters of recommendation from **three** science instructors/ supervisors that address: nature and duration of relationship to applicant; motivation; ability to conceptualize and deal quantitatively with biological problems, and research potential should be sent by email to the Coordinator of Graduate Studies in Biology at bio.gradcoord@miami.edu
5. Request UM Biology faculty sponsor submit a memo of support by email to the Coordinator of Graduate Studies in Biology (bio.gradcoord@miami.edu). Applicants **MUST** secure the sponsorship of a faculty member as a condition for admission; the research interests of the applicant and the faculty sponsor should be well-matched; the sponsor will be the major advisor.

A limited number of applicants to the Ph.D. program may be invited to interview at departmental expense in early January of the year of admission.

Materials submitted in support of an application cannot be released for other purposes or returned to the applicant.

Degree Requirements

All students are required to satisfy **the general requirements** for the appropriate degree that are listed in the **Graduate Studies Bulletin**, whether or not they are listed among the Biology requirements.

Implementation

All Graduate students will be reviewed each spring semester by GAAC.

1. The advisor will review the student's progress to date.
2. The student will provide updates for a student progress database every February.
3. The student will provide written evidence that the advisor and committee have reviewed her/his progress and plans.
4. Each student will receive a letter summarizing the results of the discussion concerning his/her progress.
5. All graduate students shall have the right to respond to GAAC, and, if necessary, the graduate faculty in matters pertaining to the review.
6. Possible outcomes of the review:

- a. Student making satisfactory progress
- b. Student not making satisfactory progress; recommendations for improvement
- c. Student not making satisfactory progress; his/her tenure terminated.

Financial Support

1. The Department intends to support all doctoral students in good standing for up to 10 semesters. Support beyond 10 semesters is contingent upon GAAC approval.
2. Master's degree students usually are not eligible for departmental stipends or tuition remission.
3. Students who do not provide annual updates for the student progress database will not be eligible for continued funding. Students who will be off-campus are still responsible for making sure that GAAC receives the data. Students who choose not to present at the annual departmental graduate student symposium may be considered as not in good standing.
4. Students holding full fellowships or research assistantships will not normally be given teaching assignments, nor will students be permitted to hold fellowships and research assistantships simultaneously. Exceptions require GAAC approval.

Masters Programs in Biology

- M.S. in Biology with Thesis (Three Year Program) (<http://bulletin.miami.edu/graduate-academic-programs/arts-sciences/biology/biology-ms-thesis-three-year/>)
- M.S. in Biology without Thesis (Two Year Program) (<http://bulletin.miami.edu/graduate-academic-programs/arts-sciences/biology/biology-ms-without-thesis-two-year/>)
- B.S./M.S. in Biology (<http://bulletin.miami.edu/graduate-academic-programs/arts-sciences/biology/biology-bs-ms/>)

Doctoral Program in Biology

- Ph.D. in Biology (<http://bulletin.miami.edu/graduate-academic-programs/arts-sciences/biology/biology-phd/>)

BIL 608. Research in Progress Seminar. 1 Credit Hour.

Through weekly research seminar presentations, students will explore current research by Biology Department graduate students, postdoctoral fellows, and faculty. Current students will also prepare and present a research seminar on their past, present, or future research objectives for feedback from fellow students and faculty.

Components: SEM.

Grading: SUS.

Typically Offered: Fall & Spring.

BIL 610. Lab Group Meeting. 1 Credit Hour.

Weekly seminar meeting for discussion of research projects and other academic issues in graduate faculty research laboratories. (Fall semesters)

Components: DIS.

Grading: GRD.

Typically Offered: Fall.

BIL 611. Lab Group Meeting. 1 Credit Hour.

Weekly seminar meeting for discussion of research projects and other academic issues in graduate faculty research laboratories. (Spring semesters)

Components: DIS.

Grading: SUS.

Typically Offered: Spring.

BIL 612. Graduate Core I. 3 Credit Hours.

Foundations of genome structure and how the information encoded in genomes is regulated by intrinsic and extrinsic factors during development and evolution. Major topics include genome structure, gene regulation, cells, development, physiology and EvoDevo.

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

BIL 613. Graduate Core II. 3 Credit Hours.

Foundations of key ecological and evolutionary theory. Major topics in Ecology include population, community, physiological and ecosystem ecology. Major topics in Evolution include principles of natural selection, speciation, biodiversity, population genetics, neutral theory, molecular evolution, phylogenetics, and systematics.

Components: LEC.

Grading: GRD.

Typically Offered: Spring.

BIL 614. Professional Writing and Grantsmanship. 3 Credit Hours.

Elements of argumentative writing, reader-oriented writing strategies, fundability of submitted grants, and techniques for mastering presentation venues such as posters and talks.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 615. Object-Oriented Programming and Agent-Based Modelling. 3 Credit Hours.

Hands-on training in object-oriented programming using Java, including Java statistical packages, and in the development of agent-based and individual-based simulation models for ecological, physiological, social, economic and physical sciences. Course includes introductions to cellular automata and models based on social and behavioral networks. No prior programming experience required.

Prerequisite: At least one BIL course at the 200 level.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 616. Professional Skills I. 1 Credit Hour.

Training and development in the skills necessary to become an accomplished professional scientist. Instruction on preparation, submission, and review of manuscripts; viewing and attending poster sessions; presenting scientific talks; communicating effectively with colleagues, lab partners, and the student's principal investigator.

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

BIL 618. Advanced Biostatistics. 4 Credit Hours.

This course will provide an overview of statistical analyses needed to understand, present, and publish biological research. Examples will primarily be drawn from the biomedical and ecological fields. The course will begin with a review of descriptive statistics, probability theory, and univariate distributions, followed by an overview of experimental design and analysis of categorical data using contingency tables. This will be followed by a unit on parametric analysis of univariate data including both simple and multiple linear regression, model selection, and analysis of variance. The final unit will cover non-parametric versions of these analyses and more advanced multivariate statistical methods. Lectures will be accompanied by a computer lab in which students learn hands-on statistical analysis in SAS JMP.

Requisite: Graduate Standing.

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

BIL 620. Evolution. 3 Credit Hours.

Evidence for evolution; microevolution including natural selection, kin selection, genetic drift, gene flow, mutation, and evolutionary game theory; macroevolution including speciation, adaptation, phylogenetics, origin of life, and extinction.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 621. Phylogenetics. 3 Credit Hours.

Concepts and methods in phylogenetic systematics. The importance of phylogenetic trees in biology. Use of phylogenies in taxonomy, trait evolution (including homology, adaptations and key innovations), biogeography, speciation, diversification rates, molecular evolution, molecular clocks, and gene duplication.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 622. Plant Diversity. 3 Credit Hours.

The diversity and evolution of seed plants, the most important plants on land that shape our physical environment, affect climate, and provide humans with food, medicines, and materials important in all aspects of our lives. Survey of major lineages of Gymnosperms and Angiosperms, their evolutionary history, adaptations to life on land, reproductive biology, ecology, and economic benefits. Techniques for the collection of plant specimens from the field, and their preparation and identification for museum collections.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 623. Advanced Biology of Marine Invertebrates. 4 Credit Hours.

Detailed study of major phyla of marine invertebrates. Special emphasis on taxa found in waters off southern Florida. Field course. Lectures, laboratory, special projects, and seminars.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 625. Advanced Herpetology. 4 Credit Hours.

Biology of reptiles and amphibians. Their evolutionary history, a description of their current diversity, and how this diversity is distributed geographically. Physiology, including thermoregulation, reproduction, locomotion, and feeding. Spatial ecology, communication, sexual selection, predation, and community assembly. Local field component will include an independent research project addressing a herpetological question.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 630. Population and Community Ecology: Theory. 3 Credit Hours.

Classical and contemporary theory in population and community ecology including population dynamics, matrix models, life tables, predator-prey models and food webs.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 631. Advanced Field Ecology. 5 Credit Hours.

Principles of and practical experience in quantitative sampling of community structure, plant and animal populations, and animal activities. Emphasis on individual projects. Lecture, 3 hours; laboratory/field, 10 hours on alternate Saturdays, plus research projects.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 632. Population and Community Ecology: Theory II. 3 Credit Hours.

Classical and contemporary theory in population and community ecology including population dynamics, matrix models, life tables, predator-prey models and food webs.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 633. Conservation Biology. 3 Credit Hours.

Challenges facing conservation practitioners and the toolkit that has been developed to face them. Distribution and value of biodiversity, threats to biodiversity, and methods that have been developed to face these threats at both species and landscape levels. Government implementation of conservation strategies.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 634. Stable Isotope Ecology. 3 Credit Hours.

Stable isotope analysis applied to ecological questions such as nutrient cycling, photosynthesis and trophic level studies.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 635. Molecular Ecology. 3 Credit Hours.

Molecular markers and analyses, and their applications to different problems in biology. Appropriate sampling, methods for assessing genetic diversity and differentiation. Approaches to studying gene flow, tools for behavioral ecology, remote sampling, tracking individuals, and paternity analysis, hybridization and speciation, DNA bar codes, and gene expression from a population biological perspective.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 636. Tropical Biology: An Ecological Approach. 8 Credit Hours.

The tropical environment and biota; ecologic relations, communities and evolution in the tropics. Conducted in Costa Rica under the Organization for Tropical Studies. Lecture, laboratory, and fieldwork.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 637. Ecología de Poblaciones. 7 Credit Hours.

Theory and practice in field study of plant and animal populations in tropical ecosystems. Given in Spanish in Costa Rica under the Organization for Tropical Studies.

Components: DIS.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 638. Tropical Managed Ecosystems. 8 Credit Hours.

Application of ecological principles to problems in agriculture, forestry, conservation and natural resource management in the tropics. Conducted in Costa Rica under the Organization for Tropical Studies.

Components: THI.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 639. Ecosystem Ecology. 3 Credit Hours.

Concepts and models of energy and nutrient flow, food webs, successional processes, human influences and effects of spatial heterogeneity.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 641. Animal Behavior. 3 Credit Hours.

Amazing behaviors of animals from an evolutionary perspective, including how the diversity of behavior in nature is shaped by natural and sexual selection.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 645. Developmental Biology. 3 Credit Hours.

A study of the process by which a fertilized egg gives rise to a multicellular organism with organs, tissues and cell types that are structurally and functionally distinct and are arranged in a characteristic three-dimensional body plan. This course will take a comparative approach using invertebrate and vertebrate models to cover the current understanding of the cellular, molecular and genetic mechanisms that regulate the development of animals. Evolutionary mechanisms and the biomedical relevance of developmental biology will be emphasized.

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

BIL 649. Seminar in Behavior. 1 Credit Hour.

Discussion of current literature in animal behavior. This course may be repeated for credit.

Components: SEM.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 650. The Biology of Symbiosis. 3 Credit Hours.

Symbiosis, interactions between species that live in close physical association, in particular those between microbes and multicellular eukaryotic hosts is fundamental to almost all aspects of biology. Building discipline specific knowledge about symbiosis. The course includes engagement with the scientific literature as a professional researcher, and development of foundational skills for presentation and synthesis of scientific information in visual, oral and written form.

Components: DIS.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 651. Population Genetics and Genomics. 3 Credit Hours.

Population genetics, which examines the evolutionary processes that affect the genetic composition of natural populations: mutation, genetic drift, natural selection, and gene flow. Theoretical and empirical aspects will be examined via mathematical models, methods of measuring genetic variation, and readings of published case studies. Taxonomic focus will be broad and will include both model organisms (e.g., *Drosophila*), and non-model organisms.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 652. Bioinformatics Tools. 3 Credit Hours.

Databases and tools of bioinformatics as relevant to research in genomics and molecular biology. Bioinformatics applications. Information retrieval, analytical tools, BLAST searches, promoter analysis, protein structure-function analysis and various applications.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 653. Bioinformatics Algorithms. 3 Credit Hours.

The complexity of bioinformatics computations. Introduction to Perl and Bioperl. Pattern matching and sequence homology. Genome assembly. Transcription factor binding site recognition and motif finding, gene prediction, phylogeny, micro array analysis, RNA folding, gene design and synthesis.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 654. Electron Microscopy. 4 Credit Hours.

Techniques in transmission electron microscopy (TEM) including tissue preparation, use of the electron microscope, photography, and interpretation of micrographs. Lecture, 1 hour; laboratory, 6 hours.

Components: LAB.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 655. Techniques in Scanning Electron Microscopy. 3 Credit Hours.

Tissue preparation, use of the scanning electron microscope (SEM), photography, and analysis and manipulation of digital images. Lecture 1 hour; laboratory 5 hours.

Components: LAB.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 656. Ecological and Evolutionary Genomics. 3 Credit Hours.

The evolution of genomes, and the ecological interactions that drive their evolution.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 661. High Altitude Biology and Medicine. 3 Credit Hours.

High altitude biology and medicine: Mechanisms of hypoxia resistance influencing the requirement to match oxygen supply and demand throughout the oxygen cascade. Topics draw from genomics, integrated physiology, population genetics, biochemistry, gene expression, evolution, and alpine medicine. Taxonomic examples from the literature will include humans, other mammals, birds, reptiles, amphibians, and fish.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 665. Evolution and Development. 3 Credit Hours.

Exploration of the relationship between common descent and biological diversity, principally changes in organismal development through time.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 668. Evolution and development of Nervous Systems. 3 Credit Hours.

Mechanisms/pathways/modules underlying formation of the nervous system during embryo development. How some properties of nervous systems have resisted change while others have diverged dramatically during evolution.

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

BIL 675. Advanced Study in Plant or Animal Sciences. 1-6 Credit Hours.

Content of course will vary by semester. Content in any semester will be expressed as course subtitle.

Components: SEM.

Grading: GRD.

Typically Offered: Fall & Spring.

BIL 678. Current Topics in Biological Research - DVP. 1 Credit Hour.

Content will vary by semester. Readings and discussions with eminent scholars temporarily resident in the department's Distinguished Visiting Professor program.

Components: SEM.

Grading: SUS.

Typically Offered: Offered by Announcement Only.

BIL 680. Research Ethics. 0 Credit Hours.

An interdisciplinary graduate course in compliance with The NIH Guide for Grants and Contracts, Vol. 18. No. 45, Dec. 22, 1989. A program in the principles of scientific integrity that forms an integral part of the proposed research training effort.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 689. Nonacademic Careers in Biology. 2 Credit Hours.

Speakers recruited from local biotech companies, conservation organizations, science museums, the National Park Service and Customs as well as invasive species specialists, medical dosimetrists, principals of schools seeking biology teachers, and others will give weekly seminars about their practice of science in their occupations. Following each seminar, students will meet with speakers in an informal setting to discuss the particulars and or prospects of the career in question. The express purpose of this course is to provide students with an idea of the utility of their biology degree in the workplace. Papers or writings that pertain to a particular career will be assigned prior to the seminar so that students will be ready with questions for the speaker.

Prerequisite: BIL 200 or Higher.

Components: DIS.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

BIL 810. Master's Thesis. 1-6 Credit Hours.

The student working on their Master's thesis enrolls for credit, in most departments not to exceed six, as determined by the student's advisor. May be regarded as full time residence.

Components: THI.

Grading: SUS.

Typically Offered: Fall, Spring, & Summer.

BIL 820. Research in Residence - Master's Thesis. 1 Credit Hour.

Used to establish research in residence for the thesis for the Master's degree after the student has enrolled for the permissible cumulative total in BIL810 (usually six credits). Credit not granted. May be regarded as full time residence.

Components: LEC.

Grading: GRD.

Typically Offered: Fall, Spring, & Summer.

BIL 830. Doctoral Dissertation. 1-12 Credit Hours.

Required of all candidates for the Ph.D. . The student will enroll for credit as determined by their advisor. Not more than 12 credits of BIL830 may be taken in a regular semester, nor more than six credits in a summer session. May be regarded as full time residence.

Components: THI.

Grading: SUS.

Typically Offered: Fall, Spring, & Summer.

BIL 840. Post-Candidacy Doctoral Dissertation. 1-12 Credit Hours.

Required of all candidates for the Ph.D. who have advanced to candidacy. The student will enroll for credit as determined by their advisor. Not more than 12 credits of BIL840 may be taken in a regular semester, nor more than six credits in a summer session. May be regarded as full time residence.

Components: THI.

Grading: SUS.

Typically Offered: Fall, Spring, & Summer.

BIL 850. Research in Residence. 1 Credit Hour.

Used to establish research in residence for the Ph.D., after the student has been enrolled for the permissible cumulative total in appropriate doctoral research. May be regarded as full time residence.

Components: THI.

Grading: SUS.

Typically Offered: Fall, Spring, & Summer.