BIOLOGY

Karolyn Hansen, Department Chairperson
Madhuri Kango-Singh, Graduate Program Director

Please visit our department website (https://www.udayton.edu/artssciences/academics/biology/).

Please apply at the Graduate School website (https://udayton.edu/apply/graduate/).

The Department of Biology offers programs leading to the Master of Science and the Doctor of Philosophy degrees. These are research focused degrees tailored to the student's interests and career plans through conversations with the faculty mentor, supported by curriculum and weekly seminars. The specific program is determined after consultation between the student and the advisory committee. Two major areas of specialization are available: Environmental/Ecological Science and Biomedical Sciences. The Department of Biology also offers a Master of Science program without a thesis requirement and an accelerated Bachelor's Plus Master's program for current undergraduates.

Assistantships

Qualified applicants are eligible for financial assistance in the form of fellowships, traineeships, and research or teaching assistantships. Students admitted to the doctoral program are given priority for these awards. In addition to a stipend, all appointments with financial aid are exempt from tuition during both the academic year and the summer session. Financial aid is available during the summer on a competitive basis.

Advising

Each student is assigned a provisional advisor for assistance during the first semester. Prior to registration for the second semester each student selects a major professor, who will serve as director of the student's advisory committee. The composition of this committee is representative of the general field of study in which the student expects to work. The committee helps to plan the student's entire program. The committee generally meets with the student twice a year to offer suggestions and assess progress in the program and thesis research.

Doctor of Philosophy in Biology (BIO)

Each student is required to complete 30 semester hours of coursework plus 60 hours of dissertation/research work. Required courses to be completed by the end of the first year include:

BIO 552 & BIO 553	Research Methods in Biomedical Science and Research Methods in Ecology	8
BIO 501	Seminar	0
BIO 601	Special Topics	1
Two advanced courses		6

All Ph.D. students who have not previously taken a biostatistics course must enroll in either MTH 527 or BIO 550. Individuals on teaching assistantships must complete the teaching seminar BIO 503 and teach at least one laboratory course during their tenure in the program.

Following completion of the first year, each Ph.D. candidate follows a program outlined by the advisory committee.

Residence Requirement

A student is strongly advised to devote as much time as possible to graduate studies. To satisfy the residency requirement, Ph.D. students must attend the University as a full-time student for at least two full years. The Ph.D. program is a full-time only program. If the advisory committee encourages attendance of a semester or a summer as a full-time student at a neighboring institution or an off-campus research site, that time may be applied to the residence requirement..

Sequence of Evaluation

The program is centered on the development of professional competence. Each student is formally assessed in the following steps:

1. A defense of a research proposal during the first Spring semester of fulltime graduate study for all graduate students.
2. A candidacy examination over the area of specialization (Ph.D. students only).
3. A defense of dissertation.

Each semester the graduate coordinating committee evaluates the overall performance of each student toward obtaining the degree. A student judged to be making unsatisfactory progress may be placed on probation or dismissed from the program. Further details concerning the policies of the graduate program can be found in the Graduate Student Handbook in the Department of Biology at the University of Dayton.

Research Proposal

During the first Spring semester of graduate work, all Ph.D. students will submit a written research proposal and orally defend it for their Graduate Committee. The purpose of this assessment is to judge the student's competence and readiness to perform research in his/her specialized area and in related fields. It also aids the student's advisory committee in planning the remainder of the program.

Utilizing the student's performance in both the written and oral phases, the advisory committee makes an evaluation and suggests one of the following possible alternatives:

1. The student should continue to work toward completion of the Ph.D. degree.
2. The student should correct obvious deficiencies and resubmit the written and/or oral portion(s) - (resubmission must be scheduled no later than six months from the original defense date and will result in a clear pass or fail/withdrawal from the program).
3. After consultation with the advisory committee, the student should switch to the M.S. program.
4. The student should withdraw from graduate work (student has failed the assessment without an opportunity of a second chance).

All other graduate assessments come at specific times in the progress of the student's program and are scheduled and administered by the advisor and advisory committee. These assessments consist of the Ph.D. candidacy examination and the defense of the Ph.D. dissertation.

Ph.D. Candidacy Examination

The candidacy examination for Ph.D. students is administered by the advisory committee, which may be supplemented by members requested by the committee and/or the department chair. The examination will be taken no later than the end of the sixth semester of the program. The purpose of the examination is to judge the student's competence in the special area and in related fields. Following the examination, the student may be directed to (a) complete the dissertation, (b) strengthen preparation by demonstrating competence in one or more areas, (c) withdraw from the Ph.D. program and complete a thesis M.S. degree, or (d) withdraw from the program. At the committee's discretion, additional competence in an area may be demonstrated by special examination or by completion of specific courses to the committee's satisfaction. The student is considered a candidate for the Ph.D. after successful completion of these requirements.

Defense of Dissertation

1. The examination on the Ph.D. dissertation will consist of a formal oral examination on the subject matter of the dissertation.
2. A Ph.D. student must present the dissertation for defense within five years after successfully completing the candidacy examination.

Master of Science in Biology (BIO)

The M.S. degree requires 24 semester hours of coursework plus a research thesis. Required courses to completed by the end of the first year include:

BIO 552 & BIO 553	Research Methods in Biomedical Science and Research Methods in Ecology	8
BIO 501	Seminar	0
BIO 601	Special Topics	1
Two advanced courses		6

All M.S. students who have not taken a biostatistics course as an undergraduate must enroll in MTH 527 or BIO 550. Individuals on teaching assistantships must complete the teaching seminar BIO 503 and teach at least one laboratory course during their tenure in the program.

Following completion of the first year, each M.S. student follows a program outlined by the advisory committee.

M.S. Non-thesis Option

Students declaring the M.S. non-thesis option are required to complete 30 hours of coursework consisting of the aforementioned courses. A research paper is required, and the subject matter of the paper is determined by the advisory committee.

Combined B.S./M.S. Program

The B.S./M.S in Biology is an accelerated, highly structured program designed for students who show an early interest in, and a strong potential for, research in the biological sciences. The combined program provides an undergraduate liberal arts education, a broad, basic background in the biological sciences, the development of expertise in a biological subfield, and thorough introduction to research instrumentation and techniques. Graduates from the program are prepared for either direct entry into the job market or for continuation toward the Ph.D. degree. The combined B.S./M.S. Program in Biology is open only to students pursuing a B.S. degree in Biology or Environmental Biology at the University of Dayton. Interested students should apply by October 15 of their Junior Year (or semester hour equivalent) of undergraduate education. Qualified students will have a minimum of a 3.5 science GPA (BCMP). The general GRE is required for admission to the program. Applicants are conditionally admitted to the program until completion of their B.S. degree, after which they will be officially admitted into the program. Students will be expected to begin Honors undergraduate thesis research in the summer prior to their 4th year of undergraduate education. The undergraduate B.S. degree in Biology or Environmental Biology will be awarded at the completion of the 4th year. The fifth year is devoted to graduate coursework and thesis research. Students are expected to maintain a graduate GPA of 3.5. Students will be expected to conduct research during the summer between the 3rd and 4th, 4th and 5th year, and the summer after their 5th year with defense of the M.S. thesis anticipated for August of that summer. The master's degree in Biology is awarded upon the successful defense of the M.S. thesis. No tuition waivers or financial support exists for the 5th year of this program, though summer research fellowship support is available on a competitive basis. Please indicate the B.S./M.S. option on your application.

Residence Requirement

A student is strongly advised to devote as much time as possible to graduate studies. To satisfy the residency requirement, M.S. students must attend the University as a full-time student for at least one full year. If the advisory committee encourages attendance of a semester or a summer as a full-time student at a neighboring institution or an off-campus research site, that time may be applied to the residence requirement.

Sequence of Evaluation

The program is centered on development of professional competence. Each student is formally assessed in the following steps:

1. A defense of a research proposal during the first Spring semester of fulltime graduate study for all graduate students.
2. A defense of thesis.

Each semester the graduate coordinating committee evaluates the overall performance of each student toward obtaining the degree. A student judged to be making unsatisfactory progress may be placed on probation or dismissed from the program. Further details concerning the policies of the graduate program can be found in the Graduate Student Handbook in the Department of Biology at the University of Dayton.

Research Proposal

During the first Spring semester of graduate work, all Ph.D. students will submit a written research proposal and orally defend it for their Graduate Committee. The purpose of this assessment is to judge the student's competence and readiness to perform research in his/her specialized area and in related fields. It also aids the student's advisory committee in planning the remainder of the program.

Utilizing the student's performance in both the written and oral phases, the advisory committee makes an evaluation and suggests one of the following possible alternatives:

1. The student should continue to work toward completion of the M.S. degree.
2. The student should correct obvious deficiencies and resubmit the written and/or oral portion(s) - (resubmission must be scheduled no

later than six months from the original defense date and will result in a clear pass or fail/withdrawal from graduate work).

3. M.S. students who show outstanding ability and wish to proceed toward the Ph.D. may be encouraged to stay at UD. They are required to present and defend an oral research progress report and present a Ph.D. proposal to their advisory committee in their third semester of the program. The advisory committee will decide if the student shows sufficient ability to enter the Ph.D. program. Upon positive recommendation from the advisory committee, the student must submit a formal application for admission to the Ph.D. program to the Admissions Committee by the third week of their fourth semester of the program. The Admissions Committee will make the final recommendation regarding their acceptance. If accepted, the student must conform to all requirements of the Ph.D. program.
4. At the time of the qualifying exam, both the student and advisory committee have the final opportunity to review the choice of the M.S. program - thesis or non-thesis option. For the non-thesis option, the nature of the requirements should be specified by the advisory committee. If under unusual circumstances, a student wishes to change options after this date and the advisory committee concurs, it should be recognized that this may result in an additional semester or more of work. However, consideration should be given to the availability of support for continuation of a M.S. program beyond two years.
5. The student should withdraw from graduate work (student has failed the assessment without an opportunity of a second chance).

All other graduate assessments come at specific times in the progress of the student's program and are scheduled and administered by the advisor and advisory committee. These assessment consist of the defense of M.S. thesis or the final M.S. non-thesis program oral exam.

Defense of Thesis

1. The examination on the M.S. thesis will consist of a formal oral examination on the subject matter of the thesis.
2. For students electing the non-thesis option, an oral examination is held over the subject matter of the research paper.
3. All those working toward the master's degree must complete the program within five years after admission to the program.

Courses

BIO 501. Seminar. 0 Hours
Presentation of biological research data by faculty members and visiting scientists. Required of all graduate students each semester.

BIO 503. College Teaching Seminar. 1 Hour
To assist graduate teaching assistants in acquiring information, understanding, and skills seen as important components of effective teaching.

BIO 509. Ecological Restoration. 3 Hours
Principles and practices of ecological restoration. The course presents the rationale and knowledge needed to understand, appreciate, plan and perform ecological restoration. Prerequisite(s): Graduate status.

BIO 511. Ecosystem Dynamics. 3 Hours
An advanced course examining ecosystem structure and function. Emphasis on community level interactions, applied ecology and the ways in which ecosystem biodiversity can be influenced by the biotic and abiotic forces of the environment, including the global impact of the human species.

BIO 512. Genetics of Human Disease. 3 Hours
Study of the molecular genetics of inherited human diseases using a systems-approach. This course is a survey of inherited diseases linked to major organs and organ systems. Prerequisite(s): Graduate student status.

BIO 515. Regulation of Growth, Development and Cancer. 3 Hours
An advance course to study Growth regulation during development and cancer. This course will cover topics such as molecular control of growth regulation and cell behavior; and evidences for the involvement of these mechanisms in cancer. This course includes journal club discussions, presentations by students on topics discussed in the course. Prerequisites: BIO 552.

BIO 517. Mechanisms in Cancer Biology. 3 Hours
Advance level course that examines the molecular and cellular signaling processes connected to initiation and progression of cancer. Course will provide in-depth understanding of topics like tumor suppressor genes, oncogenes, role of the tumor microenvironment, and epigenetic changes and their relation to cancer. Course will discuss latest research and techniques that have helped integrate the molecular mechanisms with current treatments, improved diagnosis or treatment options for cancer. Prerequisite: Upper level course in Developmental biology, cell biology, genetics with basic understanding of cancer.

BIO 518. General Pharmacology. 3 Hours
An overview of the basic principles of Pharmacology, including pharmacodynamics and pharmacokinetics, with emphasis on the mechanisms of drug action and the pharmacotherapeutic effects of major clinically important drug classes. Prerequisites: Graduate Status, OR Instructor's Permission.

BIO 521. General Microbiology. 3 Hours
A graduate level introduction to general microbiology covering fundamental topics, such as structures and functions, genetics, physiology, and metabolism. This course includes weekly journal club discussions to immerse students in current microbiology research. Students are also responsible for providing one guest lecture in the BIO 411 General Microbiology class to demonstrate their learning. Prerequisite(s): Graduate level or instructor's approval.

BIO 522. Immunology. 3 Hours
Study of innate and acquired immunity, cells and organs of the immune system, antigens and immunoglobulins. Specific emphasis on the organization and expression of immunoglobulin genes; genetic restriction; cytokines and immune regulation including hypersensitivity, immune tolerance, transplantation and autoimmunity. Biochemistry recommended.

BIO 535. Problems in Field Biology. 1-3 Hours
Course designed to acquaint students with field-oriented problems in biology.

BIO 540. Cell Biology. 3 Hours
A study of the fundamental principles of cell biology and human biology with emphasis on the function, structure, composition, heredity and growth of cells. This course focuses on the analysis of cell concepts in biochemical terms. Prerequisite(s): Graduate status.

BIO 545. Evolution & Development. 3 Hours
Molecular and population genetic examination of the evolution of animal form. Topics include comparative developmental biology, population genetics, and molecular evolution. Prerequisite(s): Student status in Biology or permission of instructor.

BIO 550. Biometrics. 3 Hours
Design and analysis of experiments in quantitative biology. Parametric and nonparametric analyses of both laboratory and field-generated data sets.

BIO 551. Laboratory Skills in the Biological Sciences. 2 Hours
Laboratory Skills in the Biological Sciences (BIO 552-P3), taught in the Department of Biology, is tailored to introduce our graduate students to this fast changing field of research by teaching shared methodologies and techniques involved in biology.

BIO 552. Research Methods in Biomedical Science. 4 Hours
Theory and applications of protein and nucleic acid techniques designed to acquaint students with advanced laboratory techniques used in biological research.

BIO 553. Research Methods in Ecology. 4 Hours
Advanced research techniques and instrumentation in Ecology and Field Biology. Prerequisite(s): Graduate Student Standing.

BIO 554. Scientific Practice. 2 Hours
Students are prepared for practicing aspects of a scientific profession. Scientific ethics, grant and manuscript writing, internal regulatory boards, and intellectual properties are covered. This course also covers topics in the responsible conduct of research drawing from case studies from the Association of American Medical Colleges and the NIH. Students will review case studies in preparation for class discussion. Graduate Student Standing.

BIO 555. Laboratory Techniques (Topic). 1-3 Hours
Advanced treatment of new techniques and instrumentation used in specialized areas of biology. Changes with advances in a specialty are reflected in the course title.

BIO 566. Biology of Infectious Disease. 3 Hours
The nature of infectious diseases, host-parasite relationships in resistance and infection, defense mechanism (antigen-antibody response); survey of the bacteria causing disease in humans; in-depth discussion of current infectious disease research.

BIO 594. Molecular Biology - Theory & Practice. 3 Hours
Introduction to the theory and practice of molecular biology techniques. Topics and laboratory exercises include the enzymatic manipulation of DNA and RNA, Southern and Northern blotting, library screening, DNA sequencing, DNA amplification, and gene promoter structure and function.

BIO 595. Neuroscience. 3 Hours
Introduction to the interdisciplinary field of Neuroscience with a focus on the integrated cellular, molecular, neurophysiological and neurochemical mechanisms governing complex brain functions. Prerequisite(s): Graduate status Or Instructor's Permission.

BIO 596. Current Biology Problems. 1-3 Hours
Consideration of recent developments in biological thought and procedure. Prerequisite(s): Permission of department chairperson.

BIO 597. Neuroscience of Brain Disorders. 3 Hours
An integrated approach to understanding the neuroscientific basis of brain disorders with emphasis on the neuronal circuits, the neurochemical and molecular neurobiological pathways underlying the pathophysiology of nervous system diseases, and available pharmacotherapies. Prerequisite(s): BIO595 (OR upper-level course in Neurobiology/Neuroscience) AND Graduate Status, OR Instructor's Permission.

BIO 599. Thesis. 1-6 Hours
Research for the master's degree.

BIO 600. Graduate Research Experience in Biology. 1 Hour
In this course, students will engage in faculty mentored research experience in Biology. These experiences may be related to biology research activity in a field or laboratory setting.

BIO 601. Special Topics. 1 Hour
Development, presentation, and discussion of topics in specialized areas of biology. Required of graduate students each semester.

BIO 699. Dissertation. 1-9 Hours
Research for the doctoral degree.