

DEPARTMENT OF BIOLOGICAL SCIENCES

Science and Technology Center (McNulty Hall)

(973) 761-9044

[shu.edu/biology/](https://www.shu.edu/biology/) (<https://www.shu.edu/biology/>)

Faculty: Bitsaktsis; Bundy; Chang; Chu (Director of Graduate Studies); Cottrell (*Chair*); Hill; Klaus; Ko; Martin; Nichols (*Director of Health Professions*); Zhou

Faculty Associates: Baglio, Ranasinghe; Tall

Lecturers: Pettit

Faculty Retired and Emeritus: Blake; Glenn*; Hsu*; Moldow; Rabacchi;

Programs of Study

The Department of Biological Sciences offers graduate programs leading to the following degrees: Master of Molecular Bioscience (M.S.) and Doctor of Philosophy (Ph.D.) in Molecular Bioscience.

The Master's degree in Molecular Bioscience has three programs of study: Plan A, with research thesis, and Plans B and C, with library thesis. Plan A is recommended for students who intend to continue their studies at the doctoral level or pursue a career in research; Plan B is primarily a degree program; Plan C, with a component in business administration courses, is for students who are interested in acquiring knowledge about the technical aspects as well as the business aspects of the biological and pharmaceutical industries. The Master's degree in Molecular Bioscience with a microbiology concentration has two programs of study: Plan D, with research thesis, and Plan E, with library thesis. Plan D is recommended for students who intend to continue their studies in microbiology/biotechnology at the doctoral level or pursue a career in research; Plan E is primarily for students pursuing a degree program. The Master's degree in biology with a neuroscience concentration has two programs of study: Plan F, with research thesis, and Plan G, with library thesis. Plan F is recommended for students who intend to continue their studies at the doctoral level or pursue a career in research; Plan G is primarily a degree option.

The Ph.D. in Molecular Bioscience program emphasizes the application of molecular and cellular biotechnology in studies on living systems and provides the students with a strong foundation in research and teaching. A brochure containing research interests of faculty members is available.

General Academic Requirements

Academic deficiencies must be made up during the first year of graduate study and before taking graduate courses for which the deficiency areas are prerequisites; these courses will not be credited toward the graduate degree.

Admission as a non-matriculated student (limited to 12 credits) may be granted pending the evaluation of an application submitted before the admission deadline.

General Admission for Biology Graduate Programs

In addition to the general University requirements for admission to graduate studies, the Department of Biological Sciences requires a B.S. in a biological science or related science with a GPA of 3.0 or above. A minimum of 24 credits in biology including general biology, cell biology

and molecular genetics; 16 credits in general chemistry and organic chemistry with adequate laboratory time; 8 credits of physics with laboratory; and 8 credits in mathematics beyond precalculus.

Graduate Record Examination scores (minimum 50th percentile, general exam) are required for:

1. all applicants whose degrees were earned at institutions outside the U.S.
2. all Ph.D. program applicants.

For applicants to the M.S. programs, a request for waiver of the GRE may be submitted if the undergraduate GPA (B.S. biological science) from a U.S. institution was 3.0 or better, on a 4.0 = A scale.

Résumé and personal statement describing candidate's scientific background, including previous laboratory training from coursework or work experience, and career goals are required.

International students must provide proper immigration documents and a TOEFL score equal to 75% of the maximum possible score. For all degrees from institutions outside the U.S., a World Education Service (WES) assessment of the transcript is required.

Three letters of recommendation are required.

Seminar Requirements

Students are required to attend seminars for a minimum of two semesters to fulfill requirements for the M.S. degree and eight semesters to fulfill the requirements for the Ph.D. degree. Students should register for the semester in which the library thesis or research thesis is presented.

General Degree Requirements

Students must maintain a minimum 3.0 GPA for all coursework toward the doctoral degree and master's degree taken at Seton Hall University. For Ph.D. Students, if a student receives a grade of B- or lower in a required course, the student must repeat the course with a satisfactory grade of B or better. Students with an overall GPA below 3.0 will be placed on probation for one year to regain acceptable status. The student who is unable to meet these remedial measures or has an overall GPA of 2.0 or below will not continue in the program.

Note to Students: The following listing represents those courses that are in the active rotation for each department, i.e., have been offered in the past five years. Some departments have additional courses offered more rarely but still available – to find the complete list of all official courses for a department, please use the "Course Catalogue Search" function in Self-Service Banner.

- Molecular Bioscience (M.S.) (<http://catalogue.shu.edu/graduate/college-arts-sciences/department-biological-sciences/molecular-biosciences-ms/>)
- Molecular Bioscience (Ph.D.) (<http://catalogue.shu.edu/graduate/college-arts-sciences/department-biological-sciences/molecular-bioscience-phd/>)

Biology

BIOL 6113 Biostatistics (3 Credits)

Elementary statistical methods as applied to experimental biology. Topics include hypotheses testing, probability and chi square, linear regression and correlation, analyses of variance, nonparametric statistics and bioassay. Introduction to use of computers in analysis of biological data.

BIOL 6115 Fundamentals of Neuroscience (3 Credits)

This introductory course provides an overview of the structure and function of the human nervous system. Emphasis is placed on understanding the cellular and molecular mechanisms underlying neural transmission, connectivity, integration of the sensory motor systems, cognitive functions and behavior.

BIOL 6216 Recombinant DNA Technology (3 Credits)

Basic techniques used in recombinant DNA studies. Hands on experience with DNA isolation, hybrid plasmid production, restriction mapping and clone selection and characterization. Lecture will focus on theory and applications of recombinant DNA technology, including: vector design, PCR strategies, bioinformatics and DNA structure. Prerequisite: Genetics, Microbiology, Molecular Biology or Biochemistry. Prerequisite: Genetics, Microbiology or Biochemistry.

BIOL 6231 Molecular Biology (3 Credits)

Study of structure and function of macromolecules. Prokaryotic and eukaryotic genome. Bacterial and bacteriophage genetics, mutation and gene expression. Genetic code, transcription, translation and the regulatory systems. Replication of viruses, genetic programming and biotechnology. Review of research papers and discussion of current topics. Prerequisite: Genetics or Biochemistry.

BIOL 6233 Biochemistry of Metabolism (3 Credits)

Synthesis and degradation of organic molecules in living systems, especially Man. Dietary, medical and genetic aspects of metabolism. Integration and regulation of pathways. Includes metabolic activities restricted to plants and microorganisms; representative antibiotics, toxins and drugs. Lecture only.

BIOL 6242 Immunology (3 Credits)

Principles of recognition, memory and specificity. Structural basis of antigenicity. Development of the immune system. Structure function and genetics of immunoglobulins, gammopathies and monoclonal antibodies. T-cell receptors and MHC antigens. Activation of lymphoid cells, tolerance, autoimmunity and regulation of the immune system. Complement system, aspects of clinical and diagnostic immunology, tissue typing and immunogenetics. A term paper is required.

BIOL 6243 Immunology Laboratory (2 Credits)

Laboratory exercises designed to illustrate the immunological principles of recognition and specificity; in vitro and in vivo antigen-antibody reactions; identification and quantitation of immunoglobulins; tests to illustrate the principles of immunochemistry and immunopathology; cell culture study; hybridoma technique and monoclonal antibodies. Pre- or corequisite: BIOL 6242.

Prerequisites: BIOL 6242 (may be taken concurrently)

BIOL 6323 Neuroendocrinology (3 Credits)

Role of hormones in coordinating homeostasis. Emphasis on neuroendocrinology, including functional neuroanatomy and neurochemistry. Study of the mechanism of action of hormones at the cellular and molecular levels. Review and analysis of current literature.

BIOL 6326 Vertebrate Physiology (4 Credits)

A comprehensive coverage of the physiology of cells, organs and organ systems with emphasis on the underlying biophysical and biochemical principles of function. Organ systems including nerve, muscle, cardiovascular, respiratory and renal are examined from the standpoint of their regulation and role in maintenance of homeostasis.

BIOL 6333 Cell Culture Techniques (3 Credits)

Discussion and practical application of the in vitro cultivation of animal cells including both general and specific techniques for obtaining, growing and maintenance of clonal cultures.

BIOL 6335 Methods in Neuroscience (3 Credits)

The participants in this course will become acquainted with basic concepts and techniques commonly used in Neuroscience to study the organization of neurons, their signaling pathways, and the mechanisms of synaptic transmission, in order to better understand the workings of the human brain.

BIOL 6353 Sel Topics in Immunology (3 Credits)

BIOL 6369 Cancer Biology (3 Credits)

This course brings together and puts into perspective a large body of knowledge about cancer, cancer research and cancer treatment. Specifically, this course will first explore microevolutionary processes to illustrate the nature of cancer and the natural history of the disease from a cellular standpoint. The molecular genetics of cancer will then be dissected to understand how abnormalities in any of the different intracellular signaling pathways of the system can lead to development of cancer. This course will also include a discussion of various cancer treatment approaches to illustrate how basic research translates to clinical aspects of cancer treatment.

BIOL 6411 Select Topics-Advanced Imaging (3 Credits)

BIOL 6412 Molecular Virology (3 Credits)

Basic principles of the virus-host cell relationship presented by lectures and student discussion of recent publications. Topics include mechanisms of viral replication, viral-mediated genetic transfer, viral-induced host changes, including neoplasia and immunologic procedures fundamental to virology.

BIOL 6421 Microbial Physiology (3 Credits)

The normal life functions of microorganisms. The metabolism of *E. coli*, anaerobes, sulfur bacteria and photosynthetic bacteria as well as one-celled eukaryotes. Emphasis on general principles of physiology and the diversity of microbial solutions to physiological stresses. Includes lectures, text and reading, and discussion of original literature. Offered in alternate years.

BIOL 6422 Microbial Physio Lab (1 Credit)

Practical exercises, both bench methods and computational biology, addressing current techniques for measuring growth and physiology in a variety of microorganisms; use of molecular databases to probe proteomics, metabolomics and other physiological processes.

BIOL 6431 Microbial Genetics (3 Credits)

Examination of the mechanisms of genetic recombination in microorganisms. Genetic changes in microorganisms and the resulting alterations in their biochemical and physiological features.

BIOL 6512 Advanced Imaging (4 Credits)

Students will gain an understanding of (1) the physical design of the compound light microscope and its relationship to image formation; (2) the physics of image formation; and (3) selected biological microscopic imaging techniques. Students will gain mastery of (1) the hands-on use of the compound light microscope, (2) basic sample preparation, (3) quantitative image analysis, and (4) the production of publication-quality images. Students will gain experience in the use of specific biological imaging techniques including wide-field fluorescence and confocal imaging, time-lapse imaging, and three-dimensional volume reconstruction. Three-hour lecture/lab.

BIOL 6611 ST: Neurobiology of Diseases (3 Credits)**BIOL 7112 Intro to Bioinformatics (3 Credits)****BIOL 7226 Signal Transduction (3 Credits)**

Course brings together and puts into perspective a large body of knowledge about intracellular and intercellular signaling systems as well as cell-cell communication. Explores the molecular and cellular pathways, the components of these pathways, as well as the regulation of these pathways in cellular homeostasis. Current findings from the scientific literature are emphasized. Prerequisite: Cell Biology or Biochemistry.

BIOL 7227 ST-Ethics in Research (3 Credits)

This course is designed to introduce future scientists to topics in research ethics. Emphasis on foundational principles underlying scientific integrity and their application to a range of issues, including data management, animal and human subjects, collaboration, mentoring, peer review, and the ethical implications in different forms of scientific research.

BIOL 7228 Fundamentals of Toxicology (3 Credits)

Principles of toxicology; testing procedures used in toxicology studies, including carcinogenesis, mutagenesis, teratogenesis and immunotoxicology; studies of individual target organs such as the liver and kidney and systems such as cardiovascular, respiratory, nervous and reproductive; studies of risk assessment of toxic substances, such as food additives and pesticides. Prerequisite: Vertebrate Physiology.

BIOL 7291 Select Topics - Mol Biol (1 Credit)

Individualized study of a specific topic in molecular biology to be arranged between instructor and student. Student will research topic and develop a library research paper analyzing current research on the topic. It is required that an oral presentation of the paper will be given during scheduled seminar (BIOL 8202) the following semester.

BIOL 7292 Select Topics- Immunology (1 Credit)

Individualized study of a specific topic in immunology to be arranged between instructor and student. Student will research topic and develop a library research paper analyzing current research on the topic. It is required that an oral presentation of the paper will be given during scheduled seminar (BIOL 8202) the following semester.

BIOL 7293 Select Topics - Genetics (1 Credit)

Individualized study of a specific topic in genetics to be arranged between instructor and student. Student will research topic and develop a library research paper analyzing current research on the topic. It is required that an oral presentation of the paper will be given during scheduled seminar (BIOL 8202) the following semester.

BIOL 7295 ST - Reproductive Biology (1 Credit)**BIOL 7392 Select Topics- Endocrinology (1 Credit)**

Individualized study of a specific topic in endocrinology to be arranged between instructor and student. Student will research topic and develop a library research paper analyzing current research on the topic. It is required that an oral presentation of the paper will be given during scheduled seminar (BIOL 8202) the following semester.

BIOL 7423 Industrial Microbiology (3 Credits)

Selection, genetic engineering and utilization of microorganisms in the production of food and drink, pharmaceuticals, chemicals and in agriculture. Emphasis on current techniques used in industry, and the principles and rationale guiding new developments that may become industrial processes of the future. Offered in alternate years. Prerequisites: Microbiology and Biochemistry or Metabolic Pathways.

BIOL 7491 Select Topics-Microbiology (1 Credit)

Individualized study of a specific topic in microbiology to be arranged between instructor and student. Student will research topic and develop a library research paper analyzing current research on the topic. It is required that an oral presentation of the paper will be given during scheduled seminar (BIOL 8202) the following semester.

BIOL 7493 Select Topics-Neuroscience (1 Credit)

Individualized study of a specific topic in neuroscience to be arranged between instructor and student. Student will research topic and develop a library research paper analyzing current research on the topic. It is required that an oral presentation of the paper will be given during scheduled seminar (BIOL 8202) the following semester.

BIOL 7498 Spec Topics Neuroendocrinology (1 Credit)**BIOL 7591 Select Topics-Toxicology (1 Credit)**

Individualized study of a specific topic in toxicology to be arranged between instructor and student. Student will research topic and develop a library research paper analyzing current research on the topic. It is required that an oral presentation of the paper will be given during scheduled seminar (BIOL 8202) the following semester.

BIOL 8201 Biology Sem for MS Students (1 Credit)

Students are required to attend seminar for a minimum of two semesters and to present their thesis research during this period. Students register for BIOL 8201 in their first year and for BIOL 8202 in the semester that they intend to present their research. Those pursuing the non-thesis option also register for a Selected Topics course (1 credit) usually in the semester before they intend to present their library thesis.

BIOL 8202 Biol Seminar for MS Student (1 Credit)

Students are required to attend seminar for a minimum of two semesters and to present their thesis research during this period. Students register for BIOL 8201 in their first year and for BIOL 8202 in the semester that they intend to present their research. Those pursuing the non-thesis option also register for a Selected Topics course (1 credit) usually in the semester before they intend to present their library thesis.

BIOL 8601 Research for MS Thesis I (3 Credits)

Credit given at completion of project.

BIOL 8602 Res for Master's Thesis II (3 Credits)

Credit given at completion of project.

BIOL 8603 Res for Master's Thesis III (3 Credits)

Credit given at completion of project.

BIOL 8604 Res for Master's Thesis IV (3 Credits)

Credit given at completion of project.

BIOL 8605 Res in Master's Thesis V (3 Credits)

Credit given at completion of project.

BIOL 9011 Read Molecular Bioscience I (2 Credits)

BIOL 9012 Read Molecular Bioscience II (2 Credits)

BIOL 9013 Read Molecular Bioscience III (2 Credits)

BIOL 9091 Spec Topics-Biol Res I (2 Credits)

Subject and hours to be arranged. Credit for this course may be obtained only once.

BIOL 9092 Spec Topics-Biol Res II (2 Credits)

Subject and hours to be arranged. Credit for this course may be obtained only once.

BIOL 9093 Spec Topics-Biol Res III (2 Credits)

Subject and hours to be arranged. Credit for this course may be obtained only once.

BIOL 9201 Biol Seminar PHD Student (1 Credit)

Mandatory for all students. Students are required to attend seminar for a minimum of eight semesters. All students are required to present at least one seminar during this period. Students must register for this course in the semester they present a seminar based on their dissertation research.

BIOL 9202 Biol Seminar PHD Student II (1 Credit)

Mandatory for all students. Students are required to attend seminar for a minimum of eight semesters. All students are required to present at least one seminar during this period. Students must register for this course in the semester they present a seminar based on their dissertation research.

BIOL 9203 Biol Seminar PHD Student III (1 Credit)

Mandatory for all students. Students are required to attend seminar for a minimum of eight semesters. All students are required to present at least one seminar during this period. Students must register for this course in the semester they present a seminar based on their dissertation research.

BIOL 9204 Biology Seminar PHD Student IV (1 Credit)

Mandatory for all students. Students are required to attend seminar for a minimum of eight semesters. All students are required to present at least one seminar during this period. Students must register for this course in the semester they present a seminar based on their dissertation research.

BIOL 9205 Biol Seminar for PHD Student (1 Credit)

Mandatory for all students. Students are required to attend seminar for a minimum of eight semesters. All students are required to present at least one seminar during this period. Students must register for this course in the semester they present a seminar based on their dissertation research.

BIOL 9206 Biol Seminar for PHD Student (1 Credit)

Mandatory for all students. Students are required to attend seminar for a minimum of eight semesters. All students are required to present at least one seminar during this period. Students must register for this course in the semester they present a seminar based on their dissertation research.

BIOL 9207 Biol Seminar PhD Student VII (1 Credit)

BIOL 9208 Biol Seminar PhD Student VIII (1 Credit)

BIOL 9601 Research for PHD Dissert I (3 Credits)

Credits given at completion of dissertation.

BIOL 9602 Research for PHD Dissert II (3 Credits)

Credits given at completion of dissertation.

BIOL 9603 Research PHD Dissert III (3 Credits)

Credits given at completion of dissertation.

BIOL 9604 Research PHD Dissert IV (3 Credits)

Credits given at completion of dissertation.

BIOL 9605 Research PHD Dissert V (3 Credits)

Credits given at completion of dissertation.

BIOL 9606 Research PHD Dissert VI (3 Credits)

Credits given at completion of dissertation.

BIOL 9607 Reserach PHD Dissert VII (3 Credits)

Credits given at completion of dissertation.

BIOL 9608 Research PHD Dissert VIII (3 Credits)

Credits given at completion of dissertation.

BIOL 9609 Research for PHD Dissert IX (3 Credits)

Credits given at completion of dissertation.