

# BIOLOGY

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## **Interim Chair**

Jialing Xiang

## **Associate Chair**

Tanya Bekyarova

## **Faculty with Research Interests**

For information regarding faculty visit the Department of Biology website.

The biology program at Illinois Institute of Technology provides a rigorous educational experience in the fundamental areas of biology including genetics, microbiology, cell biology and biochemistry, and structural biophysics. It gives students a firm foundation in the field, both in biological theory and experimentation, so that students may pursue many career paths after leaving the university.

Our students also benefit from small class sizes, classes taught by faculty (not teaching assistants) who are accessible to students, and individual advising by members of the faculty.

The curriculum is interdisciplinary and flexible, allowing degree options in biology, biochemistry, bioinformatics, and molecular biochemistry and biophysics. The university offers special degree programs in dual B.S./M.S., dual B.S./D.O., and dual B.S./optometry.

Details of the traditional programs, as well as the specialized degree programs, can be found on the following pages and in the Special Programs section.

## **Degree Programs**

- Bachelor of Science in Biochemistry
- Bachelor of Science in Biochemistry/Bachelor of Science in Psychological Science (dual degree)
- Bachelor of Science in Bioinformatics
- Bachelor of Science in Biology
- Bachelor of Science in Biology/Bachelor of Science in Psychological Science (dual degree)
- Bachelor of Science in Molecular Biochemistry and Biophysics

## **Other Degree Programs in Biology**

Beyond the traditional degree programs, the department offers several specialized programs designed for students who are interested in studying science and who wish to pursue a postgraduate education. Detailed programs of study for each of the programs listed below are available from the department.

### **Research Honors Program**

This program is specifically designed for students who plan to pursue an advanced research degree. The program of study is based on the traditional degrees but is accelerated to include a full year of research experience in a faculty research lab, culminating in a senior thesis. In addition, students selected for this program may have guaranteed stipends for the summers after their sophomore and junior years in addition to any other scholarships that have been awarded.

### **Honors Law Program**

Students in any of the biology programs are eligible for this program. For students in biology, this is a seven-year program which can be accelerated under special conditions approved by the student's adviser.

### **Five-Year Financial Markets Program**

This program combines an undergraduate science degree with the Master of Science in Financial Markets. The five-year combined B.S./M.S. program guarantees admission to the master's program, provided the student maintains an undergraduate GPA of 3.00 and obtains a satisfactory score on the GMAT. Students enrolled in any of the biology programs are eligible for this program.

## Co-Terminal Options

The Department of Biology also offers the following co-terminal degrees, which enables a student to simultaneously complete both an undergraduate and graduate degree in as few as five years:

- Bachelor of Science in Biochemistry/Master of Biology with Biochemistry specialization
- Bachelor of Science in Biochemistry/Master of Science in Biology with Biochemistry specialization
- Bachelor of Science in Biochemistry/Master of Science in Biology for the Health Professions
- Bachelor of Science in Biochemistry/Master of Food Safety and Technology
- Bachelor of Science in Biology/Master of Biology
- Bachelor of Science in Biology/Master of Science in Biology
- Bachelor of Science in Biology/Master of Science in Biology for the Health Professions
- Bachelor of Science in Biology/Master of Computer Science
- Bachelor of Science in Biology/Master of Science in Computer Science
- Bachelor of Science in Biology/Master of Food Safety and Technology
- Bachelor of Science in Molecular Biochemistry and Biophysics/Master of Science in Molecular Biochemistry and Biophysics

These co-terminal degrees allow students to gain greater knowledge in specialized areas while, in most cases, completing a smaller number of credit hours with increased scheduling flexibility. For more information, please visit the Department of Biology website ([science.iit.edu/biology](http://science.iit.edu/biology)).

## Medical Programs

- Preparatory Program for Medical Studies (Post-Baccalaureate Premed)

## Minors

- Minor in Biochemistry
- Minor in Bioinformatics
- Minor in Biology
- Minor in Pre-Medical Studies

## Course Descriptions

### BIOL 100

#### Introduction to the Profession

Introduction to the biological sciences, scientific method, computing tools, and critical thinking.

**Lecture: 2 Lab: 0 Credits: 2**

**Satisfies:** Communications (C)

### BIOL 104

#### Linux and Perl Programming

Introductory class on Linux and Perl programming. Topics include Linux/UNIX operating systems, Bash and other command line shells, remote terminals, the basics of Perl programming, and examples of Perl programming for biological data.

**Lecture: 1 Lab: 2 Credits: 3**

### BIOL 105

#### Introduction to Biology

This course, designed for non-majors, considers basic concepts and selected topics in biology beginning at the molecular level and ending with the biosphere. Topics include the following: the chemistry and structure of cells in plants and animals; how cells obtain and use energy; basic genetics and the role of biotechnology in agriculture and medicine; evolution, natural selection, and species formation; the origin and diversity of microbial, plant, and animal life; ecology, organisms, and their environments; and the impact of human population growth and human activity on the systems and resources of our planet. This course is not available to those students for whom BIOL 107 is a required course, including students majoring in Biology, Biochemistry, Chemical and Biological Engineering, Molecular Biochemistry and Biophysics, or any pre-health professional major or minor. BIOL 105 and BIOL 114 constitute a one-year sequence in biology. Acceptable as part of the science component of the General Education Program. Course does not satisfy graduation requirements for Biology, Biochemistry, Chemical and Biological Engineering, Molecular Biochemistry and Biophysics majors.

**Lecture: 3 Lab: 0 Credits: 3**

**Satisfies:** Natural Science (N)

**BIOL 107****General Biology Lectures**

This course emphasizes biology at the organismal level. It provides an introduction to the study of the structure and function of plants and animals, their origin and evolution, their reproduction and genetics, and their diversity and ecological relations. BIOL 107 plus BIOL 115 constitutes a one-year sequence in biology. Acceptable as part of the science component of the General Education Program.

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 109****General Biology Laboratory**

A laboratory course to accompany BIOL 107. An introduction to laboratory techniques and their application to the understanding of general biological concepts.

**Prerequisite(s):** BIOL 105\* or BIOL 107\*, An asterisk (\*) designates a course which may be taken concurrently.

**Lecture: 0 Lab: 3 Credits: 1**

**Satisfies:** Communications (C)

**BIOL 114****Introduction to Human Biology**

This course, designed for non-majors in biology, covers selected topics in biology of particular relevance to humans and to human health and disease. Topics include: Introductory biochemistry and cell structure, organization, and regulation of body systems; human genetics; human development; biotechnology; introduction to human pathogens and infectious diseases including sexually-transmitted diseases and immunologic diseases such as AIDS; human ecology; and human evolution. This course is not available to those students for whom BIOL 115 is a required course, including students majoring in Biology, Biochemistry, Molecular Biochemistry and Biophysics, Chemical Engineering, or Biomedical Engineering, and students in any pre-health profession major or minor. BIOL 107 and BIOL 114 constitutes a one-year sequence in biology. Acceptable as part of science component of the General Education Program.

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 115****Human Biology**

This course covers selected topics in biology of particular relevance to humans and to human health and disease. Topics include biology of human cells and selected organ systems; neurobiology including psychoactive drugs and drug addiction; development and birth defects; genetics and genetic diseases; toxicology; the immune system and immunologic diseases such as AIDS; human nutrition and nutritional effects; microbial human diseases. BIOL 107 plus BIOL 115 constitutes a one-year sequence in biology. Acceptable as part of science component of the General Education Program.

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 117****Human Biology Laboratory**

A biology laboratory course to accompany BIOL 114 or BIOL 115. A cellular approach to the functional organization of organs and organ systems. Laboratories will include the application of experimental methods and techniques for understanding the relationship between cell structure and function.

**Prerequisite(s):** BIOL 114\* or BIOL 115\*, An asterisk (\*) designates a course which may be taken concurrently.

**Lecture: 0 Lab: 3 Credits: 1**

**Satisfies:** Communications (C)

**BIOL 210****Microbiology**

This course covers basics of microbiology including structure, genetics, growth, and metabolic diversity of microorganisms. Topics relating to the importance of microorganisms in health, ecosystems, industry, and water and food safety are also covered.

**Prerequisite(s):** BIOL 107 or BIOL 114 or BIOL 115

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 214****Genetics**

An introduction to transmission and molecular genetics designed for both biology and other science and engineering majors. Applications of genetics to solution of various practical problems will also be discussed.

**Prerequisite(s):** BIOL 107 or BIOL 114 or BIOL 115

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 225****Microbiology Laboratory**

Exercises focus on sterile technique, growth requirements of microorganisms, identification of microorganisms using biochemical activities, food, and water microbiology.

**Prerequisite(s):** BIOL 210\*, An asterisk (\*) designates a course which may be taken concurrently.

**Lecture: 0 Lab: 6 Credits: 2**

**Satisfies:** Communications (C)

**BIOL 305****Human Anatomy**

This course will provide a comprehensive overview of the structural, functional, and developmental anatomy of the human body. Particular consideration will be given to the bony structures, vasculature, innervation, musculature, and relationships of the various structures to one another.

**Prerequisite(s):** BIOL 107 or BIOL 114 or BIOL 115

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 327****Introduction to Immunology**

Covers general principles of innate and adaptive immunity including structure and function of immune system components, T and B cell development, responses of the immune system to infection, and consequences of immune system failure.

**Prerequisite(s):** BIOL 107 or BIOL 115

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 401****Introductory Biochemistry**

The first part of a one-year Biochemistry series. This semester covers the basic principles of biological chemistry with particular focus on: proteins, nucleic acids, carbohydrates, and lipids; their molecular structure, chemical reactions, and practical methods in characterization; and enzymes and enzyme-catalyzed reactions.

**Prerequisite(s):** (BIOL 107 or BIOL 115 or Graduate standing) and (CHEM 237 or Graduate standing)

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 402****Metabolic Biochemistry**

The second part of a one-year Biochemistry series. This semester deals with biochemistry of metabolism, focusing on: glycolysis, the citric acid cycle, gluconeogenesis, electron transport, and the synthesis and breakdown of biomolecules (amino acids, nucleic acids, lipids, and carbohydrates), blood chemistry, lipid transportation, and metabolic control.

**Prerequisite(s):** BIOL 401 and (CHEM 239 or Graduate standing)

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 403****Biochemistry**

Molecular organization of cell structures and cell membranes. Proteins, nucleic acids, carbohydrates and lipids, their molecular structure, characterization and chemical reactions. Enzymes and enzyme-catalyzed reactions and metabolism. Does not satisfy biochemistry requirement for Biology, Biochemistry, or Molecular Biochemistry and Biophysics majors.

**Prerequisite(s):** (BIOL 107 or BIOL 115 or CHE 311) and CHEM 237

**Lecture: 4 Lab: 0 Credits: 4**

**BIOL 404****Biochemistry Laboratory**

Analytical methods in the chemistry and metabolism of proteins, amino acids, and nucleic acids, including chromatography, spectrophotometry, and electrophoresis. Enzyme reactions.

**Prerequisite(s):** BIOL 401\* or BIOL 402\* or BIOL 403\*, An asterisk (\*) designates a course which may be taken concurrently.

**Lecture: 0 Lab: 6 Credits: 3**

**Satisfies:** Communications (C)

**BIOL 410****Medical Microbiology**

Properties of pathogenic bacteria, fungi, viruses, and parasites and their mechanisms of pathogenesis with a focus on organisms that cause human disease.

**Prerequisite(s):** BIOL 210 or Graduate standing

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 413****Genomics and Transcriptomics**

Modern nucleic acid sequencing technology has revolutionized the analysis of genes and genomes. In this course, students will learn to use sequence data to analyze the structure and function of genomes. Topics will include sequencing technologies and data, genome assembly, genome annotation and gene expression analysis. Classes will consist of a mixture of lecture and hands-on exercises. A laptop is required.

**Prerequisite(s):** BIOL 214 or Graduate standing

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 414****Genetics for Engineering Scientists**

A course in genetics designed for advanced students in engineering and related disciplines. The course will cover transmission and molecular genetics and their application to the solution of various practical problems. A term paper will be required in addition to in-class examinations. \*\*Instructor permission required.\*\*

**Lecture: 3 Lab: 0 Credits: 3**

**Satisfies:** Communications (C)

**BIOL 415****Advanced Human Genetics**

Emphasis on formal genetics and molecular approaches to human genetics. Topics include analysis of Mendelian inheritance, chromosome mapping of disease genes, mutational analysis, and epigenetic s. Coverage of genomics, methods of gene manipulation, genetic databases, and regulation of gene expression. The origin and consequences of genetic variation in populations and the role of natural selection in evolution will also be discussed.

**Prerequisite(s):** BIOL 214 or Graduate standing

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 420****Population Genetics**

The study of genetic variation in natural populations is the foundation for modern evolutionary biology. Population genetics covers both the theoretical study of the effects of various forces on genetic diversity and the empirical analysis of genetic variation observed in real populations. Throughout the course, students' understanding of population genetics theory will be reinforced with examples of applications. Topics will include genetic drift, genealogical approaches and coalescence, structured populations and migration mutation and natural selection.

**Prerequisite(s):** (BIOL 214 and MATH 148) or (BIOL 214 and MATH 151) or Graduate standing

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 426****Concepts of Cancer Biology**

The course is designed to provide a complete overview of cancer as a disease. It will cover normal and abnormal cell signaling pathways, cancer genes and their regulation, experimental chemical carcinogenesis, metastasis, cancer prevention and therapy, drug development for cancer treatment, cancers of individual organ sites and application of biotechnology for cancer detection and treatment.

**Prerequisite(s):** (BIOL 107 and BIOL 115 and CHEM 237 and BIOL 445\* and BIOL 401\*) or Graduate standing, An asterisk (\*) designates a course which may be taken concurrently.

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 430****Human Physiology**

This course is designed to provide the students with comprehensive knowledge about how the human body functions. It will cover cell physiology, autonomic nervous system, neurophysiology, acid base physiology, cardiovascular physiology, respiratory physiology, renal physiology, gastrointestinal physiology, endocrine physiology, and reproductive physiology. Credits cannot be earned to both BIOL 430 and BIOL 530.

**Prerequisite(s):** BIOL 114 or BIOL 115 or Graduate standing

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 431****Animal Physiology Laboratory**

This course provides an introduction to some of the basic concepts of physiology through experimental procedures involving laboratory animals and humans. Experiments include EKG, producing and measuring nerve action potential, muscle contraction generation and its mechanism, human blood pressure measurement, human lung capacity measurement, and some other human noninvasive experiments.

**Prerequisite(s):** BIOL 430\*, An asterisk (\*) designates a course which may be taken concurrently.

**Lecture: 0 Lab: 6 Credits: 3**

**Satisfies:** Communications (C)

**BIOL 440****Neurobiology**

This course will focus on identification of the anatomical and functional organization of the nervous system and the understanding of the principles of inter-neuronal communication and the integrative functions of the nervous system. Failures in brain functions that can lead to a disease will also be discussed.

**Prerequisite(s):** BIOL 445

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 445****Cell Biology**

Modern studies of cell structure and function at the cellular, subcellular, and molecular levels. Topics include molecular components of cells, membranes, membrane-bound organelles, microtubular and cytoskeletal components and principles of bioenergetics.

**Prerequisite(s):** (BIOL 107 and CHEM 237) or (BIOL 115 and CHEM 237) or Graduate standing

**Lecture: 3 Lab: 0 Credits: 3**

**BIOL 446****Cell Biology Laboratory**

A laboratory course in cell biology to accompany BIOL 445.

**Prerequisite(s):** BIOL 445\*, An asterisk (\*) designates a course which may be taken concurrently.

**Lecture: 0 Lab: 6 Credits: 3**

**Satisfies:** Communications (C)

**BIOL 451****Biological Literature**

Library research on advanced topics in biology followed by oral presentations of this research.

**Prerequisite(s):** BIOL 400-499

**Lecture: 2 Lab: 0 Credits: 2**

**Satisfies:** Communications (C)

**BIOL 455****Macromolecular Techniques**

Advanced laboratory course in physical biochemistry and biophysical techniques, providing a broad, hands-on, experimental background reinforcing key biophysical concepts; many experiments use expertise and equipment available in our departments or otherwise available to Molecular Biochemistry and Biophysics faculty members through affiliations with the Advanced Photon Source at Argonne National Laboratory.

**Prerequisite(s):** BIOL 401\* or BIOL 403\* or CHEM 321\* or CHEM 343\* or CHEM 348\* or PHYS 304\* or PHYS 410\*, An asterisk (\*) designates a course which may be taken concurrently.

**Lecture: 0 Lab: 6 Credits: 3**

**BIOL 475****Health and Disease in Modern Society**

The course will discuss biological and medical aspects related to the diseases commonly seeing in the modern society such as diabetes, depression, cancer, Alzheimer's, and autism. The goal of the course is to provoke students' interest in health-related issues and link the life-style to health problems in the modern society. Course will cover basic clinical and molecular aspects of the diseases, and raise awareness of latest discoveries and challenge in the treatment and prevention of the diseases.

**Prerequisite(s):** BIOL 115

**Lecture: 3 Lab: 0 Credits: 3**

**Satisfies:** Communications (C)

**BIOL 490****Individual Study**

Individual study. Consent of instructor required.

**Credit:** Variable

**BIOL 491****Biology Research Project**

An opportunity for advanced undergraduates to participate in research. A written report covering the procedures, data, and conclusion of the problem is required. \*\*Instructor permission required.\*\*

**Credit:** Variable

**BIOL 495**

**Biology Colloquium**

Lectures by prominent scientists. This course exposes students to current and active research in biology both within and outside the IIT community. It helps prepare students for a career in research. It is complementary to our academic courses and provides examples of professional/scientific presentations. This course may not be used to satisfy the natural science general education requirement.

**Lecture: 1 Lab: 0 Credits: 1**

**Satisfies:** Communications (C)