

BIOLOGY (BIO)

The study of biology will introduce the student to the principle aspects of the biological sciences from a Christian perspective. The diversity of plant and animal life; their origins, form, function, heredity, development; and their relation to the environment are studied through a variety of classroom, laboratory, and field experiences.

In addition to preparing students to be good stewards of God's creation, offerings in biology prepare students for careers or graduate study leading to work in:

- agriculture, conservation, dentistry, fisheries, forestry, medicine, marine biology, medical technology, nursing, physical or occupational therapy, sports medicine, veterinary medicine, and other health professions;
- environmental research and management;
- business careers in health administration, instrumentation, pharmaceuticals, and environmental consulting;
- teaching and research at colleges or universities.

Course of Study

- A. A major in Biology consists of a minimum of 43 credits comprised of 28 core credits and 15 elective credits.
1. Core Courses: BIO 201 and 202, 310, 331, 360, 380, 401, 402 (These core courses must be completed at WLC unless previously transferred prior to enrolling at WLC).
 2. Completion of one of the following tracks which requires at least 15 credits:
 - a. Ecological Sciences: MBI 280, 283, BIO 275, 321, 322, 324, 333, 341, 350, 351, 354, 358, 372, 465, 481, 483, 490, 498, 499, x91.
 - b. Cellular and Molecular Biology: BIO 225, 255, 275, 324, 333, 335, 341, 345, 350, 351, 354, 355, 358, 365, 372, 433, 455, 490, 498, 499, x91.
 - c. Health Sciences: BIO 225, 255, 240, 323, 335, 341, 345, 350, 351, 354, 355, 358, 365, 372, 425, 433, 455, 465, 490, 498, 499, x91.
 - d. Biophysics and Biotechnology: BIO 225, 255, 333, 335, 341, 350, 351, 354, 355, 358, 365, 372, 425, 433, 455, 465, 490, 498, 499, x91.
 - e. Neuroscience: BIO 225, 255, 322, 335, 350, 351, 354, 355, 358, 365, 372, 425, 433, 455, 465, 490, 498, 499, x91.
 - g. General: all course from BIO 225 or higher.
- B. Collateral Requirements for Biology majors:
1. Core Collaterals for all tracks: CHE 161, 162, 168, 169, 221, MAT 221, and PHY 201 or 202.
 2. Completion of at least 12 credits from the collaterals listed for the corresponding biology major track.
 - a. Ecological Sciences: ANT 202, CHE 210, 310, 410, ESS 182, 300, MAT 222, 223, PHI 316, PHY 201 or 202.
 - b. Cellular and Molecular Biology: CHE 210, 222, 228, 310, 350, 351, 358, 420, CSC 131, MAT 222, 223, PHI 316, PHY

201 or 202, SPE 325, 425.

c. Health Sciences: CHE 222, 228, 350, 351, 358, 420, COM 340, MAT 222, 223, PHI 201, PHY 201 or 202, SPE 325, 425.

d. Biophysics and Biotechnology: CHE 440, 448, MAT 222, 223, PHY 201 or 202, PHY 203, 215, 216, 301, 302, 303, 304, 313, 314, 315, 316.

e. Neuroscience: PHI 203, PSY 101, 120, 285, 300, 315, 350.

g. General: Any combination of courses listed above for track collaterals.

Note: Graduate programs may require specific track collaterals. Please speak with the Biology Department for advising information.

- C. A minor in Biology consists of at least 22 credits in biology and includes:
1. Required: BIO 201 and 202.
 2. At least 8 credits of upper-level laboratory courses or BIO 490, 498.
 3. At least two additional Biology courses, excluding BIO 120, 124, and 141.

Course Descriptions

BIO 120 Life Science. 3 cr.

Major biological principles and concepts relevant to humans and their environment. The nature of doing science. Hands-on activities, investigations, and a writing component are required. Not applicable to the major or minor in biology. 3 lec.

BIO 124 Plant Science. 4 cr.

This course explores the importance of plants for life and society; plants and ecology; wild and cultivated edible plants; medicinal uses, garden, and house plants; plants and human nutrition; plant growth and reproduction. A plant collection is required. Not applicable to the major or minor in biology. 3 lec, 2 hrs. lab.

BIO 141 Introduction to Microbiology. 4 cr.

Topics include the germ theory of disease, the immune system, public health, food microbiology, agricultural and industrial application. Emphasis on current topics and reading of the secondary scientific literature. Not applicable to the major or minor in biology. 3 lec, 2 hrs. lab.

BIO 201 Principles of Biology 1. 4 cr.

Includes aspects of ecology, environmental science, plant and animal tissues, food production and intake, human anatomy and physiology, reproduction in plants and animals, living kingdoms, and animal behavior. 3 lec, 2 hrs. lab.

BIO 202 Principles of Biology 2. 4 cr.

An introduction to cellular reproduction, genetics, natural selection, biochemistry, and cellular biology. 3 lec, 2 hrs. lab.

BIO 225 Human Anatomy and Physiology 1. 4 cr.

A systematic approach to the study of human anatomy and physiology using models, charts, readings and dissection. A human cadaver is an integral part of this course. Emphasis is placed on anatomy. Mastery of anatomical vocabulary is expected. 3 lec, 2 hrs. lab.

BIO 255 Human Anatomy and Physiology 2. 4 cr.

A continuation of Human Anatomy and Physiology 1 with emphasis on the function of organ systems and cellular mechanisms responsible for homeostasis. 3 lec, 2 hrs. lab. Prereq: BIO 225.

BIO 240 Nutrition. 3 cr.

Essentials of normal nutrition and its relationship to the health and wellbeing of individuals and families will be emphasized. Included will be the study of the physiological, psychological, and economic aspects of obtaining an adequate diet. 3 lec. This course is required prior to applying to the Nursing program.

BIO 275 Evolution and Diversity. 3 cr.

A study and evaluation of the mechanisms of evolution, evolutionary history and the diversity of life. The theological implications of modern evolutionary theory will also be considered. 3 lec.

BIO 283 Marine Ecology. 3 cr.

An introduction to marine ecology for science and non-science majors in a unique field and laboratory environment on the island of Jamaica. Field trips will include coral reef, estuary, and tide pool communities. Offered during vacation breaks. (Additional fees and instructor approval are required for this course.)

BIO 310 Biostatistics. 3 cr.

An introduction to modern statistical techniques used to analyze and interpret data in the biological sciences. Experimental design, data collection, descriptive and inferential statistics will be covered. Inferential analyses covered include hypothesis testing for single means and proportions, difference between two means and proportions (t and z tests), paired means, multiple means (ANOVA), and linear regression and correlation. Statistical software program (e.g. R) use will be introduced. 3 hrs lec. Prereq: junior status or MAT 222.

BIO 321 Invertebrate Zoology. 4 cr.

A study of anatomy, behavior, classification, and ecology in invertebrates. Organisms will be collected from the Menomonee River, Milwaukee County Ponds, and Lake Michigan. 3 lec, 2 hrs. lab. Prereq: BIO 201 and BIO 202.

BIO 322 Vertebrate Zoology. 4 cr.

Aspects of anatomy, behavior, classification and ecology of vertebrates. Field trips will include bird identification and sampling fish in streams and lakes. 3 lec, 2 hrs. lab. Prereq: BIO 201 and BIO 202.

BIO 323 Medical Terminology. 2 cr.

The basic elements, rules of building and analyzing medical words, and medical terms associated with the body as a whole. Utilizing a systems approach, the student will define, interpret, and pronounce medical terms relating to structure and function, pathology, diagnosis, clinical procedures, oncology, and pharmacology. In addition to medical terms, common abbreviations applicable to each system will be interpreted. Prereq: BIO 201, 202, 225, or 255

BIO 324 Botany. 4 cr.

Study and identification of nonseed plants, gymnosperms and angiosperms. The economic and ecological importance of these plants is considered. Field studies and a plant collection are required. 3 lec, 2 hrs. lab. Prereq: BIO 201 and BIO 202.

BIO 331 Cell Biology. 4 cr.

Study of the cell as the fundamental structural and functional unit of living organisms: cell morphology and morphogenesis, cellular movement, interaction, ultrastructure and related organelle functions, reproduction, differentiation and histogenesis. 3 lec, 3 hrs. lab. Prereq: BIO 201 and BIO 202.

BIO 333 Biotechnology. 3 cr.

This course includes lectures, discussions, and laboratory experiences in biotechnology suitable for all majors (including students in the Honors program). The potential benefits and hazards of microbial, agricultural, animal and human biotechnology will be discussed. Special consideration will be given to ethical dilemmas raised by modern biotechnology. In the laboratory, successful students will achieve proficiency in cell culture, cloning, genetic engineering, and transgenesis for commercial application.

BIO 335 Stem Cell Biology. 3 cr.

This is a course in stem cell biology suitable for all majors. The scientific, medical, political, and ethical implications of embryonic stem cell research will be discussed. Alternative approaches, including adult and induced pluripotent stem cells will also be considered. In the laboratory, successful students will achieve proficiency in the culture, differentiation, and characterization of mammalian stem cells.

BIO 341 Microbiology. 4 cr.

A survey of microorganisms, their structure, geochemical activity, nutrition, growth, application in industry, and control in public health. 3 lec, 3 hrs. lab. Prereq: BIO 201 and BIO 202.

BIO 345 Microbial Pathogenesis. 3 cr.

An introduction to mechanisms of disease caused by microbial agents. This class discusses how infections occur at the molecular level due to bacteria, viruses, and their products. Topics may include: Mechanisms of infection, immune modulation and avoidance, regulation and transmission of genetic elements, movement, toxin interactions, bacterial metabolism, antibiotic resistance mechanisms, animal infection models and current research. Prereq BIO 202.

BIO 350 Biochemistry 1. 3 cr.

The first course in a comprehensive biochemistry sequence studying the chemistry of biological systems. Topics include structure and chemistry of amino acids, carbohydrates, lipids, proteins, and nucleic acids, energetics, kinetics, enzyme mechanisms and regulation, and signal transduction. 3 lec. Prereq: CHE 222. This course is cross-listed as CHE350, only BIO350 or CHE350 may be taken for credit, not both.

BIO 351 Biochemistry 2. 3 cr.

The second course in a comprehensive biochemistry sequence studying the chemistry of biological systems. A detailed survey of metabolic pathways and control (catabolic and anabolic) in bacteria, plants, and animals, as well as molecular physiology. 3 lec. Prereq: CHE 350. This course is cross-listed as CHE351, only BIO351 or CHE351 may be taken for credit, not both.

BIO 354 Immunology. 4 cr.

An introduction to the mammalian immune system. The genetic and cellular basis of the immune response is explored through lectures, readings from primary and secondary literature and discussions. 3 lec, 3 hrs. lab. Prereq: BIO 201 and BIO 202.

BIO 355 Pathophysiology. 3 cr.

An integration of human anatomy, physiology, and biochemistry with special emphasis on the etiology and mechanisms of disease. Lecture topics will include: cell injury, inflammation, immunity, neoplasia, blood & circulatory disorders, respiratory disease, gastrointestinal disease, electrolyte imbalances, endocrinology, reproductive physiology, musculoskeletal disease, pain management, and disorders of the central nervous system. 3 lec, Prereq. BIO 202.

BIO 358 Biochemistry Lab. 1 cr.

A survey of modern techniques in experimental Biochemistry. These include biomolecule separation, detection, and modification techniques; techniques for examining inherent biomolecule characteristics and interactions with other biomolecules; and bioinformatics and computational techniques. Using scientific writing to convey the results of experiments is emphasized. Prereq: CHE 350 or concurrent enrollment. This course is cross-listed as CHE358, only BIO358 or CHE358 may be taken for credit, not both.

BIO 360 Genetics. 4 cr.

Physical and chemical basis of heredity and variation: genetic system, structure and roles of nucleic acids, mutation, and genes in development and population genetics. 3 lec, 3 hrs. lab. Prereq: BIO 201 and BIO 202.

BIO 365 Muscle Physiology. 4 cr.

In-depth focus on the mechanisms, regulation and function of striated muscle metabolism and contraction with emphasis on performance and adaptation in both normal and pathological situations. Cellular and molecular adaptations to physical activity and inactivity are covered. Athletic injury and recovery and other conditions that impact muscle function are studied. 3 lec, 3 hrs. lab. Prereq: CHE 101 or CHE 161 and BIO 225.

BIO 372 Developmental Biology. 4 cr.

An introduction to the genetic, molecular, and cellular mechanisms that direct the development of multicellular organisms. Topics include: gametogenesis, fertilization, gastrulation, organogenesis, sex determination, developmental gene regulation, and teratology. The scientific, ethical and political issues surrounding assisted reproductive technology, cloning, and stem cell technology will also be considered. 3 lec, 3 hrs. lab. Prereq. BIO 201 and BIO 202.

BIO 380 Ecology. 4 cr.

Properties of populations, communities, and ecosystems; energy and nutrient exchange, population growth and regulation, competition, predation, mutualism, nature of communities, and biogeography. 3 lec, 2 hrs. lab. Prereq: BIO 201 and BIO 202.

BIO 401 Research Strategies 1. 2 cr.

An advanced student/faculty collaborative research course including in depth discussion of laboratory/field techniques, the development of an original research proposal and extensive laboratory/field experience. Required capstone for the Biology major. 2 lec/lab.

Prereq: Senior Biology major or by approval from the School of Life Sciences.

BIO 402 Research Strategies 2. 3 cr.

A continuation of the BIO 401 capstone requirement for Biology majors. Extensive laboratory/field research followed by a written and oral summary of the original capstone research project. 3 lec/lab. Prereq: BIO 401.

BIO 425 Advanced Human Anatomy 4 cr.

A systematic approach to studying human gross anatomy through lecture and human cadaver dissection. Dissections include the muscular and skeletal, nervous, cardiovascular, respiratory, digestive, urinary, and reproductive systems. Models, applications, and textbooks will also be utilized. 3 hr lec, 3 hr lab. Prereq: BIO 225 and 255.

BIO 433 Molecular Biology. 4 cr.

Major themes in biochemistry are examined in the context of mammalian physiology. Topics include: protein structure and enzyme catalysis, carbohydrate and lipid metabolism in relation to energy production, nitrogen metabolism, vitamins, protein and nucleic acid synthesis, and the nature of the genetic code. 3 lec, 3 hrs. lab. Prereq: BIO 360.

BIO 455 Advanced Physiology. 4 cr.

An integration of biochemistry, molecular biology, cell biology, and genetics focused on understanding gene expression, inter- and intra-cellular signaling, and other regulatory systems that maintain cellular and organismal homeostasis. Labs will examine how these topics serve to coordinate developmental, immunological, or disease processes. 3 lec, 3 hrs. lab. Prereq: BIO 225 and BIO 331.

BIO 465 Neuroscience. 3 cr.

The course explores the biological basis of sensation, thought, behavior and emotion. The cellular and molecular mechanisms of nervous system physiology will be emphasized. Topics include the development, plasticity and pathology of the nervous system, as well as the mechanisms of sensation, motor control, and cognition. Prereq BIO 202.

BIO 481 Natural Resource Connections. 4 cr.

A series of guest lecturers will expose students to factual examples of global and national natural resource interconnectedness issues. Many of the topics will focus on our nation's public lands with an emphasis on national forests and grasslands. Students will be required to choose a subject from the various lecture topics and work with the lecturers to obtain information and prepare a paper for presentation. Prereq: BIO 201 and BIO 202.

BIO 483 Stream Ecology. 4 cr.

The study of biotic and abiotic aspects of stream ecosystems, including sampling and identification of fish and macroinvertebrates. Anthropogenic effects on streams in the context of Christian ecological stewardship will be evaluated by comparing streams in urban and more natural watersheds. 3 lec, 3 hrs. lab. Prereq: BIO 201 and BIO 202.

BIO 490 Internship. 1-3 cr.

By arrangement with department.

BIO x91 Special Topics. 1-4 cr.

This course is a seminar in current biological topics. It may be repeated for different topics. This course may require laboratory participation. Prereq: Instructor approval.

BIO 492 Department Seminar. 1-3 cr.

A small group exploration of primary and secondary literature in various aspects of biology. Students will provide overviews of literature in their area of interest. Select discussion questions will also be sent out to Internet discussion groups for comments from students and professors at colleges and universities around the world. Prereq: BIO 201 and BIO 202.

BIO 498 Independent Research. 1-3 cr.

By arrangement with the department.

BIO 199-499 Independent Study. 1-3 cr.

By arrangement with the department.