

BIOLOGICAL SCIENCES (BIOS)

Courses

BIOS 100 - Biological Principles

Credits 3

An introductory course designed to provide a broad survey of biological principles including the cell, human anatomy, physiology, genetics, zoology, ecology, and origin of life theories. Students will gain a meaningful and adequate exposure to creation and evaluate the underlying purposes of their existence orchestrated by God. Core Curriculum: Approved for Core - Science. **Note(s):** May not be used to fulfill elective requirements for these majors: Allied Health (BIAH), Health Sciences (BIHS), Biological Science (BIOS) or Biochemistry (BCHM). **Grade Mode:** A.

Restriction(s): Must not be Allied Health (BIAH), Health Sciences (BIHS), Biological Science (BIOS), or Biochemistry (BCHM); and must be Undergraduate Level.

BIOS 103 - Introduction to Environmental Science

Credits 3

An interdisciplinary approach to the study of the environment using concepts from ecology, biology, chemistry, geology, the social sciences and Scripture to understand the interplay of natural resources, how humans are affecting the environment, and how to deal with environmental problems. Core Curriculum: Approved for Core - Science. **Grade Mode:** A.

Restriction(s): Must be Undergraduate Level.

BIOS 105 - Biology for Educators

Credits 4

A survey of general biology focusing on topics of particular interest to elementary and secondary school educators, including cells and cell division, basic genetics, plants, animals, ecology, human anatomy and physiology, and evolution. Laboratory exercises will use an observational and investigative approach to surveying a range of biological organisms and examining selected human systems. **Note(s):** Cannot be taken to fulfill elective requirements for these majors: Human Biology (BIHB), Biological Science (BIOS), or Biochemistry (BCHM); satisfies Core Curriculum Science for Liberal Studies, Elementary Education (LSEE), Liberal Studies, Multidisciplinary (LSMD), and Early Childhood (LECD). **Grade Mode:** A.

Restriction(s): Must be Liberal Studies, Elementary Education (LSEE), Liberal Studies, Multidisciplinary (LSMD), or Early Childhood (LECD); and Undergraduate Level.

Course Fee: \$130.

BIOS 111 - Fundamentals of Cellular and Molecular Biology

Credits 3

Introductory course for majors emphasizing the principles of cellular and molecular biology, genetics, and development. **Grade Mode:** A.

Corequisite(s): BIOS 113.

Restriction(s): Must be Undergraduate Level.

BIOS 112 - Fundamentals of Organismal Biology

Credits 3

Introductory course for biological science majors emphasizing the principles of systematics and biodiversity, population genetics and origins theories, ecology, and anatomy and physiology. **Grade Mode:** A.

Corequisite(s): BIOS 114.

Restriction(s): Must be Undergraduate Level.

BIOS 113 - Fundamentals of Cellular and Molecular Biology

Laboratory

Credit 1

This laboratory accompanies BIOS 111 and is divided between observational and experimental approaches, with emphasis on the collection and interpretation of quantitative data. Frequent lab discussion of relevant issues and literature will be included. **Grade Mode:** A.

Corequisite(s): BIOS 111.

Restriction(s): Must be Undergraduate Level.

Course Fee: \$130.

BIOS 1135 - Honors Fundamentals of Cellular and Molecular Biology Laboratory

Credit 1

This laboratory accompanies BIOS 111 and is divided between observational and experimental approaches, with emphasis on the collection and interpretation of quantitative data. Frequent lab discussion of relevant issues and literature will be included. The BIOS 1135 Honors Laboratory is especially designed for Stewart Science Honors students; however, it is open to other interested students. This course provides students with a rigorous, hands-on learning environment that deepens their understanding of scientific principles through experimental investigation. By integrating advanced laboratory techniques and interdisciplinary approaches, students will cultivate the skills necessary for independent research, scientific communication, and ethical inquiry, preparing them for success in academic and professional scientific pursuits. **Note(s):** Non-Stewart Honors Program students by department approval only. **Grade Mode:** A.

Corequisite(s): BIOS 111.

Restriction(s): Must be Stewart Honors Program; and Undergraduate Level.

Course Fee: \$130.

BIOS 114 - Fundamentals of Organismal Biology Laboratory

Credit 1

This laboratory, which accompanies BIOS 112, will involve dissection as well as experimentation. A field project involving the La Mirada Creek is included. Core Curriculum: Approved for Core - Science. **Grade Mode:** A.

Corequisite(s): BIOS 112.

Restriction(s): Must be Undergraduate Level.

Course Fee: \$130.

BIOS 1145 - Honors Fundamentals of Organismal Biology

Laboratory

Credit 1

This laboratory, which accompanies BIOS 112, will involve dissection as well as experimentation. A field project involving the La Mirada Creek is included. The BIOS 1145 Honors Laboratory is especially designed for Stewart Science Honors students; however, it is open to other interested students. This course provides students with a rigorous, hands-on learning environment that deepens their understanding of scientific principles through experimental investigation. By integrating advanced laboratory techniques and interdisciplinary approaches, students will cultivate the skills necessary for independent research, scientific communication, and ethical inquiry, preparing them for success in academic and professional scientific pursuits. **Note(s):** Non-Stewart Honors Program students by department approval only. **Grade Mode:** A.

Corequisite(s): BIOS 112.

Restriction(s): Must be Stewart Honors Program; and Undergraduate Level.

Course Fee: \$130.

BIOS 120 - Current Topics in Biology	Credits 3	BIOS 200 - Sophomore Writing Seminar	Credit 1
Selected topics of current interest and concern are studied. Sections are offered each year upon sufficient demand. Topics are the following: Human Biology: Selected body systems and/or diseases will be studied in detail; Marine Biology: An overview of marine biology with an emphasis on local marine species and conservation. Topics include seaweed, invertebrate animals, fish, marine mammals, and the impact of humans; Zoology: This course provides a broad overview of invertebrate and vertebrate animal species with an emphasis on comparative anatomy and ecology. Core Curriculum: Approved for Core - Science. Note(s): May not be used to fulfill elective requirements for these majors: Allied Health (BIAH), Health Sciences (BIHS), Biological Science (BIOS) or Biochemistry (BCHM). Grade Mode: A.		Being a biologist is not just about learning facts and techniques, it is a methodical way of thinking about the world. Learning how to write like a scientist also enables one to think like a scientist. Scientific writing utilizes a distinctive style that is concise, precise, evidence-based, and logical. This course teaches the techniques necessary for locating primary and secondary literature, reading and writing about statistics, ethically citing sources, critiquing articles, writing formal research reports, and preparing a curriculum vitae. Note(s): This course is required for all Allied Health, Biological Science, Health Sciences, and Human Biology majors; it is highly recommended that this course be taken during the student's sophomore year, but it may be taken later. Grade Mode: A.	
Restriction(s): Must not be Allied Health (BIAH), Health Sciences (BIHS), Biological Science (BIOS), or Biochemistry (BCHM); and must be Undergraduate Level.		Prerequisite(s): BIOS 103 or BIOS 111 or BIOS 140; BIOS 112; ENGL 100 or ENGL 112.	
BIOS 121 - Nutrition	Credits 3	Restriction(s): Must not be Freshman Class; and must be Undergraduate Level.	
A detailed study of the basic nutritional needs of humans: water, carbohydrates, lipids, proteins, vitamins and minerals. Also included is a coverage of certain nutritional issues such as health foods, megavitamins, obesity and food additives, as well as computer-aided personal diet-analysis assignment. Core Curriculum: Approved for Core - Science. Grade Mode: A.		BIOS 222 - Botany	Credits 4
Restriction(s): Must be Undergraduate Level.		The study of the organs, tissues, functions and responses to environment of typical flowering plants and the morphology and life history of the major lower plant groups. Field work required, including collection and classification of native plants for the Biola Herbarium. Lecture/Lab Hours: Three hours lecture, four hours laboratory; there will be some Saturday field trips. Grade Mode: A.	
BIOS 128 - Introduction to the Design of Life	Credits 3	Prerequisite(s): BIOS 105; or BIOS 112 and BIOS 114.	
After equipping students in non-science majors to show themselves and others that life really is designed, this course concentrates on extraordinary aspects of the design of life in comparison to human designs. Core Curriculum: Approved for Core - Science. Note(s): May not be used to fulfill elective requirements for these majors: Allied Health (BIAH), Biological Science (BIOS), Health Sciences (BIHS), or Human Biology (BIHB). Grade Mode: A.		Restriction(s): Must be Undergraduate Level.	
Restriction(s): Must not be Allied Health (BIAH), Biological Science (BIOS), Health Sciences (BIHS), or Human Biology (BIHB); and must be Undergraduate Level.		Course Fee: \$130.	
BIOS 130 - Seminar in Biological Science	Credits 1-2	BIOS 236 - Principles of Human Anatomy and Physiology	Credits 4
Online course in which students discuss current topics in biology through weekly literature searches and interactive online postings. Note(s): May not be used to fulfill elective requirements for these majors: Allied Health (BIAH), Health Sciences (BIHS), Biological Science (BIOS) or Biochemistry (BCHM). Grade Mode: A.		An introduction to the structure and the function of the systems of the human body. Integration and interaction of these systems in maintaining homeostasis will be a point of focus. The lab component will provide students the opportunity to observe and interact with human anatomical structures as well as perform relevant physiological experiments. Grade Mode: A.	
Restriction(s): Must not be Allied Health (BIAH), Health Sciences (BIHS), Biological Science (BIOS), or Biochemistry (BCHM); and must be Undergraduate Level.		Restriction(s): Must not be Freshman Class; Environmental Science (BIES), Nursing (NURS), Biological Science (BIOS), Kinesiology (KHPE), Biochemistry (BCHM), or Human Biology (BIHB); and must be Undergraduate Level.	
BIOS 140 - Introduction to Occupational Therapy	Credits 3	Course Fee: \$130.	
An introductory course designed to provide an overview of the scope of occupational therapy services. Students will gain a meaningful exposure to occupational therapy practice settings, conditions seen, and therapeutic interventions. Grade Mode: A.		BIOS 240 - Occupational Therapy Conditions	Credits 3
Restriction(s): Must be Undergraduate Level.		A study of the different conditions that can impact occupational participation and quality of life, including birth defects, traumatic injuries, mental health or behavioral problems, and chronic illness. Grade Mode: A.	
		Restriction(s): Must be Undergraduate Level.	
		BIOS 254 - Human Anatomy	Credits 4
		An introduction to the basic structure and function of the human body. Laboratory emphasis varies from section to section to meet the needs of the different majors. Lecture/Lab Hours: Three hours lecture, one hour pre-lab, three hours laboratory. Note(s): Cadavers are used. Grade Mode: A.	
		Restriction(s): Must be Undergraduate Level.	
		Course Fee: \$130.	

BIOS 281 - Physiology A study of the basic concepts of physiological regulation from the level of the cell to the integrated intact organism including neural, muscular, and neuro-endocrine regulatory systems. Laboratory includes human systems analysis and electrophysiology. Lecture/Lab Hours: Three hours lecture, three hours laboratory. Note(s): Cannot be combined with BIOS 381 for credit. Grade Mode: A. Prerequisite(s): CHEM 102 or CHEM 105 or CHEM 120. Restriction(s): Must not be Freshman Class; and must be Undergraduate Level. Course Fee: \$130.	Credits 4	BIOS 307 - Lake Ecology and Management Field study of lakes and other freshwater systems with applications to planning and management. Includes an introduction to limnology and investigation of representative lakes, streams, and wetlands of the region and compares the North American Great Lakes with other great lakes of the world and their stewardship. Note(s): Au Sable offering. Grade Mode: A. Restriction(s): Must be Undergraduate Level.	Credits 4
BIOS 282 - Microbiology A study of microbial organisms with emphasis on bacteria and viruses, including their morphology, physiology, metabolism and genetics; host parasite interactions; humoral and cell-mediated immunity. Laboratory practice in handling microorganisms, including identification and culture techniques. Lecture/Lab Hours: Three hours lecture, four hours laboratory. Note(s): Cannot be combined with BIOS 380 for credit. Grade Mode: A. Restriction(s): Must be Undergraduate Level. Course Fee: \$130.	Credits 4	BIOS 308 - Biochemistry Biochemistry explores the chemical processes occurring at the cellular and molecular level of living organisms. It covers a range of scientific disciplines including animal and plant physiology, microbiology, ecology, developmental biology as well as the fields of medicine, nutrition and pharmaceutical research. This course will survey the basic structural properties of amino acids, proteins, nucleic acids as well as the common anabolic and catabolic pathways in plant and animal cells. Real-world applications in nutrition, diseases, metabolic disorders, pharmaceuticals and supplements will be discussed. Lecture/Lab Hours: Three hours lecture. Note(s): Please note this is a one-semester survey course designed to meet the requirements of non-premed (MD/DO) schools including but not limited to Physicians Assistant (PA), Physical Therapy (PT), Occupational Therapy (OT), Dentistry (DDS/DMD), and Optometry (OD) schools; cannot be combined with BIOS 411/CHEM 411 General Biochemistry I or BIOS 412/CHEM 412 General Biochemistry II for credit. Grade Mode: A. Prerequisite(s): CHEM 301 and CHEM 311; or CHEM 321 and CHEM 322. Restriction(s): Must not be Pre-Medical Studies (BCPM) or Biochemistry (BCHM); and must be Undergraduate Level.	Credits 3
BIOS 302 - Vertebrate Biology The biology of vertebrates, stressing structure and function. Laboratory dissection of representative vertebrates emphasizes comparative anatomy. Grade Mode: A. Prerequisite(s): BIOS 105; or BIOS 112 and BIOS 114. Restriction(s): Must be Undergraduate Level. Course Fee: \$130.	Credits 4	BIOS 310 - Prosection An introduction to the human body through dissection and demonstration of a selected portion of a human cadaver. Lecture/Lab Hours: Thirty hours of laboratory. Note(s): Special approval required; may be taken for a total of 2 credits. Grade Mode: A. Prerequisite(s): BIOS 254. Restriction(s): Must be Undergraduate Level. Repeat Limit (total number of credits): 2. Course Fee: \$130.	Credits 1-2
BIOS 303 - Ecological Agriculture Environmental analysis of natural resources in relation to people and policy. Focus is on ethnobotany, ecological agriculture, and land stewardship. Employs a discussion format both in classroom and field settings. Emphasis on grappling with difficult practical and ethical problems. Note(s): Au Sable offering. Grade Mode: A. Restriction(s): Must be Undergraduate Level.	Credits 4	BIOS 311 - Neurobiology This course examines the development and anatomy of the mammalian nervous system, physical and chemical basis for action potential, synaptic transmission, sensory and motor pathways, learning and memory, and the neuroscience of brain diseases. Students will learn how the nervous system produces behavior and explore the connection between the physical and the spiritual brain. Note(s): BIOS 112 and CHEM 106 recommended. Grade Mode: A. Prerequisite(s): CHEM 105; BIOS 111 or BIOS 254 or BIOS 281 or BIOS 381. Restriction(s): Must not be Freshmen Class; and must be Undergraduate Level.	Credits 3
BIOS 305 - Global Development and Ecological Sustainability Environmental analysis and natural resources analysis in relation to society and developmental issues. Focus on ecological sustainability and sustainable society in the context of various factors that are bringing environmental degradation and impoverishment of people and cultures. Topics include tropical agriculture, hunger, poverty, international debt, appropriate technology, relief programs, missionary earthkeeping, conservation of wild nature, land tenure and land stewardship. Employs a discussion format grappling with difficult practical and ethical problems and issues that require deep and personal thought. Note(s): Biola or Au Sable offering. Grade Mode: A. Restriction(s): Must be Undergraduate Level.	Credits 3-4	BIOS 312 - Cell and Molecular Biology Discusses the molecular organization and function of cells and their organelles, with emphasis on chromosome structure, gene expression, membrane structure and function, energy conversion, and experimental methods used to study subcellular components. Grade Mode: A. Prerequisite(s): BIOS 111 and BIOS 113; concurrent registration permitted in CHEM 301 and CHEM 311; or CHEM 321 and CHEM 322. Restriction(s): Must be Undergraduate Level.	Credits 3
BIOS 306 - Land Resources Systems level perspective on landforms and ecosystems. Includes analysis and interpretation of field data, remote sensing data derived from satellites and aircraft and geological information systems (GIS). Field trips to and analysis of forests, wetlands, lakeshores and rivers. Includes application to policy and land use planning. Note(s): Au Sable offering. Grade Mode: A. Restriction(s): Must be Undergraduate Level.	Credits 4		

BIOS 315 - Nutrition and Metabolism	Credits 3	BIOS 334 - Laboratory in Genetics	Credit 1
Study of molecular structure, absorption and cellular use of macro and micronutrients as well as dietary deficiencies and disorders. Analyzes food production, distribution, preparation and digestion. Human health is emphasized. Laboratory includes food analysis, preparation and field trips. Lecture/Lab Hours: Three hours lecture. Grade Mode: A, N.		A laboratory course to accompany BIOS 332. Practical techniques used in genetic testing, molecular genetics, cytogenetics and the use of model organisms in heredity studies. Training in professional documentation and reporting of results is included. Lecture/Lab Hours: Four hours laboratory. Grade Mode: A.	
Prerequisite(s): BIOS 111 and BIOS 113; CHEM 102 or CHEM 105 or CHEM 120.		Prerequisite(s): CHEM 301 and CHEM 311; or CHEM 321 and CHEM 322 (may be taken concurrently).	
Restriction(s): Must be Undergraduate Level.		Corequisite(s): BIOS 332.	
BIOS 316 - Nutrition and Metabolism Lab	Credit 1	Restriction(s): Must be Undergraduate Level.	
The Nutrition and Metabolism Laboratory will acquaint students with fundamental techniques used in food preparation and food science. Various foods will be analyzed for total energy content using various forms of calorimetry. Foods will also be analyzed for protein, simple and complex carbohydrate as well as fat content. Students will analyze the physical properties of various foods and experiment with preparation and preservation techniques. Students will tour several food production, processing and distribution centers. Attendance at each scheduled lab session is required and students will document their experimental procedures and results in a lab notebook. Lecture/Lab Hours: Four hours laboratory. Grade Mode: A.		Course Fee: \$130.	
Prerequisite(s): BIOS 111 and BIOS 113; CHEM 102 or CHEM 105 or CHEM 120.		BIOS 335 - Field Biology	Credits 1-4
Restriction(s): Must be Undergraduate Level.		Systematics, distribution, behavior and ecology of the common plants and animals of the selected domestic or international site or region. Emphasis is on the site's biodiversity, ecology, and associated conservation issues. Trips to domestic sites may occur during Interterm or Summer terms, as well as on Saturdays or weekends during the school year. Domestic sites may include the LA region, the Sierra, the Grand Canyon, and the Channel Islands. Trips to international sites may occur in the Interterm or Summer term and may include studies world-wide. Both domestic and international sites will vary from year to year based on faculty interest and student support and enrollment. Note(s): Students taking this course as an elective will have different assignments than BIOS and BIES majors; credits vary based on different lengths of time at the study site. Grade Mode: A.	
Course Fee: \$130.		Restriction(s): Must be Undergraduate Level.	
BIOS 322 - Laboratory in Cell and Molecular Biology	Credit 1	Additional Fee(s): Varied by location and duration of trip(s).	
Practical application of traditional and current laboratory techniques used in research and industry, including microscopy, scanning electron microscopy, histology, chromosomal analysis, tissue cell culture, isolation and purification of DNA, RNA and proteins, PCR, proper documentation and protocols and other laboratory writing skills are emphasized. Lecture/Lab Hours: Four hours of laboratory. Grade Mode: A.		BIOS 340 - Assessment in Occupational Therapy	Credits 3
Prerequisite(s): BIOS 111 and BIOS 113; concurrent registration permitted in CHEM 301 and CHEM 311; or CHEM 321 and CHEM 322.		An overview of the different assessments that are used to evaluate the occupational performance across various populations and conditions, including pediatric, geriatric, mental health, cognitive, and physical assessments. Laboratory practice in clinical techniques necessary for occupational therapy assessments. Lecture/Lab Hours: Two hours lecture, four hours laboratory. Grade Mode: A.	
Restriction(s): Must be Undergraduate Level.		Prerequisite(s): BIOS 240.	
Course Fee: \$130.		Restriction(s): Must be Undergraduate Level.	
Course Fee: \$130.		Course Fee: \$130.	
BIOS 325 - Environmental Microbiology	Credits 4	BIOS 344 - Practices in Occupational Therapy	
Microorganisms exist in all areas of nature, ranging from soils and waters to extreme environments, which are too harsh for the existence of humans, animals or plants. Understanding the role played by microorganisms in these environments is critical to our survival and quality of life. Such roles include cycling of elements, breakdown of organic material and pollutants, contribution to geological processes, causing diseases, water quality and wastewater treatment, and the biodeterioration of materials. Lecture/Lab Hours: Three hours lecture, four hours laboratory. Grade Mode: A.		Interventions	Credits 3
Prerequisite(s): BIOS 103; and CHEM 106 or CHEM 120.		This foundational course will provide an overview of different occupational therapy interventions commonly used to treat occupational performance difficulties for diverse populations and conditions in various treatment settings across the lifespan. Occupational interventions selected for this class are presented in association with prevailing models of practice and practice frameworks. Laboratory includes hands-on practice of interventions covered in lecture. Lecture/Lab Hours: Two hours lecture, four hours laboratory. Grade Mode: A.	
Restriction(s): Must be Undergraduate Level.		Prerequisite(s): BIOS 340.	
Course Fee: \$130.		Restriction(s): Must be Undergraduate Level.	
Course Fee: \$130.		Course Fee: \$130.	
BIOS 332 - Genetics	Credits 3	BIOS 345 - Interventions in Occupational Therapy	Credits 3
Integrates principles of Mendelian and molecular genetics toward understanding the structure and function of chromosomal elements. Explores current issues in genetic testing and genetic engineering from technical and ethical viewpoints. Grade Mode: A.		An overview of the different interventions that are used to treat the occupational performance difficulties for various populations and conditions, including pediatric, geriatric, mental health, cognitive, and physical assessments. Grade Mode: A.	
Prerequisite(s): CHEM 301 and CHEM 311; or CHEM 321 and CHEM 322.		Prerequisite(s): BIOS 240.	
Corequisite(s): BIOS 334.		Restriction(s): Must be Undergraduate Level.	
Restriction(s): Must be Undergraduate Level.			

BIOS 346 - Medical Terminology

This course will provide an overview of the abbreviations and terminology used in medical settings. An overview of the human body, conditions, and procedures in correspondence with medical abbreviations will be covered. **Grade Mode:** A.

Prerequisite(s): BIOS 112 and BIOS 114; or BIOS 254.

Restriction(s): Must be Undergraduate Level.

BIOS 351 - Invertebrate Biology

Credits 4

Taxonomy and morphology of invertebrate phyla; laboratory dissection of invertebrates. **Lecture/Lab Hours:** Three hours lecture, four hours laboratory. **Grade Mode:** A.

Prerequisite(s): BIOS 105; or BIOS 112 and BIOS 114.

Restriction(s): Must be Undergraduate Level.

Course Fee: \$130.

BIOS 352 - Marine Biology

Credits 4

Introduction to oceanography, marine plant and animal diversity, and ecological relationships. Lab sessions will include field trips. **Lecture/Lab Hours:** Three hours lecture, four hours laboratory. **Grade Mode:** A.

Prerequisite(s): BIOS 105; or BIOS 112 and BIOS 114.

Restriction(s): Must be Undergraduate Level.

Course Fee: \$130.

BIOS 353 - Environmental Ethics

Credits 3-4

Investigation of contemporary problems in environmental stewardship including the use of renewable and nonrenewable natural resources, pollution, appropriate land use and development, third world concerns, and preservation of wild nature. In addition to developing a Christian environmental ethic from a stewardship perspective, the course considers such movements and issues as deep ecology and ecofeminism, animal rights, wilderness ethics, wildlife management, biodiversity and agro-ecology. Emphasis on considering concrete, current ethical debate. **Note(s):** Biola or Au Sable offering. **Grade Mode:** A.

Restriction(s): Must be Undergraduate Level.

BIOS 354 - Bioethics

Credits 4

The dilemmas of dangerous knowledge in environmental and medical activities are investigated, including stem cell research and applications, fetal tissue research, human gene manipulation, transgenic bioengineering, genetically modified crops, release of bioengineered organisms into natural ecosystems, and emerging disease, the ethics of environmental activism, and the religious roots of ethical values. This course uses a seminar format in which topics are presented by student teams including presentations, panel discussions and debate. Current attempts to develop a theological basis for bioethics are considered. **Note(s):** Au Sable offering. **Grade Mode:** A.

Restriction(s): Must be Undergraduate Level.

BIOS 355 - Environmental Health: An Ecological

Credits 4

Perspective

Introduction to the fundamentals of environmental health, with an introduction to environmental epidemiology and environmental medicine. Environmental pollutants and their sources, effects of environmental pollution on the environment and public health, environmental control agencies, methods of pollution control, environmental law and policy, environmental and public health research agencies, environmental epidemiology, environmental medicine, and environmental stewardship are included. Field trips and lab assignments complement the material covered in lectures. **Lecture/Lab Hours:** Three hours lecture, four hours laboratory.

Note(s): Biola or Au Sable offering. **Grade Mode:** A.

Restriction(s): Must be Undergraduate Level.

Course Fee: \$130.

BIOS 360 - Principles of Geographic Information Systems Credits 4

This course will provide an understanding of the importance of geographic information systems software (GIS) that is used worldwide to create maps and analyze digital data and photos for use in many disciplines. Within the biological and environmental sciences it is used in environmental impact reports, city or regional planning, and species and ecosystem management plans. Students will create maps and analyze data gained from the web or created by themselves. **Lecture/Lab Hours:** Three hours lecture, four hours laboratory, weekly. **Note(s):** Must have good computer skills and be familiar with Microsoft Excel.

Grade Mode: A.

Restriction(s): Must not be Freshman Class; and must be Undergraduate Level.

Course Fee: \$130.

BIOS 368 - Pathophysiology

Credits 3

Upon completing this course, students will be able to understand the functional and biochemical changes to the physiology and anatomy of the human body because of diseases. Broad categories of diseases affecting the organ systems will be considered. Students will also be introduced to clinical differential diagnosis and problem-solving in the healthcare setting. **Grade Mode:** A.

Prerequisite(s): BIOS 254; BIOS 281 or BIOS 381.

Restriction(s): Must be Undergraduate Level.

BIOS 371 - Conservation Biology

Credits 4

Principles of conservation biology with applications to sustainable human society and biospheric integrity. An integrative approach to biology and society that interrelates population biology, ecological principles, biogeochemical cycles, ecosystem functions, and human society in the context of biospheric degradation. The course develops a stewardship perspective rooted in biological principles and directed at conservation of plant and animal species, biotic communities, ecosystems and human society. Included are topics of human development, poverty and economic growth. **Note(s):** Biola and Au Sable offering. **Grade Mode:** A.

Prerequisite(s): BIOS 105; or BIOS 112 and BIOS 114.

Restriction(s): Must be Undergraduate Level.

Course Fee: \$130.

BIOS 372 - Restoration Ecology

Credits 4

Ecological and theoretical foundations for ecosystem and biotic community restoration. This course develops ecological principles for ecosystem restoration and applies them to redeeming and restoring degraded and damaged ecosystems and endangered species. Field studies include analysis of restoration and rehabilitation work with Kirtland Warbler, an officially designated wild river, coastal dunes, kettle-hole bogs, deforested lands, degraded residential and farming sites, and abandoned oil wells. A practical field laboratory is included in which techniques are applied to a specific site. **Note(s):** Au Sable offering. **Grade Mode:** A.

Restriction(s): Must be Undergraduate Level.

BIOS 380 - Advanced Microbiology	Credits 4	BIOS 410 - Topics in Environmental Science	Credits 1-4
A study of microbial diversity with emphasis on bacteria and viruses. Topics include structure, function, metabolism, nutrition and growth dynamics, control of microbial growth, and genetics. Students will gain practical hands-on experience in microbiology lab techniques used in diagnostics and research including staining and microscopy, bacteria culture, isolation and identification through various lab exercises. Core scientific skills will be developed through the following activities: critical review of primary literature; discussion of supporting theories and emerging concepts; and identifying unsolved problems in the field of microbiology. Students will design and execute an original research project and present their findings in a formal research paper. Lecture/Lab Hours: Three hours lecture, four hours laboratory. Grade Mode: A. Prerequisite(s): CHEM 106 or CHEM 120. Restriction(s): Cannot be combined with BIOS 282 for credit; must be Undergraduate Level. Course Fee: \$130.		Selected topics in environmental science. Note(s): May be taken multiple times with different content; Biola or Au Sable offering. Grade Mode: A. Restriction(s): Must be Undergraduate Level. Repeat Limit (total number of credits): 8.	
BIOS 381 - Advanced Physiology	Credits 4	BIOS 411 - General Biochemistry I	Credits 3
An advanced study of human physiology that emphasizes the mechanisms of homeostasis at the cellular, organ, and system levels. Neural, vascular, respiratory, excretory, digestive, and endocrine systems are studied. Advanced Physiology includes a major laboratory research project. Lecture/Lab Hours: Three hours lecture, four hours laboratory. Grade Mode: A. Prerequisite(s): BIOS 112 and BIOS 114, or BIOS 254; CHEM 106 or CHEM 120. Restriction(s): Cannot be combined with BIOS 281 for credit; must be Undergraduate Level. Course Fee: \$130.		Structures and properties of biomolecular components of cells, including proteins, carbohydrates, lipids, nucleotides, nucleic acids, vitamins and coenzymes, kinetics and mechanism and regulation of enzyme action in biological systems. Note(s): BIOS 111 and BIOS 113 (Fundamentals of Cellular and Molecular Biology) recommended. Grade Mode: A. Prerequisite(s): CHEM 302. Restriction(s): Must be Undergraduate Level.	
BIOS 390 - Au Sable Institute of Environmental Studies	Credits 4	BIOS 412 - General Biochemistry II	Credits 3
Au Sable is a Christian institute focusing on field studies from a stewardship perspective. Biola is a participating member of the institute. Courses are taught at field stations in Michigan, Washington, Florida and India. Coursework taken through the institute can be counted as elective credit in the Biological Sciences, or may be substituted for specific major requirements. Note(s): May be taken multiple times with different content. Grade Mode: A. Restriction(s): Must be Undergraduate Level. Repeat Limit (total number of credits): 16.		Principles of metabolic processes; mathematical treatment of bioenergetics emphasizing major concepts and problem solving. Note(s): BIOS 111 and BIOS 113 (Fundamentals of Cellular and Molecular Biology) recommended. Grade Mode: A. Prerequisite(s): CHEM 302. Restriction(s): Must be Undergraduate Level.	
BIOS 401 - General Ecology	Credits 4	BIOS 413 - Laboratory in General Biochemistry	Credits 2
An introduction to the general concepts of the ecology of populations, communities and ecosystems, including physiological ecology, speciation and evolutionary theory. Laboratory includes field trips and a research project. Grade Mode: A. Prerequisite(s): BIOS 105; or BIOS 112 and BIOS 114. Restriction(s): Must be Junior Class, or Senior Class; and Undergraduate Level. Course Fee: \$130.		A laboratory course to accompany BIOS 411, BIOS 412 (CHEM 411, CHEM 412). The isolation, characterization and analysis of biomolecules including the use of biochemical instrumentation and methodology for work in protein structure, enzymology, metabolism and genetics. Note(s): BIOS 111 and BIOS 113 (Fundamentals of Cellular and Molecular Biology) recommended. Grade Mode: A. Prerequisite(s): CHEM 302. Restriction(s): Must be Undergraduate Level. Course Fee: \$130.	
BIOS 402 - Parasitology	Credits 3	BIOS 424 - Advanced Molecular Techniques	Credits 1-2
Taxonomy, life history, physiology, molecular basis, ecology and morphology of animal parasites with emphasis on those affecting humans. Lecture/Lab Hours: Three hours lecture. Grade Mode: A. Prerequisite(s): BIOS 111, BIOS 113; and BIOS 112, BIOS 114. Restriction(s): Must be Junior Class, or Senior Class; and Undergraduate Level. Course Fee: \$130.		This 1-2 credit laboratory course will focus on methods used to assess gene expression levels, expressing transgenic genes and genotyping organisms. Techniques include: RNA isolation, reverse transcription, expression constructs, northern blotting and qPCR as well as <i>in situ</i> hybridization and genotyping. These methods are used in various biology biotechnology and pharmaceutical research labs and this course will prepare students for entry into high level research careers. Note(s): Special approval required; three hours lab required per credit. Grade Mode: A. Restriction(s): Must be Undergraduate Level. Course Fee: \$130.	
BIOS 430 - Topics in Natural Resource Management		BIOS 430 - Topics in Natural Resource Management	Credits 1-4
		Selected topics in natural resource management. Note(s): May be taken multiple times with different content; Au Sable offering. Grade Mode: A. Restriction(s): Must be Undergraduate Level. Repeat Limit (total number of credits): 8.	
BIOS 431 - Developmental Biology		BIOS 431 - Developmental Biology	Credits 3
		Analyzes the molecular, genetic and cellular mechanisms that control fertilization, the development of body form, cell specialization and differentiation as well as metamorphosis, maturation and aging. Grade Mode: A. Prerequisite(s): BIOS 312. Restriction(s): Must be Undergraduate Level.	

BIOS 440 - Topics in Advanced Biology	Credits 1-4	BIOS 460 - Clinical Observation Practicum	Credits 1-2
Selected topics of current interest and concern are studied. Note(s): Course may be taken multiple times for credit with different content (section title). Grade Mode: A.		Pre-Medical Practicum; Pre-Dental Practicum; Pre-Medical Technology; Pre-Veterinary Practicum. Practicum: A professionally supervised observation, demonstration and study in a local medical, dental or laboratory facility. Introduction to health care philosophies, hospital and patient routines, personnel, instrumentation and specific treatment practices. Note(s): Special approval required; case study and research paper required; thirty hours of observation. Grade Mode: A.	
Restriction(s): Must be Allied Health (BIAH), Biochemistry (BCHM), Biological Science (BIOS), or Health Sciences (BIHS); Junior Class or Senior Class; and Undergraduate Level.		Restriction(s): Must be Junior Class or Senior Class; and Undergraduate Level.	
Repeat Limit (after first attempt): 10.		Repeat Limit (total number of credits): 2.	
Course Fee: \$95.		Course Fee: \$95.	
BIOS 445 - Immunology	Credits 3	BIOS 470 - Seminar in Advanced Biology	Credit 1
A study of the structures and functions of the immune system, humoral and cell mediated immunity, and analysis of medically significant disorders of the immune system. Grade Mode: A.		Literature research followed by oral presentation, group discussion and evaluation; independent thought and study stressed. Grade Mode: A.	
Prerequisite(s): BIOS 312 (may be taken concurrently).		Restriction(s): Must be Junior Class, or Senior Class; and must be Undergraduate Level.	
Restriction(s): Must be Undergraduate Level.		Repeat Limit (total number of credits): 2.	
BIOS 446 - Ornithology	Credits 4	BIOS 475 - Occupational Therapy Capstone	Credit 1
Systematics, distribution, physiology, behavior and ecology of birds. Field identification emphasized. Lecture/Lab Hours: Two hours lecture, four hours laboratory/field trip; Saturday field trips are required. Grade Mode: A.		A culmination course where students bring together their understanding of the field with their developed ability to think critically and integrate their faith. Students will produce a portfolio that includes a literature review, a research proposal, a career pathway that details their academic and professional goals, and an integration paper. Grade Mode: A.	
Prerequisite(s): BIOS 105; or BIOS 112 and BIOS 114.		Prerequisite(s): BIOS 340 or BIOS 344 or BIOS 345.	
Restriction(s): Must be Undergraduate Level.		Restriction(s): Must be Junior Class, or Senior Class; and Undergraduate Level.	
Course Fee: \$130.		BIOS 480 - Internship	Credits 1-2
BIOS 448 - Design of Life	Credits 3	Professionally supervised participation in pre-approved research or a project at an off-campus site. Documentation of the time spent and the activities performed as well as a written paper explaining the project are required. Note(s): Special approval required; a minimum of forty-five hours of involvement; may be taken twice for a maximum of 2 credits. Grade Mode: A.	
After equipping students to show themselves and others that life really is designed, this course concentrates on extraordinary aspects of the design of life in comparison to human designs. Grade Mode: A.		Restriction(s): Must be Undergraduate Level.	
Restriction(s): Must be Allied Health (BIAH), Biochemistry (BCHM), Biological Science (BIOS), Health Sciences (BIHS), or Human Biology (BIHB); Junior Class or Senior Class; and Undergraduate Level.		Repeat Limit (total number of credits): 2.	
BIOS 452 - Directed Studies in Environmental Sciences	Credits 1-2	BIOS 490 - Directed Research	Credits 1-4
This course is taken as an arranged course in consultation with an academic advisor. Course is taken when it is determined that a student is deficient in content and/or credits in a given subject matter. The specific content of the course will be recorded on the student's transcript to indicate a student's completion of the major specific requirement(s) for graduation in that major. Note(s): May be taken for credit multiple times. Grade Mode: A.		Literature and laboratory or field research of a specific subject or technique in biology; advanced students gain experience in experimental design, laboratory investigation and technical writing. Note(s): Special approval required; requires a written report; may be repeated in subsequent terms. Grade Mode: A.	
Restriction(s): Must be Undergraduate Level.		Restriction(s): Must be Allied Health (BIAH), Biochemistry (BCHM), Biological Science (BIOS), or Health Sciences (BIHS); Junior Class or Senior Class; and Undergraduate Level.	
Repeat Limit (total number of credits): 6.		Repeat Limit (total number of credits): 4.	
BIOS 455 - General Virology	Credits 3	Course Fee: \$130.	
Virology is a course that examines the diversity of plant, animal and bacterial viruses. Emphasis on topics such as molecular interactions between the host and virus, the genetics and chemical nature of viruses, and the replication strategies of viruses. How viruses cause disease, how they are used in biotechnology, and their overall impact on society will also be discussed. Grade Mode: A.			
Prerequisite(s): BIOS 312.			
Restriction(s): Must be Undergraduate Level.			