Biology

Program Website: http://www.hiram.edu/biology

Introduction
Do you have an interest in plants, animals, fungi, and bacteria? Are you driven to explore all aspects of life in both the laboratory and in the field? Are you interested in molecules, cells, organisms, ecosystems, and evolution? Hiram students begin their studies of biology by developing comprehensive knowledge about life processes on the ecosystem, organismal, cellular, and molecular levels. Our faculty members help students focus that knowledge within deeper fields of specialization, such as animal behavior, biochemistry, molecular biology, human anatomy, neuroscience, ecology, genomics, and systematics. We encourage our students to explore the numerous fields of study available to biologists before identifying an area on which to concentrate, including interdisciplinary programs such as biochemistry, biomedical humanities, and neuroscience. This exploration takes place in the classroom, in the laboratory, in the field, and between faculty members and students.

Students majoring in biology at Hiram College participate in a curriculum that culminates in the APEX capstone experience. APEX is defined as "the highest point" and our curriculum is designed to provide each student with the foundation and depth necessary to advance to the highest levels of any career path they pursue, whether they begin with graduate education, professional school, or a first job. The curriculum does this by ensuring a broad background in biology as well as allowing the student significant flexibility and choice as he or she matures within the discipline. All students practice problem solving, critical thinking, and the scientific method within a dynamic, challenging, and supportive scholarly environment.

Students who are interested in the life sciences and have yet to declare a major may consider biology or one of its closely related programs.

Biology students have the option of pursuing a major or a minor in the program.

- Biology Major (https://catalog.hiram.edu/undergraduate/schools/science-technology/biology/biology-major/)
- Biology Minor (https://catalog.hiram.edu/undergraduate/schools/science-technology/biology/biology-minor/)
- Natural History Minor - Biology (https://catalog.hiram.edu/undergraduate/schools/science-technology/biology/natural-history-minor/)

The Biology Curriculum
To complete a degree in biology, students must take a minimum of 45 credit hours of coursework, spread over six core classes, three electives, and three correlative courses taken from other disciplines on campus.

Faculty
Jennifer Clark, (2012) Associate Professor of Biology; Director, Northwoods Field Station; Director of Academic Programs, James H. Barrow Biological Field Station; Co-director Hiram College FrogWatch USA Chapter
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Bradley Goodner, (2001) Director of the School of Health & Medical Humanities; Professor of Biology; Edward J. Smerek Chair of Mathematics, the Sciences, and Technology; Director of Center for Scientific Engagement
B.S., Texas A&M University; Ph.D., Purdue University goodnerbw@hiram.edu

Nicolas Hirsch, (2008) Director of the School of Science & Technology; Associate Professor of Biology
B.A., University of Chicago; Ph.D., University of California, San Diego hirschn@hiram.edu

Thomas Koehnle, (2007) Associate Professor of Biology; Neuroscience Program Coordinator
B.S., Ohio University; Ph.D., University of California, Davis koehnlet@hiram.edu

Julie M Maxson, (2012) Visiting Assistant Professor
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Course Descriptions
BIOL 10100: BEGINNING FIELD BIOLOGY-W/LAB:SM: 4 Hour(s)
BEGINNING FIELD BIOLOGY-W/LAB:SM~ An introduction to various ecosystems in temperate, tropical, desert, montane, and marine environments covering the diversity of plant and animal species and their structural and functional adaptations. Each time the course is offered it concentrates on a particular geographic area and its distinctive habitats and organisms, interactions and interrelationships among the organisms, and the abiotic factors that constrain populations. Designed for students majoring outside the sciences who have taken no other biology courses. Cannot be counted toward a biology major. Student must also register for a BIOL 10100 lab. The breakdown between lecture and lab hours is for administrative office use only. This course may only be taken as 4 credit hours. This course fulfills the Experimental Scientific Methods requirement.
Core: Experimental Scientific Method

BIOL 10200: BIOLOGY OF THE SQUIRREL:SM: 3 Hour(s)
BIOLGOGY OF THE SQUIRREL:SM~ This course is designed for nonmajors. Students taking this course will receive an intensive introduction to general problems in the study of behavioral ecology, with a specific focus on foraging, defensive behavior, social behavior, reproduction, habitat selection, and physiology. How does body size determine food choices? How do individuals living in the same area cooperate or do battle to establish territory? How does the diversity of species in the environment impact the choice of home range? How can small animals escape from, or cope with, predation? The Eastern Gray Squirrel will serve as a model species in this course. Students will read extensively in the primary and secondary literatures of animal behavior and behavioral ecology. All students will carry out a field based project studying the behavior and ecology of the gray squirrel. Appropriate for non-majors. This course fulfills the Experimental Scientific Methods requirement.
Core: Experimental Scientific Method
BIOL 10300: EVIDENCE BASED MEDICINE:SM: 3 Hour(s)
EVIDENCE BASED MEDICINE:SM~ Do cell phones cause cancer? Do aluminum cooking pots cause Alzheimer’s disease? Does taking vitamins actually reduce the incidence of cancer? Students taking this course will receive an introduction to the history of study of microbes, vitamins, and environmental toxins. The course will emphasize the roles of investigators, data analysis, and differing interpretations of evidence in the expansion of the Germ Theory of disease, the death of Vitalism, and the explanation of the development of modern toxicology. Each student will build a collection of scientific literature related to one of these health topics, and evaluate a medical hypothesis for their final project in the class. This course will help to train beginning students in some basic theories in and history of biology, and prepare them to advance into upper division coursework related to medicine or other health careers, as well as fulfill the general education goals for scientific literacy and methods. Appropriate for non-majors. This course fulfills the Scientific Methods requirement. Core: Experimental Scientific Method

BIOL 12500: PRINCIPLES&EXPERMTNS NONMJR:SM: 4 Hour(s)
TOPICS IN BIOLOGY: PRINCIPLES AND EXPERIMENTS FOR NON-MAJORS: SM~ This course takes both a concept-based and hands-on approach to learning the basic principles and unifying concepts of biology. Students will experience scientific exploration and inquiry and the rigor of the scientific method by applying biological theories to experimental data collected during the course. Further, a special focus on interpretation of results and their application to broad scale consequences will emphasize the importance of biological systems to everyday life. Specific topics of study will be chosen by the instructor. Appropriate for non-majors. Core: Experimental Scientific Method

BIOL 13100: ANATOMY/PHYSIOLOGY I:W/LAB: 4 Hour(s)
HUMAN ANATOMY AND PHYSIOLOGY I:W/LAB~ This course will familiarize students with the fundamental principles involved in the structure and function of the human body. Topics include basic cell biology and tissue structure. The course will also cover the structure and function of the skeletal, muscular, circulatory, and nervous systems. The laboratory includes study of the human skeleton, muscles, brain, animal dissection, and experiments in human physiology. This is the first part of a two-semester course. Includes a 3-hour lab. Students must register for a BIOL 13100 lab. The breakdown between lecture and lab hours is for administrative office use only. This course may only be taken as 4 credit hours. Corequisite: Chemistry 10500, Nursing students only, or permission of the department. Prerequisite: CHEM 10500 (may be taken concurrently)

BIOL 13300: ANATOMY & PHYSIOLOGY II:W/LAB: 4 Hour(s)
HUMAN ANATOMY AND PHYSIOLOGY II:W/LAB~ This is the second of a two semester sequence on the form and function of all of the systems of the human body. BIOL 13300 will cover the digestive, respiratory, urinary, cardiovascular, immune, and reproductive systems. Endocrinology, blood chemistry, and metabolism will also be covered. Includes a 3 hour lab. Prerequisite: Biology 13100, Chemistry 10500 or permission. Students must register for a BIOL 13300 lab. The breakdown between lecture and lab hours is for administrative office use only. This course may only be taken as 4 credit hours. Prerequisite: (BIOL 131 or BIOL 13100) and CHEM 10500

BIOL 15100: INTRO BIO I W/LAB: SM: 4 Hour(s)
INTRODUCTORY BIOLOGY I: BIODIVERSITY, ECOLOGY & EVOLUTION-W/LAB~ An introduction to the scientific process as exemplified by the study of ecology and evolution. The scientific process will be dissected to understand how scientists make progress in understanding nature works and how science differs from other ways of human understanding. Ecology, the sum of the interactions of organisms with their living and nonliving environment, and evolution, how organisms change and adapt to their surroundings over time, will be explored using examples from all kinds of organisms. Laboratory experience will include many opportunities to work on various aspects of the scientific process (hypothesis generation, data gathering and analysis, hypothesis testing) through a focus on the diversity of life at the James H. Barrow Field Station. Students must register for a BIOL 15100 lab. The breakdown between lecture and lab hours is for administrative office use only. This course may only be taken as 4 credit hours. Core: Experimental Scientific Method

BIOL 15200: INTRO BIO II W/LAB: SM: 4 Hour(s)
INTRODUCTORY BIOLOGY II: STRUCTURE AND FUNCTION OF ORGANISMS, CELLS & MOLECULES-W/LAB: SM~ The purpose of this course is to explore the myriad ways organisms reproduce, develop, acquire nutrients and energy, manage waste, respond to the environment, and exhibit distinctive adaptations that have resulted from evolution. One recurring key concept is the conservative nature of all life’s processes in all organisms. This is evident in the similarities found in primary energy metabolism (i.e., cellular respiration and photosynthesis), other aspects of metabolism (biomolecular building blocks and the macromolecules they form), reproduction, protein synthesis, energy flow and nutrient cycling, and managing/regulating water intake and retention. All organisms also detect and respond to their environment on many levels (organismal, organ, cellular, and subcellular), and biologists find both similarities and differences among all of life in these respects. Prerequisite: BIOL 15100 or permission. This course fulfills the Experimental Scientific Methods requirement. Students must register for a BIOL 15200 lab. The breakdown between lecture and lab hours is for administrative office use only. This course may only be taken as 4 credit hours. Prerequisite: BIOL 15100
Core: Experimental Scientific Method

BIOL 18000: WKSP: 1 Hour(s)
WORKSHOP~ This workshop will provide the opportunity for students to examine a special topic in Biology. Through readings, discussions and written assignments there will be opportunities to evaluate the topic at issue. Workshops may be taken Pass/No Credit only. Students may take no more than nine workshops for credit toward graduation. Workshops can be used as elective credit only. (For PGS students only.)
BIOL 20100: TOPICS IN MEDICAL RESEARCH: 4 Hour(s)
TOPICS IN MEDICAL RESEARCH ~ This course is for freshmen who are interested in a science major or preparation for professional school (health professions) or graduate school in a scientific field. Students will learn how to read cutting edge primary literature on the topics of cancer therapies, stem cell research and therapeutic use, and how information from the Human Genome Project is being used to treat disease. For each of these topics, you will be introduced to a current primary literature article describing the recent progress made in these areas of research. In the lab, you will be learning how to perform genetic engineering, and will also use a technique on your own DNA to identify genetic differences between individuals. The overall goal of this course is to give you the experience you need to be competitive for summer undergraduate research internships, which are essential both for students interested in professions in the health sciences and for students interested in future graduate studies in the sciences. It is most appropriate for students who are thinking about a major or minor in Biology, Biomedical Humanities, Biochemistry, Chemistry, or Neuroscience. Prerequisite: (BIOL 151 or BIOL 15100) or (CHEM 120 or CHEM 12000)

BIOL 20500: SOUTH AFRICA:PREQUEL: 1 Hour(s)
SOUTH AFRICA:PREQUEL ~ This 1 credit hour course is a prerequisite for INTD 30140 CHANGING LANDSCAPES:INTEGRATING SOCIOLOGICAL AND ECOLOGICAL LANDSCAPES IN AN EXPLORATION OF CONTEMPORARY ISSUES IN SOUTH AFRICA.

BIOL 20900: INSECTS AND SOCIETY:ES: 3 Hour(s)
INSECTS AND SOCIETY:ES ~ Insects are the most successful animals on earth: they have the greatest species diversity, they occur nearly everywhere, and they have been impacting humans since the start of civilization. Sometimes these impacts are positive (e.g., pollination), sometimes they are negative (e.g., disease). It has been this way throughout recorded history and will continue to be this way for the foreseeable future. This course begins with a brief introduction to insect biology, which is presented so that all students can be engaged, not just those majoring in the life sciences. Topics include the impacts of insects on our food, homes, and health, as well as the influence of insects on culture, world history, and the long-term maintenance of the earth’s critical support systems. Ethical issues that directly or indirectly involve insects are discussed throughout the course and students evaluate how insects are valued by society, how these values are developed, and whether these values are justified. Appropriate for non-majors. This course does not count toward a Biology major or minor. This course fulfills the Meaning, Ethics, and Social Responsibility requirement. Core: Meaning/Ethics/Soc Responsibil

BIOL 21000: RESEARCH DESIGN & ANALYSIS:SM: 4 Hour(s)
RESEARCH DESIGN AND ANALYSIS:SM ~ This course provides a thorough introduction to the research methods, analysis techniques, and writing style used in psychological science. Topics include a review of the scientific method and ethical concerns, problems of definition, measurement, reliability and validity, descriptive and inferential statistics, experimental designs and control procedures. Students will engage in hands-on experience in how psychologists conduct human behavioral research, with an emphasis on methods, computational analyses, and the interpretation of data for a scientific and a lay audience. This course is a required course for all psychology majors and minors, and is a prerequisite for many other content courses offered by the Psychology Department. Additionally, you must receive at least a ‘C’ in this course for it to count towards a psychology major or minor. This course fulfills the Scientific Methods (SM) Distribution Requirement. Prerequisites: PSYC (101 or 10100) or IES 10100
Prerequisite: PSYC 10100 or IES 10100
Core: Experimental Scientific Method

BIOL 21300: SYS OF NON-VASC PLANTS-W/LAB: 4 Hour(s)
SYSTEMATICS OF NON-VASCULAR PLANTS-W/LAB~ Classification, identification, ecology, evolution, and comparative morphology of non vascular plants, including algae, fungi, lichens and bryophytes. Emphasis on the evolutionary development in complexity of structure and of reproductive patterns. Current concepts of kingdoms of organisms are also covered. Field work includes identification of mushrooms appearing here in early fall and bryophytes. Individual projects combine basic ecological principles with the study of the local flora. Students must also register for a BIOL 21300 lab. Prerequisites: Biology 151 or 15100, 152 or 15200, or permission. The breakdown between lecture and lab hours is for administrative office use only. This course may only be taken as 4 credit hours.
Prerequisite: (BIOL 141 or BIOL 14100 or BIOL 151 or BIOL 15100) and (BIOL 142 or BIOL 14200 or BIOL 152 or BIOL 15200)

BIOL 21500: EXPERIMENTAL METHODS:SM: 4 Hour(s)
EXPERIMENTAL METHODS:SM~ This course provides a thorough introduction to the research methods, analysis techniques, and writing style used in psychological science. Topics include a review of the scientific method and ethical concerns, problems of definition, measurement, reliability and validity, descriptive and inferential statistics, correlational research, experimental designs and control procedures. Laboratories will provide hands-on experience in how psychologists conduct human behavioral research, with an emphasis on methods, computational analyses, and the interpretation of data. Prerequisite: PSYC 10100. Also listed as BIOL 21500. This course fulfills the Experimental Scientific Methods requirement.
Prerequisite: (PSYC 101 or PSYC 10100)
Core: Experimental Scientific Method

BIOL 22300: VERTEBRATE BIOLOGY-W/LAB: 4 Hour(s)
VERTEBRATE BIOLOGY-W/LAB~ An introduction to the vertebrates. Five representative vertebrate dissections with major emphasis on mammalian anatomy in comparison with other forms. The ethology and life cycles, significance in evolution, comparative morphology and taxonomy of the vertebrates are studied in the laboratory, zoological gardens, museums, and James H. Barrow Field Station. Local field trips in the spring. Must also register for a BIOL 22300 Lab component. The breakdown between lecture and lab hours is for administrative office use only. This course may only be taken as 4 credit hours. Prerequisites: Biology 151 or 15100, 152 or 15200, or permission.
Prerequisite: (BIOL 141 or BIOL 14100 and BIOL 142 or BIOL 14200) or (BIOL 151 or BIOL 15100 and BIOL 152 or BIOL 15200)
BIOL 22700: INTRO TO NEUROSCIENCE: 4 Hour(s)
INTRODUCTION TO NEUROSCIENCE~ Introduction to neuroscience is a laboratory-based course designed to orient students to the many approaches to neuroscience. In addition to covering the development, evolution, anatomy, and physiology of the nervous system, students will learn about cell and molecular, cognitive and behavioral, computational, and philosophical approaches to the study of the brain. The lecture component of the course emphasizes finding, using, and criticizing primary sources in each domain of neuroscience. The lab component comprises two major original research projects designed, carried out, summarized, and presented by students based on topics that interest them in the lecture component. Students must register for a BIOL 22700 lab. Prerequisite: CHEM (120 or 12000) and PSYC (101 or 10100). CHEM 120 or 12000 is not mandatory, you may ASK instructor for permission. PSYC 101 or 10100 is mandatory. Pre requisite: (CHEM 120 or CHEM 12000) or (PSYC 101 or PSYC 10100)

BIOL 23000: MOLECULAR&CELLULAR BIOL-W/LAB: 4 Hour(s)
MOLECULAR AND CELLULAR BIOLOGY-W/LAB~ An introduction to the structure and function of proteins and other biological macromolecules, and the fundamentals of cell biology. In addition to traditional lecture, discussion of experiments and problem solving will be components to learning. The major topics discussed in the course will include: 1) The building blocks of a functional cell; 2) cellular components and organization; 3) cell signaling; and 4) cell growth and cell death. Lab will provide hands-on experience with common molecular biology techniques and the opportunity to do original research. Offered every fall 12 week term. Prerequisites: Biology 151 or 15100 and 152 or 15200 (must pass with C- or better); and Chemistry 120 or 12000 and 121 or 12100. Biology 151 or 15100 and/or Chemistry 121 or 12100 may be taken concurrently. Student must also register for a BIOL 23000 lab. Prerequisite: BIOL 151 (may be taken concurrently) or BIOL 15100 (may be taken concurrently) and BIOL 152 or BIOL 15200 and CHEM 120 or CHEM 12000 and CHEM 121 (may be taken concurrently) or CHEM 12100 (may be taken concurrently)

BIOL 23400: ANATOMY & PHYSIOLOGY-W/LAB: 4 Hour(s)
HUMAN ANATOMY AND PHYSIOLOGY-W/LAB~ The fundamental principles involved in the structure and function of the human body. Topics include biochemistry, cell structure, tissue histology, and structure and function of the integumentary, skeletal, nervous, immune, circulatory, respiratory, digestive, urinary, reproductive and endocrine systems. Laboratory includes study of the human skeleton and anatomy of the cat and simple experiments in human physiology. Prerequisites: Biology 141 or 14100 or 120 or 12000, Chemistry 115 or 11500 or 120 or 12000. Students must also register for a BIOL 23400 lab. The breakdown between lecture and lab hours is for administrative office use only. This course may only be taken as 4 credit hours. Prerequisite: (BIOL 141 or BIOL 14100 or BIOL 120 or BIOL 12000) and (CHEM 115 or CHEM 11500 or CHEM 120 or CHEM 12000)

BIOL 23800: MEDICAL MICROBIOLOGY-W/LAB: 4 Hour(s)
MEDICAL MICROBIOLOGY-W/LAB~ An introduction to bacterial pathogens, eukaryotic parasites, and viruses with an emphasis on medical applications. Key lecture topics include controlling microbial growth, how prokaryotes differ from eukaryotes, bacterial diversity and identification, bacteria normally found on and in the human body, connecting specific pathogens and parasites to human diseases, blood cell types, innate and adaptive immunity, HIV and AIDS, autoimmunity and hypersensitivity, and vaccines. Lab topics include sterile technique, antiseptics and handwashing, Gram stain, bacterial identification, epidemiology, blood cell counts, and antibody-based medical applications. Prerequisites: Biology 133 or 13300 and Chemistry 162 or 16200 Student must also register for BIOL 23800 lab. Prerequisite: BIOL 133 or BIOL 13300 and CHEM 162 or CHEM 16200

BIOL 25000: INTRO WILDLIFE MGMT-W/LAB:SM: 4 Hour(s)
INTRODUCTION TO WILDLIFE MANAGEMENT AND TECHNIQUES-W/LAB:SM~ Human population, attitudes, land use, and climate changes are explored in relation to wildlife. Game and non-game species management plans are reviewed. Laws, values, ethics, endangered species, zoos, and poaching are a few of the topics studied. Major substantive questions regarding future habitat and species decline are examined. The student will develop a better understanding of the relationships between wildlife and humans for food, space, habitat and, ultimately, survival. Laboratories will cover management techniques and wildlife identification, and will include field experience. Appropriate for non-majors. Must also register for a lab. Prerequisites: NONE. Also listed as Environmental Studies 250 or 25000. This course fulfills the Experimental Scientific Methods requirement.
Core: Experimental Scientific Method

BIOL 25500: SERVICE LEARNING:FROGWATCH USA: 2 Hour(s)
FROGWATCH~ In the spring of 2013, Hiram College initiated a citizen science program at the James H. Barrow Field Station as an Association of Zoos and Aquariums FrogWatch USA Chapter. In this 2 credit hour seminar, students will learn about native amphibian species and their wetland habitats, and what factors threaten amphibian populations. We will train students how to identify frog species by their calls and how to conduct a survey and record and submit survey data. In addition, we will develop educational information for the public about native amphibian species and their wetland habitats, and what factors threaten amphibian populations. The overall goal of this course is to develop a Hiram student-led citizen science program that will help to increase scientific literacy in our community, contribute to amphibian conservation, and to collect long-term, large-scale data on amphibian populations in Portage County.
BIOL 25600: FROGWATCH USA:ES: 3 Hour(s)
FrogWatch USA:ES ~ Citizen science program for amphibian conservation ~ In the spring of 2013, Hiram College became one of more than 100 FrogWatch USA Chapters in the nation. “FrogWatch USA is AZA’s citizen science program and provides individuals, groups, and families opportunities to learn about wetlands in their communities by reporting on the calls of local frogs and toads." In this course, students will learn about the biology of amphibian species and their wetland habitats and conservation of species in the face of climate change and human-induced habitat destruction. Since this is an Ethics and Social Responsibility (ES) course, we will focus on the value of amphibians in human society and the consequences of our actions on amphibian populations. As part of the Service Learning component, students will be trained using FrogWatch USA standards to identify frog and toad species by their call, conduct surveys, and record and submit survey data to the national database having the opportunity to become a certified FrogWatch USA volunteer upon passing of an audio and written assessment. Students will also develop and lead community service projects that will help increase scientific literacy related to amphibian conservation in the local area.
Core: Meaning/Ethics/Soc Responsibil

BIOL 26100: SCIENCE&ETHICS HUMAN CLONING:ES: 4 Hour(s)
SCIENCE AND ETHICS OF HUMAN CLONING:ES~ Imagine a college faculty of Einsteins, or an entire basketball team of LeBron Jameses. Can it be done? Should it be done? What purpose would it serve? These are some of the questions that need to be addressed now that human cloning is cloning is closer than ever to reality. Beginning with a thorough analysis of the biological basis of cloning, this course will go on to explore the ethical arguments on all sides of the human cloning debate. The religious, social, and political issues surrounding human cloning will be discussed, using American and international examples. Appropriate for non-majors. This course fulfills the Meaning, Ethics, and Social Responsibility requirement.
Core: Meaning/Ethics/Soc Responsibil

BIOL 26300: UNDERSTANDING GENES/GENOME:SM: 4 Hour(s)
UNDERSTANDING YOUR GENES AND GENOME:SM ~ Humans have long known that children look like their parents and other ancestors, but it is only in the last century or so that we have come to understand why. Genetics is critical to all life on Earth, but we usually focus on ourselves. This course will introduce you to modern genetics, what we know and how we know it, and how genetics applies to everyday human life and to key decisions in life. This course will help you understand your family history, your medical history, and potentially the future for you and your children and their children. No biology background required. Basic math skills (simple algebra and simple probabilities) will be taught because biology, and especially genetics, is quantitative. Appropriate for non-majors.
Core: Experimental Scientific Method

BIOL 26500: HUMAN GENETICS-W/LAB:SM: 4 Hour(s)
HUMAN GENETICS-W/LAB:SM~ With the completion of the Human Genome Project, it has become increasingly important to consider how changes in our DNA result in disease. This course will focus on understanding contemporary human genetics. We will begin with the Human Genome Project, to gain an understanding of the composition of hereditary material, and of the ways in which genes are expressed into protein. The effects of mutation at the levels of the chromosome and the gene will be examined in order to understand how disease results from changes in DNA sequence. We will then focus on inheritance through replication and the process of meiosis, and will progress to a discussion of classical Mendelian inheritance patterns. Exceptions to simple inheritance patterns will be considered, such as the effects of the environment, sex-linked genes, multifactorial traits, and the ways in which genetics influences behavior. The laboratory will focus on current technology used in genetic testing, mutational analysis, and Mendelian inheritance patterns. Students must also register for BIOL 26500 lab. This course fulfills the Experimental Scientific Methods requirement. Freshmen/Sophomores ONLY. Appropriate for non-majors.
Core: Experimental Scientific Method

BIOL 26600: HUMAN GENETICS-NO LAB: 4 Hour(s)
HUMAN GENETICS-NO LAB~ With the completion of the Human Genome Project, it has become increasingly important to consider how changes in our DNA result in disease. This course will focus on understanding contemporary human genetics. We will begin with the human genome project, to gain an understanding of what the hereditary material is composed of, and how genes are expressed into protein. The effects of mutation at the level of the chromosome and the gene will be examined in order to understand how disease results from changes in DNA sequence. We will then focus on inheritance through replication and the process of meiosis, then discuss classical Mendelian inheritance patterns. Exceptions to simple inheritance patterns will be considered, such as the effects of the environment, sex-linked genes, multifactorial traits, and how genetics influences behavior. Additional topics will include the scientific and social aspects of genetic testing, gene therapy, and reproductive technologies.

BIOL 27800: ECOLOGY-W/LAB: 4 Hour(s)
ECOLOGY-W/LAB:~ In this introductory course we explore the relationships of organisms to one another and their environment. Topics may include climatology, biomes, terrestrial and aquatic ecosystems, biogeography, species interactions, population biology, community structure and dynamics, niche theory, energy flow and nutrient cycles, landscape ecology, and other relevant concepts that provide a basis for ecological understanding and investigation. The course includes lecture and laboratory components. Labs emphasize the application of the scientific method and the development of skills related to sampling and data interpretation, and will include outdoor field work. Cross-listed with EVST 27800.
Prerequisite: (INTD 225 or INTD 22500) or (BIOL 151 or BIOL 15100)

BIOL 28000: SEM:: 4 Hour(s)
SEMINAR~ An introduction to selected topics of current interest in biology. The breakdown between lecture and lab hours is for administrative office use only. This course may only be taken for the amount of credit hours listed for the lecture.

BIOL 28100: INDEPENDENT STUDY: 1-4 Hour(s)
INDEPENDENT STUDY~ A student selects a professor whose interests are compatible with the student's. They develop a program of investigation of the literature, observations, and applicable techniques in this area. A paper covering these activities is submitted to the sponsoring professor.
Biol 29800: Field Experience: 4 Hour(s)

Field Experience~

Biol 30000: Field Biology-W/Lab: 4 Hour(s)

Field Biology-W/Lab~ Study of various ecosystems in temperate, tropical, desert, montane, and marine environments covering the diversity of plant and animal species and their structural and functional adaptations. Each time the course is offered it concentrates on a particular geographic area and its distinctive habitats and organisms, interactions and interrelationships among the organisms, and the abiotic factors that constrain populations. May be taken more than once for credit if taken in different geographic areas, but may serve only once toward a biology major. Students must also register for a BIOL 30000 lab. Prerequisites: Biology 141 or 14100, 142 or 14200, or Biology 151 or 15100, 152 or 15200 or permission. The breakdown between lecture and lab hours is for administrative office use only. This course may only be taken as 4 credit hours. Prerequisite: (Biol 141 or Biol 14100 and Biol 142 or Biol 14200) or (Biol 151 or Biol 15100 and Biol 152 or Biol 15200)

Biol 30500: Avian Biology: 1 Hour(s)

Avian Biology~ Avian Biology encompasses the whole of ornithology from evolution and systematics to physiology and neurobiology to behavior and ecology. Birds have been the most well-studied and documented group of non-primate animals throughout human history. Birds have been the subjects of ground-breaking research from Darwin’s proposal of the theory of evolution to the very recent flood of neuroscience discoveries of brain plasticity and growth. With the acute studies of scientists like Rachel Carson, birds have helped us change the way we look at the environment. In this course, we will survey the state of knowledge of bird biology using ornithological research as an entry point into the fields of evolution, anatomy and physiology, neuroscience, ecology, behavior, and conservation. We will emphasize evolution, phylogenetics, physiology, life history, and behavior. We will begin to build identification and field observation skills. This is the first of two companion courses and provides the foundation for further study of birds in Field Ornithology.

Corequisite: BIOL 30600

Biol 30600: Field Ornithology: 4 Hour(s)

Field Ornithology~ Field Ornithology involves the active study of birds in the wild and builds on a foundational knowledge of avian biology and evolution. This course focuses on mastering field identification skills (recognizing birds by sight, sound, and behavior) and observing and describing avian diversity, ecology, behavior, and conservation. This is a study away course with an extended field trip to ornithological hotspots within the southeastern United States.

Corequisite: BIOL 30500

Biol 31000: Fisheries Biology-W/Lab: 4 Hour(s)

Fisheries Biology-W/Lab~ A study of factors that determine the health of world fisheries including: biological factors (population cycles, ocean regime changes, competition and predation), land use factors (on-shore development, pollution, estuarine influences, oil spills, water use), political factors (economic and cultural issues, nutritional and fish resource fads and use, recreational issues, international, state and federal issues) and conservation factors (animal rights and resource use issues). Prerequisites: Biol 151/15100 and Biol 152/15200 or EVST 225/22500 and EVST 241/24100 or permission. Students must register for a BIOL 31000 lab. The breakdown between lecture and lab hours is for administrative office use only. This course may only be taken as 4 credit hours. Prerequisite: (Biol 151 or Biol 15100 and Biol 152 or Biol 15200) or (EVST 225 or EVST 22500) and (EVST 241 or EVST 24100)

Biol 32000: Invertebrate Zoology-W/Lab: 4 Hour(s)

Invertebrate Zoology-W/Lab~ The rise of animal multicellularity is traced from the precambrian through the various evolutionary radiations of the cambrian explosion to produce a survey of phylagny, paleobiology, morphology, physiology, development, behavior, and ecology of invertebrates conducted in a comparative manner. Recent advances in our understanding of invertebrate evolution from current primary literature are incorporated into the class. Terrestrial, freshwater and marine forms are studied in lecture, laboratory, and field trip experiences. Evolution of phylum and class adaptive radiations are emphasized. Students must also register for a BIOL 32000 lab. The breakdown between lecture and lab hours is for administrative office use only. This course may only be taken as 4 credit hours. Prerequisites: Biology 151 or 15100, 152 or 15200, or permission.

Prerequisite: (Biol 141 or Biol 14100 or Biol 151 or Biol 15100) and (Biol 142 or Biol 14200 or Biol 152 or Biol 15200)

Biol 32100: Parasitology-W/Lab: 4 Hour(s)

Parasitology-W/Lab~ Relationships between animal parasites and their hosts from the perspectives of evolution, adaptations, life cycles, parasite damage to hosts, and host defenses against parasites. Molecular to ecological aspects of parasitology are covered. Parasites of wildlife, domestic animals, and humans are studied and the impact of parasitic diseases on human populations worldwide are considered. The laboratory emphasizes techniques of microscopy (light and electron), preparation and identification of specimens, Diagnostic techniques, and life cycle investigations. The breakdown between lecture and lab hours is for administrative office use only. This course may only be taken as 4 credit hours. Students must also register for a BIOL 32100 lab. Prerequisites: Biology 141 or 14100, 142 or 14200, 230 or 23000.

Prerequisite: Biol 141 or Biol 14100 and Biol 142 or Biol 14200 and Biol 230 or Biol 23000

Biol 32600: Animal Physiology-W/Lab: 4 Hour(s)

Animal Physiology-W/Lab~ Life processes of animals, including locomotion, metabolism, nutrition and digestion, water balance, excretion, reproduction, endocrine function, circulation, respiration and temperature regulation. Laboratory experiments illustrate these topics with emphasis on physiological techniques, experimental design and analysis and computer simulation and data analysis. The breakdown between lecture and lab hours is for administrative office use only. This course may only be taken as 4 credit hours. Students must also register for a BIOL 32600 lab. Prerequisite: Biology 152 or 15200.

Prerequisite: (Biol 152 may be taken concurrently) or Biol 15200 (may be taken concurrently)

Biol 33000: Cellular & Molecular Neurobiology: 4 Hour(s)

Cellular and Molecular Neurobiology~ This course is a study of the microscopic parts of the nervous system: the molecular, cellular and developmental aspects of what is arguably the most complex biological system ever studied. We will cover the basic plan of the nervous system, the cellular components of the nervous system (neurons and glia), the electrical properties of neurons, neurotransmitters and synaptic transmission. We will also study the embryonic development of the nervous system, including neurogenesis, axonal pathfinding, neuronal cell death and synapse elimination. In addition, we will discuss primary scientific papers describing fundamental breakthroughs in cellular and molecular neuroscience. Also listed as NEUR (330 or 33000).

Prerequisites: Biol 230 or 23000 or NEUR (227 or 22700)

Prerequisite: (Biol 230 or Biol 23000) or (NEUR 227 or NEUR 22700)
**Biol 33200: Plant Physiology-W/Lab: 4 Hour(s)**
PLANT PHYSIOLOGY~ A study of life processes of plants, including photosynthesis, respiration, translocation, responses to the environment, mineral nutrition, and effects on plant hormones. Laboratory experiments illustrate these topics and place special emphasis on long term projects and reports. Student must also register for a Biol 33200 lab. Prerequisites: Biology 230 or 23000 and Chemistry 220 or 22000 completed or taken concurrently. Offered in alternate years. The breakdown between lecture and lab hours is for administrative office use only. This course may only be taken as 4 credit hours.
Prerequisite: Biol 230 or Biol 23000 (may be taken concurrently) and Chem 220 or Chem 22000

**Biol 33500: Evolution: 3 Hour(s)**
EVOLUTION~ Examination of the historical development and modern interpretation of evolution and the theories proposed to account for the change of organisms over time. Topics considered include origin and age of the earth; chemical evolution and the origin of life; population genetics, structure, variation, and distribution; adaptation and selection; speciation; evolution above the species level; hybridization; polyploidy; apomixis; homology; and phylogeny. Prerequisite: Biology 365 or 36500.
Prerequisite: Biol 365 or Biol 36500

**Biol 33800: Microbiology-W/Lab: 4 Hour(s)**
MICROBIOLOGY-W/LAB~ An introduction to microorganisms, focusing on the domains Bacteria and Archaea. Topics include working with microbes, bacterial cell structure, motility and chemotaxis, microbial systematics, metabolic diversity, basics of microbial pathogenesis, and antibiotic resistance. Emphasis on hands-on experience in lab organized around a course-long project. Student must also register for a Biol 33800 lab. Prerequisite: Biology 230 or 23000. The breakdown between lecture and lab hours is for administrative office use only. This course may only be taken as 4 credit hours.
Prerequisite: Biol 230 or Biol 23000

**Biol 34000: Developmental Biol-W/Lab: 4 Hour(s)**
DEVELOPMENTAL BIOLOGY-W/LAB~ A comparative study of vertebrate development. Gametogenesis, fertilization, organogenesis of the vertebrate classes, histology of representative tissues, endocrine function in reproductive processes, implantation and review of the major contributions of experimental embryology. Student must also register for a Biol 34000 lab. Prerequisite: Biology 230 or 23000. The breakdown between lecture and lab hours is for administrative office use only. This course may only be taken as 4 credit hours.
Prerequisite: Biol 230 or Biol 23000

**Biol 34200: Marine Ecology-W/Lab: 4 Hour(s)**
MARINE ECOLGY-W/LAB~ As an introduction to the ecology of the marine environment, this course will examine the relationships that occur among various marine organisms and their biotic and abiotic environments as well as the methodologies and thinking used to obtain this information. Readings from primary literature and field investigations will explore onshore and offshore marine environments. Students must also register for a Biol 34200 lab. Prerequisites: Biol 15100 or Biol 15200 or Biol/Evst 27800 or permission. The breakdown between lecture and lab hours is for administrative office use only. This course may only be taken as 4 credit hours.
Prerequisite: Biol 15100 (may be taken concurrently) or Biol 15200 (may be taken concurrently) or (Biol 27800 (may be taken concurrently) or EVST 27800 (may be taken concurrently))

**Biol 34300: Conservation Biology-W/Lab: 4 Hour(s)**
CONSERVATION BIOLOGY-W/LAB~ Conservation Biology is the study of species diversity in human-impacted landscapes. As human populations grow and the demand for natural resources increases human activities inevitably erode the integrity of natural ecosystems. This erosion leads to the loss of species, both locally and globally. In this course we will study what biodiversity is, how it arises and why it is important both for ecosystem functions and human well-being. We will also examine how human economic activities impact the natural world, the ecological mechanisms at work in the process of species extinction, and how research in conservation biology has led to the development of ways to halt or even reverse species loss. Student must also register for a Biol 34300 lab. A revised version of this course is offered as Evst/Biol 34400 for three (3) hours. This course is also listed as Environmental Studies 34300. Prerequisite: EVST/Biol (241 or 24100) or Biol (341 or 34100) or permission. The breakdown between lecture and lab hours is for administrative office use only. This course may only be taken as 4 credit hours.
Prerequisite: (Biol 278 or Biol 27800) or (Evst 278 (may be taken concurrently) or Evst 27800)

**Biol 34600: Ancient Forests & Great Trees: 1 Hour(s)**
ANCIENT FORESTS AND GREAT TREES ~ Ninety-eight percent of the world's old-growth forests are gone. Whether humans presently living on the earth are aware of it or not, we are witnessing what ultimately may come to be known as The Age When the Ancient Forests Disappeared. For a panoply of human-caused reasons, forests everywhere are in mortal peril. The course will conduct an interdisciplinary exploration of the subject at two levels of analysis: biological and societal. The following key dimensions of this theme will benefit from these distinct perspectives: 1) the way that the ancient forests of the world came into being and to function in their mature state; 2) the threats – nearly all of which are the product of human activity – that now imperil these ancient forests; 3) what might be done – by citizens, interest groups, and policymaking bodies at different levels of government – to ensure that what remains of our planet’s ancient forests are kept from oblivion. This course serves as a prerequisite to “Taking to the Trees” (INTD 30320), a study away trip to the Pacific Northwest and West Coast in the subsequent three-week term, and begins students’ examination of ancient forests and great trees.

**Biol 36500: Genetics-W/Lab: 4 Hour(s)**
GENETICS-W/LAB~ A problem-based introduction to classical and molecular genetics. Key sections of the course are what are genes and how do they work, how are genes transmitted between generations, how is gene expression regulated, and how do genes change. Lab will provide hands-on experience with experimental approaches to these same questions and using those approaches to address a novel research project. Students must also register for Biol 36500 lab. Prerequisite: Biology 230 or 23000. The breakdown between lecture and lab hours is for administrative office use only. This course may only be taken as 4 credit hours.
Prerequisite: Biol 230 or Biol 23000

**Biol 37800: Immunology: 3 Hour(s)**
IMMUNOLOGY~ This course will examine the molecular and cellular basis of immunity in vertebrates including the differences and connections between innate and adaptive immunity, recognition of self and non-self, role of signaling molecules, disorders of the immune system and current immunotherapies. Prerequisites: Biology 230 or 23000 completed or taken concurrently.
Prerequisite: (Biol 230 (may be taken concurrently) or Biol 23000 (may be taken concurrently))
BIOL 38000: SEM: 4 Hour(s)
SEMINAR~ Includes various topics or upper level specialty courses. Prerequisites: Junior standing and permission.

BIOL 38100: SPC TPC: 1-4 Hour(s)
SPECIAL TOPIC~

BIOL 41500: ADV MOLECULAR BIOL-W/LAB: 4 Hour(s)
ADVANCED MOLECULAR BIOLOGY-W/LAB~ This course is designed to deepen understanding of the molecular processes of cells. The material builds on that from previous courses with respect to a few selected topics. Lab focuses on using molecular techniques to address novel research projects. Students must also register for a BIOL 41500 lab. Prerequisites: Biology 230 or 23000 and Chemistry 220 or 22000. The breakdown between lecture and lab hours is for administrative office use only. This course may only be taken as 4 credit hours. Prerequisite: BIOL 230 or BIOL 23000 and CHEM 220 or CHEM 22000

BIOL 41510: ADVANCED MOLECULAR BIOLOGY: 4 Hour(s)
ADVANCED MOLECULAR BIOLOGY~ This course is designed to deepen understanding of the molecular processes of cells. The material builds on that from previous courses with respect to a few selected topics. Lab focuses on using molecular techniques to address novel research projects. Non-lab. Prerequisite: Biology 365 or 36500 or 366 or 36600 or permission of instructor. Offered irregularly. Prerequisite: (BIOL 365 or BIOL 36500) or (BIOL 366 or BIOL 36600)

BIOL 48000: SENIOR SEMINAR: 1-4 Hour(s)
SENIOR SEMINAR~ Includes various topics or upper level specialty courses. Prerequisites: senior standing and permission.

BIOL 48100: INDEPENDENT RESEARCH: 1-4 Hour(s)
INDEPENDENT RESEARCH~ Students who have an original idea or topic for research may solicit support from a sponsoring faculty member and carry out the research. The student must submit a research proposal to his or her faculty research advisor, outlining the research problem, the methods to be used, possible results, and an estimate of the resources needed. The student will submit a final report to the sponsoring faculty member and a public presentation to the department if he or she is using this for the apprenticeship. Prerequisites: junior or senior standing and permission.

BIOL 48110: APPRENTICESHIP EXPERIENCE: 2 Hour(s)
SENIOR SEMINAR:APPRENTICESHIP EXPERIENCE IN BIOLOGY~
Students enrolled in this course will present research on a biological topic in both a written and oral format. Research must be approved by either the student's faculty advisor or the faculty member directing the research, internship, or student teaching. Oral presentations will be given to faculty and students. Research papers will be presented in a scientific format (manuscript, technical report, etc.).

BIOL 49800: INTERNSHIP: 4 Hour(s)
INTERNSHIP~ This apprenticeship provides field experience in various areas of biology and is typically done off campus. A student selects an internship in consultation with a departmental advisor. Internships are tailored to help students gain experience for a career in biology. Students are placed in zoological and botanical gardens, biological field stations, universities, hospitals, government agencies, and private institutions, with emphasis on practical application of biology. Each student submits to the faculty advisor a journal of his or her daily activities and a paper that succinctly details the most important aspects of the internship. Each student also gives a public presentation to the department if he or she is using this for apprenticeship.

Academic Offerings
- Biology Major (https://catalog.hiram.edu/undergraduate/schools/science-technology/biology/biology-major/)
- Biology Minor (https://catalog.hiram.edu/undergraduate/schools/science-technology/biology/biology-minor/)
- Natural History Minor - Biology (https://catalog.hiram.edu/undergraduate/schools/science-technology/biology/natural-history-minor/)