

# BIOLOGY (BIOL)

## **BIOL 10100: BEG 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.

Core: Experimental Scientific Method

## **BIOL 10200: BIOLOGY OF THE SQUIRREL:SM: 3 Hour(s)**

BIOLOGY OF THE SQUIRREL:SM ~ This course is designed for non-majors. 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 or ecology of the gray squirrel. Appropriate for non-majors.

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 explication 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.

Core: Experimental Scientific Method

## **BIOL 12500: PRINCIPLES&EXPERMNTS 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. Recommended for IES, Nursing, or Pre-Professional students only.

## **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: BIOL 13100, CHEM 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 13100

## **BIOL 15100: INTRO BIOL 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. 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.

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.

**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 and/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 15100 or CHEM 12000

**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.

Core: Meaning/Ethics/Soc Responsibil

**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 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 14100 or BIOL 15100) and (BIOL 14200 or BIOL 15200)

**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 or permission.

Prerequisite: (BIOL 14100 and BIOL 14200) or (BIOL 15100 and 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. Also listed as NEUR 22700. CHEM 12000 is not mandatory, you may ASK instructor for permission. PSYC 10100 is mandatory.

Prerequisite: CHEM 12000 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. Student must also register for a BIOL 23000 lab.

Prerequisite: BIOL 15100 (may be taken concurrently) and BIOL 15200 and CHEM 12000 and CHEM 12100 (may be taken concurrently)

**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. Student must also register for BIOL 23800 lab.

Prerequisite: BIOL 13100 (may be taken concurrently)

**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. Also listed as EVST 25000.

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 will recruit community members to the program. Once the calling season commences, we will conduct surveys at wetland sites at the James H. Barrow Field Station. 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 CLON: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 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.

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. 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:SM: 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. Also listed as EVST 27800.

Prerequisite: INTD 22500 or BIOL 15100

Core: Experimental Scientific Method

**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 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 14100 and BIOL 14200) or (BIOL 15100 and 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. Also listed as EVST 30500.

Corequisite: BIOL 30600

**BIOL 30600: FIELD ORNITHOLOGY:SM: 4 Hour(s)**

FIELD ORNITHOLOGY:SM ~ Field Ornithology involves the active study of birds in the wild and builds on a foundational knowledge of avian biology and evolution. This class 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. Also listed as EVST 30600.

Corequisite: BIOL 30500

**BIOL 30700: FIELD ENTOMOLOGY: 4 Hour(s)**

FIELD ENTOMOLOGY ~ This field-based course will examine the classification, identification, physiology, behavior, and ecology of various orders and families of insects. Students will prepare an insect collection by sampling insects in various habitats in the field followed by identification and mounting/preserving of specimens in the lab. Course fulfills a requirement for the biology major organismal biology track and a minor requirement for the natural history minor.

Prerequisite: BIOL 15100 and BIOL 15200

**BIOL 30900: AQUATIC BIOLOGY W/LAB: 4 Hour(s)**

AQUATIC BIOLOGY W/LAB ~ This course will focus on the physical, chemical, and biological properties occurring in lakes, streams, and wetlands. As part of this course, we will apply ecological concepts to freshwater systems both in the field and through class discussions, in addition to investigating some of the major impacts that human activities have on freshwater systems.

Prerequisite: BIOL 15100 and BIOL 15200

**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 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 15100 and BIOL 15200) or (EVST 22500 and 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 phylogeny, 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: BIOL 15100 and BIOL 15200, or permission.

Prerequisite: (BIOL 14100 or BIOL 15100) and (BIOL 14200 or BIOL 15200)

**BIOL 32100: PARASITOLOGY: 4 Hour(s)**

PARASITOLOGY ~ This course will examine 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 impacts of parasitic diseases on human populations worldwide are considered.

Prerequisite: BIOL 15100 and BIOL 15200

**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: BIOL 15200 (may be taken concurrently)

**BIOL 33000: CELLULAR & MOLECULAR NEUROBIO: 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 33000.

Prerequisite: BIOL 23000 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 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. 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 23000 (may be taken concurrently) and CHEM 22000

**BIOL 33500: EVOLUTION: 4 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: BIOL 15100 and BIOL 15200

**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. 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 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. 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 23000

**BIOL 34200: MARINE ECOLOGY-W/LAB: 4 Hour(s)**

MARINE ECOLOGY-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 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 EVST 34300. Prerequisite 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 27800 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. 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 23000

**BIOL 37800: IMMUNOLOGY: 4 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.

Prerequisite: 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. 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 23000 and 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. Prerequisites or permission of instructor. Offered irregularly.

Prerequisite: BIOL 36500 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: SENIOR CAPSTONE SEMINAR: 2 Hour(s)**

SENIOR CAPSTONE SEMINAR ~ 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.

**BIOL 52800: SEM.: 3 Hour(s)****BIOL 58100: EVOLUTION: 3 Hour(s)**

EVOLUTION ~ Evolutionary theory is the cornerstone of all modern biology, whether molecular, organismal, or behavioral. The theory of evolution is "true – and the truth only makes us free," according to the late invertebrate paleontologist Stephen Jay Gould. We will examine parts of Charles Darwin's fundamental text "On the Origin of Species," and will then examine the fundamental principles of evolution using population genetics, biogeography, behavioral biology and molecular genetics - which form the basis of modern evolutionary biology. We will finish by discussing human evolution to ascertain whether we follow the same "rules" of evolution as all other living organisms. Throughout the course, the emphasis will be placed upon the methods used to provide the vast array of evidence for evolution and its processes.

**BIOL 58105: EVOLUTION AND DEVELOPMENT: 3 Hour(s)**

EVOLUTION AND DEVELOPMENT ~ An exploration of the "great engine of evolution" – embryonic development. We will study how changes in embryonic gene expression can create or change form and function in animal species. Topics include: flies to butterflies, how to get a snake from a chicken, is that an enhancer or are you just glad to see me, and "endless forms most beautiful."

**BIOL 58110: GENOMIC-BIOINFORMATICS: 3 Hour(s)**

GENOMICS & BIOINFORMATICS FOR THE CLASSROOM ~ This course is designed to provide the content knowledge and hands-on experience needed for high school teachers to bring genomics and bioinformatics into their courses. You will learn how to implement in your courses a free online gene and genome analysis project on a microorganism of your choice and also how you can connect genome analysis to a wet lab project. You will also have the opportunity to put what you learned into practice by helping teach high school students in the Hiram Bio-innovation Institute.

**BIOL 58115: GENES&GENOMES 21ST CENTURY: 3 Hour(s)**

GENES & GENOMES IN THE 21ST CENTURY ~ 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 have moved beyond the transmission genetics of Mendel to a gene-centered strategy and now to a genome-wide view. This course covers our 21st century understanding of genetics and genomics. The course will focus on genetics as a "toolbox" for understanding how life works with a heavy emphasis on problem-based learning, using algebra, probability, and statistics in biology, and incorporating research into courses. Examples will come from all types of organisms.

**BIOL 58125: HUMAN BIOLOGY: 3 Hour(s)**

HUMAN BIOLOGY ~ The human body has undergone significant physical and physiological transformations across millennia since the split from great apes, and again more rapidly since the advent of agriculture. This graduate seminar covers a range of topics related to the following topics: the molecular and cellular mechanisms that form the basis of human physiology, ecology and development, and an exploration of how our evolutionary history has shaped physical, cognitive, emotional, and social development. Primary research from the sub-disciplines listed above form the content base for this course. Participants will identify additional research regarding a more specific area of interest with the themes listed above that will then form the bulk of the remaining course materials, and the basis for individual research projects.

**BIOL 58126: READINGS IN NEUROPHARMACOLOGY: 3 Hour(s)**

READINGS IN NEUROPHARMACOLOGY ~ This course will familiarize students with the operation of central and peripheral neural synapses and alterations of their normal activity under the influence of various exogenous agents. The topics covered include neuronal cytology, molecular biology of synapse, receptors, neuromodulators, and the pharmacokinetics and pharmacodynamics of multiple transmitter systems including serotonergic, dopaminergic, noradrenergic, and cholinergic cell groups. Drug trials and study design will also be addressed. Emphasis in the class is on coverage of the history of discoveries in each area as well as contemporary state of the art in approaches to the topic.

**BIOL 58130: ADVANCED TOPICS MARINE ECOLOGY: 3 Hour(s)**

ADVANCED TOPICS IN MARINE ECOLOGY ~ This course evolved from three related courses taught by at the Shoals Marine Lab since 1982, Adaptations of Marine Organisms, Experimental Marine Ecology and Research in Marine Biology. The Marine Ecology course (Biology 34200) is the Hiram College version of the course taught every other year since 2004. Through the years, the focus of the course has shifted from adaptation and marine ecology to experimental design taught at the level of a graduate course, hence the offering of this course at the master's level. In this course, we will learn skills that are required of all scientists including: designing and carrying out effective experiments, analyzing results using statistics, and communicating the meaning of your results in the form of scientific presentations and papers. The context in which you will learn these skills is marine ecology and physiology. Together we will design and three experiments, which will expose you to a variety organisms and environments, and experimental and statistical techniques. We will provide background material for each experiment in the form of lectures and readings. We will examine some data sets from Hiram courses from 2012 and 2014. The course is modeled as a biostatistics course.

**BIOL 58170: INTRO TO CANCER BIOLOGY: 3 Hour(s)**

INTRODUCTION TO CANCER BIOLOGY ~ This course introduces the cellular and genetic changes that lead normal cells to transform into malignant cancer cells. Topics will include the history of cancer, oncogenes, tumor suppressors, programmed cell death, cell proliferation, cell differentiation and genetic susceptibility as well as current strategies for treating the disease. Because of the prevalence of cancer in society, research is continuously advancing this knowledge. Students will also learn to evaluate research papers providing up to date advancements in predictors, treatments and prevention of cancer.

**BIOL 58180: PATHOPHYSIOLOGY: 3 Hour(s)**

PATHOPHYSIOLOGY ~ Provides graduate students with a theoretic foundation of human physiology, the phenomenon that produce alterations or pathology in human physiologic function, and an understanding of the basis of disease processes across the lifespan.

**BIOL 58190: ADVANCED READINGS IMMUNOLOGY: 3 Hour(s)**

ADVANCED READINGS IN IMMUNOLOGY ~ An introduction to the vertebrate immune system including the function and mechanism of action of immune cells in response to foreign invaders, tolerance to self and the consequences of system imbalance. In addition to online lecture materials, discussion of journal articles, case studies and problem solving will be used. The major topics discussed in the course will include: I. The innate, acquired and mucosal immune systems; II. The functions and development of immune cells for each system; III. The role of signaling molecules and receptors during the immune response and IV. Immunity-related diseases and modern therapeutic approaches

**BIOL 58280: SEM: 3 Hour(s)**

SEMINAR ~

**BIOL 68000: SEM:: 3 Hour(s)**

SEM: ~