



**University of  
Northern Iowa**  
**BIOLOGY**

**Fall 2015 Courses**



# BIOL:

## Course Description

### **BIOL:3100**

#### **Evolution, Ecology and the Nature of Science - 3 hr. Seminar**

The course is discussion-oriented and will be centered on student presentations based on readings from recent books and papers. In this course we will explore the following themes: (1) How organisms interact with one another and with the abiotic world, (2) the genetic continuity of all life, (3) how the past has influenced and determined the current life on earth, (4) the centrality of evolutionary theory in biology, and (5) what science is and how it is practiced. Participation in this course will better your critical thinking, public speaking, reading and writing skills, and will enhance your understanding of scientific methodology.

### **BIOL:3101**

#### **Anatomy and Physiology I - 3 hrs. Lecture, 2 hrs. Lab (This course cannot be used for biology credit.**

##### **University elective only)**

This course, the first of a two semester sequence in Anatomy and Physiology, is designed to provide students with basic information about the structure and function of the human body. Topics include anatomical terminology and directional terms, basic cell membrane physiology, tissues, the skeletal system, muscular system, and nervous system. The course is specifically designed for students planning to enter the various health professions (medicine, physical therapy, dentistry, nursing, etc.) or athletic training, though individuals in other majors (psychology, communication disorders, etc.) may find the content relevant to their field of study. Assignments tend to emphasize critical thinking and application of content to various clinical situations. Laboratory activities include anatomical terminology, membrane transport experiments, microscopy, and identification of skeletal materials, muscles, internal organs, vessels, and nerves in the human body. Common disease processes (pathophysiology) are included in both the lecture and laboratory portions of the course.

### **BIOL:3102**

#### **Anatomy and Physiology II - 3 hrs. Lecture, 2 hrs. Lab**

This course is the second of a two semester sequence in Anatomy and Physiology. The two semesters combined will provide students with a comprehensive overview of all systems in the human body. The course is specifically designed for students planning to enter the various health professions or athletic training, though individuals in other majors (psychology, communication disorders, etc.) may find the content relevant to their field of study. Body systems covered in this semester include the cardiovascular, immune, respiratory, digestive, urinary, endocrine, and reproductive systems, as well as the special senses, acid-base balance and the basics of genetic inheritance. Laboratory activities include various physiology experiments, (electrocardiograms, muscle stimulation, respiratory physiology, vision and hearing physiology, etc.), dissection of specimens, and identification of anatomical features of the human body. Common disease processes (pathophysiology) are included in both the lecture and laboratory portions of the course. As in Anatomy and Physiology I, lecture and lab assignments emphasize application of content to "real-life" clinical situations. At the completion of the Anatomy and Physiology sequence, students should have an in-depth understanding of the human body, the interrelationships between anatomy and physiology, and interactions of various organ systems with one another.

## **BIOL:3106**

### **Comparative Vertebrate Anatomy - 4 hrs. Lecture and Lab**

The primary goal of Vertebrate Anatomy is to gain a fundamental understanding of how anatomical systems have changed over evolutionary time by integrating modern evolutionary, functional, and developmental contexts. Each organ system is examined separately, then integrated with other systems to explore how changes in one system require changes in others. Evolutionary changes in anatomy are then related to human anatomical diseases and issues where appropriate. The lecture portion of the course focuses primarily on "big picture" questions regarding anatomical evolution and functional changes (especially as they relate to shifts in environmental usage) across vertebrate groups. The laboratory portion is an intensive hands-on dissection-based format. Students complete full dissections of sharks and cats, with supplementary material presented for other groups (fishes, "reptiles", birds, mammals, etc.) in order to visualize first-hand the breadth of anatomical evolution within vertebrates. Students gain a deep understanding of how vertebrate anatomy changes to meet environmental challenges, giving students a broader perspective into why and how various vertebrates look the way they do.

## **BIOL:3140**

### **Genetics - 4 hrs. Lecture and Lab**

Genetics is foundational to biology. Taking this class will improve your understanding of how genes are inherited, how they affect how a cell functions, and how mutations of those genes can lead to malfunctioning cells and disease, or to improvements that are favored by natural selection. We will explore how gene expression is controlled, how it leads to different types of cells, and what happens when gene expression is not controlled properly, as is the case with diseases such as cancer. Also covered will be how genes have changed and continue to change through time. A two-hour lab session each week allows for discussion and hands-on activities.

## **BIOL:3151**

### **General Microbiology - 4 hr. Lecture and Lab**

Bacteria and viruses are the most numerous and diverse forms of life on Earth. Human history and culture are inexorably bound with microbes. Sex, food, life, death and decomposition: you have always interacted with microbes or their products and will continue to do so for as long as you live.... and for a little while after that too! This was unknown before the 'germ theory of disease' allowed study of microorganisms, the control of many plagues, and the unending struggle toward better public health. This course covers the fundamentals of microbiology and the role of microorganisms in the environment and in human affairs. Viruses, bacteria, algae, protozoa and fungi are described and their economic importance is discussed. Other topics include cell structure and metabolism; microbial genetics; medical, food, water and soil microbiology. Emphasis is given to medical aspects—bacterial and viral diseases, immunology, chemotherapy, disease transmission, epidemiology and an understanding of the genetics of host-parasite dynamics. In the General Microbiology lab, you will employ logical reasoning, time-tested and modern methodologies to ask questions, design and carry out experiments and interpret data about the microbial world, including characterization, identification, propagation, detection and control. Experiments involve aseptic technique and manipulation of microorganisms under laboratory conditions to illustrate the basic principles of microbiology.

## **BIOL:3159**

### **Marine Biology - 3 hrs. Lecture Only**

Marine Biology focuses on four main marine habitats - the open ocean, the continental shelf, the coastal zone, and the deep sea - and the diversity of marine organisms that live there. We'll talk about the role picoplankton play in feeding whales, what happens to the benthos after oil spills, how coral reefs are formed, and what happens after whales die. We'll also consider current issues in marine biology, such as ocean acidification, invasive species, and transport of plastic debris.

## **BIOL:3170**

### **Entomology - 3 hrs. Lecture and Lab**

This course will explore some of the evolutionary paths that have been taken by insects, the largest class of animals on the planet. We will look at the evolution of wing, the eye, and even venom. We will explore the relationships insects have with each other as well as with humans. Lab will concentrate on identification, but also collecting data based on field and lab questions.

## **BIOL:3189**

### **Tallgrass Prairie – 2 hrs. Seminar**

The grassland that covered most of Iowa and the upper midwestern United States is the most endangered ecosystem on the planet, because the soils and climate are so ideally suited to agriculture. We know from historical accounts of European settlers, and from studying the tiny pieces that escaped the plow, that this ecosystem supported thousands of species of plants and animals. The goal of Tallgrass Prairie Seminar is to provide a solid foundation in the natural history of our region: native plants and animals, and their relationships with climate, soil, water, and wildfire. We will use several class periods and an optional weekend field trip to visit local prairies. Other class periods will be devoted to reading and discussion of some major debates in prairie ecology. Students will learn to recognize important species, along with their natural habitats and behavior, and gain hands-on experience in prairie management at UNI's Tallgrass Prairie Center. This course is designed to complement (not duplicate) more specialized classes in plant systematics, mammalogy, aquatic ecology, restoration ecology, wildlife ecology, etc. No previous experience or knowledge of natural history is assumed.

## **BIOL:4105/5105**

### **Wildlife Ecology - 4 hrs. Lecture and Lab**

Throughout our history, humans have interacted with populations of free-ranging wildlife. Indeed, we owe much of our "success" as a species to our ability to manipulate and manage these interactions. Whether our interest is 1) sustainably harvesting wildlife species that provide us with valuable resources; 2) controlling species that negatively affect humans, domestic animals, or crops; or 3) conserving declining wildlife populations threatened by human activities, the practice of wildlife management is fundamentally about applying ecological knowledge to achieve a population objective. We will spend the lecture/discussion portion of the course reviewing the ecological basis for wildlife management and studying how ecological principles are applied in the practical management of wildlife populations.

In addition to a strong foundation in ecology, wildlife professionals must possess a set of technical skills that enable them to collect and interpret relevant data and to use that information to make informed decisions and support public policy development. In the "lab" portion of the course, we'll focus on learning various methods and techniques for detecting and/or counting animals, studying animal movement, and monitoring wildlife habitat. In addition, we'll explore the use of simple mathematical models to estimate population trends and to examine the potential effects of management actions on wildlife populations.

## **BIOL:4121/5121**

### **Plant Biotechnology - 4 hrs. Lecture and Lab**

We use plants for food, shelter, medicine, fuel, clothing, and as raw materials for various other products. Plant biotechnology has become a major player in the effort to increase food production and enhance the quality of plants and plant products. This course will introduce students to the applications of plant biotechnology. It will cover such topics as the culturing of plants on artificial media, genetic engineering of plants to improve yield and nutrition, use of molecular markers in crop breeding, and safety and ethical issues surrounding plant biotechnology. Furthermore, advances in biotechnology bring complex issues of patent rights. The course concludes by highlighting the role of intellectual property rights on availability of plant biotechnology products. The course includes lectures, labs, and student presentations. The labs will give students hands-on experience in plant tissue culture, genetic engineering of plants, how to screen genetically modified plants, and the importance of safety in plant biotechnology research.

**BIOL:4137/5137****Comparative Vertebrate Physiology - 4 hrs. Lecture and Lab**

The goal of this class is to explore how vertebrate animals function at the organ and cellular levels. The course concentrates on understanding the role of membrane structure and function on cell function, the importance of salt and water balance to the animals overall health and function, how cells communicate chemically and electrically, how cells respond to chemical and electrical stimulation and the understanding of the underlying mechanisms of muscle contraction. The functions studied in this course are common to all vertebrates including humans and their disruption or dysfunction is the basis of many disease conditions and pathologies. The lecture portion of the course provides students with background information about these topics. The laboratory portion provides students with the opportunity to experimentally explore how these process work using cutting-edge equipment and techniques.

**BIOL:4146/5146****Developmental Biology of Animals - 4 hrs. Lecture and Lab**

This course is about how animals develop from the fertilized egg to the adult, though it also includes how sperm and eggs are made and the fertilization process itself. Following fertilization, it will cover the next period of rapid cell division known as cleavage, the formation of the germ layers (gastrulation), and then the formation and differentiation of the organs (organogenesis). It will emphasize cell movement and tissue interactions as part of the development process. The diversity of animals will be represented using developmental "model animals" such as the sea urchin, fruit fly, frog, chick, and the mouse and human representing mammals. The laboratory will include the study of the microanatomy of development, using live fertilization, video image analysis, and graphic reconstruction, but will also include observations and experiments with live sea urchin, frog and chick embryos.

**BIOL:4150/5150****Immunology - 4 hrs. Lecture and Lab**

The goal of this course is to expand the student's understanding of the immune system in both health and disease. This is accomplished by first understanding the molecular mechanisms of the immune system, then examining the cell to cell interactions, and finally, looking at the function of the immune system at the level of an individual. While examining the system from this level, we will explore the beneficial aspects of the immune response—infection prevention and resolution, cancer prevention—and the not so beneficial aspects—autoimmunity, transplant rejection, and hypersensitivity. The focus of the course is on the human immune system, but other species will be included for comparison and contrast.

**BIOL:4154/5154****Aquatic Ecology - 4 hrs. Lecture and Lab**

Students receive an introduction to the geological, physical, chemical and biological factors that interact to determine the functional characteristics of individual bodies of water. The lectures include discussions of basin and channel geology and morphometry, properties of water, light penetration, heat distribution, water movement, water chemistry, phytoplankton, zooplankton, and the benthos. Students develop a short review paper on a topic of their choice. The labs introduce students to: physical, chemical and biological sampling equipment; how to use that equipment in both lakes and streams; how to identify aquatic organisms; and how to statistically analyze data. Students develop a brief scientific paper comparing the trophic status of local lakes based on data collected during the course.

**BIOL:4157/5157****Biostatistics - 3 hrs. Lecture and Lab**

Today's society is increasingly reliant on data to shape public policy and everyday life decisions. As a result, it is increasingly important to understand how data are used to decide which medicines are safe, what agricultural practices are best, and which animals are in danger of extinction. This course is all about the modern statistical

tools used to understand and solve these and other real-life problems in medicine, ecology, agriculture, and other biological sciences. Sir Ronald Fisher once said, "To call in the statistician after the experiment is done may be no more than asking him to perform a post-mortem examination: he may be able to say what the experiment died of." The goal of this class is to ensure you do not find yourself relying on a statistician to do post-mortems; rather you will become a refined, independent-minded consumer of data in our data-rich world.

### **BIOL:4164/5164**

#### **Mammalogy - 4 hrs. Lecture and Lab**

This course will be an in-depth examination of the biology of mammals. We will survey the diversity of mammals and discuss their evolution, ecology, biogeography, and conservation. We will also discuss (and practice) methods and techniques for studying mammals in the lab and in the field. Optional fieldtrips are strong possibilities.

Prerequisites: Biology major, junior standing (or written consent of instructor) and dentary-squamosal jaw joint.

Check out the syllabus on the course web page: <http://faculty.chas.uni.edu/~demastes/Mammalogy/mammalogy.html>

### **BIOL:4166/5166**

#### **Plant Systematics - 4 hrs. Lecture and Lab**

Course lectures will focus on the methods and theory of systematic botany (plant classification, evolution, and phylogeny reconstruction) and on the characteristics of representative plant families. Labs are devoted to developing skills in plant identification, learning morphological terminology, and sight recognition of important plant families. The course is very hands-on and includes students preparing a collection of plant specimens taken from nature.

### **BIOL:4168/5168**

#### **Ecology - 4 hrs. Lecture and Lab**

Ecology focuses on the relationships between organisms and their environment with the goal of better understanding the abundance, distribution, and diversity of species on Earth. Some of the topics we will discuss include: (1) physiological ecology - how animals and plants adapt to their surrounding environment; (2) population ecology - how predation, mutualism, parasitism, and competition influence the growth or decline of a species; (3) community ecology - how species within and across trophic levels interact with one another; and (4) ecosystem ecology - how carbon and nutrients move through an ecosystem. The lab highlights the unique ecology of the tallgrass prairie ecosystem in Iowa.

### **BIOL:4172/5172**

#### **Developmental Plant Anatomy - 4 hrs. Lecture and Lab**

The goal of this course is to teach students how organs – roots, stems, leaves, flowers, and fruits, develop from a seed into a mature flowering plant. Using universal concepts in developmental biology, students will examine how plant cells communicate with each other and how cell-cell communication leads to the formation of organs. Since plants cannot move like animals, plants must adapt to their environment. Students will investigate how plants change the shape and function of various organs to adapt to their surroundings (did you know that onions are modified storage leaves that grow underground? Or that thorns on roses and many other plants are modified stems used to deter herbivory?). Labs are hands-on and will utilize plant anatomy methods such as sectioning and microscopy. Finally, an independent project is conducted using a plant of your choice from the Botanical Center. You will create a research poster from the lab work you completed and your poster will be showcased around the greenhouse.