

# BIOLOGY (BIO)

## BIO 191. General Biology I. 4 Credit Hours.

This course introduces fundamental unifying principles of biology. Topics include the scientific method, biological chemistry, cell structure and function, membranes, energetics, cellular regulation and control, genetics, cell division and evolution. Three hours lecture, three hours laboratory, and one hour recitation (recitation in fall only) per week. Carries biology major credit.

## BIO 192. General Biology II. 4 Credit Hours.

This course, while continuing to stress fundamental unifying principles of biology, presents the mechanisms that allow all living organisms to meet the common requirements for life. Topics include classification/diversity; basic characteristics of all kingdoms of life; plant and animal development, form and physiology; ecology and population biology. Three hours lecture and three hours laboratory per week. Dissection required. Carries biology major credit.  
Prerequisite: BIO 191 or permission.

## BIO 218. Cell and Molecular Biology. 4 Credit Hours.

This course is designed to introduce the student to cell biology and the concepts of genetics at the molecular level. Basic concepts of cell structure and function are presented from a biochemical perspective. Topics include metabolism, membranes, cytoskeleton, motility, and replication and expression of genetic information. Three hours lecture and three and a half hours laboratory per week. Carries biology major credit.  
Prerequisites: BIO 191 and BIO 192; CHM 151 and CHM 152 recommended.

## BIO 225. Environmental Sustainability. 3 Credit Hours.

The pollution of our air, land, and water is an ecological problem of epidemic proportions. However, before we can come to grips with this menace, we must understand what we are facing. Our present situation results from economic conflicts, social attitudes, political indecision and the overuse and misuse of scientific and technological ideas. In this course, we will examine environmental issues such as resource depletion, pollution, overpopulation, and the climate crisis. We will begin with the biological and ecological basis of these problems and then, in a multidisciplinary fashion, address the possible solutions and consequences of these issues. Carries biology major credit.

## BIO 228. Ecosystems of Costa Rica. 3 Credit Hours.

This classroom/field course offers students of biology and environmental science systems the unique opportunity to study the fundamental properties of ecosystems and how the physical environment (climate, geography, geology) controls them, with specific reference to tropical and temperate ecosystems. This study will involve travel for an extended period to Costa Rica, in addition to two weekend daytrips in central New York State. Field-based learning activities examine the ranges of biological diversity and differences in ecosystem structure, and the geological and ecological processes that determine ecosystem structure and function in these two locations. Note: Course satisfies BIO major requirement for ecology/population distribution and ESSS travel course requirement. Additional fees will be required for this course.  
Prerequisite: BIO 191.

Cross-listed Courses: ESS 228

## BIO 230. General Ecology. 4 Credit Hours.

This course uses an evolutionary approach to the study of the interrelationships of organisms with their environments. Topics include competition, co-evolution, population growth and regulation, demography, and predator-prey relationships. Laboratory work includes field study and basic methods for evaluation of data. Three hours lecture and three hours laboratory per week. Carries biology major credit.  
Prerequisites: BIO 191 and BIO 192.

## BIO 237. Ecology of the Galapagos. 3 Credit Hours.

This course allows students to study, in both classroom and field settings, the delicate balance between geological, biological, climatologic and anthropogenic processes in shaping ecological environments, with specific focus on the biogeography of tropical islands. The Galapagos Archipelago is a singular locale where the fragile nature of the environment, the processes that shape it, and the unique nature of its inhabitants are readily observed. Additionally, the historic significance of this locale in the development of one of the foundational theories of modern science will be explored fully. Additional expense for required travel component.  
Prerequisite: BIO 191 and BIO 192.

Cross-listed Courses: ESS 237

## BIO 245. Evolution. 4 Credit Hours.

The nature of the evolutionary process is studied from a number of relevant points of view, including geology, paleontology, comparative anatomy, genetics, molecular biology and anthropology. The significant influence of evolutionary concepts on human thought is discussed. Three hours lecture and three hours laboratory per week. Carries biology major credit.  
Prerequisites: BIO 191 and BIO 192.

## BIO 255. Animal Locomotion. 3 Credit Hours.

This course introduces the study of animal locomotion, one of the primary ways in which animals interact with their environment. Studying locomotion, and how it is influenced by both organismal and environmental factors, is a powerful way to gain insight into the relationships among morphology, physiology, evolutionary history, and habitat. Throughout the course we will examine the myriad and diverse ways that animals move on our planet. In addition, content will range from understanding how body structures, such as muscles, are important in generating movement to the physical principles that enable and constrain locomotion on land, air, and water. Lastly, we will also focus on the evolution of different locomotor patterns. The class is structured such that we will explore topics surrounding animal locomotion via content lectures, student led journal article discussions, and minilab activities. Participation is a crucial aspect of this course.  
Prerequisites: BIO 191 and BIO 192.

## BIO 265. Introduction to Geographic Information Systems. 4 Credit Hours.

This lab-based course introduces students to Geographic Information Systems (GIS), a system of integrated hardware, software and data-capture tools for the manipulation, modeling, analysis and display of geographic information. This course provides an introduction and practical experience with industry-standard software through three hours of lecture and a three-hour laboratory session each week. Carries BIO and ESS major credit.  
Prerequisite: BIO 191.

Cross-listed Courses: ESS 265

**BIO 275. Spring Field Botany. 3 Credit Hours.**

The three-credit course will survey the spring flora of central New York, with daily excursions to various habitats to observe the diverse plants that support the regional ecosystem, with a special focus on spring ephemerals and native plants when flowering. Habitats may include local grasslands, sand dunes, peat bogs, old-growth forests, and wetlands. Plant identification and systematics will be the major focus, and students will learn human impacts and the importance of conservation of natural habitats and native species. Carries BIO and ESS major credit.

Prerequisites: Minimum of 6 BIO/ESS credits completed.

Cross-listed Courses: ESS 275

**BIO 310. Field Ornithology. 4 Credit Hours.**

This course will cover basic bird physiology, ecology, and conservation biology with a strong emphasis on field ecology. Students will be required to actively engage in bird identification, behavioral observation, and field data collection. This course will provide students with an extensive field experience aimed at broadening their view of the biological world around them. A major component to this course will be a Spring Break experience in southern Texas. Attaining experience in different ecoregions supplies students with a valuable perspective for thinking more broadly about biology. Additional expenses-travel expenses round-trip to McAllen, TX. Students must meet with the instructor before registration. Prerequisite(s): BIO 191 BIO 192.

Cross-listed Courses: ESS 310

**BIO 315. Biology in Practice:Lab & Field Approac. 3 Credit Hours.**

Aimed at providing students, especially those who are planning to teach, with additional laboratory field experience, this course explores empirical techniques currently used in a variety of biological subdisciplines. Formulation and testing of hypothesis, experimental design, data analysis and interpretation of results will be addressed. Students will have the opportunity to get hands-on experience with various techniques as well as methods analysis. A major objective of the course is the development of exercises utilizing these techniques to foster inquiry-based learning in biology. Writing techniques appropriate to the discipline will also be an important component.

Prerequisites: BIO 191, BIO 192, BIO 218.

**BIO 320. Genetics. 4 Credit Hours.**

This course will teach students the fundamental concepts underlying the field of genetics and introduce them to the increasing role that genetics plays in society. Lectures and labs will cover principles of both classical and molecular genetics. Topics covered include inheritance, gene expression, population genetics, and biotechnology. Three hours lecture and three hours laboratory weekly. Carries biology major credit.

Prerequisite: BIO 218.

**BIO 321. Developmental Biology. 4 Credit Hours.**

This course will study embryogenesis (fertilization to birth) as well as development during later stages of life. We will examine the cellular, genetic, and molecular aspects of these processes in a number of different species. This information will be supplemented with the experimental data that led to these discoveries. The laboratory portion of this course will involve students designing and carrying out their own experiments. Three hours lecture and three hours laboratory per week. Carries biology major credit.

Prerequisite: BIO 218.

**BIO 322. Histology. 4 Credit Hours.**

Following a consideration of fundamental tissues, most of the organ systems of the mammalian body are studied showing how these systems are actually combinations of the basic tissues. Three hours lecture and three hours laboratory per week. Carries biology major credit.

Prerequisites: BIO 191, BIO 192, BIO 218.

**BIO 325. Microbiology. 4 Credit Hours.**

This course emphasizes bacteria, but also deals with other groups of organisms recognized as microbes. Topics include the structure, physiology, differentiation and genetics of microorganisms, as well as ecological, industrial and disease relationships. CHM 223 and CHM 224 recommended. Three hours lecture and four hours laboratory per week. Carries biology major credit.

Prerequisites: BIO 191 BIO 192, BIO 218.

**BIO 327. Botany - The Biology of Plants. 4 Credit Hours.**

The activities of plants support life on earth. An understanding of the biology of plants influences the welfare of humans and other animals. This course explores the diversity and basic biology of plants. Topics include classification, physiology, morphology, evolution, and life cycles.

Prerequisites or corequisites: BIO 191 and BIO 192, CHM 151 and CHM 152. Three hours lecture and three hours laboratory per week. Carries biology major credit.

**BIO 329. Field Botany. 4 Credit Hours.**

The four-credit course will survey the flora of central New York, with excursions to various habitats including grasslands, sand dunes, peat bogs, old-growth forests, and wetlands. Plant identification and systematics will be the major focus, and students will learn how to create and curate an herbarium, compare the species composition of the various habitats, and learn human impacts and the importance of conservation of natural habitats and native species. The six hour block allows for travel and time in the field.

Prerequisites: BIO 191 and BIO 192.

Cross-listed Courses: ESS 329

**BIO 331. Anatomy and Physiology I. 4 Credit Hours.**

Biology majors will study mammalian anatomy and physiology at a level appropriate for those interested in attending graduate programs in the health professions. This course is the first in a two-semester sequence. Following an overview of terminology and tissues, the skeletal, muscular, nervous, endocrine and integumentary systems will be covered. A mammal such as the cat, rabbit, or mink will serve as the primary whole-animal dissection in the laboratory; lab activities will integrate anatomy and physiology. Dissection required. Three hours of lecture and three hours of laboratory per week. Carries biology major credit. Students may take either BIO 431 or BIO 331-BIO 332, but not both.

Depending on the course instructor, the class format may be primarily traditional lectures OR may incorporate the significant use of a Learning Management System, e-lectures, case studies, and discussion. Students should consult the department chair regarding the lecture format prior to registering for this course. Pre-requisites: BIO 191 and BIO 192, CHM 151 and CHM 152, BIO 218 or permission of the instructor.

Fulfills: Organismal group requirement.

**BIO 332. Anatomy and Physiology II. 4 Credit Hours.**

This course is a continuation of BIO 331 in which biology majors will continue their study of mammalian anatomy and physiology. Systems covered include the circulatory, immune, respiratory, digestive, urinary, and reproductive. The cat is the primary dissection specimen in the laboratory; lab activities will integrate anatomy and physiology. Dissection required. Three hours of lecture and three hours of laboratory per week. Carries biology major credit. Students may take either BIO 431 or BIO 331-BIO 332, but not both.

Prerequisites: BIO 191 and 192, CHM 151 and 152, and a grade of C or better in BIO 331.

**BIO 335. Biodiversity. 4 Credit Hours.**

The course is designed to acquaint the student with the phenomenal diversity of life with which we share this planet. To do this, we will refresh the students' memories concerning evolution and the various mechanisms through which communities of life forms have become adapted to their environment. We will spend some time with taxonomy and biogeography before we can begin to examine the current state of biodiversity as well as future trends. The implications of these trends will signal a stopping point for the course but will hopefully serve as a beginning for the student as they move away from Le Moyne and take a place in society.

Prerequisites: Minimum of 10 BIO/ESS credits.

Cross-listed Courses: ESS 335

**BIO 340. Parasitology. 4 Credit Hours.**

Parasitism is the most prevalent and one of the most biologically complex of all symbiotic relationships. Parasites historically have had and continue to have a tremendous impact on the health and welfare of humans and other animals. This course explores the diversity of parasitic organisms and the adaptations which permit them to live in or on other organisms, as well as consequences to the host. Prerequisites or corequisites: BIO 191 and BIO 192 and one 200-level course. Three hours lecture and three hours laboratory per week. Carries biology major credit.

**BIO 348. Environ Research in the Field: Iceland. 4 Credit Hours.**

The environment of Iceland is shaped by the immensely dynamic geologic processes of active volcanoes and glaciers, but this environment is also deceptively fragile and subject to anthropogenic influence. The present landscape has resulted from this interaction of human and natural processes. A semester of classroom activity culminates in a field session where students conduct research on the processes of environmental change in Iceland.

Prerequisites: BIO 230 or ESS 205 or permission of instructor.

Cross-listed Courses: ESS 348

**BIO 350. Invertebrate Biology. 4 Credit Hours.**

This course introduces the study of invertebrate animals; classification, structure and life cycles are presented in detail. Three hours lecture and three hours laboratory per week. Carries biology major credit.

Prerequisites: BIO 191 and BIO 192.

**BIO 360. Insect Ecology. 4 Credit Hours.**

Insects outnumber all other species on this planet, and they have crucial roles in ecosystem structure and processes. This course explores the diversity of interactions between insects and other organisms in ecosystems, as well as insects' impact on the non-living environment. Three hours lecture and three hours laboratory per week. Carries biology major credit.

Prerequisites: BIO 191, BIO 192, BIO 225.

**BIO 365. Criminalistics for Biologists. 3 Credit Hours.**

This course will allow upper level biology majors to discover how information they have learned in their natural and physical science courses is utilized in criminalistics. In addition to lectures, students will participate in a number of hands on mini-laboratory sessions that will allow them to perform techniques used in the collection of evidence from a crime scene, as well as laboratory analyses of this evidence. Carries biology major credit.

Prerequisites: BIO 218 and CHM 151 and CHM 152; recommended courses include completion of BIO 281 and BIO 282 and two semesters of physics.

**BIO 375. Introduction to Neurobiology. 4 Credit Hours.**

The uniqueness of the central nervous system is explored in lectures and laboratory sessions dealing with the developmental, anatomical, and physiological aspects of neurobiology. This course is intended for biology and psychology majors and may be taken by others who are minoring in biology. Three lectures and three hours laboratory per week.

Prerequisites and corequisites: BIO 191 and BIO 192, BIO 218; CHM 223 is recommended, or by permission of instructor.

**BIO 380. Information in the Biological Sciences. 1 Credit Hour.**

This course will introduce the changing information landscape in the biological sciences, and help students become advanced database and "free web" searchers. Students will also become familiar with the social and ethical issues relating to the production and use of scientific information in an increasingly digital society. Prerequisite(s): BIO 191, BIO 192, and BIO 218 or permission of instructor.

**BIO 381. Disease and Disorders of the Nervous System. 3 Credit Hours.**

This course will examine several diseases and disorders of the nervous system. Symptoms, diagnoses, and prognoses of numerous pathologies will be investigated along with in-depth discussions of the anatomical and physiological changes that occur relative to the healthy nervous system. A particular emphasis will be placed on cellular and molecular changes. Students will supplement lecture material with primary literature searches investigating ongoing research including current and future strategies to treat and detect the disorders. Case studies will also be utilized to demonstrate how dysfunction can manifest in the patient, subsequently reinforcing our understanding of how the nervous system performs.

Prerequisites: BIO 218; also BIO 281 and BIO 282 or BIO 375 or permission of the instructor.

**BIO 390. Independent Study in Biology & Environmental Systems. 1-3 Credit Hours.**

A student may pursue a semester or more of independent study in a specialized area of biology of mutual interest to the student and one or more members of the faculty in the department. This course is for the above average student whose interests and abilities go farther than normal course offerings. Proposals, indicating credit sought, must have approval prior to registration. Prerequisites or corequisites: 15 credit hours in BIO in addition to BIO 380. Carries biology major credit for the tenth biology course.

Cross-listed Courses: ESS 390

**BIO 409. Virology. 3 Credit Hours.**

This course will explore fundamental aspects of viral biology including viral replication strategies, structural attributes, virus evolution and tactics used by viruses to evade host immune responses. Several currently relevant viruses will be discussed in detail to explore how molecular features of viruses impact human disease. In addition, we will discuss the broader applications of virology with particular emphasis on viruses and cancer, the use of viruses in vaccine approaches and gene therapy, targeting bacterial infections with bacteriophage and newly emerging viruses. In addition to lecture material, students will critically read and discuss primary virological literature.

Prerequisite: BIO 218.

**BIO 410. Toxicology. 3 Credit Hours.**

This course is designed to be of interest to students of environmental biology as well as those planning for a career in the health professions. General principles and mechanisms of toxicology, effects of exposure to different types of toxins, and various applications of toxicology will be discussed. Prerequisites or corequisites: BIO 191, BIO 192, BIO 218; CHM 223, and CHM 224. Three hours of lecture per week. Carries Biology major credit.

**BIO 412. Immunology. 3 Credit Hours.**

This course will offer students the opportunity to study the function of one of the human body's most intricate, and somewhat underappreciated systems. Students will examine how the human immune system is capable of producing a coordinated response to combat infectious organisms as well as what can happen when the immune system functions improperly. Coupled with establishing a base of immunology fundamentals will be the opportunity for the students to apply the knowledge acquired from text readings and from lecture. Through the individual and group discussion of primary scientific literature throughout the semester the student will be able to develop critical thinking and analytical skills. Three hours of lecture per week. BIO 281 and BIO 282 are recommended.

Prerequisite: BIO 218.

**BIO 415. Pathogenic Microbiology. 4 Credit Hours.**

The interaction between a pathogen and its host has two potential outcomes, resistance or disease. Pathogenic microbiology, therefore, is a discipline that demands an understanding of the microorganisms that cause disease, the human immune system and the mechanistic interplay between the two. This course aims to provide foundational knowledge in the area of host-pathogen interactions. Following an introduction to the microbes that naturally colonize humans, students will learn the molecular mechanisms used by microbial pathogens to overcome host barriers to infection. We will then begin a survey of clinically relevant microbial pathogens, including those that have the potential to be used as bioterror agents. We will end the semester with an in-depth examination of methods to detect infectious agents and therapeutics to limit disease. Three hours lecture and three hours laboratory per week. Carries biology major credit.

Prerequisites: BIO 218.

**BIO 418. Advanced Molecular Biology. 4 Credit Hours.**

This is an advanced, lab-intensive course focusing on the application and development of molecular genetic data. Lectures will focus on the practical applications of molecular data to address ecological, evolutionary, and medical questions. Lectures will also provide students with the theoretical background necessary to understand current molecular analytical and lab techniques. Labs will provide students with hands-on experience generating and analyzing molecular genetic data. Two hours lecture and six hours laboratory per week. prerequisites or corequisites: BIO 218; CHM 223 and CHM 224 and at least junior standing.

**BIO 420. Special Topics in Biology. 3 Credit Hours.**

Courses in this series (BIO 420-426) offer an in-depth exploration of specific issues within the field of biology, as well as topics of current interest to students and instructors.

Prerequisite: 15 credit hours in biology and permission of instructor.

**BIO 427. Bioinformatics. 4 Credit Hours.**

Bioinformatics is the use of computer technology to store and analyze large genetic and genomic datasets. The availability of these datasets and increasing computational abilities have led to a "bioinformatics revolution" in biology with applications in many biological disciplines, including molecular ecology and health care. In this course, students will learn the theory behind the major concepts of bioinformatics and apply this knowledge analyzing biological datasets in computer labs. Topics covered may include searching sequence databases, sequence alignment, sequence motif discovery, phylogenetic analyses, analysis of protein and nucleic acid structure and genome mapping. Three hours lecture and three hours computer laboratory per week. Carries biology major credit.

Prerequisites: BIO 218.

**BIO 428. Research in Tropical Biology. 4 Credit Hours.**

A variety of ecosystems exist throughout the tropics and are home to the majority of the terrestrial biodiversity found around the globe. Studies of organismal interactions and species diversity are still leading to the creation of new scientific knowledge and discovery of new species, and Costa Rica represents a county with diverse tropical forests that form the basis for many of these discoveries. This upper-level field-experience course will allow students to search, analyze and interpret the scientific literature during classroom activities at Le Moyne College, then apply the scientific process through observation, experimentation, and hypothesis testing during a 10 to 15 day session in Costa Rica. Additional fees will be required for the travel component of this course. Registration by instructor approval. Carries BIO and ESS major credit.

Prerequisites: BIO 191 and BIO 192.

Cross-listed Courses: ESS 428

**BIO 431. Mammalian Physiology. 3 Credit Hours.**

This course is designed to teach basic principles of mammalian physiology involving the following systems: nervous, endocrine, muscular, circulatory, excretory, digestive, immune and reproductive. CHM 223-224 recommended. Carries biology major credit. Students may take either BIO 431 or BIO 281 and BIO 282, but not both.

Prerequisites: BIO 191-192, BIO 218.



**BIO 450. Biology of Sharks. 3 Credit Hours.**

Few organisms fascinate humans as much as sharks and their relatives, the skates, rays and chimaeras (class Chondrichthyes). Despite this, many people lack an understanding of these fishes and their beliefs and opinions are biased by misperceptions that permeate society. This course provides a detailed overview of the biology of sharks, including morphology, physiology, ecology, behavior, and genetics. Special emphasis will also be placed on the evolution and diversity of sharks and shark-human interactions, including shark fisheries.

Prerequisites: BIO 218 and BIO 225.

**BIO 458. Global Climate Systems. 3 Credit Hours.**

In this class, students will come to recognize that Earth's biosphere, atmosphere, hydrosphere, and geosphere operate in complexly linked systems in which various components are exchanged over greatly varying time scales. Using laboratory and field studies, students will measure, discuss and define the impact of global change on natural systems. Prerequisites: CHM 151 and CHM 152 and a minimum of 15 credits of BIO, including at least one course in the Ecology/Population Biology Area.

Cross-listed Courses: ESS 458

**BIO 460. Biochemistry I. 3 Credit Hours.**

A lecture course in the chemistry of physiologically relevant compounds. These include proteins, nucleic acids, carbohydrates and lipids. The interactions, regulation and metabolism of these compounds will be introduced. Three hours of lecture per week. Carries biology major credit. Prerequisites: CHM 224 and BIO 191 or permission of instructor.

Cross-listed Courses: CHM 460

**BIO 461. Biochemistry II. 3 Credit Hours.**

This course is a continuation of BIO 460. Topics to be covered include cellular metabolism and energy production; synthesis and degradation of lipids, amino acids, nucleotides; and regulation of gene expression. Carries biology major credit. Prerequisite: BIO 460.

Cross-listed Courses: CHM 461

**BIO 462. Biochemistry Laboratory. 2 Credit Hours.**

This laboratory will introduce techniques for studying proteins, nucleic acids and lipids. Prerequisite or corequisite: BIO 460. Carries biology major credit. Prerequisites: CHM 224 and BIO 191, or permission of instructor.

Cross-listed Courses: CHM 462

**BIO 470. Seminar: Environmental Topics. 3 Credit Hours.**

This advanced seminar provides students with the opportunity to explore the complexity of environmental issues in detail. By choosing current topics and analyzing the scientific and socio-economic factors underlying environmental problems, students will develop greater awareness and understanding of society's ability to mitigate these problems. This course places a high emphasis on oral and written presentation skills. Prerequisite(s): 20 credits in BIO, ESS, PSC, ECO from 200, 300 or 400 level courses.

Cross-listed Courses: PSC 470, ESS 470

**BIO 475. Stem Cell Biology. 3 Credit Hours.**

This course will examine the relatively new and expanding field of Stem Cell Biology. Students will dissect and analyze the most current primary literature from this exciting new field along with examining the basic science of molecular biology, fate determination, cell proliferation and differentiation. We will analyze the biology and ethics involved in this rapidly growing field and discuss the direction this field might and perhaps should go in. Throughout this course we will discuss how this field of study may impact our lives along with the potential benefits and dangers of this pursuit.

Prerequisite: BIO 218.

**BIO 480. Seminar: Biology of Cancer. 3 Credit Hours.**

This seminar will offer advanced students the opportunity to further develop research and presentation skills required in graduate or medical school. Cancer biology is an area of intense research in fields ranging from toxicology and environmental biology to molecular biology. This seminar will examine the cell and molecular basis of cancer as a means to improve students' ability to critically evaluate the scientific literature. Students will select papers from the scientific literature for analysis and presentation in both written and oral formats. Students may be required to attend a scientific lecture off campus during the semester. Prerequisites or corequisites: BIO 218 and junior or senior standing in biological sciences or biochemistry or permission of the instructor. Three hours of lecture per week. Carries biology major credit.

**BIO 481. Seminar: Endocrine Disruptors. 3 Credit Hours.**

This seminar will offer upper level students in the sciences the opportunity to develop or enhance research and presentation skills required in graduate or professional school. Improper use and disposal of chemicals and physical agents by humans have caused a number of adverse effects in all living things. This seminar will specifically focus on environmental contaminants that have been shown to alter the function of the endocrine system in wildlife and humans. Although this course will utilize textbooks, it will rely heavily on the scientific literature for additional readings and assignments. Students may be required to attend one scientific lecture off campus during the semester. Prerequisites or corequisites: BIO 218, junior or senior standing in biological sciences or biochemistry or permission of the instructor. Carries biology major credit.

**BIO 482. Seminar: Current Issues in Genetics. 3 Credit Hours.**

This seminar will offer advanced students the opportunity to further develop skills of critically analyzing primary literature in the field of genetics and presenting those literature critiques. Genetics is at the foundation of all areas of biology. This seminar will examine both forward and reverse genetic approaches, mapping genes and creating gene knockouts to understand gene function and the implications to these broader areas of study. Students will select papers from the scientific literature for analysis and presentation in both written and oral formats. Students may be required to attend a scientific lecture off campus during the semester. Three hours of lecture per week. Carries biology major credit. Prerequisite(s): BIO 218 and permission of the instructor, BIO 320 is strongly recommended.

**BIO 490. Internship in Biology. 1-3 Credit Hours.**

The goal of this class is participation in a field-learning experience closely related to the student's major field of study. The student intern will meet regularly with his or her supervisor in the agency and will report as required to the faculty member assigned to supervise the internship. Students are expected to apply what they have learned in the academic program to the internship. An evaluation of the experience will also be required. The internship and placement must be approved by the faculty coordinator. Three hours of field work per week are required to generate one credit hour. Therefore, a three-credit internship will require at least nine hours on site per week. The number of credit hours to be awarded must be determined and contracted prior to registration. A signed Memorandum of Understanding (MOU) with the placement site must be on file with the Office of Career Services prior to the start of the internship experience.

Prerequisite: 64 credit hours of coursework in the major program or permission of the department chair.

**BIO 499. Research in Bio & Environmental Systems. 1-3 Credit Hours.**

The student conducts a laboratory or field investigation under the guidance of the faculty in the department. Proposals, indicating credits sought, must have approval prior to registration. Written research report and oral public presentation of the research are required. Prerequisites and corequisites: 15 credit hours in environmental science or biology in addition to BIO 380. For biology majors, three credits of BIO 499 carries credit for the 10th biology course. For ESS majors, three credits of ESS 499 is required for graduation.

Cross-listed Courses: ESS 499