

# Biology (BIOL)

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## Courses

### **BIOL 100. Becoming a Stetson Biologist. 0.0 Units.**

This course encourages students to think critically about current issues in biology while they consider their own future in the life sciences. Classroom discussions of how to be successful in the classroom, career exploration, community engagement, field trips, and experiential exercises will provide students with a clear pathway toward becoming a Stetson biologist.

### **BIOL 111P. The Human From Cell to Organism. 1 Unit.**

This course is for non-science majors. It covers the biological study of the human using cellular, genetic, organismal, and environmental approaches. Laboratory exercises will allow students to investigate a range of topics in human biology through both observation and manipulation.

### **BIOL 112P. Environmental Biology. 1 Unit.**

This course is for non-science majors. It is a survey of the interrelationships of humans and their environment emphasizing a basic knowledge of ecology to understand environmental problems. Laboratory exercises will allow students to investigate the natural world through both observation and manipulation. Typically offered once a year.

### **BIOL 113P. Human Food and Nutrition. 1 Unit.**

This course is for non-science majors. This course offers an in-depth examination and analysis of the nutrient and chemical composition of food and its relationship to the health and well-being of the individual. The course employs an interdisciplinary approach to gain a working knowledge of the science of nutrition and explores food choices and the behaviors associated with making those choices.

### **BIOL 114V. Genes, Biotechnology and Genetic Engineering. 1 Unit.**

This course is for non-science majors. This course focuses on Stetson's Ethical or Spiritual Inquiry Value. The biological study of the discovery and applications of gene analysis, biotechnology and genetic engineering in bacteria, animals, and humans. This course integrates scientific background and hands-on laboratory activities with real world applications. The course will also focus on critical analysis and discussion of the bioethical implications of new biotechnology applications.

### **BIOL 116P. Aquatic and Marine Biology. 1 Unit.**

This course is for non-science majors. This course explores the biodiversity and unique adaptations found in aquatic and marine ecosystems. Although topics will vary year to year, the course focuses on the ecology and biology of Florida organisms and environments, such as alligators, sharks, springs, mangroves, and coral reefs. The lab portion of the course includes field excursions to local aquatic and marine habitats.

### **BIOL 118P. The Natural World: Systems and Processes of Science. 1 Unit.**

This course is for non-science majors. This is a survey course designed to introduce students to major scientific concepts from chemical, physical, earth and life sciences. With an emphasis on the ways in which scientific method is used to address questions about the natural world, the course will encompass the breadth of science from atoms and elements to ecosystems and solar systems. The laboratory portion of the course will include opportunities for students to design and execute original experiments. This course is appropriate for any student interested in gaining a broad understanding of scientific principles and practice, and will also incorporate all of the science knowledge areas required for K-6 education majors.

### **BIOL 121P. The Biological Basis of Behavior. 1 Unit.**

This course is for non-science majors. It covers the study of behavior at all levels; from cellular processes to human cognition. Specifically, this course will cover the cell biology, genetics, organ systems, and physiology underlying animal behavior. Evolutionary and ecological influences on behavior also will be addressed. The laboratory exercises will provide hands-on experiences to reinforce the concepts covered in lecture and expose students to the use of the scientific method.

### **BIOL 141P. Introductory Biology: Biochemistry, Cell Biology and Molecular Genetics. 1 Unit.**

This course is for science majors and students interested in the health professions. For students majoring in Biology, Aquatic and Marine Biology, or Molecular and Cellular Biology it is part of a four-course introductory sequence (BIOL 141P, BIOL 142P, BIOL 243Q and BIOL 244) that meets the introductory Biology requirement for science majors and satisfies the General Education 'P' requirement. Primary topics include the molecules of life, organelle function, mitosis and meiosis, and DNA function and repair. There are three hours of lecture and three hours of laboratory per week. This course is prerequisite for all 300- and 400-level biology courses except BIOL 310 and the Junior Seminars.

### **BIOL 142P. Introductory Biology: Animal and Plant Physiology. 1 Unit.**

This course is for science majors and students interested in the health professions. For students majoring in Biology, Aquatic and Marine Biology, or Molecular and Cellular Biology it is part of a four-course introductory sequence (BIOL 141P, BIOL 142P, BIOL 243Q and BIOL 244) that meets the introductory Biology requirement for science majors and satisfies the General Education 'P' requirement. Primary topics include the structure and function of organ systems in animals, and plant growth and reproduction. There are three hours of lecture and three hours of laboratory per week. This course is prerequisite for all upper-division biology courses except BIOL 310 and the Junior Seminars.

### **BIOL 180. Biology Elective. 0.75 to 1 Units.**

### **BIOL 185. Independent Study. 0.5 or 1 Units.**

### **BIOL 190. Special Topics in Biology. 0.5 or 1 Units.**

May be repeated for credit. Focused study of a contemporary issue in the life sciences. Topics vary according to interests of faculty members coordinating this class. Prerequisite may be required.

**BIOL 222V. Current Issues in Food and Nutrition. 1 Unit.**

This course focuses on Stetson's Health and Wellness Value. Designed to introduce non-science majors to basic concepts and contemporary research in nutrition. The course emphasizes the relationship of food consumption with the development of inherited predispositions for heart disease, cancer, type 2 diabetes and other disorders associated with dietary choices.

**BIOL 243Q. Biostatistics. 1 Unit.**

Required for the Biology major, this class will provide students with direct experience in the process of doing science, from study design to writing and publication. We will focus on the basics of hypothesis generation, experimental design, data analysis, and the interpretation and presentation of data. The class emphasizes a variety of techniques used in both descriptive and inferential statistics. The presentation of biological research in written and oral presentations will be covered. We will strongly stress using computers to manage, analyze, and present data. Prerequisite: BIOL 141P and BIOL 142P or ENSS 141P. This course is offered every fall.

**BIOL 244. Introductory Biology III: Ecology and Evolution. 1 Unit.**

This course provides an overview of the ecology and evolution of plants and animals. Emphasis is on models that explain the way organisms evolve and interact with one another and the environment. The process of science is emphasized through the use of examples of current research in the area of evolutionary ecology. The laboratory portion of the course is designed to increase student understanding of experimental design, and data analysis and presentation. Prerequisite: BIOL 243Q or ENSS 345Q. This course is offered every spring.

**BIOL 285. Independent Study. 1 Unit.**

Study of a topic not covered in other courses under the guidance of a professor.

**BIOL 290. Special Topics in Biology. 0.5 or 1 Units.**

May be repeated for credit. Focused study of a contemporary issue in the life sciences. Topics vary according to interests of faculty members coordinating this class. Prerequisites: BIOL 141P and BIOL 142P.

**BIOL 298. Pre-Medical Student Clinical Experience. 1 Unit.**

A concentrated experience designed to expose students to actual clinical conditions and techniques. Limited to pre-med students; selection of participating students will be made by the University Health Professions Advisory Committee.

**BIOL 300. Molecular Biology and Biotechnology. 1 Unit.**

This course focuses on mechanisms and applications of molecular biology including gene expression, regulation, and biotechnology innovations. Students investigate a scientific research question through collaboration with their peers in lab, and thus explore how molecular biology is utilized in biological experimentation. Students will utilize and apply techniques of molecular biology, including DNA extraction, polymerase chain reaction, and DNA sequencing and analysis. Prerequisites: BIOL 141P, BIOL 142P, and BIOL 243Q.

**BIOL 301. Microbiology. 1 Unit.**

This course is an introduction to the microbial world and covers major areas of modern microbiology including microbial cell structure, physiology, genetics, biochemistry, and pathogenicity. An emphasis is placed on the role of microbial pathogens in human disease and therefore fundamental concepts of immunology, virology, and infectious diseases are also covered. The laboratory is designed so that students complete a semester-long research project isolating and identifying microbes from the microflora, with an emphasis on scientific writing. Prerequisites: BIOL141P and BIOL142 and BIOL 243Q. This course is usually offered every fall.

**BIOL 302. Genetics. 1 Unit.**

Introduction to the fundamental concepts of genetics and gene transmission. Topics covered include genetic inheritance, human genetic analysis, genetic mapping in various organisms, the physical nature of genes and their functions, and modern genetic techniques. Prerequisites: BIOL 141P and BIOL 142P.

**BIOL 303. Comparative Vertebrate Anatomy. 1 Unit.**

Structure and function of the vertebrate body is explored in depth by comparative analysis of the major organ systems and their functional morphology among the vertebrate classes (Jawless Fish, Cartilaginous Fish, Bony Fish, Amphibians, Reptiles, Birds and Mammals). The laboratory component includes dissections of representative vertebrates (lamprey, shark, mudpuppy, rabbit) as well as study of skeletal components and skin-derived structures. Prerequisites: BIOL 141P and BIOL 142P. Offered every other year.

**BIOL 305. Flora of Florida. 1 Unit.**

Identification, classification, and evolution of the vascular plants of Florida. Laboratory exercises will include field trips that provide a chance for students to identify plants in a variety of Florida ecosystems. Prerequisites: BIOL 141P and BIOL 142P. Offered every other year.

**BIOL 306. Invertebrate Zoology. 1 Unit.**

Morphology, natural history, and evolutionary relationships of the invertebrate phyla with special emphasis on aquatic and marine invertebrates. The laboratory portion includes field trips to sandy beaches, mangrove forests, saltmarshes, seagrass beds, ponds, forests, and freshwater marshes. Lab work also includes observation and dissection of representative invertebrates. Prerequisites: BIOL 141P, BIOL 142P, BIOL 244, and either BIOL 243Q or ENSS 345Q.

**BIOL 308. Mammalogy. 1 Unit.**

A thorough examination of mammalian biology. Focus will be placed on the ecology and evolutionary biology of mammals through examination of their origins, diversity, functional morphology, reproduction, behavior, population biology, ecological roles, classification and identification. Special focus will be placed on the mammals of Florida. Laboratory sessions will include field research, molecular laboratory methods, and observation and dissection of representative organisms. Field trips to local habitats, zoological parks, and nature centers will provide an opportunity to observe and understand representative mammals. Prerequisite: BIOL 244.

**BIOL 310. Ornithology. 1 Unit.**

This course includes broad coverage of the biology of birds, including topics such as evolution and classification, anatomy and physiology, flight and aerodynamics, and selected aspects of behavior and ecology. Laboratories are spent in the field learning Florida birds and how they cope with their environment. Bird skins may be prepared from salvaged bird carcasses. No prerequisites. Offered every other year and some summers.

**BIOL 312. Marine Vertebrate Biology. 1 Unit.**

An in-depth exploration of the systematics and biology of and issues facing marine fish, sharks, reptiles, birds, and mammals. Labs will include field trips to local beach habitats and dissections of preserved specimens. Prerequisites: BIOL 141P, BIOL 142P, BIOL 244 and either BIOL 243Q or ENSS 345Q. Offered every other year.

**BIOL 313. Oceanography. 1 Unit.**

The study of ocean dynamics and how they influence marine ecosystems. A special emphasis is placed on practical applications and modeling. Topics will include plate-tectonics, properties of seawater, wind & ocean circulation, waves, tides, biological productivity, and ocean ecosystems. Students will be expected to become proficient at mathematical problem solving and interpreting data sets. Prerequisites: BIOL 141P, BIOL 142P, BIOL 244 and either BIOL 243Q or ENSS 345Q. Offered every other year.

**BIOL 314. Immunology and Hematology. 1 Unit.**

Study of defense systems of mammals and birds, particularly inducible systems leading to antibody formation and study of the components of blood and how they are measured. In the laboratory, students perform assays of blood components and do serological tests, including inducing an immune response in experimental animals.

**BIOL 315. Endocrinology. 1 Unit.**

A study of the synthesis, release, and action of hormones. Endocrine disorders are discussed to help understand homeostasis and its disruption. Experiential exercises include observing endocrine gland histology, measuring glucose and cortisol levels, and case studies. Prerequisites: BIOL 141P and BIOL 142P. Offered every third year.

**BIOL 316. Animal Behavior. 1 Unit.**

Topics covered include the genetic, neural, and physiological processes underlying behavior, and the evolution and ecology of behavior. Scientific literature is used to supplement the textbook and gain an appreciation of the approaches to the study of animal behavior. Laboratory exercises are open-ended with student groups designing experiments to investigate specific behaviors. Prerequisites: BIOL 141P and BIOL 142P. Offered every third year.

**BIOL 317. Marine Ecology. 1 Unit.**

This course is an exploration of biological interactions within diverse marine environments. The laboratory portion of the course will include field trips to mangrove swamps, sandy beaches, and salt marshes, during which students will learn data collection techniques commonly used in coastal field biology. We will apply field observations, experimental design, and analysis of scientific literature to evaluate how interactions amongst marine organisms, such as mating, predation, and symbiosis, contribute to the function of surrounding ecosystems. We will also investigate human impacts to these ecosystems and assess best practices in marine conservation. Prerequisites: BIOL 141P, BIOL 142P, BIOL 244, and either BIOL 243Q or ENSS 345Q.

**BIOL 318. Tropical Biodiversity and Conservation. 1 Unit.**

This course will focus on an overview of the biodiversity and conservation of tropical ecosystems. We will discuss flora, invertebrate and vertebrate fauna, and the composition and function of tropical ecosystems. Within these ecosystems, conservation practices will be a focal point, including considerations for successful conservation, human impact in conservation, and existing conservation efforts. Prerequisites: BIOL 141P and BIOL 142P. Sophomore standing or higher required.

**BIOL 319. Environmental Physiology of Marine Organisms. 1 Unit.**

This course examines how environmental change impacts the physiology of marine organisms. Course topics include physiological responses to natural fluctuations in marine environments and to anthropogenic stressors, such as accelerated changes in climate. The laboratory portion of this course includes specimen collection from local coastal environments and development of laboratory skills in physiology, such as osmometry, spectrophotometry, and analysis of biomechanics. The course will culminate in a final project – the EPMO Challenge, during which students collaborate to find a physiological solution to an environmental disruption. Prerequisites: BIOL 141P and BIOL 142P.

**BIOL 333. Limnology. 1 Unit.**

This course examines the processes that create and regulate our wonderful variety of freshwater resources, including lakes, rivers, streams, and wetlands. We investigate 1) the physical processes that underlie all life in water, 2) the chemical interactions between the organisms and their wet habitat, 3) the diversity of life in freshwater, and 4) ways to manage water bodies to our water resources and ecological systems. In particular, we highlight the unique qualities of Florida water bodies in discussion and in hands-on field trips. Prerequisites: BIOL 141P, BIOL 142P, BIOL 244 and either BIOL 243Q or ENSS 345Q. Offered every other year.

**BIOL 371V. Ecology of our Changing Earth. 1 Unit.**

This course focuses on Stetson's Environmental Responsibility Value. Study of ecological principles with emphasis on the relationship between humans and their environment. Topics explored include population growth, global climate change, biodiversity, species interactions, and environmental resource management. Students will use mathematical models, computer simulations, and observations of nature to generate a deep understanding of our dependency on the natural world. We will focus on both the causes of environmental problems and potential solutions with a strong emphasis on sustainable interactions with the biosphere. Junior Seminar.

**BIOL 372V. Microorganisms: Bane or Boon?. 1 Unit.**

This course focuses on Stetson's Health and Wellness Value. This course is a seminar course exploring the ways that microorganisms impact our lives, our nutrition, and our health by using case studies. Junior Seminar.

**BIOL 373V. A Bionic Human? The Future of Human Health and Wellness. 1 Unit.**

This course focuses on Stetson's Health and Wellness Value. This seminar is open to anyone interested in the future of Human Health and Wellness. We will consider both individual and societal perspectives. While our focus will be future technology we will encourage critical analysis from a variety of interdisciplinary perspectives, including ethics, the law, business, government regulation, biomedical and drug discovery & clinical testing, economics, global dynamics, genetic engineering, orphan diseases, and more. Junior Seminar.

**BIOL 374V. Water Wars. 1 Unit.**

This course focuses on Stetson's Environmental Responsibility Value. What will be the future of conflict? Many ecologists, environmental biologists, sociologists, and political scientists, agree that future conflicts are likely to be waged over water scarcity and the quality of water resources. Historians can point to many examples of conflicts in decades past that appear to have been purely political, but in fact were waged over water sources. Tearing apart the many angles of a water conflict provides a broader prospective of the workings of the natural world and human society. This course will examine the potential causes of water conflict through geographical studies of water distribution, hydrological studies of water movement, and sociopolitical studies of different regions of the globe. Junior Seminar.

**BIOL 375V. Looking for Longleaf and other Botanical Adventures. 1 Unit.**

This course focuses on Stetson's Environmental Responsibility Value. This course examines the ways in which plants are directly and indirectly important to humans, as components of natural systems and as sources of food and medicine, using in-depth examples from several dynamic species. With a focus on Florida, students will visit local natural areas and participate in restoration of a longleaf pine community on campus. Junior Seminar.

**BIOL 385. Independent Study. 0.5 or 1 Units.**

Study of a topic not covered in other courses under the guidance of a professor. Prerequisites: 2 units advanced biology and permission of faculty member.

**BIOL 390. Special Topics Biology. 1 Unit.**

May be repeated for credit. Focused study of a contemporary issue in the life sciences. Topics vary according to interests of faculty members coordinating this class. Prerequisites: BIOL 141P and BIOL 142P.

**BIOL 395. Teaching Apprenticeship. 0.5 Units.**

Pass/Fail only. This course provides an opportunity for select Biology majors to work closely with a faculty member in planning, teaching, and assessing an introductory-level course in their major. Prerequisite: Junior or senior status and permission of the instructor. May be repeated once.

**BIOL 397. Internship in Biology. 0.5 or 1 Units.**

Pass/Fail only. Through placement in an approved setting, students will have an opportunity to enrich their classroom knowledge with experience in the field of biology. Typically, full unit internships require approximately 200 hours for the semester for a full-unit internship and 100 hours for the semester for a half-unit internship. Specific requirements will be presented by way of a contract signed by the students. Basic expectations include a journal, research paper, or appropriate work product, and a letter of evaluation from the site supervisor. Prerequisites: permission of department head and instructor, major or minor status, and successful completion of BIOL 141P and BIOL 142P. Credit may not be applied toward the major. Enrollment in an internship course requires students to attend an orientation prior to beginning work at their internship site. For more information regarding internship orientations, please contact Career & Professional Development at [career@stetson.edu](mailto:career@stetson.edu) or 386-822-7315.

**BIOL 398. Internship in Aquatic/Marine Biology. 0.5 or 1 Units.**

Pass/Fail only. An opportunity for Aquatic & Marine Biology majors to apply disciplinary specific knowledge to practical situations through an internship. Students must complete a 200 hour internship with a professional outside Stetson for a full-unit internship and 100 hours with a professional outside Stetson for the semester for a half-unit internship. In addition, students will submit a written description of their accomplishments, a paper that reflects on their experiences and how well they were able to apply the concepts they learned at Stetson to their internship, and a letter of evaluation from the site supervisor. All students planning internships must obtain prior approval of the internship from the AQB Program Director, attend pre-internship programming on campus, and sign a contract that lays out internship expectations. Pre-requisites: Permission of Program Director, major status, and successful completion of BIOL141, BIOL142, BIOL243, and BIOL244. Enrollment in an internship course requires students to attend an orientation prior to beginning work at their internship site. For more information regarding internship orientations, please contact Career & Professional Development at [career@stetson.edu](mailto:career@stetson.edu) or 386-822-7315.

**BIOL 401. General Physiology. 1 Unit.**

An in-depth course on mechanisms of body function. The course is structured from a systems approach (cardiovascular, respiratory, reproductive, etc.) and will be focused on human physiology. Cross-disciplinary perspectives from molecular biology to space biology to pathology and disease mechanisms show the integrative nature of physiology as a discipline. Prerequisites: BIOL 141P and BIOL 142P.

**BIOL 405. Ecology. 1 Unit.**

The study of the relationship between organisms and their environment, with a focus on the factors that influence the abundance and distribution of organisms. In the lab sessions students conduct independent investigations of ecological principles in local habitats. Prerequisites: BIOL 141P, BIOL 142P, BIOL 244, and either BIOL 243Q or ENSS 345Q.

**BIOL 409. Neurobiology. 1 Unit.**

Anatomy and physiology of the nervous system with particular emphasis upon cellular and molecular processes. The laboratory is designed to emphasize the multidisciplinary nature of neuroscience by having students design and complete experiments using anatomical, behavioral and physiological techniques. Prerequisites: BIOL 141P and BIOL 142P. Offered every other year.

**BIOL 410. Developmental Biology. 1 Unit.**

An interactive exploration of the processes (genetic, chemical and evolutionary) that shape the embryonic development of model animal systems (plants, fruit flies, salamanders, fish and chickens). Labs will consist of a variety of experiments that allow students to gain hands-on experience with developing organisms and the chemical and environmental factors that influence them. Prerequisites: BIOL 141P, BIOL 142P, and BIOL 243Q. Usually offered every other year.

**BIOL 415. Cancer Biology. 1 Unit.**

This course explores the cellular and molecular hallmarks of cancer. Topics will include oncogenes, tumor suppressor genes, DNA damage and repair, angiogenesis, invasion, metastasis and current cancer treatments. Student will learn how mutagens and carcinogens contribute to the development of cancer and explore the various differences between malignant and non-malignant cells. Prerequisite: BIOL 141P, BIOL 142P, BIOL 243Q and either BIOL 300, BIOL 301, or BIOL 425.

**BIOL 422. Molecular Ecology. 1 Unit.**

This course explores the use of molecular genetic markers to study the ecology and evolution of natural populations. Includes an introduction to population genetics, phylogenetic theory and computer analysis of molecular data. Prerequisites: BIOL 141P, BIOL 142P, BIOL 244, and either BIOL 243Q or ENSS 345Q.

**BIOL 425. Cell Biology. 1 Unit.**

An in-depth course on cellular structure and function. Focus will be primarily on eukaryotic cells, but prokaryotic examples will also be discussed. A strong component of molecular biology is included to elucidate experiments designed to better understand cellular components and structural interactions, regulation of cell function and cell interactions with other cells and the local environment. Prerequisite: BIOL 141P and BIOL 142P and BIOL 243Q.

**BIOL 444V. Conservation Biology. 1 Unit.**

This course focuses on Stetson's Environmental Responsibility Value. This course provides an interdisciplinary look at the causes of conservation problems, such as species extinctions and loss or degradation of ecosystem function. Once defined, we analyze an array of approaches to rectifying or minimizing these problems. During the first half of the semester, laboratory exercises focus on techniques for studying species diversity and distributions. During the second half of the semester, we attack a real, local conservation problem using community-based research. Prerequisites: BIOL 141P, BIOL 142P, BIOL 244, and either BIOL 243Q or ENSS 345Q.

**BIOL 450. Plant Ecology. 1 Unit.**

This course investigates principles of plant growth, reproduction, anatomy, and physiology as they relate to whole plant adaptation. We will use evolutionary principles to understand adaptation to the environment and to elucidate strategies for maximizing reproductive success, avoiding predation, and maximizing carbon gain while avoiding water loss. Lectures and laboratory sessions will complement the study of basic botanical concepts with an emphasis on the ecological and evolutionary implications of plant structure and function. Prerequisites: BIOL 141P, BIOL 142P, BIOL 244, and either BIOL 243Q or ENSS 345Q.

**BIOL 485. Independent Study. 1 Unit.**

Study of a topic not covered in other courses under the guidance of a professor. Prerequisites: 2 units advanced biology and permission of faculty member.

**BIOL 490. Special Topics in Biology. 0.5 or 1 Units.**

May be repeated for credit. Focused study of a contemporary issue in the life sciences. Topics vary according to interests of faculty members coordinating this class. Prerequisites: BIOL 141P and BIOL 142P.

**BIOL 497. Research Proposal. 0.5 Units.**

Taken in spring of the junior year, a research proposal is written and defended prior to undertaking senior project. Prerequisites: BIOL 141P, BIOL 142P and either BIOL 243Q or ENSS 345Q. Writing enhanced course.

**BIOL 498. Senior Project I. 1 Unit.**

This is the capstone of the undergraduate experience in biology in which students are trained to become research colleagues. Initiated with a proposal in the junior year (BIOL 497), data collection and synthesis for the senior research project is completed in this course. Students will present their research findings in writing and through oral presentations in the spring semester (BIOL 499). Most projects are completed in a faculty member's laboratory, but approved off-campus mentors may be acceptable. Prerequisites: BIOL 141P, BIOL 142P, BIOL 497 and either BIOL 243Q or ENSS 345Q.

**BIOL 499. Senior Project II. 0.5 to 1 Units.**

Following the completion of data collection and analysis in BIOL 498, students will strengthen their written and oral communication skills by: 1) writing a scientific paper, in the form of primary literature in their discipline and 2) preparing both a poster and oral presentation in the style used at scientific conferences. Prerequisites: BIOL 141P, BIOL 142P, BIOL 497, BIOL 498 and either BIOL 243Q or ENSS 345Q. Writing Enhanced course.