

# Biological Sciences (BIO)

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## **BIO 105 Biology in the Modern World** (3 credit hours)

Concepts in biology taught from the perspective of civically engaging issues or problems. Themes and topics of wide interest, such as climate change, stem cells and cloning, antibiotic resistance, evolution, and human health. Lecture and the corresponding laboratory are designed to deepen an appreciation for the connections between science and "real-world" issues. For non-science majors. Students cannot receive credit for both BIO 105 and (BIO 181 or BIO 183).

*GEP Natural Sciences*

*Typically offered in Fall, Spring, and Summer*

## **BIO 106 Biology in the Modern World Laboratory** (1 credit hours)

Laboratory experience in biological principles to complement BIO 105. For non-science students. Students may not receive credit for both BIO 106 and (BIO 181 or BIO 183).

Corequisite: BIO 105; May not receive credit for both BIO 106 and (BIO 181 or BIO 183)

*GEP Natural Sciences*

*Typically offered in Fall, Spring, and Summer*

## **BIO 140 Survey of Animal Diversity** (3 credit hours)

Classification and phylogeny of animals; patterns of diversification in body design and relationship between body design and the environment; study of selected animal assemblages. Students may not receive credit for both BIO 140 and (BIO 350 or BIO 402 or BIO 403). Students may not receive credit for both BIO 140 and BIO 350 or BIO 402 or BIO 403 or ZO 150.

*GEP Natural Sciences*

*Typically offered in Fall only*

## **BIO 141 Animal Diversity Laboratory** (1 credit hours)

Observation of living animals, dissections of preserved specimens, and microscopy; emphasis on classification of animals, patterns of diversification in body design, and relationship between body design and the environment. Students may not receive credit for both BIO 141 and BIO 350 or BIO 402 or BIO 403 or ZO 150.

Prerequisite: BIO 140

*Typically offered in Fall only*

## **BIO 165 Introduction to Environmental Research** (5 credit hours)

Introduction to environmental research is a hands-on learning experience for incoming freshmen interested in pursuing scientific research. The course introduces students to scientific methods and research through active participation in research on an environmental problem involving chemicals of environmental concern. Students will explore a topic in this field through guided readings, field samplings, and lab experimentation. Restricted to incoming freshmen who have been accepted into the HHMI RISE program. Individualized/Independent Study and Research courses require a Course Agreement for Students Enrolled in Non-Standard Courses be completed by the student and faculty member prior to registration by the department.

*GEP Interdisciplinary Perspectives*

*Typically offered in Summer only*

## **BIO 181 Introductory Biology: Ecology, Evolution, and Biodiversity** (4 credit hours)

Introduction to ecology, evolution, and biodiversity within the context of structure and function including the adaptive strategies that organisms use to manage the everyday challenges of life. Emphasis on interactions of organisms with their environments, evolutionary change and role of natural selection in the evolution of life forms. Builds a foundation for understanding how science works, how to think critically and communicate scientifically.

X: Cannot receive credit for both BIO 181 and BIO 105 or BIO 106.

*GEP Natural Sciences*

*Typically offered in Fall, Spring, and Summer*

## **BIO 183 Introductory Biology: Cellular and Molecular Biology** (4 credit hours)

Basic concepts and principles of molecular, cellular, and developmental biology. Emphasis is placed on the physical basis of life, on the molecular mechanisms that guide evolution, on the cell as the fundamental unit of life, and on the mechanisms involved in the development of multicellular organisms. The course promotes the development of crucial scientific skills including critical thinking, problem solving, design of experiments, and effective oral and written scientific communication. Students cannot receive credit for both BIO 183 and (BIO 105 or BIO 106).

*GEP Natural Sciences*

*Typically offered in Fall, Spring, and Summer*

## **BIO 227 Understanding Structural Diversity through Biological Illustration** (3 credit hours)

Biological concepts of diversity and anatomy taught through direct observation and illustrative techniques. Lecture topics include plant ID and structure, microscopic life forms, animal anatomy and identification. Laboratory work emphasizes close observation of structures and comparative anatomy as well as illustrative techniques to produce accurate drawings of specimens. Students will be required to provide their own transportation for one field trip.

*GEP Natural Sciences, GEP Interdisciplinary Perspectives*

*Typically offered in Spring only*

## **BIO 230 The Science of Studying Dinosaurs** (3 credit hours)

This course introduces students to the scientific method as applied to the study of dinosaurs and the world in which they lived. Because we cannot directly observe dinosaurs, estimating biological features such as running speed, growth rates, and reproductive and other physiological strategies presents challenges. We will examine a range of biological concepts (including cellular biology and physiology, functional morphology and biomechanics, evolutionary relationships, and paleoecology), as well as geological concepts (such as sedimentology, radiometric dating, plate tectonics, and the geologic time scale) as they apply to dinosaurs as living organisms. An understanding of biology at the introductory college level will be assumed.

Prerequisite: C- or better in BIO 181 or BIO 183 or BIO 105

*GEP Interdisciplinary Perspectives, GEP Natural Sciences*

*Typically offered in Fall only*

**BIO 240 Principles of Human Anatomy & Physiology (A): Nervous, Skeletal, Muscular, & Digestive Systems** (4 credit hours)

BIO 240 provides an introduction to the anatomy and physiology of the nervous, skeletal, muscular, and digestive systems. Fundamental principles addressed throughout the course include (1) maintenance and regulation of homeostasis, (2) communication and control processes throughout the body, (3) integration and interdependence across organ systems, (4) structure-function relationships, and (5) anatomical and physiological adaptation. Together, BIO 240 and BIO 245 provide a strong foundation in human anatomy and physiology (through both lecture and lab) for students preparing for a variety of health-related professions.

Prerequisite: C- or better in BIO 183; Cannot receive credit for both this course and BIO 212 or BIO 421

*Typically offered in Fall, Spring, and Summer*

**BIO 245 Principles of Human Anatomy & Physiology (B): Endocrine, Cardiovascular, Respiratory & Renal Systems** (4 credit hours)

BIO 245 provides an introduction to the anatomy and physiology of the endocrine, cardiovascular, respiratory, and renal systems. Fundamental principles addressed throughout the course include (1) maintenance and regulation of homeostasis, (2) communication and control processes throughout the body, (3) integration and interdependence across organ systems, (4) structure-function relationships, and (5) anatomical and physiological adaptation. Together, BIO 240 and BIO 245 provide a strong foundation in human anatomy and physiology (through both lecture and lab) for students preparing for a variety of health-related professions.

Prerequisite: C- or better in BIO 183; Cannot receive credit for both this course and BIO 212 or BIO 421

*Typically offered in Fall, Spring, and Summer*

**BIO 267 Research in the Life Sciences I: Research Skills** (3 credit hours)

This course is designed to help first year students learn basic skills associated with scientific research. Class structure is interactive and relies on group collaboration for most projects. Students will become confident in reading and analyzing scientific literature, communicating scientific principles, compiling a poster presentation, presenting at scientific conferences, and attending local scientific symposia as well as practicing some basic laboratory techniques. The 2-semester Research PackTrack Program (BIO 267 and 269) is designed to prepare undergraduates for an original research experience in a scientific laboratory. A B- or better in BIO 267 is required to take BIO 269. Students in BIO 267 are required to attending one research symposium outside of regular class time. Individualized/Independent Study and Research courses require a Course Agreement for Students Enrolled in Non-Standard Courses be completed by the student and faculty member prior to registration by the department.

Prerequisite: C- or better in BIO 181 and Corequisite: BIO 183

*Typically offered in Spring only*

**BIO 269 Research in the Life Sciences II: Guided Research** (3 credit hours)

This course is designed to provide students with a laboratory framework for conducting original research and (together with BIO 267) preparation to move on to conducting research in a scientific laboratory. Students will generate their own research goals, write research proposals, conduct original mentored independent research, and present their findings at poster symposia both at NC State and at local conferences.

Prerequisite: C- or better in BIO 183 and B- or better in BIO 267

*Typically offered in Fall and Spring*

**BIO 270 Introduction to Evolution** (3 credit hours)

Evolution is the "grand unifying theory" that underlies all of modern biology. In this team-taught, lecture and discussion-based introductory course, students will learn about: the history of the concept of evolution and how it is discussed in modern society; sources of variation and forces of evolution; microevolution, speciation, and the nature of species; common descent, phylogeny, and the tree (and web) of life; macroevolution and modeling evolutionary trends; and the role of the fossil record, including that of our own lineage, in understanding evolution in deep time. Students will learn core foundational knowledge and how to discuss and contextualize evolutionary concepts.

Prerequisite: C- or better in BIO 181 or in (BIO 105 and 106)

*Typically offered in Fall and Spring*

**BIO 310 Quantitative Approaches to Biological Problems** (3 credit hours)

This course serves as an introduction to the use of mathematical, statistical and computational models and tools for understanding biology at the molecular, population, ecological and evolutionary scales. We will use discrete and continuous mathematics to model disease spread, ecological competition and biochemical systems. We explore the effect of random events in biochemistry and learn how to model such randomness in a statistical framework. We will also use computation tools to analyze genetic data and write a short computer program that simulates the change in allele frequencies in a population in time due to random effects. All course topics will involve hands-on computational exercises, but no prior experience in these tools and methods is expected.

Prerequisite: BIO 181 and MA 131 or MA 141 (or equivalents).

*Typically offered in Spring only*

**BIO 315 General Parasitology** (3 credit hours)

General principles of parasitic symbiosis. Emphasis on life cycles, epidemiology, and pathology of major parasites of humans and domestic animals.

Prerequisite: C- or better in BIO 181 and BIO 183

*Typically offered in Spring only*

**BIO 323 Paleoecology** (3 credit hours)

Paleoecology offers insights into the ancient ecosystems of Earth across millions of years and how the study of these extinct realms compares and contrasts with ecological studies of the modern world. Students will learn about ancient organisms through firsthand observation of fossil specimens, will have hands-on experience with paleontological data collection, and will learn to perform data analysis on paleontological datasets. At least one optional weekend field trip (illustrating concepts learned in class) will be offered during the semester.

Prerequisite: BIO 181

*Typically offered in Fall only*

**BIO 325 Paleontological Field Methods** (4 credit hours)

Understanding the history of life is not possible without first and foremost unearthing it. Discovering, collecting, and conserving fossil specimens for research is a time- and labor-intensive endeavor that requires hands-on training in the field. This course provides introductions to the evolution of life; Mesozoic biodiversity, biostratigraphy, and biogeography; vertebrate skeletal anatomy; stratigraphic and sedimentary concepts; and geomorphology. The course also covers paleontological research methods, including: specimen data collection, conservation, and preparation; topographic and geologic maps; GPS techniques; prospecting and excavation of fossil localities; and taphonomic indicators. Field work in Utah; additional costs involved.

Prerequisite: BIO 181 or BIO 230 or BIO 270 or BIO 330 or MEA 202  
*Typically offered in Summer only*

**BIO 330 Evolutionary Biology** (3 credit hours)

Principles and patterns of organic evolution. Topics will include the origin of life, patterns of genetic variation, adaptations, natural selection, and the formation of species, the relationship between micro and macroevolution, and the importance of evolution to humans and medicine.

Prerequisite: C- or better in BIO 181 and BIO 183  
*Typically offered in Spring only*

**BIO 361 Developmental Biology** (3 credit hours)

In this course students will discover the amazing journey that cells must take to get from an egg to an embryo, form a mature adult, and reproduce in order to continue the life cycle. Students will relate science to everyday life using developmental biology as a forum to integrate many aspects of biology from the molecules in single cells to the complete organism and how it is influenced by evolution and the environment. Cannot receive credit for both BIO 361 and GN 434.

Prerequisite: C- or better in BIO 183  
*Typically offered in Fall only*

**BIO 370 Developmental Anatomy of the Vertebrates** (3 credit hours)

An integrated study of the functional anatomy, phylogeny, and embryonic development of organ systems in vertebrate animals.

Prerequisite: C- or better in BIO 181 or BIO 140  
*Typically offered in Spring only*

**BIO 375 Developmental Anatomy Laboratory** (2 credit hours)

A hands-on study of embryonic development and organ systems in vertebrate animals, utilizing microscopic examination of living and preserved embryos, demonstrations of skeletons and mammalian organs, and dissections of preserved shark, salamander, and mink.

Prerequisite: C- or better in BIO 181 or BIO 140  
*Typically offered in Spring only*

**BIO 405 Functional Histology** (3 credit hours)

Offered only as a distance education course via the internet. Functional Histology describes the cellular structure of tissues and organs. Human organs are emphasized, with brief consideration given to variation in other mammals. Tissue and organ structure is related to function, including examples of malfunction (histopathology). The course is especially appropriate for students planning a career in veterinary science, medicine, or allied health fields. Offered by distance education only.

Prerequisite: C- or better in BIO 183  
*Typically offered in Summer only*

**BIO 414 Cell Biology** (3 credit hours)

The chemical and physical bases of cellular structure and function with emphasis on methods and interpretations.

Prerequisite: C- or better in BIO 183 and (CH 221 or CH 225)  
*Typically offered in Spring only*

**BIO 416 Cancer Cell Biology** (3 credit hours)

Cancer cells are defective and yet they survive and often thrive despite having these defects. We will explore changes in tumor cells as they transition from normal cells - looking at disrupted growth signaling and cell death pathways, alterations in cell motility patterns and the induction of changes in other cells. Current research and treatments will be discussed. A focus will be on problem solving and critical thinking skills as we integrate case studies as well as primary and review literature into the course. This course will involve lecture, discussion, and group activities. Students will be expected to do assigned reading prior to coming to class, make presentations or lead discussions, analyze data, and design experiments.

P: C- or better in BIO 183 and GN 311. JR or SR standing; Students may not earn credit for both BIO/PB 414 and BIO 416.  
*Typically offered in Fall only*

**BIO 418 Cell Biology Research Lab** (2 credit hours)

BIO 418 is a laboratory course that emphasizes collaborative, inquiry-based learning through research. Students will design and implement experiments to explore mechanisms relating to cellular growth, metabolism, cell signaling pathways, environmental toxins, and/or intrinsic and extrinsic apoptotic processes in various cell lines. This course will include primary literature analysis, experimental design and implementation, maintenance of lab notebooks, data analysis, discussions, and presentations.

C: BIO/PB 414 or BIO 416. JR or SR standing  
*Typically offered in Fall and Spring*

**BIO 424 Endocrinology** (3 credit hours)

This course will explore the function of hormones and bioactive compounds in regulating animal physiology and homeostasis. Topics will include a study of hormones and their mechanism of actions in regulating various biological processes including development and growth; reproduction; feeding, digestion and metabolism; ion and water balance; stress and immunity; and sex determination. The methods used to study hormones and their physiological functions will also be addressed. 80% of enrollment is restricted to Biological Sciences and Zoology students with the remaining 20% open for all other majors.

Prerequisite: C- or better in BIO 250 or BIO 212 or BIO 240 or BIO 245  
*Typically offered in Fall, Spring, and Summer*

**BIO 432 Evolutionary Medicine** (3 credit hours)

This course introduces the rapidly emerging field of evolutionary medicine as one approach to appreciating evolution as a unifying principle of biology. The primary goal is for students to better understand the evolutionary nature of many issues connected to human health and to better understand the field of evolution via examples that are medically relevant. The course will require reading and discussing scientific literature. Credit is not allowed for both BIO 432 and BIO 330.

R: Junior or Senior standing; Prerequisite: C- or better in BIO 181 or BIO 183 or GN 311.  
*Typically offered in Spring only*

**BIO 434 Hormones and Behavior** (3 credit hours)

This course will focus on the field of behavioral neuroendocrinology, which explores mechanisms by which hormones affect and are affected by behavior. The course will use highly interactive lectures and discussions of material from the primary literature (seminal papers and recent exciting contributions). Student participation in class discussions and in-class assignments will be critical components of the learning process.

Prerequisite: C- or better in BIO 212 or Bio 250 or (ANS 205 & ANS 206) or BIO 240 or BIO 245

*Typically offered in Spring only*

**BIO 440 The Human Animal: An Evolutionary Perspective** (3 credit hours)

An in-depth look at the evolution of a wide range of human behaviors, and some aspects of physiology as well. We will critically explore the perceptions we hold of ourselves and the research that has sought to lend new insights into the fundamental bases of human behavior. New uses of evolutionary theory, including the field of evolutionary psychology, will be examined using a comparative approach and careful readings from primary and secondary literature in evolutionary biology and psychology. Classes will be largely discussion based.

Prerequisite: C- or better in one of the following: ZO 317, BIO 270, BIO 330, ZO 410, PSY 406, or PSY 416

*GEP U.S. Diversity, Equity, and Inclusion, GEP U.S. Diversity*

*Typically offered in Spring only*

**BIO 444 The Biology of Love and Sex** (3 credit hours)

The need to find and seduce a mate is one of the most powerful forces in biology. In this course, we will examine the biological factors that contribute to love and sex. We will adopt a broad evolutionarily-based perspective, examining a variety of strategies in both human and animal systems. Our readings and discussions will cover current hypotheses and experimental methodologies spanning genetics, neuroscience, and endocrinology.

P: C- or better in two of the following: BIO 330, BIO 410, BIO 424, BIO 488, GN 311; R: Junior or Senior Standing

*Typically offered in Spring only*

**BIO 481 Senior Capstone Project** (1 credit hours)

This course provides students an opportunity to integrate and apply knowledge and skills gained from their major studies in addressing an important challenge or problem that they identify. Emphasis will be placed on (1) reflections on the value of experiences outside of the classroom, (2) using discipline-specific knowledge and approaches from both biology and from the second disciplinary area that they chose to study within the B.A. in Biological Sciences, and (3) peer- and self-critiques based on the intellectual standards of critical and creative thinking. Restricted to seniors who will graduate with a B.A. in Biological Sciences. 17BIOBA majors only.

*Typically offered in Fall and Spring*

**BIO 482 Capstone Course in Molecular, Cellular, and Developmental Biology** (3 credit hours)

Topical problems in molecular, cellular, and developmental biology. BIO 482 provides a challenging opportunity for students to integrate and apply knowledge and skills gained from their major studies. Emphasis will be placed on collaborative learning and on effective, professional communication. Topics and instructors will vary from semester to semester. Priority will initially be given to seniors in the MCD curriculum; other students with the necessary prerequisites will be admitted on a space available basis.

Prerequisite: C- or better in BIO 361, BIO/PB 414, and one of the following: BCH 351 or BCH 451 or BIT 410 or GN 311.

*Typically offered in Fall and Spring*

**BIO 483 Capstone Course in Integrative Physiology and Neurobiology** (3 credit hours)

Topical problems in integrative physiology and neurobiology. BIO 483 provides a challenging opportunity for students to integrate and apply knowledge and skills gained from their major studies. Emphasis will be placed on collaborative learning and on effective, professional communication. Topics and instructors will vary from semester to semester, and the course description for each topic will indicate what prior knowledge is important for students to have for that offering.

Prerequisites: C- or better in BIO 488 and any two of the following: BIO 240, BIO 361, BIO 414, BIO 416, BIO 424, BIO 432, BIO 434, BIO 444, GN 301, GN 311, GN 434, MB 351, MB 411, MB 441, ST 311

*Typically offered in Fall and Spring*

**BIO 484 Capstone Course in Human Biology** (3 credit hours)

Topical problems in human biology. BIO 484 provides a challenging opportunity for students to integrate and apply knowledge and skills gained from their major studies. Emphasis will be placed on collaborative learning and on effective, professional communication. Topics and instructors will vary from semester to semester. Priority will initially be given to seniors in the HB curriculum; other students with the necessary prerequisites will be admitted on a space available basis.

Prerequisite: C- or better in BIO 421, MB 351 and one of the following: BCH 351 or BCH 451 or GN 311 or ST 311.

*Typically offered in Fall and Spring*

**BIO 485 Capstone Course in Ecology, Evolution, and Conservation Biology** (3 credit hours)

Topical problems in ecology, evolution, and conservation biology. BIO 485 provides a challenging opportunity for students to integrate and apply knowledge and skills gained from their major studies. Emphasis will be placed on collaborative learning and on effective, professional communication. Topics and instructors will vary from semester to semester. Priority will initially be given to seniors in the EEC curriculum; other students with the necessary prerequisites will be admitted on a space available basis.

Prerequisite: C- or better in BIO/PB 330, BIO/PB 360, and one of the following: BIO 460 or GN 311 or NR 406 or ST 311.

*Typically offered in Fall and Spring*

**BIO 488/BIO 588 Neurobiology** (3 credit hours)

Overview of the neurosciences, with a focus on fundamental principles in the function, structure, and development of the nervous system. Topics include neuroanatomy, electrical signaling, synaptic transmission, sensory and motor systems, neural development, neural plasticity, and complex brain functions. Multiple levels of analysis, from molecular to behavioral, with an emphasis on the mammalian nervous system. Motivated students who do not meet listed prerequisite can contact the instructor for permission to take the course.

Prerequisite: C- or better in BIO 250 or BIO 212 or BIO 240 or BIO 245 or permission of instructor

*Typically offered in Fall only*

**BIO 498 Honors Project Part I** (3 credit hours)

Together, BIO 498 and BIO 499 provide a two-semester sequence for honors projects conducted by students in good standing in an honors program within the Department of Biological Sciences. Before enrollment in BIO 498, students (1) identify a project in consultation with a faculty member, (2) work with that mentor to complete a contract describing the expectations for their work together in BIO 498, and (3) have the contract approved by the honors program coordinator. The approved contract will describe the specific requirements and expectations of the BIO 498 experience. Enrollment only by permission of the honors program director.

*Typically offered in Fall, Spring, and Summer*

**BIO 499 Honors Project Part 2** (3 credit hours)

Together, BIO 498 and BIO 499 provide a two-semester sequence for honors projects by students in good standing in an honors program within the Department of Biological Sciences. Before beginning BIO 499, students will have successfully completed BIO 498 as well as a contract describing the expectations for their work with the mentor in BIO 499. The contract must be approved by the honors program director. The approved contract will describe the specific requirements and expectations of the BIO 499 experience. Enrollment only by permission of honors program director.

Prerequisite: BIO 498

*Typically offered in Fall, Spring, and Summer*

**BIO 520 Skeletal Biological Laboratory Methods in Human Identification & Cold Cases** (3 credit hours)

This laboratory-based course covers skeletal biological methods such as those used in human identification applied to medicolegal issues or issues of the law. Forensic identification methods will be introduced via lecture and students will apply these methods in the laboratory. The investigation of cold cases will be addressed through laboratory methodologies that intersects with missing persons cases. This course covers a broad array of investigative skeletal methods. However, students will not be qualified to practice after taking this course.

P: Graduate Standing

*Typically offered in Fall only*

**BIO 555/PSC 555 Creative Media Production for Scientists** (3 credit hours)

This course will be an introduction to producing videos and other online science media. Students will survey and discuss research-based best practices for online science media and will produce their own media pieces.

R: Grad Standing or Instructor Approval

*Typically offered in Spring only*

**BIO 560/BMA 560 Population Ecology** (3 credit hours)

Dynamics of natural populations. Current work, theories and problems dealing with population growth, fluctuation, limitation and patterns of dispersion, species interactions, community structure and ecological genetics. One semester of calculus and a junior/senior level ecology course are required.

Co-requisite: ST 511

*Typically offered in Spring only*

**BIO 562 Fundamentals of Bioinformatics** (3 credit hours)

Almost every aspect of modern biology involves large-scale datasets and computational analyses. This course will cover some of the basic theoretical and practice background needed to understand and use computational tools for biological analyses. The course will feature a mixture of lecture, activity-based and hand-on computational analyses using the LINUX operating system. A background in biology or computer science is recommended.

*Typically offered in Fall only*

**BIO 570 Evolutionary Ecology** (3 credit hours)

This course provides a detailed overview of evolutionary ecology, the multidisciplinary interface of ecological and evolutionary processes. The course includes an historical perspective of the development of the field, major theoretical and empirical milestones, and the cutting edge of modern evolutionary ecology research and application. This is a discussion-oriented course, drawing heavily from peer-reviewed literature. Grading is centered on participation, leading discussions, critical literature reviews, and a research project. The course Moodle website will contain files for all assigned readings, the course syllabus, tips for leading discussions, and a schedule of class meetings and discussion leaders.

Prerequisite: Graduate Standing or C- or better in AEC/PB 360 and

Corequisite: C- or better in BIO 330 or BIO 432

*Typically offered in Fall only*

**BIO 572/CH 572/BIT 572 Proteomics** (3 credit hours)

Introduction and history of the field of proteomics followed by the principles and applications of proteomics technology to understand protein expression and protein post-translational modifications. Laboratory sessions include growing yeast with stable-isotope labeled amino acids, protein purification, Western blots, protein identification and quantification, and protein bioinformatic analysis. This is a half-semester course.

Prerequisite: BIT 410 or BIT 510 or BCH 454 (or approval from the instructor)

*Typically offered in Spring only*

**BIO 578 The Physiology of Stress** (3 credit hours)

Stress is a nearly unavoidable component of modern life, bound to affect each of us at some point during the week (or day!) And stress can wreak havoc on both mental and physical health. Beginning with a look at the normal stress response in humans and animals, this course then examines the biological effects of both physical and psychological stress. We'll examine what happens to various systems in the body when the stress response occurs and doesn't shut down. Among the systems explored will be neuroendocrine, cardiovascular, digestive, immune, and reproductive. We'll also look at how stress affects sleep, depression, prenatal and childhood development, and memory and judgment. And we'll spend some time with stress management techniques (and why they do or don't work) as well.

P: Graduate Standing

*Typically offered in Spring only*

**BIO 588/BIO 488 Neurobiology** (3 credit hours)

Overview of the neurosciences, with a focus on fundamental principles in the function, structure, and development of the nervous system. Topics include neuroanatomy, electrical signaling, synaptic transmission, sensory and motor systems, neural development, neural plasticity, and complex brain functions. Multiple levels of analysis, from molecular to behavioral, with an emphasis on the mammalian nervous system. Motivated students who do not meet listed prerequisite can contact the instructor for permission to take the course.

Prerequisite: C- or better in BIO 250 or BIO 212 or BIO 240 or BIO 245 or permission of instructor

*Typically offered in Fall only*

**BIO 592 Topical Problems** (1-3 credit hours)

Organized, formal lectures and discussion of a special topic.

*Typically offered in Fall, Spring, and Summer*

**BIO 624 Topical Problems** (1-3 credit hours)

Organized, formal lectures and discussion of a special topic.

*Typically offered in Fall and Spring*

**BIO 705/CBS 705 Fundamentals of Neuroscience** (3 credit hours)

This is a fundamental course that will provide the student with an up-to-date coverage of molecular, cellular, physiological, and circuit-based aspects of Modern Neurosciences in the Comparative Biomedical Sciences Graduate Program. Being a graduate-level class, the instructors will assume that the students have acquired some background in basic biology and biochemistry. The most important goal of this course is to train PhD students in neuroscience function and disorders, preparing them for neuroscience research. Emphasis will be placed on the systems and skills needed to pursue experimental neuroscience activities. Important components of the learning process will be presentations from neuroscience experts, class discussions, exams and in class activities.

P: BIO 488 or permission of instructor

*Typically offered in Fall only*

**BIO 727/CH 727 Biological Mass Spectrometry** (3 credit hours)

Fundamentals of mass spectrometry including topics such as: mass, isotopic distributions, resolving power, mass accuracy. Ionization source topics: electron impact, chemical ionization, matrix-assisted laser desorption ionization, electrospray ionization and contemporary methods. Instrumentation and mass analyzers: quadrupole, time-of-flight, Fourier transform based mass analyzers; hybrid instruments such as a quadrupole orbitrap. Tandem mass spectrometry and dissociation. Applications: quantitation, small molecule analysis, and peptide sequencing.

Prerequisite: CH 223 or CH 227

*Typically offered in Fall only*

**BIO 792 Topical Problems** (1-6 credit hours)

Organized, formal lectures and discussion of a special topic.

*Typically offered in Fall, Spring, and Summer*

**BIO 805/CBS 805 Special Topics in Neuroscience** (1 credit hours)

Topics in neuroscience. This course will provide an opportunity for students to integrate and apply knowledge and skills gained from their graduate studies. Emphasis will be placed on primary literature, scientific practice, and on effective, professional communication and presentations. Topics and instructors will vary from semester to semester. Priority will initially be given to graduate students participating in the neuroscience concentration; other students with the necessary prerequisites will be admitted on a space available basis.

R: Grad Standing or Instructor Approval

*Typically offered in Spring only*

**BIO 811 Forensic Sciences Seminar** (1 credit hours)

This is a webinar series that includes professional development as well as practitioner presentations about the current state of the various forensic sciences disciplines. Topics covered fill in the background and gaps needed for a career as a forensic science practitioner and/or academician.

Prerequisite: Graduate Standing or Instructor Permission

*Typically offered in Fall only*

**BIO 824 Topical Problems** (1-3 credit hours)

Organized, formal lectures and discussion of a special topic.

*Typically offered in Fall and Spring*