BIOLOGY (BIO)

BIO 100 Orientation to the Biology Major 1
Introduction to the Biology major at UNCG. What it means to be a Biology major at UNCG, in our community, and as a career.

BIO 105 Major Concepts of Biology 3
Introduction to major concepts in biology. Topic sections emphasize specific areas including conservation biology, biotechnology, and current issues. Survey sections emphasize basic aspects of biology, including genetics, physiology and ecology.

GE Core: GNS
LEC: GLS

Notes: For students not planning to take additional biology courses. Students who have prior credit for BIO 111, BIO 112 may not take BIO 105 for credit.

BIO 105L Major Concepts of Biology Laboratory 1
Designed to acquaint non-science majors with the process of scientific inquiry and major ideas in biology, including function of cells, the human body, mechanisms of heredity, ecology, and evolution. Online sections must have previously passed or be concurrently enrolled in online lecture. (Fall & Spring)

GE Core: GNS
LEC: GLS

BIO 111 Principles of Biology I 3
Prerequisite for most other biology courses and includes laboratory. Lecture covers the fundamental principles of biology including the molecular and cellular basis of life, genetics, and biotechnology. Prerequisite or

GE Core: GNS
LEC: GLS
Corequisites: BIO 111L.

Notes: May not be taken more than twice.

BIO 111L Principles of Biology I Laboratory 1
Laboratory supporting BIO 111. Prerequisite or

Corequisites: BIO 111.

BIO 112 Principles of Biology II 3
Prerequisite for 300-level courses and above. This course includes laboratory. Fundamental principles of biology including botany, zoology, evolution, and ecology. A passing grade in lecture and laboratory must be achieved for successful completion of this course. Prerequisite or

GE Core: GNS
LEC: GLS
Corequisites: BIO 112L.

BIO 112L Principles of Biology II Laboratory 1
Laboratory supporting BIO 112. Prerequisite or

Corequisites: BIO 112.

BIO 113 Principles of Biology Laboratory 1
Basic laboratory practices and fundamental principles of biology including molecular and cellular basis of life, genetics, and biotechnology. Prerequisites: BIO 110.

BIO 271 Human Anatomy 3
Human anatomy with study of skeletons, models, and anatomical preparations. Includes dissection of cat. Prerequisites: A grade of C- or better in BIO 110 or BIO 111 and BIO 111L. Prerequisite or

Corequisites: BIO 271L.

Notes: May not be taken more than twice.

BIO 271L Human Anatomy Laboratory 1
Laboratory supporting BIO 271. Prerequisite or Corequisites: BIO 271.

BIO 277 Human Physiology 3
Human physiology with emphasis on homeostatic mechanisms. Prerequisites: A grade of C- or better in BIO 110 or BIO 111 and BIO 111L and high school chemistry with grade of C or better. Prerequisite or

Corequisites: BIO 277L.

Notes: May not be taken more than twice.

BIO 277L Human Physiology Laboratory 1
Laboratory supporting BIO 277. Prerequisite or Corequisites: BIO 277.

BIO 280 Fundamentals of Microbiology 3
General survey of microscopic life and its impact on medicine, public health, and the environment. Includes laboratory work with bacteria, emphasizing aseptic technique. Prerequisites: A grade of C- or better in BIO 110 or BIO 111 and BIO 111L, and successful completion of either BIO 271 or BIO 277. Prerequisite or Corequisite: BIO 280L.

Notes: Students cannot receive credit for both this course and BIO 481. May not be taken more than twice.

BIO 280L Fundamentals of Microbiology Laboratory 1
Laboratory supporting BIO 280. Prerequisite or Corequisites: BIO 280.

BIO 301 Principles of Ecology 3
Introduction to fundamentals of ecology. Principles relating to populations, communities and ecosystems. Particular emphasis placed on the many dimensions of interdependence within ecosystems. Prerequisites: Minimum grade of C- in both BIO 111 and BIO 112. Notes: May not be taken more than twice.

BIO 302 Introductory Ecology Lab 1
Laboratory course to accompany BIO 301. Several field trips.

BIO 315 Ecology and Evolution Laboratory 2
This course is designed to help students understand, via hands-on activities, how species and populations evolve and how species and individuals interact with one another and with their environment. Prerequisites: Either BIO 301 or BIO 330.

Corequisites: If not completed as a prerequisite, either BIO 301 or BIO 330.

BIO 330 Evolution 3
Fundamental principles of evolutionary biology, including processes and patterns of biological evolution and an overview of the historical and contemporary biodiversity resulting from evolution. Prerequisites: Minimum grade of C- in both BIO 111 and BIO 112.

BIO 355 Cell Biology 3
Study of cellular organization and function. Fundamental biochemical properties, including cellular components, enzyme function, energetics, and metabolism studied in relation to cellular structure, membrane function, cell movement, and cytoplasmic compartments. Prerequisites: Minimum grade of C- in both BIO 111 and BIO 112.

CHE 114 (or equivalent);

Notes: May not be taken more than twice.

BIO 356 Cell Biology Laboratory 1
Laboratory exercises to complement lecture material of 355.
**BIO 301.** Biology and Conservation of Sea Turtles 3
Students spend 2 weeks in July/August in Tortuguero, Costa Rica assisting with tagging and collecting data on nesting turtles. Seminar and N.C. field trip in spring.
**Prerequisites:** Minimum grade of C- in both BIO 111 and BIO 112 and permission of instructor.
**Notes:** May not be taken more than twice. Travel fees involved; see instructor for details.

**BIO 375 Cell Biology and Genetics Laboratory 2**
Laboratory and online course that integrates modern genetic, cellular, and molecular techniques and methods to understand the concept of the gene to phenotype in biology and human health.
**Prerequisites:** Either BIO 355 or BIO 392.
**Corequisites:** If not completed as a prerequisite, either BIO 355 or BIO 392.

**BIO 392 Genetics 3**
Mendelism and modern trends in genetics.
**Prerequisites:** Minimum grade of C- in both BIO 111 and BIO 112
**Notes:** May not be taken more than twice.

**BIO 393 Genetics Laboratory 1**
Laboratory course to complement BIO 392. Exercises employ both classic genetic approaches and modern recombinant DNA technology.

**BIO 420 Marine Biology 3**
An introduction to marine organisms and their habitats; special attention given to adaptations necessary for marine life, physical oceanography, and basic ecological principles; one weekend coastal field trip is required.
**Prerequisites:** One of BIO 301, BIO 330, BIO 355, or BIO 392.

**BIO 422 Plant Diversity 4**
Introduction to plant, fungi, and protista kingdoms. Emphasis is on structure, reproduction, and life cycles of the organisms.
**Prerequisites:** BIO 330 or BIO 301 or BIO 392.
**Notes:** Passing grade in lecture must be achieved for successful completion of this course. May not be taken more than twice.

**BIO 422L Plant Diversity Lab 0**
Introduction to plant, fungi, and protista kingdoms. Emphasis is on structure, reproduction, and life cycles of the organisms. Passing grade in lecture must be achieved for successful completion of course. NOTE: Students cannot receive credit for both BIO 322 and BIO 422. (LAB)

**BIO 424 Plant Physiology and Biotechnology 3**
Physiological processes involved in plant growth spanning effects from the molecular to the environmental level. Laboratories will utilize biotechnological manipulations of the model plant Arabidopsis.
**Prerequisites:** BIO 355.

**BIO 425 Biological Clocks 3**
Descriptive survey of behavioral and physiological rhythms in humans and other animals, including circadian, tidal, lunar, seasonal and circannual cycles, with ecological considerations and implications for human health.
**Prerequisites:** One of BIO 301, BIO 330, BIO 355, BIO 392.

**BIO 430 Biological Evolution 3**
Fundamental principles of evolution biology, including mechanisms and consequences of evolutionary change, levels of selection, speciation, population genetics, and major evolutionary patterns at human and geologic time scales.

**BIO 431 The Biosphere 3**
A study of environmental issues in biology, specifically ecosystems, population dynamics, biodiversity and extinction.
**Prerequisites:** BIO 301.

**BIO 438 Animal Behavior 3**
Application of theory of evolution to the explanation of animal behavior. Surveys a variety of species, addressing several behavioral categories as well as issues in sociobiology and human evolution.
**Prerequisites:** PSY 121 and PSY 230, or minimum grade of C- in both BIO 111 and BIO 112;
**Notes:** Students cannot receive credit for both this course and BIO 439 or PSY 438 or PSY 438L. Same as PSY 438.

**BIO 439 Animal Behavior with Laboratory 4**
Application of theory of evolution to animal behavior. Includes laboratory and field techniques for assessing behavioral adaptations. Surveys several behavioral categories in a variety of species.
**Prerequisites:** PSY 230 and PSY 311, or minimum grade of C- in both BIO 111 and BIO 112;
**Notes:** Students cannot receive credit for both this course and BIO 438 or PSY 438 or PSY 438L. Same as PSY 438.

**BIO 441 Invertebrate Zoology 3**
Major invertebrate groups with emphasis on their phylogenetic relationships, ecology, physiology, evolution, and structural adaptations of representative types. Weekend coastal field trip may be required.
**Prerequisites:** BIO 330.
**Notes:** Includes a laboratory component. May not be taken more than twice; Students cannot receive credit for both BIO 341 and BIO 441.

**BIO 441L Invertebrate Zoology Laboratory 1**
Major invertebrate groups with emphasis on their phylogenetic relationships, ecology, physiology, evolution, and structural adaptations of representative types. Weekend coastal field trip may be required.
**Prerequisite or Corequisites:** BIO 441.
**Notes:** Students cannot receive credit for both BIO 341 and BIO 441.

**BIO 452 Plant Diversity Lab 0**
Introduction to plant, fungi, and protista kingdoms. Emphasis is on structure, reproduction, and life cycles of the organisms. Passing grade in lecture must be achieved for successful completion of course. NOTE: Students cannot receive credit for both BIO 322 and BIO 422. (LAB)

**BIO 453 Plant Physiology and Biotechnology 3**
Physiological processes involved in plant growth spanning effects from the molecular to the environmental level. Laboratories will utilize biotechnological manipulations of the model plant Arabidopsis.
**Prerequisites:** BIO 355.

**BIO 453L Vertebrate Morphology Lab 0**
Vertebrate development focused on cellular and molecular mechanisms of induction, differentiation, and morphogenetic processes that give rise to the adult body plan. Laboratory includes study of vertebrate embryos and adult specimens.
**Prerequisites:** BIO 355.

**BIO 454 Developmental Biology 3**
A survey of developmental processes in plants and animals. Topics will include fertilization, achievement of multicellularity, cell determination and differentiation, pattern development, and the genetic regulation of such processes.
**Prerequisites:** C (2.0) or better in BIO 355 and BIO 392.

**BIO 464 Developmental Biology Laboratory 1**
Laboratory supporting BIO 464. Prerequisite or Corequisites: BIO 464.

**BIO 470 Vertebrate Zoology 3**
Evolution of major vertebrate groups with emphasis on morphology, ecology, and behavior. Comparisons of vertebrates in the laboratory through dissections and field work.
**Prerequisites:** BIO 330.
**Notes:** May not be taken more than twice. Students cannot receive credit for both BIO 370 and BIO 470.

**BIO 470L Vertebrate Zoology Laboratory 1**
Laboratory supporting BIO 470. Prerequisite or Corequisites: BIO 470.
BIO 472 Histology 3
Microscopic anatomy of vertebrate tissues. Emphasis on correlation of cell and tissue functions with structures visible under the light and electron microscopes.
Prerequisites: BIO 355. Prerequisite or
Corequisites: BIO 472L.

BIO 472L Histology Laboratory 1
Laboratory supporting BIO 472. Prerequisite or
Corequisites: BIO 472.

BIO 477 Animal Physiology 3
Physiology of invertebrates and vertebrates including metabolism, temperature regulation, respiration, blood, circulation, water and ion balance, excretion, and the nervous, sensory, endocrine, and muscular systems.
Prerequisites: BIO 355 and one of BIO 277, BIO 470, or BIO 441.

BIO 479 Neurobiology 3
Survey of major integrative mechanisms used by nervous systems from invertebrates to humans. Synaptic transmission, sensory processing and activity of neural circuitry controlling behavior will be analyzed.
Prerequisites: BIO 355.
Notes: PHY 212 or PHY 292 recommended.

BIO 479L Neurobiology Laboratory 1
Computer-based laboratory exercises to complement BIO 479 lecture material, including intracellular and extracellular recording simulations.
Prerequisites: Pr. or Coreq.: BIO 479.
Notes: PHY 212 or PHY 292 recommended.

BIO 481 General Microbiology 3
Introductory survey of microbiology, emphasizing the role of microorganisms in everyday life.
Prerequisites: BIO 301, BIO 355, and BIO 392, or permission of instructor. Prerequisite or
Corequisites: BIO 481L.

BIO 481L General Microbiology Laboratory 1
Laboratory supporting BIO 481. Prerequisite or
Corequisites: BIO 481.

BIO 488 Essentials of Toxicology 3
This course is designed to introduce undergraduate students to the fundamentals of toxicology and serve as the key introductory course for students who require a background in toxicology.
Prerequisites: Grade of C- or better in BIO 111, BIO 112, BIO 301 and BIO 355, or permission of instructor.

BIO 493 Honors Work 3-6
Honors Work. A maximum of 6 (six) s.h. of any combination of 493, 496, 497, and 499 allowed.

BIO 494 Introduction to Biotechnology 4
Introduction to the principles and techniques of biotechnology. Includes molecular cloning, DNA sequencing, and gene expression. Explores topics such as gene amplification, gene therapy, and DNA fingerprinting.
Prerequisites: BIO 392 and BIO 375.

BIO 496 Science Pedagogy for Learning Assistants 1
Students learn about current research in science pedagogy in a weekly seminar and apply their knowledge to support active learning and inquiry as in-class learning assistants in a biology course.
Prerequisites: Permission of instructor.
Notes: May be repeated once for a total of 2 s.h. A maximum of 6 s.h. total of any combination of BIO 493, BIO 496, BIO 497, or BIO 499 may be counted toward the BIOL major.

BIO 497 Internship in Biology 1-3
Students work at site outside University for a minimum of 45–135 hours under direction of faculty and on-site supervisor. Times vary. Prior approval required. A maximum of 6 (six) s.h. of any combination of 493, 496, 497, and 499 allowed.

BIO 498 Biology Seminar 1
Oral reports and discussions of topics from current literature of biology by students, faculty and guest lecturers.

BIO 499 Undergraduate Research 1-3
Directed readings in the literature of physiological ecology, growth and regulation of populations, community structure, energy flow, mineral cycling, and other areas of current research interest.
Prerequisites: Permission of instructor.

BIO 501 Advanced Topics in Animal Ecology 3
Directed readings in the literature of physiological ecology, growth and regulation of populations, community structure, energy flow, mineral cycling, and other areas of current research interest.
Prerequisites: Permission of instructor.

BIO 502 Advanced Topics in Animal Physiology 3
Study of physiological mechanisms; selected problems from current literature.
Prerequisites: Permission of instructor.

BIO 503 Advanced Topics in Biochemistry 3
Directed readings and reports from the biochemical literature. Structure and biosynthesis of macromolecules and the composition and kinetic characteristics of biochemical pathways.
Prerequisites: Permission of instructor.

BIO 504 Advanced Topics in Cell Biology 3
Advanced treatment of cell biology covering selected topics such as gene regulation, protein sorting, cell cycle control, apoptosis. The course will consist of lectures and discussion of research articles.
Prerequisites: Permission of instructor.

BIO 505 Advanced Topics in Ecological Physiology 3
Directed readings in the literature of physiological ecology, growth and regulation of populations, community structure, energy flow, mineral cycling, and other areas of current research interest.
Prerequisites: Permission of instructor.

BIO 506 Advanced Topics in Genetics 3
Basic mechanisms of gene action in microbes, animals, and plants.
Prerequisites: Permission of instructor.

BIO 507 Advanced Topics in Neurobiology 3
Directed readings on fundamental physiological principles of nervous system functioning. Topics may include motor pattern generation, sensory transduction, sensory-motor integration, neurohormonal modulation of behavior.
Prerequisites: Permission of instructor.

BIO 509 Advanced Topics in Microbiology 3
Critical review of current research covering a wide range of topics including infectious diseases, bacterial physiology, marine microbiology, and immunology. Focus on students’ interests or needs.
Prerequisites: Permission of instructor.

BIO 510 Advanced Topics in Plant Ecology 3
Studies of special terrestrial communities or plant groups.
Prerequisites: Permission of instructor.
BIO 511 Advanced Topics in Plant Physiology 3
The physiology of growth and development in vascular plants treated in terms of phytohormones, nutrition, theories of transport, and environmental factors.
Prerequisites: Permission of instructor.

BIO 512 Advanced Topics in Plant Structure and Evolution 3
Study of current topics in plant structure, development, and evolution. A term paper is normally required.
Prerequisites: Permission of instructor.

BIO 513 Advanced Topics in Reproductive Biology 3
Directed readings and original research on reproductive biology, with emphasis on structural, regulatory, behavioral, and evolutionary aspects.
Prerequisites: Permission of instructor.

BIO 515 Advanced Topics in Vertebrate History 3
Directed/independent study of classification and phylogeny of particular vertebrate groups that results in a term paper.
Prerequisites: Permission of instructor.

BIO 518 Computational Biology 3
The class will introduce concepts and methods to analyze biological data including DNA sequence data, genome assembly and annotation, DNA sequence comparison, phylogeny construction and protein structure analyses.
Prerequisites: BIO 330 and BIO 392.

BIO 519 Introduction to Nanotechnology 3
This course introduces students to the emerging field of nanotechnology and exposes them to current research and topics that are being influenced by nanomaterials including biology, healthcare, and the environment.
Prerequisites: BIO 392, BIO 355, CHE 342, CHE 351, or permission of instructor.
Notes: Same as NAN 519.

BIO 520 Ecosystem Ecology and Biogeochemistry 3
Introduction to ecosystem function, structure, and dynamics; basic ecosystem theories; discussions of key processes governing energy flow and nutrient cycling; comparison of ecosystems; selected original literature.
Prerequisites: BIO 301 or permission of instructor.

BIO 522 Landscape Ecology 3
Prerequisites: BIO 301. STA 271; recommended
Corequisites: BIO 523.

BIO 523 Landscape Ecology Laboratory 1
Field labs to observe different landscape structures and conduct course projects for comprehending principles of landscape ecology. Students will use computer labs for GIS basics, landscape analyses.
Prerequisites: BIO 301.
Corequisites: BIO 522.

BIO 526 Conservation Biology 3
Introduction to habitat and species conservation; topics include genetic diversity, demographic patterns of rare species, habitat fragmentation, design and management of nature reserves, ecological restoration.
Prerequisites: BIO 301 and BIO 392. STA 271 recommended.

BIO 528 Microbial Ecology 3
Emphasis on current areas of active research with reference to applied problems.
Prerequisites: BIO 280 or BIO 481, or permission of instructor.

BIO 529 Aquatic Ecology 3
The study of the geology, physics, chemistry, and ecology of lakes, including reservoirs and streams with comparisons to the ocean.
Prerequisites: BIO 301 and CHE 114, or permission of instructor.

BIO 530 Aquatic Ecology Laboratory 1
Practical study of water chemistry methods, lake and stream morphometry, identification of freshwater zooplankton, benthic invertebrates and fish, and field trips to area reservoirs and streams.
Prerequisites: BIO 301.
Corequisites: BIO 529.

BIO 531 Biochemistry: Metabolic Regulation in Health and Disease 3
Chemical properties of major cellular compounds; biosynthesis, degradation, and function of carbohydrates, lipids, proteins, nucleic acids, vitamins, and hormones; energy metabolism; enzymatic catalysis.
Prerequisites: BIO 355 and BIO 392. or permission of instructor.

BIO 532 Biology of Aging 3
An integrative look at biological theory and mechanisms to explain the diversity of the aging process, including human implications.
Prerequisites: BIO 301, BIO 355, BIO 392, or permission of instructor.

BIO 535 Human Evolutionary Genetics 3
Study of primary literature testing hypotheses about human ancestry and evolution using molecular genetic methods.
Prerequisites: BIO 330 and BIO 392. or permission of instructor.

BIO 536 Biology of Aging 3
An integrative look at biological theory and mechanisms to explain the diversity of the aging process, including human implications.
Prerequisites: BIO 301, BIO 355, BIO 392, or permission of instructor.

BIO 538 Biochemistry: Metabolic Regulation in Health and Disease 3
Chemical properties of major cellular compounds; biosynthesis, degradation, and function of carbohydrates, lipids, proteins, nucleic acids, vitamins, and hormones; energy metabolism; enzymatic catalysis.
Prerequisites: BIO 355 and BIO 392. or permission of instructor.

BIO 539 Entomology 3
A theoretical and practical overview of the insect orders, selected topics of insect behavior, ecology, and evolution, and an introduction to human-insect interactions. BIO 392 and BIO 441 recommended.

BIO 540 Genes and Signals 3
Investigates the regulation of gene expression in bacteria, yeast, and higher eukaryotes, and explores how such regulatory systems have evolved.
Prerequisites: BIO 355 and BIO 392.

BIO 541 General Biochemistry Laboratory 1
Experimental work designed to complement lecture material of BIO 535.
Prerequisites: Pr. or Coreq.: BIO 535.

BIO 542 Conservation Biology 3
Advanced topics courses in the biological sciences. Topics vary with instructor.
Prerequisites: Minimum grade of C- in both BIO 111 and BIO 112 and permission of instructor.

BIO 543 Biophysics 3
Introduction to cellular biophysics, with emphasis on the physical properties of membranes, including membrane transport mechanisms and electrical properties of membranes.
Prerequisites: BIO 355, CHE 114, MAT 191, and either PHY 211 with PHY 212 or PHY 291 with PHY 292. or permission of instructor;
Notes: Same as PHY 543.

BIO 544 General Biochemistry Laboratory 1
Experimental work designed to complement lecture material of BIO 535.
Prerequisites: Pr. or Coreq.: BIO 535.

BIO 547 Current Topics in Biology 1-3
Advanced topics courses in the biological sciences. Topics vary with instructor.
Prerequisites: Minimum grade of C- in both BIO 111 and BIO 112 and permission of instructor.

BIO 549C Cur Tpc Neurons / Behavior 1-3
BIO 549D Cur Tpc Bio: Synaptic Plstcty 3
BIO 549E Cur Tpc Bio: Hormones / Phermns 1-3
Advanced topics courses dealing with contemporary issues in the biological sciences. Course topics vary with instructor.
BIO 552 Metamorphosis 3
Readings, discussions, and oral presentations of current literature on metamorphosis in animals, mechanisms controlling metamorphosis, evolution of complex life cycles, and adaptations to differing habitats.

BIO 554 Vascular Plant Systematics 4
Principles, methods, and the history of systematic biology are covered in the context of vascular plant classification and evolution.
Prerequisites: BIO 330 or BIO 301 or BIO 392.
Notes: Passing grade in lecture must be achieved for successful completion of this course. May not be taken more than twice.

BIO 554L Vascular Plant Systematics Lab 0
Principles, methods and the history of systematic biology are covered in the context of vascular plant classification and evolution. Passing grade in lecture must be achieved for successful completion of course. (LAB)

BIO 555 Vertebrate Reproduction 3
An advanced treatment of the diversity of vertebrate reproductive biology, with emphasis on structural, regulatory, behavioral, and evolutionary aspects.
Prerequisites: One of BIO 277, BIO 425, BIO 453, BIO 464, BIO 470, or BIO 477.

BIO 560 Symbiosis 3
Symbiotic interactions of living organisms from an evolutionary perspective. Metabolic, genetic, behavioral, and ecological adaptations which allow symbioses to be formed and maintained will be discussed.
Prerequisites: Three courses selected from BIO 301, BIO 330, BIO 355, BIO 392, BIO 554, or permission of instructor.

BIO 573 Drugs and the Brain 3
Pharmacology of major neurotransmitter systems in the brain and nervous system. Actions of clinically relevant drugs on these systems will be analyzed along with major drugs of abuse.
Prerequisites: BIO 355, and one of the following: BIO 277, BIO 477, BIO 479, PSY 230. or permission of instructor;
Notes: CHE 351 recommended.

BIO 575 Neuroanatomical Techniques 3
Practical experience with a variety of neuroanatomical procedures used to investigate the structural framework of nervous systems in invertebrate and vertebrate preparations. Students will learn to conduct independent projects.
Prerequisites: BIO 111 and BIO 112, and BIO 355 and one of the following: BIO 453, BIO 472, BIO 477, BIO 479, PSY 435, or permission of instructor.

BIO 578 Hormones in Action 3
Hormonal signaling in humans and other animals is examined using developmental, physiological, behavioral, cellular, and molecular perspectives, with special emphasis on the adrenal glands and the gonads.
Prerequisites: BIO 355 and BIO 392.

BIO 579 Environmental Physiology 3
Lectures, discussions, and student presentations on the physiology of animals as it is influenced by and is adapted to environmental conditions.
Prerequisites: BIO 355 and either BIO 277 or BIO 477.

BIO 583 Virology 3
Selected topics in virology. Emphasis upon new trends in the study of animal, plant, and bacterial viruses at both molecular and cellular levels.
Prerequisites: BIO 355 and BIO 392. or permission of instructor.

BIO 584 Immunology 3
Principles of immunology and serology covering both humoral and cellular aspects of immunobiology. Selected topics include: T and B cell, immunoglobulins, tolerance, hypersensitivity.
Prerequisites: BIO 481 or permission of instructor.

BIO 586 Cell Cycle and Cancer 3
Molecular basis of cell division and cancer examined through lectures and discussions of primary literature. Topics include cell cycle control, genomic stability, carcinogenesis, and cancer genetics.
Prerequisites: BIO 355 and BIO 392, or permission of instructor.

BIO 587 Epigenetics 3
Study of epigenetic mechanisms involved in chromatin structure, DNA and histone modifications, gene expression, dosage compensation, imprinting, heterochromatin structure, stem cell differentiation, development, human disease, and environmental-gene interactions.
Prerequisites: BIO 355 and BIO 392.

BIO 590 Introduction to Mathematical Models in Biology 3
Exploration of research and methodology at the interface of mathematics and biology, with an overview of relevant fields and in-depth case studies. Focus will be on mathematical models in biology.
Prerequisites: Minimum grade of C- in BIO 111 and minimum grade of B-in BIO 112 and either MAT 191 or STA 271. or permission of instructor;
Notes: Same as MAT 590.

BIO 591 Population Genetics and Molecular Evolution 3
Application of population genetic and molecular evolutionary theory to the study of natural history, natural selection, genome variation and organization, human evolution, conservation biology, and forensics.
Prerequisites: BIO 330 and BIO 392. or permission of instructor.

BIO 593 Genetics of Complex Traits 3
Theory, experimental methods, and analysis related to the genetic basis for variation in complex traits, including quantitative and threshold traits in animals and plants, and complex human diseases.
Prerequisites: BIO 392 or permission of the instructor.

BIO 595 Advanced Genetics 3
Selected topics in genetics at an advanced level. Emphasis placed on comparative view of molecular mechanisms underlying animal and plant development.
Prerequisites: BIO 392.

BIO 596 Molecular Biological Approaches in Research 1
Use of novel molecular approaches to address current questions in the life sciences will be explored by analyzing recent research reports and learning the principles underlying these approaches.
Prerequisites: BIO 392.
Notes: May be repeated for a total of 3 s.h. credit.

BIO 597 Workshops in Biotechnology 1
Individual, intensive four-week workshops focused on specific techniques in biotechnology. Provides hands-on experience designing and implementing a focused project utilizing current methods and bioinformatics.
Prerequisites: BIO 494 or permission of instructor.
Notes: May be repeated for credit as long as letter suffix of course differs: workshops of a given letter may be taken only once.
BIO 597C Workshops in Biotechnology 1
BIO 597D Wkshp Biotech: Cell Structure 1
BIO 597E Wkshp Biotech: Forensic Tech 1
BIO 597F Wkshp Biotech:Confocal Micr 1

May be repeated for credit as long as letter suffix of course differs: workshops of a given letter may only be taken once. Individual, intensive four-week workshops focused on specific techniques in biotechnology. Provides hands-on experience designing and implementing a focused project utilizing current methods and bioinformatics. (Fall & Spring)

BIO 597J Comp Tools DNA Seq Genmc Anlys 1

BIO 600 Introduction to Graduate Studies 1
Training in research ethics and oral-visual communication. Topics include plagiarism, experimental design, statistical interpretation, conflicts of interest, animal safety, authorship, peer review, and scientific presentations.
Prerequisites: Biology graduate student or permission of instructor.

BIO 601 Seminar in Animal Ecology 3
Literature of animal ecology including both classical and recent papers. Using student presentations and class discussions, the ontogeny of some overarching ecological themes are explored.
Prerequisites: BIO 301.

BIO 602 Seminar in Animal Physiology 3
Discussion of recent breakthroughs in topics ranging from the hormonal and neural mechanisms involved in homeostasis to the interactive effects of physiology and behavior.
Prerequisites: BIO 477.

BIO 603 Seminar in Biochemistry 3
Study of recent progress in biochemical research; reading, discussion, and critical evaluation of current literature.
Prerequisites: At least one previous course in biochemistry.

BIO 604 Seminar in Ecological Physiology 3
Discussions of primary literature in the physiological ecology of animals.
Prerequisites: BIO 477, BIO 505, or BIO 579.

BIO 605 Seminar in Ecology 3
Broad view of ecological literature and in-depth studies of selected aspects of population and community ecology.
Prerequisites: Previous course in ecology.

BIO 606 Seminar in Microbiology 3
Study of recent progress in microbiological research; reading, discussion, and evaluation of current literature.
Prerequisites: BIO 481.

BIO 609 Seminar in Molecular Cell Biology 3
Topics in cell and molecular biology will be reviewed through discussion of research journal articles. Emphasis on modern experimental techniques and approaches.
Prerequisites: BIO 355.

BIO 610 Seminar in Molecular Genetics 3
Recent advances in molecular genetics, reinforcing basic concepts underlying these developments and understanding their impact on the life sciences.
Prerequisites: BIO 355 and BIO 392.

BIO 612 Seminar in Plant Structure and Evolution 3
Reading and discussion of current research in plant structure, development and evolution.
Prerequisites: BIO 322, BIO 354, or BIO 440.

BIO 613 Seminar in Reproductive Biology 3
Directed readings and original research on selected topics in reproductive biology, with emphasis on structural, regulatory, behavioral, and evolutionary aspects.
Prerequisites: BIO 464.

BIO 614 Prenatal Development: Embryology and Teratology 3
Human embryological development with emphasis on normal and abnormal development. Issues in teratology and birth defects, clinical problems associated with birth defects and their means of prevention.
Prerequisites: Enrollment in MS genetic counseling program or permission of instructor.

BIO 616 Human Molecular Genetics 3
Review and extension of basic principles of molecular genetics and their application for the characterization, understanding, and treatment of genetically based disorders and susceptibilities.
Prerequisites: Enrollment in MS genetic counseling program or permission of instructor.

BIO 621 General Biology for Teachers I 3
Topics include scientific method, biochemistry, cells, cellular processes, animal development, and animal physiology.

BIO 622 General Biology for Teachers II 3
Topics include botany, cell division, genetics, evolution, and ecology.
Prerequisites: BIO 621.

BIO 625 Advanced Animal Behavior 3
Current research and theories including development and evolution of behavior, sociobiology, behavioral genetics, behavioral ecology, and the use of comparative method.
Prerequisites: BIO 435 or BIO 436 or BIO 438 or permission of instructor.
Notes: Same as PSY 726.

BIO 635 Molecular Toxicology 3
Molecular mechanisms involved in the toxicant-induced adverse health effects and discussion of molecular pathways altered in cells in response to environmental xenobiotic exposure.

BIO 636 Ecotoxicology 3
This course is designed to provide an in-depth understanding of the sources and transport of environmental pollutants, and their adverse ecological impacts.
Prerequisites: Introductory undergraduate-level course in Ecology or Environmental Sciences or equivalent or permission of the instructor.

BIO 641 Stream Ecology 3
Study of ecology and management of flowing water ecosystems. Topics such as community and ecosystem processes, major paradigms, management of point versus non-point pollutants, and restoration addressed.
Prerequisites: BIO 301 or equivalent.

BIO 645 Ecoepidemiology of Infectious Diseases 4
Understanding and managing emerging infectious diseases, primarily zoonotic, using an ecologically-based approach. Students learn theory and skills in the epidemiology and ecology of infectious diseases.
Prerequisites: Permission of instructor.
Notes: Registration in both lecture and laboratory is mandatory.

BIO 695 Biological Research 1-6
Student engages in advanced biological research under the supervision of a member of the Graduate Faculty.
Notes: Course may be repeated with a maximum of 9 hours credit counting toward the MS degree. Grade: Satisfactory/Unsatisfactory (S/U).
BIO 699 Thesis 1-6
Individual research for the completion of a thesis.
Prerequisites: Successful presentation of thesis proposal to Biology Department.

BIO 707 Seminar in Environmental Health Science 2
Development of critical-thinking and writing skills through discussions and critiques of primary literature in environmental health science and through writing assignments.
Prerequisites: Biology graduate student or permission of instructor.

BIO 711 Experimental Course 3
This number reserved for experimental courses. Refer to the Course Schedule for current offerings.

BIO 731 Environmental Health Science I: Ecosystems to Individuals 3
Causes of environmental problems that society faces and the effects on ecosystem and community function and species survival. Implications for environmental and human health are explored.
Prerequisites: Biology graduate student or permission of instructor.

BIO 732 Environmental Health Science II: Individuals to Molecules 3
Introduction to fundamentals of toxicology with a focus on toxicological consequences of environmental perturbations on physiological and cellular processes, genome structure, and gene function.
Prerequisites: Biology graduate student or permission of instructor.

BIO 733 Workshops in Environmental Health Science 1
Individual six-week workshops focusing on analytical tools and experimental approaches used in freshwater/riparian ecosystem analysis, environmental genomics, environmental forensics, and cellular/physiological research.
Prerequisites: Biology graduate student or permission of instructor.

BIO 734 Current Research in Environmental Health Science 1
Weekly discussion of research journal articles in the area of environmental health science. Students will present and discuss research journal articles.
Notes: May be repeated for a total of 2 credit hours.

BIO 749 Research Lab Rotations 1
Optional course providing credit for participation in laboratory meetings and/or the initiation of preliminary research training in the labs of 1 to 3 potential thesis advisors.
Notes: May be repeated for a total of 3 hours credit. Grade: Satisfactory/Unsatisfactory (S/U).

BIO 790 Directed Study in Environmental Health Science 1-6
Advanced research in environmental health science under the direction of a graduate faculty advisor. Preparation of doctoral research proposal and planning for dissertation research.
Prerequisites: Admitted to PhD in environmental health science and approval of graduate faculty advisor.
Notes: May be repeated for a maximum of 12 hours credit counting towards the PhD degree. Grade: Satisfactory/Unsatisfactory (S/U).

BIO 791 Independent Doctoral Research 1-6
Independent research in environmental health science related to the student's primary area of research specialization leading to dissertation.
Prerequisites: Admitted to candidacy.
Notes: May be repeated for a maximum of 15 hours credit counting towards the PhD degree. Grade: Satisfactory/Unsatisfactory (S/U).

BIO 799 Dissertation 1-18
Individual research for the completion of the doctoral dissertation.
Prerequisites: Admitted to candidacy.
Notes: May be repeated for a maximum of 18 hours credit. Grade: Satisfactory/Unsatisfactory (S/U).

BIO 801 Thesis Extension 1-3
Thesis Extension.

BIO 802 Dissertation Extension 1-3
Dissertation Extension.

BIO 803 Research Extension 1-3
Research Extension.