

# Biology

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## About the Department

The Department of Biology familiarizes students with basic concepts inherent to biological science and allows them to master new, cutting edge areas of biological research. Its degree programs prepare students to enter exciting and challenging careers in the many diverse and rapidly expanding areas of biological employment, including environmental biology, conservation, microbiology, the health sciences, science teaching, pharmacology, biotechnology, molecular biology, neurobiology, and forensics as well as in basic biological research. Superior teaching and faculty involvement with students is a high priority in the department. Many of its faculty have received university-wide awards for teaching excellence. Biology faculty have internationally recognized research programs in which students are actively encouraged to participate through credit for supervised research. Thus, students can prepare for careers in specific areas of biology by being actively engaged in research related to that career area under faculty supervision.

Graduate Programs (<https://catalog.uta.edu/science/biology/graduate/>)

Undergraduate Programs (<https://catalog.uta.edu/science/biology/undergraduate/>)

## Contact Information

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## COURSES

### **BIOL 1131. BIOLOGY FOUNDATIONS. 1 Hour.**

This onboarding course is designed to help you navigate your first year by introducing you to the department, key resources, and an overview of what you'll learn in your biology courses. Through engaging workshops and small-group discussions, you'll meet faculty, learn about research opportunities, and build connections with fellow students. You'll also gain valuable insights into college study skills, lab expectations, and career pathways in biology, setting you up for a confident and successful start in your program.

### **BIOL 1282. INTRODUCTION TO BIOLOGY LABORATORY. 2 Hours.**

Laboratory exercises will illustrate basic concepts covered in BIOL 1333 and BIOL 1334. This course is for non-science majors, and, with BIOL 1333 and BIOL 1334, will satisfy the laboratory science requirements for students in the Colleges of Liberal Arts and Business Administration and in the School of Social Work. Prerequisite: BIOL 1333.

### **BIOL 1301. NUTRITION. 3 Hours. (TCCN = BIOL 1322)**

This course offers a foundation in nutrition science and explores how food relates to the overall health of an individual. The curriculum includes functions of nutrients, food sources, digestion, absorption, and metabolism. Food labels and nationally established nutrition guidelines are addressed. By understanding classes of nutrients and their respective guidelines, students will gain the skills to make informed dietary choices that promote a healthy lifestyle. May not be used for biology grade point calculation or biology credit toward a degree in biology, microbiology, or medical technology. Credit will be granted in only one department.

### **BIOL 1302. RESEARCH METHODS IN SCIENCE. 3 Hours.**

This course has four main objectives: (1) provide quantitative, critical thinking, and communication skills as well as basic concepts in science; (2) kindle a passion and facility for scientific inquiry; (3) develop skills for experimental design, execution, analysis, and presentation; and (4) expose the student to what it means to be a scientist and what it feels like to conduct research. The course will involve lecture, discussion, and laboratory time. Students will develop independent research inquiries using the scientific method, create an original research proposal and corresponding experiments, analyze results, and present their conclusions to their peers through formal oral, written, and other communication methods such as posters and demonstrations. Offered as BIOL 1302 and CHEM 1302; credit will be granted only once.

### **BIOL 1310. CAREERS IN ALLIED HEALTH. 3 Hours.**

An overview of allied health careers and concepts relevant to the health care industry. Topics include: the organization of health care in America, external factors affecting the health care industry, medical ethics, biotechnology and health care, and alternate careers in biology. May not be used for Biology grade point calculation or Biology credit toward a BS degree in Biology, Microbiology or Medical Technology.

### **BIOL 1333. BIOLOGY FOR NON-SCIENCE MAJORS: CELLS AND DISEASE. 3 Hours. (TCCN = BIOL 1308)**

Scientific literacy is crucial for navigating health-related issues in today's society. In this lecture and lab course, non-science majors will learn about the molecules of life, the cell, energy and metabolism, cell division, genetics and inheritance and diseases, such as cancer and diabetes. This course will satisfy the laboratory science requirements for students in the Colleges of Liberal Arts and Business Administration, and in the School of Social Work. Formerly listed as BIOL 1433, credit will not be given for both.

**BIOL 1334. BIOLOGY FOR NON-SCIENCE MAJORS: LIFE ON EARTH. 3 Hours. (TCCN = BIOL 1309)**

Scientific literacy is crucial for understanding the natural world and our relationship to it. In this lecture and lab course, non-science majors will learn about biologically-based problems facing today's society. Course themes include evolution, antibiotic resistance, genetic diversity, animal and bacterial and plant diversity, ecosystems, ecology and global change. This course will satisfy the laboratory science requirements for students in the Colleges of Liberal Arts and Business Administration, and in the School of Social Work. Formerly listed as BIOL 1434, credit will not be given for both.

**BIOL 1341. CELL AND MOLECULAR BIOLOGY. 3 Hours.**

The first of a three-part introductory Biology sequence, this course focuses on the chemical and molecular basis of life, including metabolism, cell structure and function, and genetics. This course may only be taken by students in the ASSURE program, and when combined with BIOL 1343 will satisfy the introductory lab requirement for Biology majors. It may satisfy the introductory lab requirement for other College of Science majors--please check with your academic advisors and/or the COS Assistant Dean for Undergraduate Research and Student Advancement.

**BIOL 1342. GENERAL BIOLOGY. 3 Hours.****BIOL 1343. RESEARCH STREAM LABORATORY I. 3 Hours.**

In this laboratory course, students will learn core concepts in Biology through an intense research experience that complements material taught in BIOL 1341 and BIOL 1342. Students will master skills including quantitative data analysis, oral and written communication, and critical thinking. This course may only be taken by students in the ASSURE program. Prerequisite: BIOL 1341 or BIOL 1441. Co-requisite: BIOL 1342. Offered as CHEM 1343; credit will be granted only once.

**BIOL 1345. GENERAL BIOLO. 3 Hours.****BIOL 1346. GENERAL BIOLO. 3 Hours.****BIOL 1433. INTRODUCTION TO BIOLOGY I. 4 Hours.**

This course is for non-science majors and with BIOL 1434, will satisfy the laboratory science requirements for students in the Colleges of Liberal Arts and Business Administration, and in the School of Social Work. Emphasis is on fundamental principles, concepts, and topical subjects relating to biology. Laboratory experiments are designed to complement theory presented in lecture. Formerly listed as BIOL 1333, credit will not be granted for both.

**BIOL 1434. INTRODUCTION TO BIOLOGY II. 4 Hours.**

A continuation of BIOL 1433. Students are encouraged to apply pertinent biological concepts to biologically-based problems in today's society. This course is for non-science majors, and with BIOL 1433 will satisfy the laboratory science requirements for students in the Colleges of Liberal Arts and Business Administration and in the School of Social Work. Laboratory experiments are designed to complement theory presented in lecture. Prerequisite: BIOL 1433, or BIOLTRAN, or BIOL 1333. Formerly listed as BIOL 1334, credit will not be granted for both.

**BIOL 1441. BIOLOGY I FOR SCIENCE MAJORS: CELL AND MOLECULAR BIOLOGY. 4 Hours. (TCCN = BIOL 1406)**

(BIOL 1406) This course focuses on the chemical and molecular basis of life, including metabolism, cell structure and function, and genetics. Laboratory experiments are designed to complement theory presented in lecture. Formerly listed as BIOL 1449; credit will not be given for both.

**BIOL 1442. BIOLOGY II FOR SCIENCE MAJORS: ECOLOGY AND EVOLUTION. 4 Hours. (TCCN = BIOL 1407)**

Reviews significant aspects of organismal biology and presents current hypotheses concerning the origin and diversification of life on earth. The ecological and behavioral interactions between organisms and their biotic/abiotic environments are considered from an evolutionary perspective. The laboratory will examine evolution, ecology and the diversity of life using hands-on observational and experimental approaches. Prerequisite: BIOL 1441.

**BIOL 1443. INTRO BIOL. 4 Hours.****BIOL 1444. INTRO BIOL. 4 Hours.****BIOL 1445. GEN ZOO. 4 Hours.****BIOL 1446. GEN ZOO. 4 Hours.****BIOL 1447. GENERAL BIOLOGY. 4 Hours.****BIOL 1448. GENERAL BIOLOGY. 4 Hours.****BIOL 1449. PRIN BIOL. 4 Hours.****BIOL 1450. COMPUTER LITERACY IN BIOLOGY. 4 Hours.**

Basic computer skills and the utilization of biological resources on the Internet. Assignments are constructed to enable the student to acquire skills in the use of software programs on graphics, statistics, spread sheets, and word processing as they apply to the biological sciences. Prerequisite: BIOL 1441, BIOL 1442.

**BIOL 2310. PRIN OF HEALTH. 3 Hours.**

**BIOL 2311. MAN&ENVIRONMENT. 3 Hours.**

**BIOL 2312. HERED HUM AFF. 3 Hours.**

**BIOL 2313. GEN ECOLOGY. 3 Hours.**

**BIOL 2315. PLANTS & MAN. 3 Hours.**

**BIOL 2317. BASIC CONCEPTS IN HUMAN SEXUALITY. 3 Hours.**

The physiological, psychological, and sociological aspects of human sexuality. Offered as BIOL 2317, HEED 2317, PSYC 2317, and GWSS 2317. Credit will be granted for one of these courses only. Students seeking certification in Health Education must enroll in HEED 2317. Students seeking credit toward their science requirement must enroll in BIOL 2317. May not be used for biology grade point calculation or biology credit toward a BS degree in biology, microbiology, medical technology, psychology, or sociology.

**BIOL 2319. INSECTS & MAN. 3 Hours.**

**BIOL 2341. INVERT ZOOLOG. 3 Hours.**

**BIOL 2343. EVOLUTION & ECOLOGY. 3 Hours.**

Reviews significant aspects of organismal biology and presents current hypotheses concerning the origin and diversification of life on earth. The ecological and behavioral interactions between organisms and their biotic/abiotic environments are considered from an evolutionary perspective. Prerequisite: BIOL 1441.

**BIOL 2344. COMP VERT ANAT. 3 Hours.**

**BIOL 2345. GENERAL BOTANY. 3 Hours.**

**BIOL 2351. BACTERIOLOGY. 3 Hours.**

**BIOL 2357. ANAT & PHYS. 3 Hours.**

**BIOL 2358. ANAT & PHYS. 3 Hours.**

**BIOL 2444. GENERAL MICROBIOLOGY. 4 Hours. (TCCN = BIOL 2421)**

Fundamental principles of microbiology including the structure and function of microbial cells and their activities in nature. Bacteria will be used in the laboratory to provide training and experimental methodology. Formerly listed as BIOL 3444; credit will not be granted for both. Prerequisite: BIOL 1441, CHEM 1441 or CHEM 1341.

**BIOL 2450. MICROBIOLOGY. 4 Hours.**

**BIOL 2452. COMP VERT ANAT. 4 Hours.**

**BIOL 2453. GEN ZOOLOGY. 4 Hours.**

**BIOL 2454. GEN BOTANY. 4 Hours.**

**BIOL 2455. ANATOMY&PHYSIO. 4 Hours.**

**BIOL 2457. HUMAN ANATOMY AND PHYSIOLOGY I. 4 Hours. (TCCN = BIOL 2401)**

Functional morphology of humans, cellular function, principles of support and movement, and neural control systems. Laboratory exercises involve both anatomical and physiological aspects of principles introduced in the lecture. This class is designed for students in sport activities (EXSA), nursing, and health. Prerequisite: BIOL 1345 or BIOL 1441 or equivalent, or approval of the department. May not be used for biology grade point calculation or biology credit toward a degree in biology or microbiology.

**BIOL 2458. HUMAN ANATOMY AND PHYSIOLOGY II. 4 Hours. (TCCN = BIOL 2402)**

Functional morphology of humans, maintenance of the human body, and continuity of life. Topics will include the endocrine, cardiovascular, respiratory, digestive, urinary, immune, and reproductive systems. Laboratory exercises explore both anatomical and physiological aspects of principles introduced in the lecture. This class is designed for students in sport activities (EXSA), nursing, and health. Prerequisite: BIOL 2457 or equivalent. May not be used for biology grade point calculation or biology credit toward a degree in biology or microbiology.

**BIOL 2460. MICROBIOLOGY FOR NON-SCIENCE MAJORS. 4 Hours. (TCCN = BIOL 2420)**

This course covers basic microbiology and immunology and is primarily directed at pre-nursing, pre-allied health, and non-science majors. It includes the nature of microorganisms, microbial diversity, the importance of microorganisms and acellular agents in the biosphere, and their roles in human and animal diseases. Major topics include microorganism structure, growth, physiology, pathogenesis, and biochemistry. Emphasis is on medical microbiology, infectious diseases, and public health. The laboratory component covers essential microbiology laboratory skills including aseptic technique, assessment of antimicrobial agents, microscopy, and staining techniques. This course cannot be applied for credit toward a degree in Biology. Prerequisite: BIOL 1345, or BIOL 1441 or equivalent.

**BIOL 3101. CURRENT TOPICS IN BIOLOGY. 1 Hour.**

Seminar on significant topics and issues in modern biology. Students will attend seminars on selected topics. Topics will vary each semester. May be repeated once for biology credit.

**BIOL 3131. SERVICE LEARNING. 1 Hour.**

Service learning is a credit-bearing learning experience; therefore, credit is awarded for academic learning and not for service hours. Students engage in classroom activities, assignments, and discussions and in addition, integrate course content and learning outcomes with genuine community needs or issues. Collaborations with the community result in relationship-building and partnerships through intentional, structured service experiences. Students are required to analyze and evaluate these experiences by engaging in reflective activities, such as discussion and journaling. This process of structured service and learning in the community promote a sense of civic responsibility and commitment to others. Students commit to serve weekly time resulting in at least fifteen hours during one semester. This time is agreed upon by student, faculty, and community agency. Prerequisite: Permission of the Instructor.

**BIOL 3133. CELL BIOL LAB. 1 Hour.****BIOL 3142. LABORATORY IN BEHAVIORAL NEUROSCIENCE. 1 Hour.**

Research methodologies employed in the study of the biological bases of behavior. Must have completed or be concurrently enrolled in PSYC 3322 or BIOL 3322. Offered as BIOL 3142 and PSYC 3142; credit will be granted only once. BIOL prerequisite: BIOL 1441 & BIOL 1442. PSYC 3142 prerequisite: PSYC 2442 or PSYC 2444.

**BIOL 3149. COOPERATIVE PROGRAM IN BIOLOGY. 1 Hour.**

The purpose of this course is to allow students to earn college credit for relevant field work in the areas of biology and microbiology. Students must apply for the program and be cleared for registration during the semester prior to enrollment.

**BIOL 3170. LIMNOLOGY LABORATORY. 1 Hour.**

A laboratory and field-based course designed to acquaint the student with common laboratory practices in the study of inland waters. Prerequisite: BIOL 3318 or concurrent enrollment.

**BIOL 3177. ORAL COMMUNICATION SKILLS IN BIOLOGY. 1 Hour.**

Study and practice of effective oral communication skills in Biology. Students will gain experience in developing effective oral communication techniques by learning to evaluate, prepare, and deliver oral presentations based on selected topics in Biology. This course will satisfy the Oral Communication Competency required in Biology. Graded by pass/fail only.

**BIOL 3181. LABORATORY IN GENETICS. 1 Hour.**

An experimental laboratory in which breeding experiments with certain plants, *Neurospora* and *Drosophila*, are used to verify the principles of classical genetics. In addition, studies on probability theory and analysis of results, population genetics, and salivary gland chromosomes are completed. Prerequisite: BIOL 3315 or concurrent enrollment.

**BIOL 3182. BASIC AND APPLIED BIOSCIENCE. 1 Hour.**

Designed to encourage junior and senior level biology students to explore career opportunities in biology and to develop degree plans that best suit their specific areas of interest as they near graduation. This seminar based course provides an overview of current employment and research.

**BIOL 3183. PLANT SCIENCE LABORATORY. 1 Hour.**

The laboratory is designed to support and expand the course content of Plant Science, BIOL 3327. Includes the study of structure, function, reproduction and classification of plants.

**BIOL 3231. SERVICE LEARNING. 2 Hours.**

Service learning is a credit-bearing learning experience; therefore, credit is awarded for academic learning and not for service hours. Students engage in classroom activities, assignments, and discussions and in addition, integrate course content and learning outcomes with genuine community needs or issues. Collaborations with the community result in relationship-building and partnerships through intentional, structured service experiences. Students are required to analyze and evaluate these experiences by engaging in reflective activities, such as discussion and journaling. This process of structured service and learning in the community promote a sense of civic responsibility and commitment to others. Students commit to serve weekly time resulting in at least fifteen hours during one semester. This time is agreed upon by student, faculty, and community agency. Prerequisite: Permission of the Instructor.

**BIOL 3249. COOPERATIVE PROGRAM IN BIOLOGY. 2 Hours.**

The purpose of this course is to allow students to earn college credit for relevant field work in the areas of biology and microbiology. Students must apply for the program and be cleared for registration during the semester prior to enrollment.

**BIOL 3300. BIostatISTICS. 3 Hours.**

Introduction to the collection, description, and analysis of data with statistical methods appropriate for biological sciences. Specific topics covered include but are not limited to: descriptive statistics, frequency distributions, random sampling, probabilities, binomial distribution, normal distribution theory and calculations, confidence intervals, t-tests (independent sample and paired designs), Chi-square tests (one-way and two-way analysis), analysis of variance, correlation and linear regression. Prerequisite: BIOL 1441.

**BIOL 3301. CELL PHYSIOLOGY. 3 Hours.**

An introduction to the basic physical, chemical, and biological principles which govern function in eukaryotic cells, and the relationships between cells and their environments. Prerequisite: BIOL 1441. CHEM 2181 and CHEM 2321 are recommended.

**BIOL 3302. TISSUE CULTURE LABORATORY. 3 Hours.**

Focus on hands-on knowledge of animal and plant tissue culture for biomedical and biotechnology research. Basic protocols in cell biology and imaging will also be performed. Restricted to students in the 5 year Bioengineering program. Prerequisite: BIOL 1441.

**BIOL 3303. DRUGS AND BEHAVIOR. 3 Hours.**

A survey of the psychoactive agents, their therapeutic uses, and social abuses. Alcohol, nicotine, caffeine, narcotics, hallucinogens, stimulants, and tranquilizers. Offered as BIOL 3303, HEED 3303, and PSYC 3303; credit will be granted only once. May not be used for biology grade point calculation or biology credit toward a B.S. degree in biology, microbiology, or medical technology. Students seeking certification in health education must enroll in HEED 3303.

**BIOL 3304. MICROBIAL GENETICS. 3 Hours.**

Consideration of the physical, chemical, and functional nature of genetic processes in micro-organisms. Prerequisite: BIOL 2444, or permission of instructor.

**BIOL 3305. SCIENTIFIC AND TECHNICAL WRITING. 3 Hours.**

Study and application of the written and verbal communication skills involved in gathering, analyzing, and distributing scientific and technical information efficiently and accurately for specific scientific audiences. Can be used to satisfy the Technical Writing portion of English, Technical Writing and Speech requirement. Prerequisite: BIOL 1441 and BIOL 1442, or permission of the instructor.

**BIOL 3306. BACTERIAL PHYSIOLOGY AND ANTIBIOTICS. 3 Hours.**

This course will cover the fundamentals of how bacterial cells work, and how antibiotics interfere with essential functions to stop bacterial cells from working. This class is taught largely through reading and discussion of the primary literature, and with active learning and writing assignments. Prerequisite: BIOL 2444.

**BIOL 3307. EVOLUTIONARY MEDICINE. 3 Hours.**

The application of evolutionary theory to the practice of medicine from an anthropological perspective. Topics include diet/paleodiets, sleep habits, infectious diseases, the developmental origins of health and disease, mental health, women's health and reproduction, and aging/senescence, among others. Offered as BIOL 3307 and ANTH 3307; credit will only be granted in one department.

**BIOL 3308. MICROBIAL ECOLOGY AND EVOLUTION. 3 Hours.**

The diversity, ecology and evolution of microorganisms in natural systems. Topics will include the role of bacteria and fungi in the functioning of terrestrial ecosystems; microbial biogeography; taxonomic and metabolic diversity; evolutionary diversification; and interactions among microbes and with plant and animal hosts. Prerequisite: BIOL 2444.

**BIOL 3310. SELECTED TOPICS IN BIOLOGY. 3 Hours.**

Topics in biology not treated in the regular curriculum. Topic, format, and prerequisites to be determined by the instructor. May be repeated for biology elective credit as different topics are offered. Prerequisite: BIOL 1441, BIOL 1442.

**BIOL 3311. SELECTED TOPICS IN MICROBIOLOGY. 3 Hours.**

Topics in microbiology not treated in the regular curriculum. Topic, format, and prerequisites to be determined by the instructor. May be repeated for microbiology elective credit as different topics are offered. Prerequisite: BIOL 1441, BIOL 2444.

**BIOL 3312. IMMUNOLOGY. 3 Hours.**

An introduction to the components, properties, and manifestations of the adaptive immune response that occurs in vertebrates. Prerequisite: BIOL 1441, BIOL 2444. CHEM 2181, CHEM 2321 are recommended.

**BIOL 3313. HUMAN ADAPTATION AND THE CONCEPT OF RACE. 3 Hours.**

The study of modern human biological variation in the context of the history of the concept of race. Detailed historical review explores changing perspectives on variation within our species. Course examines physiological adaptations to environmental stress among a variety of human populations and implications of recent genetic research. Offered as BIOL 3313 and ANTH 3311; credit will only be granted in one department.

**BIOL 3314. PRIMATE EVOLUTION AND BEHAVIOR. 3 Hours.**

An overview of the Primate Order covering primate origins, evolution, ecology, adaptation, and behavior. Examination of the environmental context within which primates live, how the form of their bodies reflects their activities, and how they relate behaviorally to their environments and to one another. Offered as BIOL 3314 and ANTH 3313; credit will only be granted in one department.

**BIOL 3315. GENETICS. 3 Hours.**

Principles of molecular and classical genetics. The function and transmission of hereditary material in microorganisms, plants, and animals, including humans. Prerequisite: BIOL 1441.

**BIOL 3316. ASTROBIOLOGY I. 3 Hours.**

This is an interdisciplinary course between astrophysics, biology and geology. Topics include properties of life, origin and evolution of life on Earth, terrestrial geology and habitability, environmental forcings, extremophiles, mass extinctions, meteorites, searches for life in the solar system. Offered as BIOL 3316, GEOL 3316 and PHYS 3316; credit will be granted only once. Prerequisite: PHYS 1441 & PHYS 1442 or equivalent and PHYS 2315 or PHYS 3315, or permission from instructor. Prerequisites for Biology majors: PHYS 1441 & PHYS 1442 or equivalent.

**BIOL 3317. GENOMICS. 3 Hours.**

This course presents an integrative approach to genome science, combining elements of genetics, state of the art technologies in genomic analysis. A basic knowledge of genetics and probability concepts is required. Use of the World Wide Web will be an essential part of the course. Prerequisite: BIOL 3315 or permission of instructor.

**BIOL 3318. LIMNOLOGY. 3 Hours.**

The living and nonliving components of inland waters. An introduction to the geological, physical, and chemical background, and to the major organisms and ecological processes. Prerequisite: BIOL 1441.

**BIOL 3319. HUMAN GENETICS. 3 Hours.**

This course will enable students to comprehend the basic principles of genetics applied to human inheritance and disease, to interpret the research strategies aimed to identify and study the genes responsible for diverse functions and traits, as well as to assess the consequences of the genetic technologies in our society. Prerequisites: BIOL 1441 and BIOL 3315.

**BIOL 3320. BIOLOGY OF TEXAS. 3 Hours.**

This course is an introduction to habitat diversity and the number of species found in the state of Texas. Students will learn about the physical, climatological, and human geography of Texas and how that affects animal and plant life within the state. Descriptions of state and federal endangered species listing processes will also be covered. Prerequisite: BIOL 1441 and BIOL 1442.

**BIOL 3321. INFECTIOUS DISEASE. 3 Hours.**

This course will cover key concepts that relate to the history and background of infectious diseases, as well as the emergence, spread, and control of infectious disease epidemics. Vaccination, antibiotic resistance, and eradication of diseases will also be discussed. Prerequisite: BIOL 3444.

**BIOL 3322. BRAIN AND BEHAVIOR. 3 Hours.**

An introduction to the anatomical structures and physiological processes that determine behavior. Topics include the acquisition and processing of sensory information, the neural control of movement, and the biological bases of complex behaviors (such as learning, memory, sex, language, and addiction), as well as the basic functioning of the nervous system. Offered as BIOL 3322 and PSYC 3322. Credit will be granted only once. BIOL 3322 prerequisite: BIOL 1441, BIOL 1442. PSYC 3322 prerequisite: BIOL 1441 or PSYC 1315.

**BIOL 3323. NEUROBIOLOGY. 3 Hours.**

General principles of the function, structure, and organization of the nervous system. Topics include the gross and microscopic anatomy of nervous tissues; physical and chemical basis for action potentials and synaptic transmission; sensory and motor pathways of transduction; molecular, cellular, and systems study of learning and memory; development; and a study of neural diseases and disorders. Prerequisite: BIOL 1441, BIOL 1442.

**BIOL 3324. HUMAN ECOLOGY OF FOOD. 3 Hours.**

Modern food production and consumption is a complex, interdisciplinary topic directly relevant to global environmental and public health issues. This course will examine our place in the food web from ecological, biogeographical, historical, cultural, and sociopolitical perspectives. Course participants will examine the implications of our everyday decisions as consumers who play a key role in an intricate ecological system. Prerequisite: BIOL 1441 and BIOL 1442.

**BIOL 3325. PLANT ECOLOGY. 3 Hours.**

Introduction to the field of plant ecology including physiological, population, community, and ecosystem ecology. Prerequisite: BIOL 1442.

**BIOL 3326. ANIMAL BEHAVIOR. 3 Hours.**

A survey of research and theory comparing behavior at various phyletic levels. Offered as BIOL 3326 and PSYC 3326. Credit will be granted for only one of these courses. Prerequisite: BIOL 1441, BIOL 1442.

**BIOL 3327. MICROBIAL DIVERSITY. 3 Hours.**

This course is an introduction to the great diversity of microbial life. The topic material explores this diversity by considering the great age of bacteria, their evolution, biochemistry, habitat and form. The course of study focuses attention on organisms not commonly encountered in General Microbiology laboratories. Prerequisite: BIOL 3444 Microbiology.

**BIOL 3328. ENVIRONMENTAL MICROBIOLOGY. 3 Hours.**

An introduction to the principles, methodology, and practical applications and implications of environmental microbiology. Lecture topics include habitat and community approaches to environmental microbiology, measures of microbial populations and activities, interactions among microbial communities, the role of microorganisms in the origin of mineral resources, microorganisms and pollution, and current developments on energy flow through microbial communities. Prerequisite: BIOL 3444.

**BIOL 3329. BEHAVIORAL ENDOCRINOLOGY. 3 Hours.**

The effects of hormones on behavior and the physiological mechanisms which mediate these effects. Principles of brain-hormone interaction, sexual and aggressive behavior, parental care, ingestion, activity, motivation, learning and memory, behavioral disorders, environmental, and experiential influences on hormone production. Also offered as BIOL 3329; credit will be granted for only one of these courses. Students seeking credit toward the science requirement must enroll in BIOL 3329. Prerequisite: PSYC 1315 or BIOL 4315.

**BIOL 3330. DEVELOPMENTAL BIOLOGY. 3 Hours.**

The primary goal of this course is to describe how organismic complexity is generated during embryonic and post-embryonic development. The course will cover current areas of research in developmental biology which include: the roles of genetic networks, induction events, cell lineage, maternal inheritance, cell-cell communication, and hormonal control in developmental processes in well-suited organisms such as vertebrates, insects, and nematodes. Prerequisite: BIOL 3315.

**BIOL 3331. SERVICE LEARNING. 3 Hours.**

Service learning is a credit-bearing learning experience; therefore, credit is awarded for academic learning and not for service hours. Students engage in classroom activities, assignments, and discussions and in addition, integrate course content and learning outcomes with genuine community needs or issues. Collaborations with the community result in relationship-building and partnerships through intentional, structured service experiences. Students are required to analyze and evaluate these experiences by engaging in reflective activities, such as discussion and journaling. This process of structured service and learning in the community promote a sense of civic responsibility and commitment to others. Students commit to serve weekly time resulting in at least fifteen hours during one semester. This time is agreed upon by student, faculty, and community agency. Prerequisite: Permission of the Instructor.



**BIOL 3333. CELL BIOLOGY. 3 Hours.**

A survey of current knowledge of cell structure and function from the microscopic to the molecular level. Prerequisite: BIOL 1441, 1442, 2343, and one year of chemistry.

**BIOL 3339. INTRODUCTION TO EVOLUTION. 3 Hours.**

The goals of this course are: to introduce students to the process of evolution, the patterns that result, and the way that evolutionary history has shaped the diversity of organisms on Earth; to explore how evolutionary biologists formulate and test hypotheses; to investigate applications of evolutionary biology to mainstream medical research; and to investigate current controversies in evolutionary biology. Prerequisites: BIOL 1441 and BIOL 3315 (or equivalent), or permission of instructor.

**BIOL 3340. MEDICAL ENTOMOLOGY. 3 Hours.**

The major goal of this course is to provide an introduction to the biology of harmful arthropods, life cycles of transmitted pathogens, disease symptoms and epidemiology, as well as approaches to control arthropod-borne diseases. Classes will also cover unorthodox points of intersection between entomology and medical sciences, including psychiatry, surgery, and forensic medicine. Prerequisites: BIOL 1442 or equivalent.

**BIOL 3341. ENTOMOLOGY. 3 Hours.**

This course is a study of the basic principles of insect life including structure, physiology, life cycles, and classification. Certain related arthropods are included. Lab work emphasizes collection and identification of local insects. Prerequisite: BIOL 1441, BIOL 1442.

**BIOL 3342. DEVELOPMENTAL BIOLOGY IN HEALTH AND DISEASE. 3 Hours.**

An introduction to fundamental developmental events that form complex organisms with an emphasis on human health and disease. Prerequisites: BIOL 1441 and 1442. BIOL 3301 is recommended.

**BIOL 3343. GENERAL MYCOLOGY. 3 Hours.**

A survey of the fungi; their morphology, taxonomy, life cycles, and identification of representative organisms. Prerequisite: BIOL 1441, 3444.

**BIOL 3344. PLANT MORPHOLOGY. 3 Hours.**

The development, comparative structures and life cycles of the vascular plants.

**BIOL 3345. HUMAN PHYSIOLOGY. 3 Hours.**

Study of human function from the cellular through organismal levels. Attention will be paid to the interrelationships between physiological research and medicine. Will give students a knowledge of the basic principles of structure, function and functional integration of human tissues and organs. Prerequisite: BIOL 1441 and BIOL 1442.

**BIOL 3347. ENVIRONMENTAL BIOLOGY. 3 Hours.**

Examines major environmental problems that affect biological systems with an emphasis on problem solving. Prerequisite: BIOL 1441, 1442, 2343, 3315 or permission of instructor.

**BIOL 3348. PLANT SYSTEMATICS. 3 Hours.**

The biology of plants, their classification, general morphology, and environmental relationships. Lab work includes the identification of local and Texas flora. Prerequisite: BIOL 1441, 1442, 2343; 3327 or 3427.

**BIOL 3349. COOPERATIVE PROGRAM IN BIOLOGY. 3 Hours.**

The purpose of this course is to allow students to earn college credit for relevant field work in the areas of biology and microbiology. Students must apply for the program and be cleared for registration during the semester prior to enrollment.

**BIOL 3352. INTRODUCTION TO FORENSIC LAB SCIENCE. 3 Hours.**

An introduction to the various disciplines of Forensic Science including DNA analysis, drug analysis, and firearms basics. Laboratory consists of hands-on investigation of mock crime scenes, fingerprint enhancement methods, and biological analysis of fluids. Prerequisite: BIOL 1441, BIOL 1442, CHEM 1441.

**BIOL 3353. PATHOGENIC BACTERIOLOGY. 3 Hours.**

The major groups of disease-causing bacteria, including group characteristics, host ranges, pathogenic mechanisms, and public health significance. This course is reserved for Microbiology and Medical Technology majors. Prerequisite: BIOL 1441, BIOL 3444, CHEM 2181, CHEM 2321, and permission of instructor.

**BIOL 3355. TOXICOLOGY. 3 Hours.**

An introduction to the general principles of toxicology with an emphasis on certain classes of toxic agents, their sources and toxic effects, as well as their environmental fates. Pollution of various media (air, water and soil) and the differences between them will be discussed. Prerequisite: BIOL 1441, BIOL 1442, CHEM 1441 and CHEM 1442.

**BIOL 3356. ENVIRONMENTAL SYSTEMS, BIOLOGICAL ASPECTS. 3 Hours.**

Biological components of environmental systems. Population dynamics, species interactions, community structure, biodiversity, bioenergetics, nutrient cycling and human impacts are reviewed. Prerequisite: BIOL 1441, BIOL 1442.

**BIOL 3357. MARINE BIOLOGY. 3 Hours.**

Principles of oceanographic and ocean circulation, adaptations of marine organisms to their environment, ecological principles of marine biology and human impacts on the sea. Prerequisites: BIOL 1441, BIOL 1442.

**BIOL 3358. BACTERIOLOGY. 3 Hours.****BIOL 3359. MEDICAL MOLECULAR BIOLOGY. 3 Hours.**

This course is an introduction to modern molecular biology and human diseases. This course will use medical diseases, class projects, and problem sets to explore and learn modern molecular biology. The molecular mechanisms and underpinnings for several human diseases will be covered. Topics may include, gene regulation, the dynamic genome and how to rewrite it, modern cloning schemes, synthetic biology, and drug design. BIOL 3315 or BIOL 2444 are recommended, but not required. Prerequisite: BIOL 1441.

**BIOL 3360. PRACTICUM IN ZOO RESEARCH METHODS. 3 Hours.**

A hands-on introduction to research methodologies commonly used to collect behavioral and physiological data in zoos. Students will learn how to develop an ethogram, design data sheets, observe animals and collect data. Data will be summarized, analyzed, interpreted and presented in both written and oral form. Prerequisite: PSYC 2443, PSYC 2444, PSYC 3326 (or their equivalents) and permission of instructor. Offered as BIOL 3360 and PSYC 3352; credit will be granted only once.

**BIOL 3371. TEACHING BIOLOGICAL CONCEPTS I. 3 Hours.**

Teaching current concepts in the chemical/molecular basis of life, cellular metabolism/structure/function and genetics. This class cannot be taken for Biology majors credit by students in the Biology or Microbiology B.S. degree programs. It is intended for students pursuing a career in science teaching. Prerequisite: permission of the Biology Teacher Certification Advisor and the Biology Undergraduate Advisor.

**BIOL 3372. TEACHING BIOLOGICAL CONCEPTS II. 3 Hours.**

Teaching current concepts in animal and plant structure/function including cell, tissue, organ and organismal structure, growth, transport/circulation/gas exchange, nutrition, reproduction, development, endocrinology, and animal neural regulation. This class cannot be taken for Biology majors credit by students in the Biology or Microbiology B.S. degree programs. It is intended for students pursuing a career in science teaching. Prerequisite: permission of the Biology Teacher Certification Advisor and the Biology Undergraduate Advisor.

**BIOL 3373. TEACHING BIOLOGICAL CONCEPTS III. 3 Hours.**

Teaching current concepts in evolution, ecology and biodiversity including the origin and diversification of life on Earth, and the ecological and behavioral interactions between organisms and their biotic/abiotic environments from an evolutionary perspective. This class cannot be taken for Biology majors credit by students in the Biology or Microbiology B.S. degree programs. It is intended for students pursuing a career in science teaching. Prerequisite: permission of the Biology Teacher Certification Advisor and the Biology Undergraduate Advisor.

**BIOL 3374. TEACHING BIOLOGICAL CONCEPTS IV. 3 Hours.**

Current concepts in laboratory teaching in biology. This course will cover modern methods of teaching laboratories in biology designed by master biology teachers and various biology publishers. This class cannot be taken for Biology majors credit by students in the Biology or Microbiology B.S. degree programs. It is intended for students pursuing a career in science teaching. Prerequisite: permission of the Biology Teacher Certification Advisor and the Biology Undergraduate Advisor.

**BIOL 3388. MEDICAL TECH. 3 Hours.****BIOL 3390. BIOL SEL TOPICS. 3 Hours.****BIOL 3391. BIOL SEL TOPICS. 3 Hours.****BIOL 3392. BIOL SEL TOPICS. 3 Hours.****BIOL 3409. PALEOANTHROPOLOGY. 4 Hours.**

Paleoanthropology: an exploration of fossil evidence for human origins and human evolution. Course focuses on the evolution of humans and our close relatives, from our origins as a distinct lineage to "anatomically modern" Homo sapiens, including the relationship between biological and cultural/behavioral evolution. Offered as BIOL 3409 and ANTH 3409; credit will be granted only once.

**BIOL 3410. SELECTED TOPICS IN BIOLOGY. 4 Hours.**

Topics in biology not treated in the regular curriculum. Topic, format, and prerequisites to be determined by the instructor. May include lab, service learning or any other experiential learning module. May be repeated for biology elective credit as different topics are offered. Prerequisite: BIOL 1441 or BIOL 1442.

**BIOL 3420. GENETICS METHODS LAB. 4 Hours.**

This course combines computational and experimental approaches to study genome composition, evolution, and disease. Students will learn contemporary laboratory techniques while exploring transposable elements as tools for genetic analysis. Topics include genetic variation, Mendelian genetics, gene regulation, and gene-directed therapy. Prerequisite: BIOL 3315.

**BIOL 3427. PLANT SCIENCE. 4 Hours.**

A survey of plant science including the importance of plants to people and the human side of botany: the structure, reproduction, physiology, and classification of plants. The laboratory includes the study of structure, function, reproduction, and classification of plants. Replaces BIOL 3327 and BIOL 3183. Credit cannot be given for BIOL 3427 and BIOL 3327 and 3183. Prerequisite: BIOL 1441, BIOL 1442 or equivalent.



**BIOL 3440. VERTEBRATE PHYS. 4 Hours.****BIOL 3441. VERT EMBRYOLO. 4 Hours.****BIOL 3442. HUMAN PHYSIOLOGY. 4 Hours.**

A comparative study of vertebrate function. The general principles of physiological mechanisms on the cellular, tissue, organ, and organismal levels will be examined. Laboratory studies will complement lecture material and will stress experimental design, data analysis, and the understanding of critical research in physiology. Prerequisite: BIOL 1441, BIOL 1442.

**BIOL 3443. CELL BIOLOGY. 4 Hours.****BIOL 3445. METHODS IN MOLECULAR MICROBIOLOGY. 4 Hours.**

An overview of different techniques used during manipulation of microorganisms. It will allow students to gain an historical perspective of techniques used in microbiology as well as learn state of the art molecular characterization of microorganisms and their genetic manipulation. Introduces biochemical, physiological, and molecular biology methods to assess community diversity and microbial activity in a variety of ecosystems. Bacterial growth and survival, population biology, and microbial interactions will also be discussed. Prerequisite: BIOL 1441 and BIOL 3444.

**BIOL 3446. HUMAN ANATOMY. 4 Hours.**

Study of the gross functional anatomy of the human body. Students will participate in laboratory exercises designed to familiarize them with human anatomical structures and their functions. Use of eponyms for anatomical terms will be minimized. Prerequisite: BIOL 1441, BIOL 1442 or 8 hours of Bioltran.

**BIOL 3452. COMPARATIVE VERTEBRATE ANATOMY. 4 Hours.**

A comparative study of the anatomy of the protochordates and the vertebrates. The laboratory includes a detailed study of the shark and the cat. Prerequisite: BIOL 1441, BIOL 1442. BIOL 3454 recommended, but not required.

**BIOL 3454. GENERAL ZOOLOGY. 4 Hours.**

An overview of animal life including the diversity and evolution of major animal phyla, reproduction, development and aspects of physiological function. The laboratory examines form, function and phyletic relationships in a wide variety of animal types. Prerequisite: BIOL 1441, BIOL 1442, or equivalent, or permission of instructor.

**BIOL 3455. INVERTEBRATE ZOOLOGY. 4 Hours.**

The structure, function, and evolution of invertebrate animals. Survey covers all invertebrate phyla with the exception of protozoa and includes the invertebrate chordates. Emphasis is on the major animal phyla. Prerequisite: BIOL 1441, 1442, 2343.

**BIOL 3456. LIMNOLOGY. 4 Hours.****BIOL 3457. GENERAL ECOLOGY. 4 Hours.**

An examination of the theoretical and experimental aspects of the relationship between the biological and physical environments (organisms, food, space, and time) at the individual, population, community, and ecosystem levels. Prerequisite: BIOL 1441, BIOL 1442.

**BIOL 4089. RESEARCH IN BIOLOGY. 0 Hours.**

Research problems on an individual basis, conducted under the direction of a member of the biology faculty. Prerequisite: written permission of the supervising instructor prior to registration. This is a non-credit course. Prerequisite: Written permission of the supervising instructor prior to registration.

**BIOL 4101. SEL TOP BOTANY. 1 Hour.****BIOL 4105. FAC RES SEM. 1 Hour.****BIOL 4111. SEMINAR. 1 Hour.****BIOL 4150. SEMINAR IN MATHEMATICAL BIOLOGY. 1 Hour.**

Formulation and definition of interdisciplinary research problems in Mathematical Biology, the formulation and execution of strategies of solution, and the presentation of results. Research under faculty supervision and mentorship involving collaboration within a small group. Prerequisite: Consent of instructor.

**BIOL 4179. RESEARCH AND DIRECTED STUDY. 1 Hour.**

Research or independent study by individual students in biology under the supervision of a biology faculty member. Topics must be approved by the supervising faculty member. Prerequisite: BIOL 1441, BIOL 1442, and permission of instructor.

**BIOL 4189. RESEARCH IN BIOLOGY. 1 Hour.**

Research problems on an individual basis, conducted under the direction of a member of the biology faculty. A limit of two hours per semester is imposed and only a total of three hours may be counted toward degree requirements. These courses are offered only on a pass/fail basis. Prerequisite: written permission of the supervising instructor prior to registration.

**BIOL 4191. PROB IN BIOLOGY. 1 Hour.****BIOL 4193. SC LC BIO INST. 1 Hour.****BIOL 4279. RESEARCH AND DIRECTED STUDY. 2 Hours.**

Research or independent study by individual students in biology under the supervision of a biology faculty member. Topics must be approved by the supervising faculty member. Prerequisite: BIOL 1441, BIOL 1442, and permission of instructor.

**BIOL 4288. METHOD DEV BIO. 2 Hours.****BIOL 4289. RESEARCH IN BIOLOGY. 2 Hours.**

Research problems on an individual basis, conducted under the direction of a member of the biology faculty. A limit of two hours per semester is imposed and only a total of three hours may be counted toward degree requirements. These courses are offered only on a pass/fail basis. Prerequisite: written permission of the supervising instructor prior to registration.

**BIOL 4301. INTRODUCTION TO NEUROSCIENCE. 3 Hours.**

An in depth understanding of the mechanisms underlying the function of the nervous system. Topics include cellular mechanisms of neural communication, neuroanatomy and neurophysiology of sensory, motor, and autonomic systems, cellular mechanisms of learning and memory, and neuropathological conditions that contribute to neurological disorders. Course offered as BIOL 4301 and PSYC 4301. Credit will be granted only once. Prerequisite: PSYC 3322 (BIOL 3322) or permission of instructor.

**BIOL 4303. MICROBIOMES: HEALTH AND THE ENVIRONMENT. 3 Hours.**

The development, interactions, and change of polymicrobial communities in both humans and the environment with implications in health, nutrition, disease, research, ecology and agriculture. Prerequisite: BIOL 2444.

**BIOL 4305. ENVIRONMENTAL PHYSIOLOGY. 3 Hours.**

Survey of the physiological adaptations of animals to their environments. Emphasizes physiological mechanisms and evolutionary changes that allow animals to survive under and respond to a variety of environmental conditions. Prerequisite: BIOL 3442 or permission of instructor.

**BIOL 4307. MOLECULAR EVOLUTION. 3 Hours.**

This course focuses on understanding how genes and genomes evolve at the molecular level. Molecular biology provides the data while population genetics provides the theoretical framework. Prerequisite: BIOL 3315, BIOL 3339.

**BIOL 4308. GENOME ANALYSIS. 3 Hours.**

This course will provide students with hands-on experience in genome analysis. Topics covered include population genomics, phylogenomics, genome assembly, genome annotation, and the analysis of repetitive elements and genome structure. Students will learn the computational tools to analyze genomes, including Unix/Linux, Perl programming, and database management. Prerequisite: BIOL 3315 or consent of the instructor.

**BIOL 4309. NEUROPHARMACOLOGY. 3 Hours.**

A survey of how drugs affect the nervous system. General topics will include cellular and molecular foundations of neuropharmacology, receptors and modulation of neural signaling. The specific role of neurotransmitter systems (i.e. acetylcholine, dopamine, norepinephrine, serotonin, and opiate) will be explored. Offered as BIOL 4309 and PSYC 4309; credit will be granted only once. Prerequisite: one or more of the following courses or permission of instructor: BIOL 1441 or PSYC 3322/BIOL 3322 or BIOL 3301.

**BIOL 4311. HISTOLOGY. 3 Hours.**

Histology is a branch of biological science concerned with structure and function of the organism on a cellular level. The objective in this class is to provide students with the skills and knowledge needed to identify and describe tissues and organs in the microscopic images based on the characteristic morphologies of cells and arrangement of tissues. Students will learn about basic histological techniques used in slide preparation, four basic tissue types and types of tissue, followed by the survey of microscopic images of all organ systems. This course bridges the "whole body" disciplines of anatomy and physiology and cell-level sciences such as cell physiology and genomics. It will help students understand how the differential expression of the genome leads to different cell morphology that in turn leads to different functions. Prerequisite: BIOL 1441, BIOL 1442.

**BIOL 4312. INTRODUCTION TO VIROLOGY. 3 Hours.**

The nature, reproduction, and host cell interactions of viruses and virus-like agents of bacteria, animals, and plants. Prerequisite: BIOL 2444.

**BIOL 4313. MOLECULAR GENETICS. 3 Hours.**

A comprehensive survey of molecular genetics with an emphasis on eucaryotic systems: DNA structure and chromosome arrangement; molecular evolution; gene regulation and expression; RNA processing; signal transduction; cancer biology. Prerequisite: BIOL 1441, BIOL 3315.

**BIOL 4315. GENERAL ENDOCRINOLOGY. 3 Hours.**

The vertebrate endocrine system. The cellular origin of hormones, their role in physiological regulation, and the mechanism of hormone action. Prerequisite: BIOL 1441, BIOL 1442, BIOL 3301, BIOL 3315; at least one physiology course, and senior standing.

**BIOL 4316. GROWTH, DEVELOPMENT, AND EVOLUTION. 3 Hours.**

A survey of topics at the nexus of modern human biological research in growth and development and the evolutionary record of hominid subadults. Offered as BIOL 4316 and ANTH 4315; credit will be granted only in one department. Prerequisite is only required for students registering for ANTH 4315. Prerequisite: ANTH 2307 or permission of the instructor.

**BIOL 4317. BACTERIAL PATHOGENESIS. 3 Hours.**

Host-pathogen relationships in microbial diseases. Topics include bacterium-host interactions; pathogens and pathogenic factors; techniques in pathogenesis research; molecular mechanisms of pathogenesis by major bacterial pathogens; antimicrobial compounds and resistance to antibiotics; and discussion of human genomics and susceptibility to infections. Prerequisites: BIOL 3312, BIOL 2444.

**BIOL 4321. ADVANCED PROBLEM SOLVING IN BIOLOGY. 3 Hours.**

This course will focus on crucial techniques needed to solve application-based questions in biology. Students will develop and practice reading comprehension, problem solving, critical thinking, and reasoning skills while deepening their understanding of core biological concepts, including cell and molecular biology; biochemistry; anatomy and physiology; and behavior. The goal of this course is to improve students' critical reasoning skills to prepare them for problem-based exams. BIOL 3442 is recommended. Prerequisite: BIOL 1442, BIOL 3301, BIOL 3315.

**BIOL 4322. ENV RISK ASSEMT. 3 Hours.****BIOL 4326. WETLAND ECOLOGY. 3 Hours.**

Introduction to the diverse field of wetland ecology including formation of wetlands, biogeochemistry of wetland soils, hydrology, and biotic adaptations to wetland environments. Prerequisite: BIOL 2343, CHEM 1441.

**BIOL 4327. BEHAVIORAL GENETICS. 3 Hours.**

Genetic influences on behavioral phenotypes. Research strategies, quantitative methods, and pharmacogenetic approaches to the brain; sociality and altruism; the personality, emotionality and intelligence; psychopathology; chromosomal abnormalities; forensic implications of genetic counseling. Offered as BIOL 4327 and PSYC 4327; credit will be granted only once. Students seeking credit toward the science requirement must enroll in BIOL 4327. Prerequisite: PSYC 1315 or BIOL 1441.

**BIOL 4329. NEURAL ENGINEERING. 3 Hours.**

This course consists of both lecture/discussion and laboratory. Lecture topics include central and peripheral nervous system injury and regeneration, brain/machine interfacing, primary culture of neural cells, neuroinflammatory and neurodegenerative disease. Laboratories include embryonic and neonatal rat derived neuronal culturing, immunostaining and quantitative analysis. Prerequisites: BIOL 3301, CSE 1310, CHEM 2322, and MATH 3319.

**BIOL 4330. EVOLUTION OF DEVELOPMENT. 3 Hours.**

The diversity of animal and plant forms can largely be traced to evolutionary changes in the genes that control the development of the embryo. Changes in when and where these genes are active have been important in the diversification of body form. A major goal of this course is to provide an interdisciplinary framework for studies related to evolution, genetics, and development. The course will mainly consist of lectures and seminars; relevant scientific papers will be read and commented on in class. Prerequisite: BIOL 3315.

**BIOL 4331. ADVANCED MOLECULAR BIOLOGY. 3 Hours.**

Molecular biology, protein-nucleic acid interactions, nucleic acid biochemistry, and the RNA World. Prerequisite: BIOL 1441, BIOL 1442, BIOL 3315, General Chemistry (CHEM 1441 & CHEM 1442). Recommended, but not required: CHEM 2321.

**BIOL 4332. POLYMERS IN BIOMEDICAL ENGINEERING. 3 Hours.**

This is a foundation course in polymeric biomaterial design, synthesis, characterization, and processing. The topics include design, surface-engineering, functionalization, characterization, as well as micro- and nano-fabrication of polymeric biomaterials. The biomedical applications of the polymeric biomaterials and their interaction with cell/tissue is discussed. Prerequisite: BIOL 3301, CSE 1310, CHEM 2322 and MATH 3319.

**BIOL 4333. NANOBOMATERIALS. 3 Hours.**

Synthesis, fabrication, characterization, and biomedical applications of nanobiomaterials. Topics include synthetic nanobiomaterials, biological nanobiomaterials (DNA nanomaterials, protein and peptide nanomaterials, etc.), biofunctionalization of nanobiomaterials, use of nanobiomaterials in tissue engineering, drug delivery, gene delivery. Prerequisites: BIOL 3301, CSE 1310, CHEM 2322, and MATH 3319.

**BIOL 4338. COMMUNITY ECOLOGY. 3 Hours.**

The effects interspecific interactions have on the distribution and abundance of organisms. Prerequisite: BIOL 1441, BIOL 1442, and three semester hours of ecology.

**BIOL 4339. EVOLUTION. 3 Hours.****BIOL 4340. PLANT PHYSIOLOGY. 3 Hours.**

The relationship of plant metabolism to cellular organization and the interaction of environmental, metabolic, and hormonal factors of vegetative growth and reproduction. Prerequisite: BIOL 1441, 1442, 2343.

**BIOL 4341. ECOLOGY. 3 Hours.****BIOL 4342. BACT ECOLOGY. 3 Hours.****BIOL 4343. PLANT ANATOMY. 3 Hours.**

The internal structure of the existing seed plants, with emphasis on the angiosperms. Prerequisite: BIOL 1441, 1442, 2343, 3327 or 3427.

**BIOL 4344. HIST OF VERT. 3 Hours.****BIOL 4345. MICROBIAL PHYSIOLOGY. 3 Hours.**

This course considers the anatomy and physiology of the bacterial cell in detail. Lecture topics consider the molecular architecture of cell walls, membranes and organelles, synthesis of wall material and membranes, insertion of proteins into membranes and regulation of biosynthetic systems at the whole cell level. Prerequisite: BIOL 1441 and BIOL 3444. CHEM 4311 recommended.

**BIOL 4346. TECHNIQUES IN MICROBIAL AND MOLECULAR GENETICS. 3 Hours.**

A laboratory based techniques course focusing on current methods in microbial and molecular genetics. Students will design experiments and perform: bacterial mutagenesis and phage transduction; selection, screening and physical mapping of mutants; blots, plasmid manipulations including purification, digestion, subcloning, bacterial transformations; PCR and DNA sequencing. Prerequisite: BIOL 1441, BIOL 3444, and BIOL 3315 or permission of the instructor.

**BIOL 4347. LIMNOLOGY. 3 Hours.****BIOL 4348. AQUATIC BIOLOGY. 3 Hours.**

Ecological relationships of organisms in freshwater and marine ecosystems. Prerequisite: BIOL 1441, 1442, 2343 or permission of the instructor.

**BIOL 4350. CONSERVATION BIOLOGY. 3 Hours.**

Introduction to theory and practice of conservation biology, with emphasis on applications of modern quantitative and genetic techniques to preservation of organisms and habitats. Topics include identification and prioritization of units for protection; conservation genetics; preserve design; public policy issues; and case studies. Prerequisite: BIOL 3315 or equivalent (Genetics), or permission of the instructor.

**BIOL 4351. IMM TO PARASITE. 3 Hours.****BIOL 4352. FORENSIC BIOLOGY. 3 Hours.**

A comprehensive review of biological principles, applied to forensic science, including sample recovery and handling, analytical techniques, profile matching/exclusion, reporting, and testimony. Prerequisite: BIOL 3315; statistics course recommended; or permission of instructor.

**BIOL 4353. SCANNING ELECTRON MICROSCOPE. 3 Hours.**

Principles and operation of the Scanning Electron Microscope (SEM). Training in the use of the JEOL, JSM, SEM. Specimen preparation for SEM included in the lecture and laboratory. Open to non-biologists. Prerequisite: permission of instructor.

**BIOL 4354. ENVIRONMENTAL HEALTH. 3 Hours.**

Basics of the broad range of health considerations at the core of environmental projects and regulation. The course will provide the knowledge required for students to successfully complete the Texas Registered Sanitarian Examination or the Environmental Health Association's Registered Environmental Health Specialist Examination. Prerequisite: BIOL 1441, 1442; CHEM 1441, 1442; PHYS 1441 or permission of the environmental biology option advisor.

**BIOL 4355. METHODS IN FORENSIC BIOLOGY. 3 Hours.**

Analysis of typical biological evidentiary samples including extraction of DNA, quantitation, amplification and electrophoresis of examples. Instrumentation utilized includes thermal cyclers and ABI 377 genetic analyzer. Prerequisite: BIOL 4352 or concurrent enrollment.

**BIOL 4357. HEALTH PSYCHOLOGY. 3 Hours.**

This course provides a broad introduction to health psychology and its interface with the medical world. The course provides a balanced presentation of the important issues in the field, as well as specific content topics that are especially relevant today to better understand health and illness. Offered as BIOL 4357, HEED 4357, and PSYC 4357. Students seeking science requirement credit must enroll in BIOL 4357; students seeking Certification in Health must enroll in HEED 4357. Prerequisite: PSYC 1315 or BIOL 1333 or BIOL 1441 or BIOL 2457; junior standing recommended.

**BIOL 4358. HISTO TECHN. 3 Hours.****BIOL 4359. BIO ULTRASTRUCT. 3 Hours.****BIOL 4360. PHYSIOLOGY II. 3 Hours.****BIOL 4361. METH IMMUNOLOGY. 3 Hours.****BIOL 4365. TISSUE ENGINEERING LAB. 3 Hours.**

Each student will be given the opportunity to perform the techniques commonly used in tissue engineering and biomaterial research. These techniques are culture media preparation, cell culture/subculture, degradable scaffold preparation, scaffold modification, histological sections and staining, and cell imaging analyses. Prerequisites: BIOL 3301, CSE 1310, CHEM 2322, and MATH 3319.

**BIOL 4379. RESEARCH AND DIRECTED STUDY. 3 Hours.**

Research or independent study by individual students in biology under the supervision of a biology faculty member. Topics must be approved by the supervising faculty member. Prerequisite: BIOL 1441, BIOL 1442, and permission of instructor.

**BIOL 4388. INSTRUCTIONAL TECHNIQUES IN BIOLOGY. 3 Hours.**

Students will participate in laboratory instruction and student recitation sessions under the supervision of a faculty member. A maximum of 3 hours can be applied to the major for biology or microbiology credit. Enrollment by departmental permission only. A maximum of 6 hours credit from this class will be used to calculate a student's grade point average. Students on probation or who have not qualified for major status may not enroll in this course.

**BIOL 4389. RESEARCH. 3 Hours.****BIOL 4390. INSTRUCTIONAL TECHNIQUES IN MICROBIOLOGY. 3 Hours.**

Students will participate in laboratory instruction and laboratory preparation under the supervision of the lab coordinator. A maximum of 3 hours can be applied to the major for biology or microbiology credit. Enrollment by departmental permission only. A maximum of 6 hours credit from this class will be used to calculate a student's grade point average. Students on probation or who have not qualified for major status may not enroll in this course.

**BIOL 4391. RESEARCH WORKSHOP IN MATHEMATICAL BIOLOGY. 3 Hours.**

Special topics in mathematics are assigned to individuals or small groups. Faculty members closely supervise the projects and assign library reference material. Small groups will hold seminars at suitable intervals. May be repeated for credit.

**BIOL 4392. BIOL MAT TCHRS. 3 Hours.****BIOL 4393. HONORS SENIOR PROJECT IN BIOLOGY. 3 Hours.**

A topic will be selected after consultation with a supervising professor and will involve both original research and writing a formal report. The work will be evaluated by a faculty honors committee. Completion of this course will satisfy the thesis requirement for the Honors College described elsewhere in this catalog.

**BIOL 4395. FORENSICS-EL PA. 3 Hours.****BIOL 4406. HUMAN OSTEOLOGY. 4 Hours.**

Detailed examination of human skeletal morphology. Topics include form and function of all skeletal elements in the human body, differentiation of each bone, left and right side identification, identification of fragmented remains, and muscle attachments and articulations. Content useful in forensic anthropology, archaeology, and hominid paleontology. Offered as BIOL 4406 and ANTH 4406; credit will be granted only in one department.

**BIOL 4421. ADVANCED TOPICS IN NEUROSCIENCE. 4 Hours.**

This course will cover current topics in Neuroscience using an interactive, participatory format that includes a lecture portion and a laboratory section. The course will focus on specific content topics that are especially relevant today to better understand and use advanced concepts in Neuroscience research. Completion of this course is essential for students who are interested in pursuing a career in Neuroscience research. Offered as BIOL 4421 or PSYC 4421. Credit will be granted only once. Junior standing recommended. Prerequisite: C or better in BIOL 3322 or PSYC 3322.

**BIOL 4440. LABORATORY METHODS IN BACTERIAL PATHOGENESIS. 4 Hours.**

This course is intended to expose students to research techniques for studying bacterial pathogens. Students will use molecular and classical techniques to isolate, identify, and characterize bacteria and their response to stimuli. Techniques will range from polymerase chain reaction (PCR), gene sequencing, sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE) and Immunofluorescence Microscopy. Prerequisites: BIOL 3312, BIOL 3444, BIOL 4317, or permission of instructor.

**BIOL 4441. ADVANCED MICROBIOLOGY LAB. 4 Hours.**

An overview of advanced microbiology techniques used in microbial genetics and physiology. It will allow students not only to gain an advanced and applicable perspective of techniques used in microbiology, but also to learn current state-of-the-art molecular techniques for genetic manipulation and physiological characterization of microorganisms. Included are molecular, physiological, and biochemical methods as well as metagenomics approaches and basic analysis of sequencing data for studying microbiomes. Enrollment requirements: BIOL 1441, General Microbiology (BIOL 2444), and Microbial Genetics (BIOL 3304). Prerequisite: BIOL 1441, BIOL 2444, BIOL 3304.

**BIOL 4443. COMP INV PHYS. 4 Hours.****BIOL 4444. VERTEBRATE NATURAL HISTORY. 4 Hours.**

Lecture will cover the systematics, life histories, morphology, ethology and distribution of world vertebrates, with emphasis on tetrapods. The laboratory will provide the opportunity to examine and identify a taxonomically comprehensive collection of amphibians, reptiles, birds and mammals. Prerequisite: BIOL 1441, BIOL 1442.

**BIOL 4445. MICROBIAL STRUCTURE AND FUNCTION. 4 Hours.**

This course considers the anatomy and physiology of the bacterial cell in detail. Lecture topics consider the molecular architecture of cell walls, membranes and organelles, synthesis of wall material and membranes, insertion of proteins into membranes and regulation of biosynthetic systems at the whole cell level. The laboratory focuses on growth of the bacterial cell, single and multiple substrate utilization, and growth kinetics. Prerequisite: BIOL 1441 and 3444. CHEM 4311 recommended. This course is reserved for Microbiology majors.

**BIOL 4450. Conversion. 4 Hours.****BIOL 4455. VERT PHYSIO. 4 Hours.****BIOL 4459. BIOARCHAEOLOGY. 4 Hours.**

The study of human remains in archaeological contexts in order to reconstruct individual identity, life history, and past population characteristics. No formal prerequisites, but familiarity with the human skeleton is helpful. Lab component is required. Offered as BIOL 4459 and ANTH 4459; credit will be granted only in one department.

**BIOL 4460. ENTOMOLOGY. 4 Hours.****BIOL 4461. METH IN IMMUNO. 4 Hours.****BIOL 4465. PHYCOLOGY. 4 Hours.****BIOL 4680. FIELD BIOLOGY. 6 Hours.****BIOL 5101. SPECIAL TOPICS IN BIOLOGY. 1 Hour.**

Seminar on significant biological research. May be repeated for credit. Prerequisite: consent of the instructor.

**BIOL 5102. PROFESSIONAL DEVELOPMENT. 1 Hour.**

This course will provide senior graduate students with important information regarding various aspects of their professional development including job searching, interviewing, stress and time management, and professional ethics.

**BIOL 5103. COMPUTER APPLICATIONS. 1 Hour.**

An introduction to the software applications needed to collect and analyze data, prepare scientific papers and present research findings. Both Macintosh and PC platform applications will be reviewed.

**BIOL 5104. GRANT PROPOSAL WRITING. 1 Hour.**

Methods of preparation of research proposals to granting agencies, including: use of library research facilities; standard proposal formats; elements of successful proposals; survey of funding agencies in the biological sciences.

**BIOL 5105. RESEARCH SEMINAR I. 1 Hour.**

Once during a student's first semester for attending a seminar series of talks by Biology Department faculty and graduate students.

**BIOL 5106. RESEARCH SEMINAR II. 1 Hour.**

For attending a seminar series of talks by Biology Department faculty and graduate students. Students enrolling in Research Seminar II will be required to present a seminar on the results of their graduate research.

**BIOL 5193. RESEARCH IN BIOLOGY. 1 Hour.**

Conference course in which the student undertakes intensive investigation of topics under the supervision of a staff member. Prerequisite: consent of the instructor. Graded P/F/R.

**BIOL 5200. SEM SCI AS PROF. 2 Hours.****BIOL 5210. EVOLUTION. 2 Hours.****BIOL 5211. HIST OF BIOL. 2 Hours.****BIOL 5280. MTHDS DEV BIOL. 2 Hours.****BIOL 5289. LAB DEVELOP GEN. 2 Hours.****BIOL 5290. EX METHODS BIO. 2 Hours.****BIOL 5291. INDIVIDUAL PROBLEMS IN BIOLOGY. 2 Hours.**

Individual research projects supervised by a faculty member. Prerequisite: consent of the instructor.

**BIOL 5293. RESEARCH. 2 Hours.****BIOL 5301. LABORATORY ROTATION. 3 Hours.**

This course is an elective designed to enable students to choose a major advisor and laboratory. Rotations among two or three faculty laboratories will familiarize students with faculty research interests, sharpen individual research skills, and expose students to different study systems, instruments, and research methods. May only be taken once for credit by MS students; may be repeated for credit once by Ph.D. students.

**BIOL 5302. MICROBIAL GENETICS. 3 Hours.**

Consideration of the nature, expression and regulation of the genetic processes in micro-organisms.

**BIOL 5303. MOLECULAR GENETICS. 3 Hours.**

Study of molecular genetics presentation of quantitative methods used in the design of experiments, collection and analysis of data associated with research in population, community and landscape ecology with emphasis on eucaryotic systems including DNA structure and chromosome arrangement: molecular evolution, and gene regulation and expression. Prerequisites: BIOL 3315 or consent of the instructor.

**BIOL 5304. VIROLOGY. 3 Hours.**

The nature, reproduction and host-cell interactions of viruses and animals. Emphasizes molecular aspects of viral replication and the molecular basis of pathogenesis. Prerequisite: consent of the instructor.

**BIOL 5305. TECHNIQUES IN MICROBIAL AND MOLECULAR GENETICS. 3 Hours.**

Laboratory based techniques course focusing on current methods in microbial and molecular genetics. Prerequisites: BIOL 4302 or equivalent and consent of the instructor.

**BIOL 5306. SCIENTIFIC WRITING. 3 Hours.**

Discussion and critique of student's writing in peer response workshop groups. This course offers the opportunity for students to learn how to identify and fix problems in scientific texts. In order to enroll in this course, students must be actively writing a paper, proposal, poster, dissertation, or any other scientific text. Instructor's permission to enroll in the course is required.

**BIOL 5307. NEUROBIOLOGY. 3 Hours.**

General principles of the function, structure, and organization of the nervous system. Topics include the gross and microscopic anatomy of nervous tissues; physical and chemical basis for action potentials and synaptic transmission; sensory and motor pathways of transduction; molecular, cellular, and systems study of learning and memory; development; and a study of neural diseases and disorders.

**BIOL 5308. GENOME ANALYSIS. 3 Hours.**

This course will provide students with hands-on experience in genome analysis. Topics covered include population genomics, phylogenomics, genome assembly, genome annotation, and the analysis of repetitive elements and genome structure. Students will learn the computational tools to analyze genomes, including Unix/Linux, Perl programming, and database management. Prerequisite: BIOL 3315.

**BIOL 5309. IMMUNOLOGY. 3 Hours.**

This course is designed to acquaint students with the cellular processes involved in the generation of an immune response. It will provide students with detailed knowledge of the cells and organs of the immune system, their organization and diversity and their specialized functions at different anatomical locations. The importance of immune cell receptors and cytokines in cellular interactions and co-ordination of immunological mechanisms is also emphasized.

**BIOL 5310. SELECTED TOPICS IN BIOLOGY. 3 Hours.**

Topics may vary depending on the needs and interests of the students. May be repeated for credit. Prerequisite: consent of the student's thesis committee and the current course instructor.

**BIOL 5311. EVOLUTION. 3 Hours.**

Study of the origin of living systems and the mechanism of their evolution.



**BIOL 5312. ADVANCED GENETICS. 3 Hours.**

Mechanisms of transmission and function of genetic material. Covers fundamental concepts in transmission genetics including: genotype/phenotype relationships; inheritance; linkage; genome organization; and gene expression. Experimental and quantitative approaches to genetic analyses are emphasized. Prerequisite: consent of the instructor.

**BIOL 5313. EVOLUTION OF DEVELOPMENT. 3 Hours.**

The diversity of animal and plant forms can largely be traced to evolutionary changes in the genes that control the development of the embryo. Changes in when and where these genes are active have been important in the diversification of body form. A major goal of this course is to provide an interdisciplinary framework for studies related to evolution, genetics, and development. The course will mainly consist of lectures and seminars; relevant scientific papers will be read and commented on in class. Prerequisite: BIOL 3315.

**BIOL 5314. BIOMETRY. 3 Hours.**

An examination of statistical methods and procedures in relation to the design of biological experiments and the analysis of their results. Prerequisite: consent of the instructor.

**BIOL 5315. COMMUNITY ECOLOGY. 3 Hours.**

An investigation of the effects of interspecific interactions on the distribution and abundance of organisms. Prerequisite: consent of the instructor.

**BIOL 5316. ADVANCED EVOLUTIONARY BIOLOGY. 3 Hours.**

An analysis of existing biological phenomena with regard to their selective advantage in biological systems. Prerequisite: BIOL 5311 or consent of the instructor.

**BIOL 5317. BACTERIAL PATHOGENESIS. 3 Hours.**

Host-pathogen relationships in microbial diseases. Topics include bacterium-host interactions, pathogens and pathogenic factors: techniques in pathogenesis research: molecular mechanisms of pathogenesis by major bacterial pathogens; antimicrobial compounds and resistance to antibiotics; and discussion of human genomics and susceptibility to infections.

**BIOL 5318. POPULA BIOL. 3 Hours.****BIOL 5319. HUMAN GENETICS. 3 Hours.**

This course will enable students to comprehend the basic principles of genetics applied to human inheritance and disease, to interpret the research strategies aimed to identify and study the genes responsible for diverse functions and traits, as well as to assess the consequences of the genetic technologies in our society.

**BIOL 5320. BIOGEOGRAPHY. 3 Hours.**

The role of natural and artificial transport, population pressure and limiting agencies are examined in the light of the patterns of distribution of living organisms. Prerequisite: consent of the instructor.

**BIOL 5321. ADVANCED PROBLEM SOLVING IN BIOLOGY. 3 Hours.**

This course will focus on crucial techniques needed to solve application-based questions in biology. Students will develop and practice reading comprehension, problem solving, critical thinking, and reasoning skills while deepening their understanding of core biological concepts, including cell and molecular biology; biochemistry; anatomy and physiology; and behavior. The goal of this course is to improve students' critical reasoning skills to prepare them for problem-based exams. BIOL 3442 is recommended. Prerequisite: BIOL 1442, BIOL 3301, BIOL 3315.

**BIOL 5325. PLANT ECOLOGY. 3 Hours.**

An introduction to plant ecology including physiological, population, community and ecosystem ecology.

**BIOL 5326. WETLANDS ECOLOGY. 3 Hours.**

An introduction to wetland ecology including the formation of wetlands, biogeochemistry of wetland soils, hydrology and biotic adaptations to wetland environments.

**BIOL 5327. QUANTITATIVE ECOLOGY. 3 Hours.**

A presentation of quantitative methods used in the design of experiments, collection and analysis of data associated with research in population, community and landscape ecology.

**BIOL 5328. LANDSCAPE ECOLOGY. 3 Hours.**

Landscape ecology focuses on the spatial organization of the landscape mosaic and the flows of energy, nutrients, and species among landscape elements and ecosystems.

**BIOL 5330. DEVELOPMENTAL BIOLOGY. 3 Hours.**

The primary goal of this course is to describe how organismic complexity is generated during embryonic and post-embryonic development. The course will cover current areas of research in developmental biology, which include: the roles of genetic networks, induction events, cell lineage, maternal inheritance, cell-cell communication, and hormonal control in developmental processes in well-suited organisms such as vertebrates, insects, and nematodes.

**BIOL 5331. ADVANCED MOLECULAR BIOLOGY. 3 Hours.**

Molecular biology, protein-nucleic acid interactions, nucleic acid biochemistry, and the RNA World.

**BIOL 5333. BIOLOGICAL MODELING. 3 Hours.**

Computational and mathematical techniques for representing biological processes, including dynamical systems, simulation, and stochastic processes, using examples from ecology, evolution, and other areas of biology. Prerequisite: consent of the instructor.

**BIOL 5334. MOBILE DNA MECHANISMS & REGULATION. 3 Hours.**

This is a graduate course that covers the classification of transposable elements, and the mechanisms and regulation of transposition in a broad range of organisms. In addition to traditional lectures given by the instructor, students will present and discuss papers among the classic and recent literature on the topic.

**BIOL 5335. ESSENTIALS OF GENOMICS. 3 Hours.**

An integrative approach to genome science, combining elements of genetics, statistics and bioinformatics. Current technologies used in genomics analysis will be presented.

**BIOL 5336. MOLECULAR EVOLUTION. 3 Hours.**

An exploration of how genes and genomes evolve at the molecular level. The presentation uses the theoretical framework provided by population genetics to analyze molecular biology data.

**BIOL 5337. BEHAVIORAL ECOLOGY. 3 Hours.**

Introduction to predictive modeling techniques used in studying behavior and ecology of animals. Includes optimization, dynamic optimization, utility theory, and game theory. Prerequisite: consent of the instructor.

**BIOL 5338. ENDOCRINOLOGY. 3 Hours.**

An exploration of the vertebrate endocrine system with emphasis on cellular origin of hormones, hormone roles in physiological regulation and hormonal mechanisms of cellular action. Prerequisites: BIOL 3301 or 3442 or consent of the instructor.

**BIOL 5339. MOBILE DNA & GENOME EVOLUTION. 3 Hours.**

This is a graduate discussion course that tackles the broad topic of the role of transposable elements in the evolution of genomes. Students will choose topics of interest to present and lead discussion. Organisms discussed will viruses, bacteria, archaea and eukaryotes.

**BIOL 5340. BIOINFORMATICS. 3 Hours.**

This course is an applied introduction to bioinformatics and computational genomics. The course is geared toward the student with a biology background and limited programming experience. The course provides an entrance to commonly used programming/scripting languages and an introduction to numerous aspects of modern genomic data analyses (e.g. identification of coding and regulatory features in novel sequences, expression analysis, and comparative/phylogenetic analyses).

**BIOL 5341. PRINCIPLES OF NEUROSCIENCE. 3 Hours.**

Organization and function of the mammalian nervous system including: sensory functions, motor activity, regulation of autonomic function, memory and association. Prerequisites: three hours of advanced physiology courses or consent of the instructor.

**BIOL 5342. ICHTHYOLOGY. 3 Hours.**

Classification, anatomy, physiology and natural history of fishes. Prerequisite: consent of the instructor.

**BIOL 5343. REPTILE BIOLOGY. 3 Hours.**

Diversity, systematics, distribution and behavior of major groups of reptiles. Laboratory includes museum techniques, identification and anatomical study. Prerequisite: consent of the instructor.

**BIOL 5344. AMPHIBIAN BIOLOGY. 3 Hours.**

Diversity, systematics and behavior of major groups of amphibians. Laboratory includes museum techniques, identification and anatomical study. Prerequisite: consent of the instructor.

**BIOL 5345. ORNITHOLOGY. 3 Hours.**

Anatomy, physiology, identification, population dynamics and ethology of birds. Laboratory includes field identification, preparation of specimens, and field study techniques. A weekend field trip is required. Prerequisite: consent of the instructor.

**BIOL 5346. MICROBIAL PHYSIOLOGY. 3 Hours.**

This course considers the anatomy and physiology of the bacterial cell in detail. Lecture topics consider the molecular architecture of cell walls, membranes and organelles, synthesis of wall material and membranes, insertion of proteins into membranes and regulation of biosynthetic systems at the whole cell level.

**BIOL 5347. PHYCOLOGY. 3 Hours.****BIOL 5348. ENVIRONMENTAL BIOLOGY. 3 Hours.**

Examines major environmental problems that affect biological systems with an emphasis on problem solving. Includes a survey of potential employment opportunities for biologists in environmentally related fields. A weekend field trip is required. Prerequisite: consent of the instructor.

**BIOL 5349. COOPERATIVE PROGRAM IN BIOLOGY. 3 Hours.**

The purpose of this course is to allow students to earn credit for relevant field work in the areas of biology and microbiology. Students must apply for the program and be cleared for registration during the semester prior to enrollment.

**BIOL 5350. CONSERVATION BIOLOGY. 3 Hours.**

Theory and practice of conservation biology, with emphasis on applications of modern quantitative and molecular genetic techniques to preservation of organisms and habitats. Includes: identification and prioritization of units for protection; conservation genetics; preserve design; public policy; and current case studies. Prerequisites: BIOL 3315 or equivalent or consent of the instructor.

**BIOL 5351. ENVIRONMENTAL MICROBIOLOGY. 3 Hours.**

Principles, methodology, and practical applications of environmental microbiology. Topics include: habitat and community approaches to environmental microbiology; measures of microbial populations and activities; interactions among microbial communities; role of microorganisms in the origin of mineral resources and pollution and energy flow through microbial communities. Prerequisite: BIOL 3444 or equivalent or consent of the instructor.

**BIOL 5352. BIO EL MICRSCOP. 3 Hours.****BIOL 5353. SCANNING ELECTRON MICROSCOPY. 3 Hours.**

Principles and operation of the Scanning Electron Microscope (SEM). Training in the use of the JEOL JSM SEM. Specimen preparation for SEM included in the lectures and laboratory. Open to non-biologists. Prerequisite: consent of the instructor.

**BIOL 5354. LIMNOLOGY. 3 Hours.**

The study of biotic and abiotic components of inland waters. Prerequisite: consent of the instructor.

**BIOL 5355. AQUATIC BIOLOGY. 3 Hours.**

Ecological relationships of organisms in freshwater and marine ecosystems. Prerequisite: consent of the instructor.

**BIOL 5356. PRIN CHEM II. 3 Hours.****BIOL 5357. MARINE BIOLOGY. 3 Hours.**

Principles of oceanography and ocean circulation, adaptations of marine organisms to their environment, ecological principles of marine biology and human impacts on the sea.

**BIOL 5358. LAB PROB CHEM. 3 Hours.****BIOL 5359. ADV GENETICS. 3 Hours.****BIOL 5360. DEV GENETICS. 3 Hours.****BIOL 5361. ADVANCED BIOMETRY. 3 Hours.**

Topics include introduction to matrix algebra, regression, correlation, residual analysis, and multivariate statistics. Several computerized statistical packages are introduced. Prerequisite: BIOL 5314 or consent of the instructor.

**BIOL 5362. EXPERIMENTAL DESIGN. 3 Hours.**

Various analysis of variance models will be explored including hierarchic models, multiway factorial models, Latin square designs, split plots designs, and incomplete block designs. Nonparametric methodologies and analysis of covariance techniques will also be presented. Prerequisite: BIOL 5314 or consent of the instructor.

**BIOL 5363. QUANTITATIVE APPROACHES TO PHYSIOLOGY. 3 Hours.**

Advanced methodologies for the analysis of physiological systems. Quantitative aspects of transport, respiration, electrophysiology, and cardiovascular physiology. Laboratory will emphasize practical measurement methodologies and principles of physiological measurement and instrumentation.

**BIOL 5364. POPULATION GENETICS. 3 Hours.**

The genetics of evolution with emphasis on measuring, predicting, and modeling genetic change in populations. Prerequisite: consent of the instructor.

**BIOL 5365. IMAGE ANALYSIS. 3 Hours.**

Quantitative methods used in the analysis of microscopical and other types of biological images. Images studied will be obtained from light and electron micrographs, energy dispersive electron analysis maps and normal, aerial, and laboratory photography. Prerequisites: consent of the instructor. Prerequisite: consent of the instructor.

**BIOL 5366. THEOR ECOLOGY. 3 Hours.****BIOL 5367. THEORETICAL SYSTEMATICS. 3 Hours.**

Introduction to the study of organismal diversity and evolutionary relationships. Emphasizes quantitative methods for phylogeny reconstruction, and interpretation and application of molecular data. Prerequisite: BIOL 3315 and BIOL 3339 or equivalents, or consent of the instructor.

**BIOL 5370. THESIS RESEARCH IN CELL BIOLOGY. 3 Hours.**

Faculty supervised thesis research.

**BIOL 5371. THESIS RESEARCH IN ECOLOGY AND EVOLUTION. 3 Hours.**

Faculty supervised thesis research.

**BIOL 5372. THESIS RESEARCH IN BIOINFORMATICS. 3 Hours.**

Faculty supervised thesis research.

**BIOL 5373. THESIS RESEARCH IN MICROBIOLOGY. 3 Hours.**

Faculty supervised thesis research.

**BIOL 5374. THESIS RESEARCH IN GENETICS AND GENOMICS. 3 Hours.**

Faculty supervised thesis research.

**BIOL 5390. EX METHODS BIO. 3 Hours.****BIOL 5391. INDIVIDUAL PROBLEMS IN BIOLOGY. 3 Hours.**

Individual research projects supervised by a faculty member. Prerequisite: consent of the instructor.

**BIOL 5392. MASTER'S NON-THESIS CAPSTONE. 3 Hours.**

The Master of Science in Biology Non-Thesis (MSNT) capstone course creates opportunities for students to integrate, reflect on, and apply what they have learned in their coursework. Students also practice professional competencies including communication, teamwork, critical thinking, research, problem-solving, and analytical thinking. This course satisfies the capstone requirement for the MS in Biology (non-thesis) degree.

**BIOL 5393. RESEARCH IN BIOLOGY. 3 Hours.**

Conference course in which the student undertakes intensive investigation of topics under the supervision of a staff member. Prerequisite: consent of the instructor. Graded P/F/R.

**BIOL 5398. THESIS. 3 Hours.**

Graded R/F only. Prerequisite: consent of faculty.

**BIOL 5410. BIOLOGICAL TECHNIQUES. 4 Hours.**

Students will study the basic laboratory and field research techniques utilized in a wide variety of biological research areas.

**BIOL 5420. GENETICS METHODS LAB. 4 Hours.**

This course combines computational and experimental approaches to study genome composition, evolution, and disease. Students will learn contemporary laboratory techniques while exploring transposable elements as tools for genetic analysis. Topics include genetic variation, Mendelian genetics, gene regulation, and gene-directed therapy.

**BIOL 5421. METHODS IN MOLECULAR MICROBIOLOGY. 4 Hours.**

This course will provide an overview of different techniques used during manipulation of microorganisms. It will allow students to gain a historical perspective of techniques used in microbiology (Winogradsky column, Koch solid agar plating) as well as learn state of the art molecular characterization of microorganisms and their genetic manipulation. This course introduces current biochemical, physiological and molecular biology methods to assess community diversity and microbial activity in a variety of ecosystems. Other topics discussed include bacterial growth and survival, population biology, and microbial interactions.

**BIOL 5440. BACT PHYSIOL. 4 Hours.****BIOL 5442. EXPERIMENTAL ANIMAL PHYSIOLOGY. 4 Hours.**

An integrative study of physiological mechanisms at molecular, cellular, tissue, organ and organismal levels. Focuses on nervous system and neuronal regulation of major physiological systems (i.e., cardiovascular, ventilatory, muscular) and responses to environmental variables. Laboratory complements lecture, stressing physiological techniques and experimental design, computer data acquisition, and data analysis and presentation. Prerequisite: consent of the instructor.

**BIOL 5446. GEN PHYSIOLOGY. 4 Hours.****BIOL 5447. PLANKTON ECOL. 4 Hours.****BIOL 5449. PARASITOLOGY. 4 Hours.**

Lecture deals with ecology of parasites, morphologic and physiologic adaptations to a parasitic way of life, host adaptations to parasitism, and effects of parasites on hosts. Laboratory deals with clinical and veterinary parasitology, animal dissections, diagnosis of parasitic infections, and identification of parasites. Prerequisite: 16 hours of laboratory biology or consent of the instructor.

**BIOL 5450. PARASITIC DISEASE. 4 Hours.****BIOL 5451. ACAROLOGY. 4 Hours.****BIOL 5455. MICROBIAL ECO. 4 Hours.****BIOL 5493. RESEARCH. 4 Hours.****BIOL 5593. RESEARCH. 5 Hours.****BIOL 5693. RESEARCH IN BIOLOGY. 6 Hours.**

Conference course in which the student undertakes intensive investigation of topics under the supervision of a staff member. Prerequisite: consent of the instructor. Graded P/F/R.

**BIOL 5698. THESIS. 6 Hours.**

Graded P/F/R. Prerequisite: consent of faculty.

**BIOL 5998. THESIS. 9 Hours.**

Graded P/F/R. Prerequisite: consent of faculty.

**BIOL 6101. GRADUATE DEVELOPMENT. 1 Hour.**

An introduction to graduate school for incoming students. Students will learn basic science communication skills (oral presentation, abstract writing etc.), an overview of university infrastructure, and an introduction to grant management.

**BIOL 6102. RESPONSIBLE CONDUCT IN RESEARCH. 1 Hour.**

An overview of bioethics and responsible conduct in research according to standards set by the National Institutes of Health and the National Science Foundation. This includes establishing conflicts of interest, mentor and trainee proper practices, data acquisition and management, and proper practices as an author when publishing.

**BIOL 6103. CAREER DEVELOPMENT. 1 Hour.**

Students will learn valuable skills when applying for academic and non-academic jobs. This includes CV preparation, interview skills, presenting a job seminar, and resources for searching jobs.

**BIOL 6191. ADVANCED RESEARCH. 1 Hour.**

Faculty supervised individual research. May be repeated for credit. Graded P/F/R.

**BIOL 6291. ADVANCED RESEARCH. 2 Hours.**

Faculty supervised individual research. May be repeated for credit. Graded P/F/R.

**BIOL 6301. ESSENTIAL TOPICS IN GENOMICS. 3 Hours.**

This course will explore diverse aspects of genome biology, including the evolutionary principles that influence how genomes change through time, genome structure, and genome function. Emphasis will be given on how genome technology influences the way we do modern biology and how genomics influences the world around us.

**BIOL 6302. MICROBIOLOGY, MOLECULAR AND CELLULAR BIOLOGY. 3 Hours.**

Using model microorganisms, this course will investigate their (1)Physiology, biochemistry, and genetics, (2)The hosts innate and adaptive immune responses, (3)The molecular basis for virulence and pathogenesis and (4)The ecological and economic impact of microbial pathogens including epidemics and pandemics.

**BIOL 6303. ECOLOGICAL AND EVOLUTIONARY ANALYSIS. 3 Hours.**

Analysis-based/applied course with instruction on advanced statistical approaches. Topics to be covered include Poisson and Binomial Error Distribution, mixed effect models, phylogenetic comparative methods, structural equation modeling, power analysis, Bayesian analysis, study/sampling design, and generating publication-ready figures.

**BIOL 6310. SELECTED TOPICS IN BIOLOGY FOR PhD STUDENTS. 3 Hours.**

Topics may vary depending on the needs and interests of the students. May be repeated for credit. This course is specific to students in the PhD program.

**BIOL 6391. ADVANCED RESEARCH. 3 Hours.**

Faculty supervised individual research. May be repeated for credit. Graded P/F/R.

**BIOL 6399. DISSERTATION. 3 Hours.**

BIOL 6399 and BIOL 6699 graded R/F only; BIOL 6999 graded P/F/R. Prerequisite: admission to candidacy for the degree Doctor of Philosophy in Quantitative Biology.

**BIOL 6491. ADVANCED RESEARCH. 4 Hours.**

Faculty supervised individual research. May be repeated for credit. Graded P/F/R.

**BIOL 6591. ADVANCED RESEARCH. 5 Hours.**

Faculty supervised individual research. May be repeated for credit. Graded P/F/R.

**BIOL 6691. ADVANCED RESEARCH. 6 Hours.**

Faculty supervised individual research. May be repeated for credit. Graded P/F/R.

**BIOL 6699. DISSERTATION. 6 Hours.**

BIOL 6399 and BIOL 6699 graded R/F only; BIOL 6999 graded P/F/R. Prerequisite: admission to candidacy for the degree Doctor of Philosophy in Quantitative Biology.

**BIOL 6999. DISSERTATION. 9 Hours.**

BIOL 6399 and BIOL 6699 graded R/F only; BIOL 6999 graded P/F/R. Prerequisite: admission to candidacy for the degree Doctor of Philosophy in Quantitative Biology.

**BIOL 7399. DOCTORAL DEGREE COMPLETION. 3 Hours.**

This course may be taken during the semester in which a student expects to complete all requirements for the doctoral degree and graduate. Enrolling in this course meets minimum enrollment requirements for graduation, for holding fellowships awarded by The Office of Graduate Studies and for full-time GTA or GRA positions. Students should verify that enrollment in this course meets other applicable enrollment requirements. To remain eligible in their final semester of study for grants, loans or other forms of financial aid administered by the Financial Aid Office must enroll in a minimum of 5 hours as required by the Office of Financial Aid. Other funding sources may also require more than 3-hours of enrollment. Additional hours may also be required to meet to requirements set by immigration law or by the policies of the student's degree program. Students should contact the Financial Aid Office, other sources of funding, Office of International Education and/or their graduate advisor to verify enrollment requirements before registering for this course. This course may only be taken twice. Students who do not complete all graduation requirements while enrolled in this course must enroll in a minimum of 6 dissertation hours (6699 or 6999) in their graduation term. Graded P/F/R.