Course Catalog

Biology

Faculty

Gerard Beaudoin III, Ph.D. , Assistant Professor
Frank Healy, Ph.D. , Professor
Michele Johnson, Ph.D. , Associate Professor
Jonathan King, Ph.D. , Professor; Chair
Kevin Livingstone, Ph.D. , Associate Professor
Kelly Lyons, Ph.D. , Professor
Troy Murphy, Ph.D. , Associate Professor
Gabriela Rennebeck, Ph.D. , Lecturer
David Ribble, Ph.D. , Professor; Associate Vice President for Academic Affairs
James Shinkle, Ph.D. , Professor
Bethany Strunk, Ph.D. , Assistant Professor

Overview

The Department of Biology engages and supports students in a dynamic learning environment that promotes a broad, integrated, and interdisciplinary understanding of biological systems. The introductory biology curriculum emphasizes the core concepts and competencies described by the National Science Foundation in Vision and Change, and upper-division courses provide an opportunity to develop greater depth in select areas. The department supports a variety of interdisciplinary programs and encourages joint student-faculty research projects.

Requirements

- The Major
- Guidelines for Acceptance of Majors
- Honors in Biology
- Minor in Biology
- Bachelor of Science Degree in Biochemistry and Molecular Biology
- Honors in Biochemistry and Molecular Biology
- Teacher Certification in Biology

The Major

The requirements for the degree of Bachelor of Science with a major in Biology are a Follow:

I. A minimum of 32 credit hours of biology distributed as follows:

A. Area A: BIOL 1311, 1111, 2312, 2112, and 3413.

B. Area B: Students complete one of the following concentrations.

1. **Ecology and Evolution.** BIOL 3301 and three courses from the following list: BIOL 3420, 3426, 3427, 3424, or 3435.
2. **Cellular and Molecular Biology.** BIOL 3302 and three courses from the following list: BIOL 3450, 3451, 3457, 3458, 3459, 3462, 3463, 3466, or 3474.
3. **Individualized Program.** BIOL 3301 or 3302 and three additional courses selected in consultation with the student's advisor from the lists in 1 or 2.

C. 3 additional hours in biology at the 2000 level or higher.

D. BIOL 4201 or BIOL 4399

II. CHEM 1318, 1118, 2319, and 2119; MATH 1311; and MATH 1320 or PSYC 2401.

III. One of the following options:

A. CHEM 2320 and 2220 and one of the following: CHEM 3330, CHEM 3334, or ENGR 2311.

B. PHYS 1309, 1111, 1310, and 1112.

C. CSCI 1320, MATH 1312 or MATH 2308, and an upper division MATH or CSCI course approved by the student’s advisor.

D. GEOS 2400 and one course from GEOS 2401, 2304, 3402, or 3310.

IV. Completion of BIOL 4001 and 4002

V. University requirements: completion of all other required elements of the Pathways curriculum and at least 124 credit hours.

Guidelines for Acceptance of Majors

Full acceptance in the major is granted if the following requirements are met at the time of application:

1. Completion of BIOL 1311, 1111, 2312, and 2112 with grades of C- or better in each class.
2. Completion of CHEM 1318, 1118, 2319, and 2119 with grades of C- or better in each class.
3. An overall grade point average of at least 2.0.

Students who do not meet the above criteria may be granted provisional acceptance if it is judged that there is a reasonable expectation they can complete the degree program.

Honors in Biology

Biology majors are eligible to enroll in the Honors Program if they satisfy the University requirements that are described elsewhere in this bulletin. During their junior year, honors candidates should identify a faculty mentor and meet with the Department Chair. Completion of the Honors Program includes six hours of research courses (BIOL 4398 and 4399). Honors candidates must submit to the Department Chair a written proposal to graduate with Honors in Biology prior to starting BIOL 4398. The decision to confer or not to confer honors will be made by the departmental faculty and will be based on the quality of the written thesis and the oral presentation of that thesis.

Minor in Biology

A student may minor in Biology by satisfying the following requirements:

I. Completion of BIOL 1311, 1111, 2312, 2112, and 3413.
II. Completion of either BIOL 3301 or 3302
III. Completion of one additional four credit hour course from Area B.

Bachelor of Science Degree in Biochemistry and Molecular Biology

The requirements for the degree Bachelor of Science with a major in Biochemistry and Molecular Biology are as follows:

I. **Departmental requirements**

A. At least 47 credits in chemistry and biology, distributed as follows:

1. Core Courses. BIOL 1311, 1111, 2312, 2112, 3413, 3474, CHEM 1318, 1118, 2319, 2119, 2320, 2220, 3330, 2130, 3131, 3334, and 4340; BIOL 3000 or CHEM 3000 (1 semester).
2. Advanced Electives. Two courses chosen from the following list (one from each department): BIOL 3450, 3458, 3466, CHEM 3432, 4346, 4347, or the combination of 3321 and 3121.

B. Math 1311, 1312

C. PHYS 1309, 1111, 1310, 1112

II. **University requirements:** completion of all other required elements of the Pathways curriculum and at least 124 credit hours.

Guidelines for Acceptance of Majors

Full acceptance is granted if the following requirements are met at the time of application:

I. Completion of CHEM 1318, 1118, 2319, 2119, 2320, 2220 and BIOL 1311, 1111, 2312, 2112, and 3413 with grades of C or better.
II. Completion of MATH 1311 with a grade of C or better.
III. A grade point average of at least 2.0 on all other university work.

Provisional acceptance may be granted if it is apparent that an applicant can meet the requirements for full acceptance by the end of the semester in which application is made.

Honors in Biochemistry and Molecular Biology

Students may undertake honors under the direction of faculty in either the Biology or Chemistry Departments. The procedures and requirements will be determined by the department affiliation of the research mentor. These are described in the Biology and Chemistry sections of this bulletin.

Teacher Certification in Biology

Students majoring in biology can receive certification to teach biology in grades 4-8 and grades 8-12. In order to receive certification, students major in biology, complete 11-14 undergraduate hours of education coursework, and

complete the Master of Arts in Teaching graduate program at Trinity. After this course of study, students would have a B.S. in Biology, a master's in teaching, and teacher certification in Texas. For more information and specific requirements, see the Education Department's program description in the course catalogue.

Courses

BIOL-1307 Biological Impact and Issues

The content of this course will deal with the impact of biological knowledge on the issues of society and culture. Examples of the topics to be discussed are as follows: the influence of the concepts of evolution on human thought and society; medical science and its manipulation of the human body; gene pool alteration and the resultant restructuring of life; agricultural science and its effect on nutrition and human population; impact of the alteration of the environment on the biological world. (Offered every year).

BIOL-1308 The Microbial Mothership

Chemical, geological and fossil data suggest that the earth is about 4.5 billion years old, and that bacterial life was present on earth for at least 3 billion years before any evidence of humans is found. The emergence of complex multicellular organisms such as humans has taken place in intimate association with microbial communities; and the present-day human-microbe association, the "metaorganism", is the product of an expansive and complex coevolutionary process. We have only recently begun to recognize the complexity and importance of the interrelationships that have evolved over millennia between human and animal cells and their associated microbial communities. In this course we will develop a framework to aid our understanding of the species diversity and critical interspecies dependencies (microbe-microbe and microbe-human) that comprise the human microbial mothership. We will explore the tools and technologies used to characterize and analyze complex microbial communities. We will examine how microbial community composition influences such things as autism and diabetes. We will also explore the impact of perturbations to metaorganismal communities on health and well-being, for example the effect of antibiotics and dietary changes. (Offered every other year).

BIOL-1309 The Nature of Cancer

This course is a survey of cancer biology examining the development, progression and treatment of the disease(s). A major emphasis will be on using a scientific framework to understand the disease along with the many myths and misperceptions. The course is designed as a studio course that includes both lectures and laboratory experiments during the class period. Additionally, there will be four required field trips during the semester that will require a total of sixteen hours on weekends. A minimum of one half of the course meeting times will be laboratory activities. (Offered every other year).

BIOL-1320 The Darwinian Revolution

Populations change through time, and understanding how and why they change is central to the study of biology. But, this wasn't always the case. In the Nineteenth Century, as Charles Darwin was developing the theory of evolution by natural selection, most scientists and the public alike believed that plants and animals were static, not changing since the time of creation. Thus, the writings of Darwin transformed our understanding of the dynamic natural world. His ideas have further shaped the fields of medicine, agriculture, and social policy, and motivated

great works of art and literature. This discussion-based course will explore the development of Darwin's revolutionary ideas through a survey of his life, his major written works, and the influence of his writing on modern thinking. (Offered every year).

BIOL-1322 The Ecology and Bioconservation of China

The course will focus on the fundamentals of ecology and how these are important in determining the current distribution and abundance of plants and animals in China. The course will also examine the current human impacts on native biodiversity in China and what conservation practices are in place. Through this course students will engage in a collaborative group project in which they will collect data on a particular element of biodiversity near the United International College (UIC), Zhuhai, China. (Offered Occasionally).

BIOL-2301 Advanced Placement Biology

Students earning a 4 or 5 on the Advanced Placement Biology exam or a 5, 6, or 7 on the Higher-Level International Baccalaureate Exam will receive credit for this course.

BIOL-2305 The Science of Novel Environments

This course explores the scientific background supporting the literature studied in CMLT 2301, World Literature and the Environment, and CMLT 2350, Science Fiction. Two themes are emphasized: 1) ecological and physical approaches to studying the environment; and 2) the organismal biology, genetics, and molecular biology of crop plants as related to global agriculture and genetically modified organisms. This course is organized around a mixture of lectures and discussion. Hands-on/laboratory experiences are incorporated. Prerequisite or Corequisite: CMLT 2301 or 2350.

BIOL-2306 Infectious Diseases

This course will examine the biology of infectious diseases and the role of these diseases in global and public health policy. The lecture will consider disease organisms ranging from viral to helminthic and their associated vectors. The laboratory component of this lab/lecture course could focus on a number of aspects such as: 1) transmission of disease by water, 2) the role of sanitation in disease prevention, and 3) examination of selected life cycles of infectious agents as the contribute to disease. Trips to local public health sites are required and will take place outside of the regular class schedule. (Offered every other year). Prerequisite: BIOL 1311 and 1111

Area A: The Core

BIOL-1311 Integrative Biology

This course is designed to introduce students to the wide range of knowledge in the biological sciences and to the methods that have built this knowledge base. The course is organized around a series of topic-based modules, each of which will integrate modern biological approaches at the cellular, organismal, and population levels. Modules for this first semester course include global change, the evolution of sexual reproduction, or other contemporary topics. (Offered every Spring) Corequisite: BIOL 1111

BIOL-1111 Introductory Biology Lab

This is an introductory course that provides an understanding of the scientific methods used to investigate biological questions and how the results of these studies are communicated. The semester is divided into investigative modules in which student groups learn a technique, conduct an experiment or study, and write their results in the form of a scientific paper. (Offered every Spring.) BIOL 1311 must be taken concurrently.

BIOL-2112 Cells and Cell Systems Lab

Laboratory experiences that support the Cells and Cell Systems course. Emphasis on development of laboratory abilities including the design, execution and analysis of a biological investigations. Students will also be expected to demonstrate competency in techniques such as liquid handling, microscopy, data acquisition, and data analysis. (Offered every Fall). Prerequisites: BIOL 1311/1111 and CHEM 1318 or 1300 Corequisites: BIOL 2312

BIOL-2312 Cells and Cell Systems

This course addresses structure and function of cells using selected examples from biological systems to illustrate core biological concepts and motivate development of science competencies. Students will be expected to learn how cells regulate processes; how these processes relate to system function; how the physical world influences cell behavior; how to analyze and interpret experimental findings from both primary data and research literature; and how to predict cell and cell system behavior. (Offered every Fall.) Prerequisites: BIOL 1311/1111 and CHEM 1318 or 1300 Corequisites: BIOL 2112

Area B: Courses

BIOL-3301 Experiential Learning in Ecology and Evolution

This is a field-based, inquiry-driven course that emphasizes hypothesis-testing in the natural world. In close collaboration with biology faculty in an ecological field setting, students will design and conduct field experiments on a variety of topics in ecology and evolution. The objectives of the course are for students to gain hands-on experiences with organisms in the field; develop the skills, techniques, and methods of analysis required to conduct biological field studies; communicate the results of scientific studies; and gain an appreciation for natural history. This course will enhance students' ability in critical thinking in the context of their upper division courses in ecology and evolution. Class time will be used to learn important techniques and means of analysis for field studies. Students will be required to participate in two overnight field trips and one four-day field excursion in mid- to late-March. (Offered every Spring). Prerequisites: Biol 3413, Chem 1318, 1118, and one upper division biology course in the ecology and evolution area (3420 through 3435) or Microbiology (Biology 3458). A statistics course is highly recommended.

BIOL-3302 Experiential Learning in Cell and Molecular Biology

The course focuses on modern laboratory techniques in cell and molecular biology. Research skills are developed through hypothesis generation, experimental design, implementation, data analysis, and scientific communication. Students will conduct guided--inquiry projects utilizing technologies such as flow cytometry, confocal microscopy, gene expression analysis, and quantitative modeling. Students will be required to complete 3 hours/week in lab and 1 hour weekly in recitation. Students will be expected to maintain projects outside scheduled laboratory

sections. (Offered every Spring). Prerequisites: one upper--level Area B Biology course in the cell and molecular area (BIOL 3450--3474).

BIOL-3413 Genes, Phenotypes, and Evolutionary Dynamics

This course uses a single biological theme, for example human-viral interactions, to illustrate core biological concepts and motivate development of science competencies. Students are expected to learn how the structures of biological molecules relate to their functions; how biological information is stored and retrieved in diverse organisms; how mutation and selection have led to genetic changes and what molecular evidence supports evolution through time; how biological systems interact; and how to construct mathematical models that lead to testable predictions. Prerequisite: BIOL 2312/2112

BIOL-3420 Animal Behavior

This course will investigate both evolutionary and proximate aspects of animal behavior. Using the logical framework of the four levels of analysis, we will cover: 1) the adaptive value of specific behaviors and the role of natural selection in maintaining behaviors; 2) how behaviors have evolved over time; 3) how behaviors develop within an individual; and 4)the neural, hormonal, and physiological mechanisms underlying behaviors. Lectures will cover a variety of topics, including: natural selection and evolution; genes and the environment; animal learning and cognition; hormones and their role in mediating behavior; neural mechanisms; foraging behavior; predator-prey interactions; sexual selection; animal communication; courtship and mate choice; and social behavior. In addition to lectures, we will develop skills to understand and interpret primary literature, which will be facilitated through group-discussions of journal articles. The laboratory will focus on developing skills of hypo-deductive inquiry, and on the design, implementation, and analysis of experiments that will be carried out in the laboratory and field. As part of the laboratory, students will develop a sophisticated and in-depth review of the literature focusing on a specific topic of animal behavior, culminating in a final paper and a presentation to the class. Prerequisite: BIOL 3413, CHEM 2319, 2119

BIOL-3426 Vertebrate Biology

This course is an evolutionary survey of vertebrates that will focus on major evolutionary innovations and systematic relationships, and major features of the anatomy, physiology, life history, and behavior of vertebrate taxa. The laboratory includes studies of evolutionary adaptations, surveys of taxa, field trips, and identification of local vertebrates. Grades for the course will be determined from lecture exams, laboratory practicals, one comprehensive final exam, and a series of presentations in lecture and lab sessions. One weekend field trip is required. (Offered every other year.) Prerequisites: BIOL 3413, CHEM 2319, 2119.

BIOL-3427 Plant Biology

This course is a comprehensive study of plants from a variety of perspectives including plant morphology, anatomy, physiology, evolution, and ecology. The course will also cover plant ethnobotany, biogeography, and the taxonomy of several notable plant families. The laboratory is designed to give students experience with live and preserved specimens and laboratory and field techniques frequently associated with the study of plants. Students will apply skills learned in the core courses to the processes of experimental design and hypothesis testing by conducting experiments that are pertinent to the current literature. Some experiments will require time outside of scheduled lab for care of experimental subjects. The course includes two week-day and one weekend field trip.

(Offered every Spring) Prerequisite: BIOL 3413, CHEM 2319, 2119

BIOL-3434 Ecology

This course is designed to facilitate students' understanding of how biotic and abiotic factors determine abundance and distribution of organisms in natural communities and how scientists study these phenomena. Principal ecological theory serves as a framework for the course. This course is also designed to facilitate student learning of laboratory and field techniques to make observations; design experiments; and measure and analyze information about the biotic and abiotic world. Exams and assignments are designed to assess if students have learned how to 1) analyze information across levels of ecological organization and apply what they learn to new situations, 2) critically evaluate published research, 3) develop sound ecological questions and hypotheses, 4) design and implement experiments to test hypotheses, 5) analyze and interpret data, and 6) communicate findings in written and oral format to the class and in a manner that would translate to the scientific community. The course is constructed as a combination of interactive discussions and activities designed to reinforce student engagement with an electronic textbook and field-based laboratory. Students will be outside for most laboratory sessions and are required to attend a weekend field trip. (Offered every year). Prerequisites: Biol 3413, Chem 2319, 2119. Strongly recommended: PSYC 2401 or MATH 1320.

BIOL-3435 Evolution

This course will survey the history of evolutionary thought, the mechanisms and patterns of evolutionary change, and the methods scientists use to study evolution. Topics to be explored include evolution by natural and sexual selection, neutral drift, fitness and adaptation, modes of speciation, phylogenetics, extinction, and applications of evolution in modern medicine. The laboratory portion of the course will include methods to describe and measure diversity, to experimentally create diversity, and to use evolutionary statistics to address broad biological questions. Some experiments will require time outside of scheduled lab. (Offered every Year). Prerequisites: BIOL 3413, CHEM 2319, 2119. Strongly Recommended: MATH 1320 or PSYC 2401

BIOL-3440 Costa Rican Ecology

Middle America, the region extending from central Mexico to Colombia, is one of the most biologically diverse regions of the world with a high degree of endemism (species found nowhere else). This diversity and endemism have resulted from a complex tectonic and climatic history that has promoted the evolution of different species. The objective of this course is to explore this diversity across different ecoregions of Costa Rica, focusing on the diversity and abundance of small to medium-sized mammals at elevations ranging from sea-level rainforests and dry forests to high-elevation cloud forests. The course will begin by studying rainforest ecology at the Osa Peninsula and then transitioning up the coast of Costa Rica to sea-level dry forests and the highlands of the Monteverde area to study the biodiversity on both the Pacific and Caribbean sides of the Tilaran mountains. While the focus will be surveying and sampling mammals, students will also study the flora, fauna, and cultural elements in these different regions. Additionally, we will explore the unique Costa Rican cultural character and some of the reasons for this uniqueness and engage in a service project in the Monteverde area. (Offered every other year). Prerequisites: BIOL 3413, CHEM 1318, 1118 .

BIOL-3450 Genetics

An understanding of genetics is fundamental to most studies in biology because of the central role of heredity in

life and evolution. This course will use a text and primary literature to study the following subjects and principles: Mendelian inheritance of qualitative and quantitative characters and probabilistic analysis of heredity; the molecular nature of genes, including the basic classes and functions of genes and regulation of transcription in both prokaryotic and eukaryotic systems; and the behavior of genes in populations, including mathematical treatments of Hardy-Weinberg equilibrium and the five evolutionary forces (mutation, migration, selection, drift, and non-random mating). The laboratory will use model systems to investigate these basic principles. Some experiments will require time outside of schedule lab hours. Prerequisites: BIOL 3413, CHEM 2319, 2119

BIOL-3451 Microanatomy

Structure-function relationships are explored through an analysis of animal histological features. The microscopy-based laboratory examines tissues by means of comparisons of normal and pathological features. Student performance is measured by in-class exams, written reports, oral presentations, and a course project. Computer imaging and analysis are integrated into the fabric of the course along with several case studies. Prerequisites: Biol 3413, Chem 2319, 2119.

BIOL-3457 Neurobiology

Neurobiology focuses on the organization and function of nervous tissues and systems. The course begins with an anatomical overview, followed by an examination of neural system function at the level of signaling and synaptic transmission, sensory systems, and central system integration and control. With this foundation, the course explores brain development and plasticity. Additional hours are required to monitor experiments. (also listed as NEUR 3447.) (Offered every year). Additional Prerequisites: BIOL 3413, NEUR 2310, and CHEM 2319, 2119

BIOL-3458 Microbiology

The study of microbial organisms is of tremendous importance in our world today. This course emphasizes the basic biology of bacteria, including their varied morphology, growth and nutritional requirements, cell motility, gene regulation, mechanisms of antibiotic resistance, and bacterial interactions as populations and with other organisms. Other topics covered include viruses and the Archaea. The impact of microbes on medicine, public health, agriculture and biotechnology are discussed. In addition to exams, a research paper on a recent topic from the primary research literature in microbiology is required. The laboratory covers diverse techniques on manipulation and growth of bacterial cultures, microscopy, testing of environmental samples, bacterial genetics and molecular biology, and identification of unknown organisms. Multiple experiments are run concurrently. Students are expected to visit the lab on days other than the assigned period to monitor experiments. (Offered every Spring) Prerequisites: BIOL 3413 and CHEM 2319, 2119.

BIOL-3459 Endocrinology

A study of the function of the endocrine system and how it regulates the metabolic processes of living organisms. The course begins with a hormone synthesis/action and then progresses through the functional endocrine systems including stress, reproduction, pregnancy, energy, balance and bone. Attention will also be given to neuro-endocrine mechanisms involved in regulating these systems. 3 class hours, 3 laboratory hours a week for one semester. (Offered every other year.) Prerequisites: BIOL 3413 and CHEM 2319, 2119

BIOL-3462 Animal Physiology

This course is a study of the principles of homeostasis with emphasis on major vertebrate organ systems. This course begins with a detailed molecular investigation of excitable membrane physiology (nerve and muscle) followed by a systematic investigation of endocrine, cardiovascular, respiratory, renal and gastrointestinal physiology. Integrative problem sets are assigned to address the complex interactions between organ systems. Laboratory experience involves experimentation with sophisticated physiological equipment and computerized data acquisition systems to reinforce concepts presented in lecture. Lecture examinations, laboratory reports, homework problem sets, and a research paper with presentation will be used to assess student understanding in this course. Prerequisites: Biol 3413, Chem 2319, 2119.

BIOL-3463 Developmental Biology

Through integration of information from various biology subdisciplines, course topics include the following: vertebrate body plan pattering, genetic control of the Drosophila body plan, early morphogenesis, cell differentiation, organogenesis, gamete formation, and fertilization. The laboratory follows development using microscopy and through special projects involving several animal systems, including avian. Course assessment includes in-class examinations, oral presentations, and group projects. Additional laboratory hours are required to monitor experiments. Prerequisites: Biol 3413, Chem 2319, 2119.

BIOL-3466 Cell Biology

Cells form the basic working units of organs and the systems that organs comprise. This course is designed to build an understanding of the fundamental processes that govern the operations of cells. Cells face challenges of maintaining boundaries, communicating with neighboring cells, transporting essential components across barrier membranes, generating chemical energy, regulating cell phenotype, and maintaining cell structure. In order to function as part of a specialized tissue or organ, cells elaborate specific subsets of organelles to dedicate themselves to performing specific functions. The course will provide the background to understand the cellular mechanisms of specialized cells, and allow one to predict the underlying cellular physiology of most tissue systems. The laboratory takes an investigative approach, introducing microscopic, molecular, and biochemical tools for studying cells. Grades for the course are to be determined by in-class examinations and laboratory reports. Additional Prerequisite: BIOL 3413, CHEM 2319, 2119; at least one Area B course or CHEM 3330

BIOL-3474 Molecular Biology

The focus of this course is the gene. The lecture portion of the course considers the major topics of gene structure, expression, duplication, and recombination. The laboratory takes an investigative approach and offers experimentation in protein electrophoresis, northern blotting, reporter gene expression, PCR-based gene cloning and sequencing, and microarray screens. Lecture and laboratory principles are reinforced through computer-based problem-solving projects using genome databanks. Grades for the course are to be determined by in-class examinations, the projects, and laboratory reports. 3 lecture hours, 3 laboratory hours a week for one semester. Prerequisites: BIOL 3458, 3466, or CHEM 3330.

Area C: Technique and Research Concentration

BIOL---91 Selected Topics

Study of a topic or field not covered by other courses. Lower division offerings will provide an introductory approach to a topic. Upper division courses will involve in-depth analysis of a specific area and will usually require prerequisite courses, at the discretion of the instructor. May be repeated for credit on different topics.

BIOL-3000 BCMB Seminar

Students must attend a minimum of 10 scientific seminars. Appropriate seminars are those offered by the Department of Biology, the Department of Chemistry, the Department of Physics and Astronomy, the Neuroscience Program, and/or seminars presented as part of the Distinguished Scientist Lecture Series. Pass/Fail.

BIOL-3-90 Independent Study

Individual work arranged with a faculty member on problems in biology as indicated by the student's preparation and interest. Attendance at the weekly Biology Seminar is required. Credit may be from 1 to 3 hours per semester with no more than 6 cumulative credit hours possible. Prerequisites: Consent of instructor and approval of a study/research plan submitted to the department chair prior to the semester of enrollment in the course.

BIOL-3-92 Research Internship

Off-campus study in a research laboratory arranged by the student. Prior written approval of a faculty member and departmental permission are required. Guidelines are available in the departmental office. May be repeated for a maximum of 3 credit hours. Graded only on a pass-fail basis.

BIOL-3-93 Practical Internship

Off-campus study in a professional biology setting arranged by the student. Credit will be granted for internships, externships and shadowing limited to those that incorporate academic biology content. Prior written approval of a faculty member and departmental permission are required. Guidelines are available in the departmental office. May be repeated for a maximum of 3 credit hours. Graded on a pass/fail basis. Credit for BIOL 3-93 may not be used to satisfy the "three additional hours in biology at the 2000 level or higher" component of the requirements for the Biology major.

BIOL-4001 Senior Comprehensive Exam

Each September or early October, those Biology majors who have earned 90 total credits or 23 hours in Biology by the end of the preceding semester, will take the Biology Major Field Test (MFT). Students will be required to attend a one hour meeting held early in the fall semester; the examination will be administered on a Saturday soon thereafter . Alternative arrangements will be made for students unable to take the exam at the scheduled time because of University commitments. Students will receive a grade of Pass for completion of the test, but performance on the exam will factor into the grade for BIOL 4002.

BIOL-4002 Senior Retrospective

Students will meet with their advisors during the first day of class and schedule a series of meetings that will guide them in the preparation of a written summary addressing the following: 1) A review of each student's performance on the MFT describing the strengths and weaknesses of the student's preparation; 2) A comparison of the MFT results to the courses taken and grades received and; 3) An assessment of how the student's performance might have been affected by course selection, course content or learning environment, or the student's own learning

strategies. In some instances a student might be advised to change their course selection for their final semester based upon their test score. Grades assigned for this course will be based on a combination of the MFT score and the quality of the student's written summary.

BIOL-4201 Biology Senior Seminar

Built around the Biology Department's seminar series, students will interact with seminar speakers visiting campus to discuss readings provided by the speaker the week before. Students will maintain a journal that briefly summarizes the readings and logs thoughts about the significance of the work, how it extends what has been learned in biology classes at Trinity, and what major questions the work raises. After the discussion, students will attend the seminar to learn about the broader context of the work. Prerequisite: Senior standing and biology major.

BIOL-4351 Conservation Biology

This course will explore the cross-disciplinary nature of conservation biology, which is the applied science of maintaining the earth's biological diversity. Students will lead weekly discussions on the various sub-disciplines of conservation biology and their applications, including evolution, ecology, genetics, and economics. A detailed case history analysis of a local conservation issue will be required. Prerequisite: An upper division course in biology or consent of instructor.

BIOL-4398 Senior Seminar and Thesis Research I

The purpose of this course is to provide opportunity and guidance in research under the direction of a faculty member. Students must submit a progress report to the department chair if they plan to enroll in BIOL 4399. Attendance at the weekly Biology Seminar, which consists of presentations of original research from diverse fields of Biology, is required. Prerequisites: Senior standing and submission of a formal research proposal to the department chair prior to the semester of enrollment in the course.

BIOL-4399 Senior Seminar and Thesis Research II

This course is a continuation of student projects begun in BIOL 4398. Students are required to write a thesis and make an oral presentation of their research project at an appropriate venue. Attendance at the weekly Biology Seminar is also required. Prerequisite: BIOL 4398.