

**SWAIN FAMILY SCHOOL
OF
SCIENCE
AND
MATHEMATICS**

Col. Darin Zimmerman, Dean

Department of Biology

Lt. Col. Mary Katherine Zanin, Interim Head

Department of Chemistry

Lt. Col. Robert M. Granger II, Head

Department of Cyber and Computer Sciences

Col. Shankar Banik, Head

Department of Health and Human Performance

Lt. Col. Timothy Bott, Head

Department of Mathematical Sciences

Col. Mei-Qin Chen, Head

Swain Department of Nursing

Col. Kimberly Subasic, Head

Department of Physics

Lt. Col. Henry "Hank" Yochum, Head

Department of Biology

Department Head: Zanin

Professors: Gramling, J. , Gustafson, Nolan, Weinstein, Zardus

Associate Professors: Donnell, , Johnson, Rocha, Zanin

Assistant Professors: Moran, Capers

Senior Instructor: Gramling, A.

The Biology Department is structured to offer courses which give students a better understanding of themselves, their relationship with their environment, and the diversity of life. Enrichment courses with minimum prerequisites are offered in summer and evening programs for interested individuals.

B.S. Biology Major

The B.S. in Biology degree is intended for those students who plan to enter graduate, medical, dental, veterinary, or other professional schools; military service; and technical positions in the broader field of biology. The major is designed to provide students with a broad background in modern biology that will prepare them for employment or further study. All students majoring in biology are required to take the Introduction to Biology I and II sequence (BIOL 130, 131, 140, 141), Cell Biology (BIOL 210, 211), Evolution (BIOL 208), Genetics (BIOL 308), Ecology (BIOL 406), and Senior Seminar (BIOL 411).

All undergraduate courses taken at The Citadel with a subject prefix of BIOL will count towards the major GPA.

Students must take four additional biology electives. One must be chosen from each of the following course groupings:

Cell and Molecular Biology Courses:

- BIOL 290 Microbiology
- NURS 340 Pathophysiology
- NURS 341 Pharmacology
- BIOL 401 Developmental Biology
- BIOL 402 Descriptive Histology
- BIOL 424 Molecular Genetics
- BIOL 427 Immunology

Ecology and Field Biology Courses:

- BIOL 314 Vascular Flora of South Carolina
- BIOL 407 Conservation Ecology
- BIOL 408 Ornithology
- BIOL 409 Marine Biology
- BIOL 425 Tropical Rainforest and Reef Ecology
- BIOL 426 Freshwater Biology

Organismal Biology Courses:

BIOL 203	Introduction to Plant Biology
BIOL 301	Invertebrate Zoology
BIOL 302	Comparative Vertebrate Anatomy
BIOL 309	Animal Behavior
BIOL 410	Vertebrate Natural History
BIOL 419	Economic Botany
BIOL 421	Toxicology

Physiological Biology Courses:

BIOL 403	Mammalian Physiology
BIOL 414	Environmental Physiology

Bachelor of Science in Biology/Secondary Teaching Specialization

The Bachelor of Science in Biology/Secondary Teaching Specialization major is designed to provide students with a broad background in modern biology that will prepare them for certification to teach Biology and General Science at the secondary school level. All students choosing this major are required to take the Introduction to Biology I and II sequence (BIOL 130, 131, 140, 141), Cell Biology (BIOL 210, 211), Evolution (BIOL 208), Genetics (BIOL 308), Methods and Applications of Science (BIOL 330), Ecology (BIOL 406), and Senior Seminar (BIOL 411). Students must take four additional biology electives chosen from the list below and all other indicated courses. Students in this program must make a formal application for admission to the School of Education for the Internship in Teaching as outlined on page 165.

All undergraduate courses taken at The Citadel with a subject prefix of BIOL, EART, EDUC and STAT will count towards the major GPA.

Biology Electives: One course must be chosen from each of the three areas below.

Animal Physiology Area

BIOL 403	Mammalian Physiology
BIOL 414	Environmental Physiology

Botany Area

BIOL 203	Introduction to Plant Biology
BIOL 314	Vascular Flora of South Carolina

Zoology Area

BIOL 301	Invertebrate Zoology
BIOL 302	Comparative Vertebrate Anatomy
BIOL 408	Ornithology
BIOL 410	Vertebrate Natural History

Allied Science and Mathematics Courses

CHEM 151/161	General Chemistry I
CHEM 152/162	General Chemistry II
EART 201	Earth Science
MATH 106/107	Applied Calculus I and II
PHYS 203/253	College Physics I
PHYS 204/254	College Physics II
STAT 160	Statistical Methods

Required Education Courses

EDUC 101	Education in Modern Society
EDUC 202	Educational Psychology
EDUC 206	Adolescent Development
EDUC 306	Teaching Reading in the Middle and High School
EDUC 312	Learners with Exceptionalities
EDUC 401	Methods and Materials of Middle and High School Teaching
EDUC 402	Special Methods in Teaching
EDUC 499	Internship in Teaching (Spring Semester Senior Year)

ROTC Courses

AERO, MLTY, or NAVL sequence (101, 102, 201, 202, 301, 302, 401 and 402)

Premedical-Pre dental Program

Students who are planning to enter medical school, dental school, veterinary school, or professional school in allied health should consider the B.S. Biology major. The flexibility of the major course of study permits the preprofessional students to tailor their plans of study to each area of specialty. The department coordinates a voluntary program where students may gain practical experience before graduation. The large number of electives available in the biology curriculum makes it possible for the student to develop the broad science-humanities background necessary in the medical or dental profession.

Research Opportunities

The Biology Department strongly urges majors to engage in research under the direction of a Citadel faculty member. The best way to learn science is to become actively involved in doing science and the Biology Department faculty offer majors many opportunities to become involved in their research programs. Majors can earn academic credit for research by enrolling in BIOL 320 (Intern Research) or in the undergraduate research series (BIOL 321-324). These courses can be used once as a biology elective and may be repeated one time as a general elective.

Minor in Biology

Students seeking a minor in Biology will be required to complete either Foundations of Biology (BIOL 105 and 115) and a Natural Science strand course (NTSS) or the Introduction to Biology I and II sequence (BIOL 130, 131, 140, 141). A minimum of 12 additional credit hours is required for the minor. One course must be selected from each of the three areas listed below and at least two of these courses must involve laboratory work.

Cell and Molecular Category Courses

- BIOL 210 Cell Biology
- BIOL 211 Cell Biology Laboratory
- BIOL 290 Microbiology
- BIOL 308 Genetics
- NURS 340 Pathophysiology
- NURS 341 Pharmacology
- BIOL 401 Developmental Biology
- BIOL 402 Descriptive Histology
- BIOL 424 Molecular Genetics
- BIOL 427 Immunology

Field Biology Category Courses

- BIOL 209 Environmental Science
- BIOL 314 Vascular Flora of South Carolina
- BIOL 406 Ecology
- BIOL 407 Conservation Ecology
- BIOL 408 Ornithology
- BIOL 409 Marine Biology
- BIOL 410 Vertebrate Natural History
- BIOL 425 Tropical Rainforest and Reef Ecology
- BIOL 426 Freshwater Biology

Organismal Category Courses

- BIOL 203 Introduction to Plant Biology
- BIOL 208 Evolution
- BIOL 217 Human Anatomy and Physiology I
- BIOL 218 Human Anatomy and Physiology II
- BIOL 227 Human Anatomy and Physiology I Laboratory
- BIOL 228 Human Anatomy and Physiology II Laboratory
- BIOL 291 History of Biology
- BIOL 301 Invertebrate Zoology
- BIOL 302 Comparative Vertebrate Anatomy
- BIOL 309 Animal Behavior
- BIOL 403 Mammalian Physiology
- BIOL 414 Environmental Physiology
- BIOL 419 Economic Botany
- BIOL 421 Toxicology

Total Credit Hours Required: 12 credit hours beyond the general education requirement, 9 of which must be completed at The Citadel

Minor in Molecular Biology and Biochemistry

The Departments of Biology and Chemistry offer a joint minor in Molecular Biology and Biochemistry. This minor will be beneficial to students interested in careers in medicine, dentistry, and other health science fields as well as those who wish to pursue careers in the chemical and biochemical industry. Active learning exercises, use of scientific literature, computer modeling, inquiry-based laboratories, and research are important components of the courses in the sequence. Requirements for the minor vary slightly depending on the student's major. The following courses are prerequisites for the minor: BIOL 130/131 and 140/141; CHEM 151/161, 152/162, 207/217, and 208/218.

Requirements for Students Majoring in Biology

BIOL 424	Molecular Genetics
BIOL or CHEM 429	Literature Seminar
CHEM 409	Biochemistry I
CHEM 410	Biochemistry II
CHEM 460	Biochemistry Laboratory
BIOL 290	Microbiology
or	
CHEM 300	Quantitative Analysis

Requirements for Students Majoring in Chemistry

BIOL 308	Genetics
BIOL 424	Molecular Genetics
BIOL or CHEM 429	Literature Seminar
CHEM 409	Biochemistry I
CHEM 410	Biochemistry II
CHEM 460	Biochemistry Laboratory

Requirements for All Other Majors

BIOL 308	Genetics
BIOL 424	Molecular Genetics
BIOL or CHEM 429	Literature Seminar
CHEM 409	Biochemistry I
CHEM 410	Biochemistry II
CHEM 460	Biochemistry Laboratory

Total Credit Hours Required: 16 credit hours, 9 of which must be completed at The Citadel

Minor in Sustainability and Environmental Studies

Objectives:

The minor in sustainability and environmental studies is an interdisciplinary minor designed to help undergraduate students gain environmental science literacy; develop an understanding of the environment and an appreciation of sustainability from a variety of perspectives such as business and engineering; and create and/or participate in a project related to local environmental and sustainability efforts. Students pursuing the minor will have the opportunity to take a variety of classes addressing sustainability and environmental studies culminating in a capstone course. The capstone course will provide the students a chance to build upon their previous coursework in the minor through a semester long research project, service-learning activity or internship.

Potential Students:

The minor may be appropriate for undergraduate students from all five schools who are interested in the environment and sustainability. Possible areas of interest could include sustainable agriculture, environmental degradation, supply chain sustainability, environmental history or environmental economics.

Requirements:

To complete a minor in sustainability and environmental studies, students must take a minimum of 15 credit hours from the approved list of courses listed below.

REQUIRED COURSES:

Must take both of the following:

- BIOL 209: Environmental Science (1st course)
- Capstone Course: Including EDUC 409: Service Learning in

Environmental and Sustainability Studies, BIOL 320: Intern Research, or similarly approved high-impact experiences.

OPTIONAL COURSES:

Must take **THREE** of the following:

SCMT 302– Quality Management

SCMT 402 – Purchasing and Materials Management

SCMT 304- Project Management

MGMT 311 – Human Resource Management

CIVL 322 – Introduction to Environmental Engineering

CIVL 408 – Water and Wastewater Systems

MECH 417 – Renewable Energy

ELEC 427 – Energy Systems Engineering

HIST 392 – Special Topics in History*** (Environmental History)

PSCI 433 – Special Topics in International Politics*** (Global Environment)

BIOL 292 – Leadership for Environmental Sustainability

BIOL 314 – The Vascular Flora of South Carolina

BIOL 406 – Ecology

BIOL 407 – Conservation Ecology

BIOL 409 – Marine Biology

BIOL 414 – Environmental Physiology

BIOL 419 – Economic Botany

BIOL 412 –Special Topics in Biology***

BIOL 421 – Toxicology
 BIOL 426 – Freshwater Biology
 PHYS 243 – Meteorology
 PHYS 301 – Biological Physics
 PHYS 343 – Applied Climatology
 EART 201 – Introduction to Earth Science
 EDUC 409 – Special Topics in Education***

*note only one course can be counted for both a major and a minor

**CIVL 322 and CIVL 408 can be appropriate for non-CE STEM majors. These non-CE STEM majors must complete CHEM 151/161 as a pre-requisite for CIVL 322 and CIVL 322 as a prerequisite for CIVL408. The CE department must be notified prior to attempting registration to open the course to non-CE STEM majors.

***Special Topics Courses will require approval from the Program Director on a case-by-case basis.

Total Credit Hours Required: 15, at least 9 of which must be completed at The Citadel.

Biology Course Descriptions

BIOL 101 *General Biology I* Three Credit Hours

Corequisite: BIOL 111

An introductory course in biology designed for non-majors that emphasizes the importance of biology and its impact on human society. Topics include the methods of science, cell structure and function, photosynthesis and cellular respiration, molecular biology, and genetics.

Lecture: three hours.

BIOL 102 *General Biology II* Three Credit Hours

Corequisite: BIOL 112

A continuation of the introductory course for non-majors that covers topics including evolution, the diversity of life, plant and animal form and function, and principles of ecology. It is recommended that students complete BIOL 101 and 111 before taking BIOL 102 and 112.

Lecture: three hours.

BIOL 105 *Foundations of Biology* Three Credit Hours

Corequisite: BIOL 115

An introductory course in biology designed for non-majors that emphasizes the importance of biology and its impact on society. Topics include the method of science and an overview of key principles related to cell structure and function, genetics, evolution, organisms, and ecology.

- BIOL 111 *General Biology I Laboratory* One Credit Hour
 Corequisite: BIOL 101
 Laboratory exercises designed to parallel and support the lecture content of BIOL 101.
 Laboratory: two hours.
- BIOL 112 *General Biology II Laboratory* One Credit Hour
 Corequisite: BIOL 102
 Laboratory exercises designed to parallel and support the lecture content of BIOL 102.
 Laboratory: Two hours.
- BIOL 115 *Foundations of Biology Laboratory* One Credit Hour
 Corequisite: BIOL 105
 Laboratory exercises designed to parallel and support the lecture content of BIOL 105.
- BIOL 130 *Introduction to Biology I* Three Credit Hours
 Corequisite: BIOL 131
 An introductory course required of all biology majors and education majors whose teaching field is biology; recommended for students in other majors who are interested in medicine or other health professions. Topics include the scientific method and data analysis, cell and molecular biology, and genetics.
 Lecture: three hours.
- BIOL 131 *Introduction to Biology I Laboratory* One Credit Hour
 Corequisite: BIOL 130
 Laboratory exercises designed to parallel the lecture content of BIOL 130.
 Laboratory: three hours.
- BIOL 140 *Introduction to Biology II* Three Credit Hours
 Prerequisite: BIOL 130 and 131 or a grade of "B" or better in BIOL 101 and 111
 Corequisite: BIOL 141
 A continuation of the introductory course for biology majors. Topics include evolution, the diversity of life, plant and animal biology, and ecology.
 Lecture: three hours.
- BIOL 141 *Introduction to Biology II Laboratory* One Credit Hour
 Prerequisite: BIOL 130 and BIOL 131
 Corequisite: BIOL 140
 Laboratory exercises designed to parallel the lecture content of BIOL 140.
 Laboratory: three hours
- BIOL 150 *General Biology for Engineers* Three Credit Hours
 Corequisite: BIOL 151
 An introductory course in biology designed for engineering students. Topics include the methods of science, chemistry and cells, evolution, ecology, and microbiology.
 Lecture: three hours.
- BIOL 151 *General Biology for Engineers Laboratory* One Credit Hour

Corequisite: BIOL 150

Laboratory exercises designed to parallel and support the lecture content of BIOL 150.

Laboratory: two hours.

BIOL 203 *Introduction to Plant Biology* Four Credit Hours

Prerequisite: BIOL 102/112 or 140/141

A general survey of the vascular and nonvascular plants. Lecture and laboratory experiences will include a study of the characteristics, life cycles, evolutionary trends, ecological importance, and economic value of each plant group.

Lecture: three hours; laboratory: three hours.

BIOL 206 *Human Genetics* Three Credit Hours

Prerequisite: BIOL 101

Does not count toward the biology major

This course will introduce students to a variety of genetic issues that they will encounter during their lives including: 1) the genetic basis of disease; 2) genetically modified organisms; 3) genetic screening and prenatal diagnosis; 4) cancer; 5) the human genome; 6) genetically modified organisms; and 7) DNA fingerprinting. In addition to gaining a scientific understanding of these issues, the ethical and societal impacts will be discussed.

Lecture: three hours.

BIOL 207 *Bioterrorism* Three Credit Hours

Prerequisite: BIOL 101

Does not count toward the biology major

This course will focus on specific organisms that could be used as bio-weapons, discussing their normal existence, common methods of weaponization of such organisms, their potential effects on a human population, and strategies for protecting populations from bioterrorism attacks (vaccine development). A detailed study of the biological characteristics of these organisms will be the main focus study for this course.

Lecture: three hours.

BIOL 208 *Evolution* Three Credit Hours

Prerequisite: BIOL 140/141

Required of all biology majors

A basic course in the concepts of evolution and population dynamics. The history of evolutionary thought, the processes of organic evolution, and systematics are included.

Lecture: three hours.

BIOL 209 *Environmental Science* Three Credit Hours

Does not count toward biology major.

Human impact on our environment has never been so intensive or so far-reaching. Fundamental conditions in global nutrient cycling, biological diversity, atmospheric composition, and climate are changing at an unprecedented rate. This course will use real world case studies to investigate the complex interactions among ecology, geology, chemistry, ethics, policy, and economics.

Lecture: three hours.

- BIOL 210 *Cell Biology* Three Credit Hours
 Prerequisites: BIOL 130/131
 An introduction to the morphological, biochemical and biophysical properties of cells and their significance in life processes. Lecture: three hours.
 Lecture: three hours
- BIOL 211 *Cell Biology Lab* One Credit Hour
 Prerequisites: BIOL 130/131
 Laboratory exercises designed to illustrate and support the lecture content of BIOL 210.
 Laboratory: three hours
- BIOL 217 *Human Anatomy and Physiology I* Three Credit Hours
 Prerequisite: BIOL 101/111 or BIOL 105/115 or BIOL 130/131 and EXSC major or Permission of Biology Department Head.
 Does not count toward biology major.
 An introduction to the integrated structure and function of human organ systems covering cells and tissue; integumentary, skeletal, and nervous systems; and sensory organs.
 Lecture: three hours; laboratory: BIOL 227 is optional.
- BIOL 218 *Human Anatomy and Physiology II* Three Credit Hours
 Prerequisite: BIOL 217
 Does not count toward biology major.
 A continuation of the study of integrated structure and function of the human organ systems covering muscular, cardiovascular, lymphatic, respiratory, digestive, urinary, endocrine, and reproductive systems.
 Lecture: three hours; laboratory, BIOL 228 is optional.
- BIOL 227 *Human Anatomy and Physiology I Lab* One Credit Hour
 Prerequisite: BIOL 101/111 or BIOL 105/115
 Corequisites or prerequisites: BIOL 217
 Does not count toward biology major.
 Laboratory exercises designed to illustrate and support lecture content of BIOL 217.
 Laboratory: two hours.
- BIOL 228 *Human Anatomy and Physiology II Lab* One Credit Hour
 Prerequisite: BIOL 217
 Corequisites or prerequisites: BIOL 218
 Does not count toward biology major.
 Laboratory exercises designed to illustrate and support lecture content of BIOL 218.
 Laboratory: two hours.
- BIOL 290 *Microbiology* Four Credit Hours
 Prerequisite: BIOL 205 or approval of instructor.
 A general study of microorganisms and their importance to humans with special emphasis on their fundamental life processes. Includes a brief introduction to epidemiology and immunology.
 Lecture: three hours; laboratory: three hours.

BIOL 291 *History of Biology* Three Credit Hours

Prerequisite: BIOL 140/141 or permission of the instructor.

This course covers major aspects of the development of biological sciences and their relationship to other scientific disciplines. Special attention will be paid to the development and content of theories and to changes in the methods of biological research.

Lecture: three hours.

BIOL 292 *Leadership for Environmental Sustainability* Three Credit Hours

This course is designed to explore the role of sustainability in managing natural resources and in guiding informed decision-making by principled leaders in the fields of business, politics, science, and beyond. Sustainability is the use of guiding principles to manage the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change so that they are consistent with future as well as present needs. This course highlights the roles of stewardship and sustainability in the decisions that principled leaders must make. Students will develop an understanding of how to evaluate short-term and long-term resource needs and how to communicate the environmental decision-making process..

Lecture: three hours.

BIOL 301 *Invertebrate Zoology* Four Credit Hours

Prerequisite: BIOL 140/141

A general study of the invertebrate animals, including taxonomy, morphology, and ecology.

Lecture: three hours; laboratory: three hours.

BIOL 302 *Comparative Vertebrate Anatomy* Four Credit Hours

Prerequisite: BIOL 140/141

A study of the functional anatomy of representative vertebrate animals. Emphasis will be placed on the evolution of the vertebrate body and adaptations in form and function in response to environmental pressures.

Lecture: three hours; laboratory: three hours.

BIOL 308 *Genetics* Four Credit Hours

Prerequisite: BIOL 140/141 or permission of the instructor; STAT 160 strongly recommended.

Required of all biology majors.

A study of inheritance, including Mendelian genetics, molecular genetics, changes in chromosome structure and number, cytogenetics, and population genetics.

Lecture: three hours; laboratory: three hours.

BIOL 309 *Animal Behavior (Ethology)* Four Credit Hours

Prerequisite: BIOL 140/141 or PSYC 201

This course deals with the description, development, and adaptive nature of behavior in free-living animals. The laboratory will emphasize the description and quantification of behavior patterns. It is highly recommended that students take STAT 160 before enrolling in this course.

Lecture: three hours; laboratory: three hours.

BIOL 314 *The Vascular Flora of South Carolina* Four Credit Hours

Prerequisite: BIOL 102/112 or BIOL 209 or BIOL 140/141

An introductory study of the native vascular flora of South Carolina, emphasizing the identification and collection of native plants. The student will have practice in use of taxonomic keys and in preparation of specimens.

Lecture: two hours; laboratory: four hours.

BIOL 320 *Intern Research* Three Credit Hours

Prerequisite: Permission of the department head and supervising instructor.

Students will have the opportunity to participate in ongoing research projects with faculty at The Medical University of South Carolina, National Marine Fisheries Services, and The South Carolina Department of Natural Resources, etc. Students must plan their schedule to allow two free afternoons per week, totaling eight hours per week in the laboratory or field, excluding travel. They are expected to maintain a weekly laboratory notebook and write a research paper detailing their work.

Eight hours per week.

BIOL 321 *Undergraduate Research in Biology I* Three Credit Hours

Prerequisite: Permission of the department head and supervising instructor.

Students will have the opportunity to participate in ongoing research projects with faculty at The Citadel. Students must plan their schedule to allow two free afternoons per week, totaling eight hours per week in the laboratory or field, excluding travel. They are expected to maintain a weekly laboratory notebook and write a research paper detailing their work. This class may be taken for Biology elective credit with permission of the department head.

Eight hours per week.

BIOL 322 *Undergraduate Research in Biology II* Three Credit Hours

Prerequisite: Permission of the department head and supervising instructor, and completion of BIOL 321.

Students will have the opportunity to participate in ongoing research projects with faculty at The Citadel. Students must plan their schedule to allow two free afternoons per week, totaling eight hours per week in the laboratory or field, excluding travel. They are expected to maintain a weekly laboratory notebook and write a research paper detailing their work. This class may be taken for Biology elective credit with permission of the department head.

Eight hours per week.

BIOL 323 *Undergraduate Research in Biology III* Three Credit Hours

Prerequisite: Permission of the department head and supervising instructor, and completion of BIOL 322.

Students will have the opportunity to participate in ongoing research projects with faculty at The Citadel. Students must plan their schedule to allow two free afternoons per week, totaling eight hours per week in the laboratory or field, excluding travel. They are expected to maintain a weekly laboratory notebook and write a research paper detailing their work. This class may be taken for Biology elective credit with permission of the department head.

Eight hours per week.

BIOL 324 *Undergraduate Research in Biology IV* Three Credit Hours

Prerequisite: Permission of the department head and supervising instructor, and completion of BIOL 323.

Students will have the opportunity to participate in ongoing research projects with faculty at The Citadel. Students must plan their schedule to allow two free afternoons per week, totaling eight hours per week in the laboratory or field, excluding travel. They are expected to maintain a weekly laboratory notebook and write a research paper detailing their work. This class may be taken for Biology elective credit with permission of the department head.

Eight hours per week.

BIOL 401 *Developmental Biology* Four Credit Hours

Prerequisites or corequisites: BIOL 205 and BIOL 308

A study of animal embryology and its molecular control, including: the process of fertilization; the processes of cleavage, gastrulation, and neurulation; the formation of tissues and organs from the three primordial germ layers; the role of secondary induction and of hormones in development; the role of the environment in development; and some of the techniques of molecular biology that are used in the study of developmental processes. The laboratory will include use of model systems to investigate the principles discussed in lecture.

Lecture: three hours; laboratory: three hours.

BIOL 402 *Descriptive Histology* Four Credit Hours

Prerequisite: BIOL 140/141

A detailed study of the chief types of animal tissues and a description of the histology of organs. Laboratory work includes microscopic study of cells, tissues, and organs of animals.

Lecture: three hours; laboratory: three hours.

BIOL 403 *Mammalian Physiology* Four Credit Hours

Prerequisites: BIOL 140/141 and CHEM 208

A systematic study of the general physiology of mammalian organ systems.

Lecture: three hours; laboratory: three hours.

BIOL 406 *Ecology* Four Credit Hours

Prerequisite: BIOL 140/141

Required of all biology majors.

An introduction to the study of biological interrelationships and the effects of the environment on the structure and function of animal and plant populations. Laboratory will emphasize methods and materials of ecological investigations. It is highly recommended that students take Statistics before enrolling in this course.

Lecture: three hours; laboratory: four hours.

BIOL 407 *Conservation Ecology* Three Credit Hours

Prerequisite: BIOL 102/112 or BIOL 209 or BIOL 140/141

Conservation ecology is an integrated science based primarily on ecology, with important contributions from genetics, evolution, biogeography, sociology, economics, and political science. The course will address definitions, origins, and patterns of biological diversity, explore why the maintenance of biodiversity in native and human dominated ecosystems is fundamentally important to the continued well-being of humans and other species, and examine the context and causes of extinction and strategies for preventing or ameliorating the loss of biodiversity.

Lecture: three hours

BIOL 408 *Ornithology* Four Credit Hours

Prerequisite: BIOL 102/112 or BIOL 209 or BIOL 140/141

A study of the structure, function, and ecology of birds. Field trips and bird specimens will give students a working knowledge of birds common to South Carolina.

Lecture: three hours; laboratory: three hours.

BIOL 409 *Marine Biology* Four Credit Hours

Prerequisite: BIOL 140/141

The lectures cover major ecological factors and the fundamentals of oceanography. Laboratory work stresses familiarities with species, taxonomic methods, sampling procedures, experimental design, use of equipment, and data handling.

Lecture: three hours; laboratory: three hours.

BIOL 410 *Vertebrate Natural History* Four Credit Hours

Prerequisite: BIOL 140/141

An introduction to the classification, ecology, evolution and distribution of the vertebrates. Laboratory with emphasis on identification and field study techniques, especially with respect to the vertebrates of South Carolina.

Lecture: three hours; laboratory: three hours.

BIOL 411 *Senior Seminar* One Credit Hour

Required of all biology majors. Open only to seniors.

A group study of current topics of biological interest.

Lecture: one hour.

BIOL 412 *Special Topics in Biology* Four Credit Hours

Prerequisite: permission of the instructor.

A course designed for the study of specialized topics in modern biology.

Lecture: variable; laboratory: variable

BIOL 414 *Environmental Physiology* Four Credit Hours

Prerequisite: BIOL 205

This course will cover the physiological adaptations of organisms to physical and chemical parameters of the environment. It includes molecular mechanisms which help organisms adapt to environmental factors.

Lecture: three hours; laboratory: three hours.

BIOL 419 *Economic Botany* Three Credit Hours

Prerequisite: BIOL 102/112 or BIOL 209 or BIOL 140/141

An introductory course in economic botany devoted to the consideration of plants which are useful or harmful to humans; their origins and history, botanical relationships, chemical constituents which make them economically important, and their roles in prehistoric and modern cultures and civilizations.

Lecture: three hours.

BIOL 421 *Toxicology* Four Credit Hours

Prerequisites: BIOL 102 or 140 and CHEM 104 or 152, or BIOL 218

An overview of the basic science of poisons, including the disposition of chemicals in the body, the role of metabolism in enhancing or reducing their toxicity, mechanisms of toxicity, and the effects of toxicants on major organ systems.

Lecture: three hours; laboratory: three hours.

BIOL 424 *Molecular Genetics* Four Credit Hours

Prerequisites: BIOL 308, CHEM 208; CHEM 409 Strongly Suggested; BIOL 290 suggested.

Coordinated lecture/laboratory class covering classical molecular and cellular biochemistry as well as modern molecular genetics. Study of the manner in which genetic information is carried in DNA and how DNA directs the synthesis of proteins in bacterial and eukaryotic cells and their associated viruses. Specific topics to be covered include mechanisms governing gene expression, metabolic control system, gene therapy, oncogenesis, molecular genetics of genetic diversity, molecular basis of human diseases, and a review of known disease-causing genes such as the cystic fibrosis gene, Huntington's chorea gene, and the Duchenne Muscular Dystrophy gene.

Lecture: three hours; laboratory: three hours.

BIOL 425 *Tropical Rainforest and Reef Ecology* Four Credit Hours

The objectives of this experiential course are to survey biodiversity and provide understanding of ecological principles in tropical habitats through physical involvement with the environment. Two co-instructors will lead students on a 10-12 day excursion in forest and reef habitats of the Neotropics, providing natural history instruction and interpretation. Participants will have the opportunity to immerse themselves in the subject by walking forest paths, swimming forest streams, spelunking caves, paddling mangrove swamps, combing beaches, and snorkeling coral reefs. A species list of plants and animals will be assembled for each habitat and readings from the scientific literature, appropriate to the region, will be assigned for analysis and discussion.

BIOL 426 *Freshwater Biology* Four Credit Hours

Prerequisite: BIOL 140/141

The study of freshwater organisms and their environment. Instruction will cover the biological diversity, ecological and physiological adaptations, and the physical setting of freshwater systems. Local systems of interest include large coastal rivers and lakes, upper portions of estuaries and old rice fields.

BIOL 427 *Immunology*

Three Credit Hours

Prerequisites or corequisites: BIOL 205 and BIOL 308

A description of the immune system including the cells and organs involved in immunity; antigen-antibody reactions; immunoglobulin structure, function; organization and expression of immunoglobulin genes; the major histocompatibility complex; immune regulation and tolerance. These basic concepts will be applied to understanding the role of the immune system in vaccinations; infectious disease; organ transplantation; autoimmune disease; immunodeficiency diseases; AIDS and cancer.

Lecture: three hours.

BIOL 429 *Literature Seminar*

One Credit Hour

Prerequisite: BIOL 140/141

A current topics course that involves discussions of relevant journal articles and related materials.

BIOLOGY MAJOR
First Semester

FRESHMAN YEAR

First Year Experience.....	LDRS	101	1	(2,0)*
Freshman Seminar	FSEM	101	3	(3,0)
Freshman Linked Writing Intensive.....	FSWI	101	3	(3,0)
Physical Fitness, Resiliency, and Wellness	RPED	260	3	(3,0)
Introduction to Biology II	BIOL	140	3	(3,0)
Introduction to Biology II Laboratory	BIOL	141	1	(0,3)
General Chemistry I.....	CHEM	151	3	(3,0)
General Chemistry I Laboratory	CHEM	161	1	(0,2)
1st Year Basic ROTC		101	1	(1,0)

SOPHOMORE YEAR

Leadership Service Lab.....	LDRS	211	0	(0,1)
(May be taken either semester)				
Evolution.....	BIOL	208	3	(3,0)
Organic Chemistry I.....	CHEM	207	3	(3,0)
Organic Chemistry I Laboratory	CHEM	217	1	(0,3)
Applied Calculus I	MATH	106	3	(3,0)
General Elective.....			3	(3,0)
Modern Language			3	(3,0)
2nd Year Basic ROTC.....		201	2	(2,0)

JUNIOR YEAR

Junior Ethics Enrichment Experience.....	LDRS	311	0	(1,0)
Leadership in Organizations	LDRS	371	3	(3,0)
Strand Course§.....			3	(3,0)
Strand Course§.....			3	(3,0)
Genetics.....	BIOL	308	4	(3,3)
College Physics I.....	PHYS	203	3	(3,0)
College Physics I Laboratory.....	PHYS	253	1	(0,2)
1st Year Advanced ROTC				

SENIOR YEAR

Strand Course§.....			3	(3,0)
Senior Leadership Integration Seminar	LDRS	411	0	(1,0)
Biology Senior Seminar.....	BIOL	411	1	(1,0)
Biology Elective**.....	BIOL		3(4)	(var)
Biology Elective**.....	BIOL		3(4)	(var)
General Elective.....			3	(3,0)
General Elective.....			3	(3,0)
2nd Year Advanced ROTC.....				

*Represents semester credit, lecture, and laboratory hours, in that order. Var = varies according to course.

**Biology electives must include at least one course from each of the following four areas. Cell and Molecular Biology: BIOL 290, 340, 341, 401, 402, 424; 427; Ecology and Field Biology: BIOL 314, 407, 408, 409, 425, 426; Organismal Biology: BIOL 203, 301, 302, 309, 410, 419, 421; Physiological Biology: BIOL 403 and 414.

§Students must complete four strand courses, which may be completed in any order: English (ENGS 30X), History (HISS 30X), Social Science (SCSS 30X), and Science (NTSS 30X).

BIOLOGY MAJOR
Second Semester

FRESHMAN YEAR

Introduction to Biology I	BIOL	130	3	(3,0)*
Introduction to Biology I Laboratory.....	BIOL	131	1	(0,3)
General Chemistry II.....	CHEM	152	3	(3,0)
General Chemistry II Laboratory.....	CHEM	162	1	(0,2)
Statistical Methods.....	STAT	160	3	(3,0)
Modern Language			3	(3,0)
General Elective.....			3	(3,0)
1st Year Basic ROTC		102	1	(1,0)

SOPHOMORE YEAR

Principled Leadership in American Gov.	LDRS	202	3	(3,0)
Cell Biology	BIOL	210	3	(3,0)
Cell Biology Laboratory	BIOL	211	1	(0,3)
Organic Chemistry II	CHEM	208	3	(3,0)
Organic Chemistry II Laboratory.....	CHEM	218	1	(0,3)
Applied Calculus II	MATH	107	3	(3,0)
Technical Writing and Communication	COMM	260	3	(3,0)
2nd Year Basic ROTC.....				

JUNIOR YEAR

Strand Course§.....			3	(3,0)
Ecology	BIOL	406	4	(3,4)
Biology Elective**.....	BIOL		3(4)	(var)
College Physics II	PHYS	204	3	(3,0)
College Physics II Laboratory	PHYS	254	1	(0,3)
General Elective.....			3	(3,0)
Required Physical Education	RPED		0	(0,1)
1st Year Advanced ROTC				

SENIOR YEAR

General Education Capstone.....	GEND	422	3	(3,0)
Biology Elective**.....	BIOL		3(4)	(var)
General Elective.....			3	(3,0)
General Elective.....			3	(3,0)
Required Physical Education	RPED		0	(0,1)
2nd Year Advanced ROTC.....				

REQUIRED FOR GRADUATION: 131 - 133 credit hours plus successful completion of all RPED, ROTC, and LDRS graduation requirements. ROTC hours (credits, lectures, and labs) vary each semester by military department.

BIOLOGY MAJOR**Teaching Specialization in Biology & Comprehensive/Broad Field Science****First Semester****FRESHMAN YEAR**

First Year Experience	LDRS	101	1	(2,0)*
Freshman Seminar	FSEM	101	3	(3,0)
Freshman Linked Writing Intensive.....	FSWI	101	3	(3,0)
Physical Fitness, Resiliency, and Wellness.....	RPED	260	3	(3,0)
Introduction to Biology II.....	BIOL	140	3	(3,0)
Introduction to Biology II Laboratory	BIOL	141	1	(0,3)
General Chemistry I.....	CHEM	151	3	(3,0)
General Chemistry I Laboratory	CHEM	161	1	(0,2)
Education in Modern Society.....	EDUC	101	3	(3,0)
1st Year Basic ROTC		101	1	(1,0)

SOPHOMORE YEAR

Sophomore Seminar in Principled Leadership.. (211 may be taken either semester).....	LDRS	211	0	(0,1)
Principled Leadership in American Govt.....	LDRS	202	3	(3,0)
Evolution.....	BIOL	208	3	(3,0)
Strand Course§.....			3	(3,0)
Applied Calculus I	MATH	106	3	(3,0)
Adolescent Development.....	EDUC	206	3	(3,0)
2nd Year Basic ROTC.....		102	2	(2,0)

JUNIOR YEAR

Junior Ethics Enrichment Experience.....	LDRS	311	0	(1,0)
Leadership in Organizations	LDRS	371	3	(3,0)
Genetics.....	BIOL	308	4	(3,3)
College Physics I.....	PHYS	203	3	(3,0)
College Physics I Laboratory.....	PHYS	253	1	(0,2)
Learners with Exceptionalities.....	EDUC	312	3	(3,0)
Strand Course§.....			3	(3,0)
Required Physical Education	RPED		0	(0,1)
1st Year Advanced ROTC				

SENIOR YEAR

Senior Leadership Integration Seminar	LDRS	411	0	(1,0)
Biology Senior Seminar	BIOL	411	1	(1,0)
Biology Elective**.....	BIOL		3(4)	(var)
Biology Elective**.....	BIOL		3(4)	(var)
Strand Course§.....			3	(3,0)
Teaching Reading in Middle & High School....	EDUC	306	3	(3,0)
Special Methods in Teaching	EDUC	402	3	(3,0)
2nd Year Advanced ROTC.....				

*Represents semester credit, lecture, and laboratory hours, in that order. Var = varies according to course.

**Biology electives must include at least one course from each of the following four areas. Animal Physiology Area: BIOL 403, BIOL 414; Botany Area: BIOL 203, BIOL 314; Zoology Area: BIOL 301, BIOL 302, BIOL 408, BIOL 410.

§Students must complete four strand courses, which may be completed in any order: English(ENGS 30X), History (HISS 30X), Social Science (SCSS 30X), and Science (NTSS 30X).

BIOLOGY MAJOR

**Teaching Specialization in Biology & Comprehensive Broad Field Science
Second Semester**

FRESHMAN YEAR

Introduction to Biology I	BIOL	130	3	(3,0)
Introduction to Biology I Laboratory.....	BIOL	131	1	(0,3)
General Chemistry II.....	CHEM	152	3	(3,0)
General Chemistry II Laboratory.....	CHEM	162	1	(0,2)
Statistical Methods.....	STAT	160	3	(3,0)
Physical Fitness, Resiliency, and Wellness...	RPED	260	3	(3,0)
Educational Psychology.....	EDUC	202	3	(3,0)
Year Basic ROTC.....		102	1	(1,0)

SOPHOMORE YEAR

Cell Biology	BIOL	210	3	(3,0)
Cell Biology Laboratory	BIOL	211	1	(0,3)
Applied Calculus II	MATH	107	3	(3,0)
Foundations in Reading	EDUC	301	3	(3,0)
Technical Writing and Communication	COMM	260	3	(3,0)
Introduction to Earth Science.....	EART	201	4	(3,1)
2nd Year Basic ROTC.....				

JUNIOR YEAR

Ecology	BIOL	406	4	(3,4)
Biology Elective**.....	BIOL		3(4)	(var)
College Physics II	PHYS	204	3	(3,0)
College Physics II Laboratory	PHYS	254	1	(0,3)
Strand Course§.....			3	(3,0)
Methods & Materials-Middle & High School	EDUC	401	3	(3,0)
Required Physical Education	RPED		0	(0,1)
1st Year Advanced ROTC				

SENIOR YEAR

Internship in Teaching.....	EDUC	499	12	
2nd Year Advanced ROTC.....				

REQUIRED FOR GRADUATION: 146-149 credit hours plus successful completion of all RPED, ROTC, and LDRS graduation requirements. ROTC hours (credits, lectures, and labs) vary each semester by military department.