BIOE 4610 International Study in Bioengineering

BIOE 4600 International Bioengineering Research

BIOE 4710* Biophotonics 3 (3)
Introduction to selected bioengineering topics through participation in international study abroad summer programs. Offers an international study experience to undergraduates through lectures, guest speakers, tours, and/or laboratory exposure on a selected bioengineering topic chosen annually by the department. Prereg: Consent of instructor.

BIOE 4821* Biomaterial Implantology Laboratory

BIOE 4900 Internship 1 (3)
Observation and assignment in a medical school, dental school, hospital, regulatory agency, or industrial department. May be repeated for a maximum of six credits. Includes Honors sections. Prereg: Consent of instructor.

BIOE 4910 Mentored Research in Bioengineering

BIOE 4920* Biomaterial Implantology Laboratory

BIOE 4921* Biomaterial Implantology Laboratory

BIOE 5090 Introduction to Life Science 4 (3)
Survey of topics in botany, zoology, microbiology, and ecology emphasizing comprehension and practical application of life-science concepts to experiments and activities for the elementary school classroom. Enrollment priority will be given to Early Childhood and Elementary Education majors. Coreq: BIOL 1091.

BIOE 5091 Introduction to Life Science Laboratory 0 (3) Non-credit laboratory to accompany BIOL 5090. Coreq: BIOL 5090.

BIOE 5100 Principles of Biology I 5 (4) Introductory course designed for students majoring in biological disciplines. Integrates lecture and laboratory and emphasizes a modern, quantitative, and experimental approach to explanations of structure, composition, dynamics, interactions, and evolution of cells and organisms. High school chemistry is recommended. Credit toward a degree will be given for BIOL 1100 or 1040 only. Includes Honors sections. Coreq: BIOL 1101.

BIOE 5101 Principles of Biology I Laboratory 0 (3) Non-credit laboratory to accompany BIOL 5100. Coreq: BIOL 5100.

BIOE 5110 Principles of Biology II 5 (4) Continuation of BIOL 5100, emphasizing the study of plants and animals as functional organisms and the principles of ecology. Credit toward a degree will be given for BIOL 1110 or 1041 only. Includes Honors sections. Prereg: BIOL 5100. Coreq: BIOL 1111.

BIOE 5111 Principles of Biology II Laboratory 0 (3) Non-credit laboratory to accompany BIOL 5110. Coreq: BIOL 1110.

BIOE 5120 Biological Inquiry Laboratory 1 (3) Required laboratory experience to accompany BIOL 1220 or 1230. Focuses on the process and outcomes of scientific inquiry. Students employ scientific methodology in a laboratory environment as well as critical analysis of biological problems in a small group context. Prereg or concurrent enrollment: BIOL 1220 or BIOL 1230.

BIOE 5122 Keys to Biodiversity 3 (3) Introduction to scientific inquiry through analysis of biodiversity. Biological foundations for life are studied, including evolution, ecology, genetics, cells, and molecules. Also includes discussion of ethical issues related to biodiversity. Credit toward a degree will be given for only one of BIOL 1220 or 1230.

BIOE 5130 Keys to Human Biology 3 (3) Introduction to scientific inquiry through human biology. Considers biological processes occurring within humans and human impact on global biological processes. Interrelationships ultimately affecting evolution and diversity are explored. Credit toward a degree will be given for only one of BIOL 1220 or BIOL 1230.

BIOE 5190 Directed Research 1-3 (3-9) Research projects, supervised by faculty in the College of Agriculture, Forestry and Life Sciences introducing research methods. Restricted to outstanding high school students, selected using Governor’s School for Science and Mathematics ranking criteria. May be repeated for a maximum of six credits. Prereg: Entering high school junior or senior status and consent of faculty research supervisor and department in which research is conducted.

BIOE 4710* Biophotonics 3 (3) Biophotonics is an interdisciplinary subject of applying photonics to study biological samples from individual cells to the entire body. Introduces fundamental and frontier topics in optical imaging aspects of biophotonics for senior-level undergraduates and graduate students to gain the ability to solve biomaging-regulated biomedical problems. Prereg: MATH 2080; and PHYS 2210; and either ECE 2070 or ECE 3200.

BIOE 4760 Biosurface Engineering 3 (3) Study of how surface design influences the interactions of biomolecules with biomaterials and how this in turn influences implant biocompatibility. Laboratory addresses both the theory and application of various analytical instruments commonly used in bioengineering to characterize biomaterials surfaces and investigate biomolecules-surface interactions. Prereg: Senior standing in Bioengineering and BCHM 3050. Coreq: BIOE 4761.

BIOE 4761 Biosurface Engineering Laboratory 0 (3) Non-credit laboratory to accompany BIOE 4760. Coreq: BIOE 4760.

BIOE 4820* Biomaterial Implantology 3 (2) Provides training in the planning and conduct of experimental surgery, including laws and regulations; institutional requirements; selection of animal models; ethical considerations of animal research; preparation of animals for surgery; general and special surgical techniques; aseptic surgical techniques; and basic and applied instrumentation. Prereg: Junior standing in Bioengineering. Coreq: BIOE 4821.

BIOE 4821* Biomaterial Implantology Laboratory 0 (3) Non-credit laboratory to accompany BIOE 4820. Coreq: BIOE 4820.

BIOE 4900 Internship 1 (3) Observation and assignment in a medical school, dental school, hospital, regulatory agency, or industrial department. May be repeated for a maximum of two credits. To be taken Pass/No Pass only. Prereg: Senior standing in Bioengineering and consent of department chair.
BIOL 2200 Biology in the News 3 (3) For non-science majors. Students examine current topics of biology appearing in newspapers and other current media. Uses a problem-based learning approach, with students working as teams and individually on areas of interest identified by the class. Students are expected to have completed the General Education Natural Science Requirement prior to enrolling in this course. Preq: ENGL 1030.

BIOL 2100 Biotechnology and Society 3 (3) Introduction to the theories, fields, and applications of biotechnology, including the structure and function of genes and their manipulation to improve plant and animal productivity and human health. Individual case studies are examined, including social and ethical issues surrounding biotechnology-based research and development. Not open to Genetics majors. Preq: BIOL 1200; and one of BIOL 1220 or BIOL 1230; and General Education Natural Science requirement.

BIOL 2030 Human Disease and Society 3 (3) Focuses on the basic biology underlying human disease, how disease is understood, and current methods of prevention and treatment of disease. The economics as well as the social and ethical issues surrounding human disease are a common thread throughout the course. Preq: Both BIOL 1040 and BIOL 1060; or BIOL 1110; or BIOL 1220; or BIOL 1230.

BIOL 2040 Environment, Energy and Society 3 (3) Examines power and energy production, the resultant environmental effects, and the relationship between this technology and society. Introduces historical and contemporary sources of energy and power; the economic, social, and political forces important for types and patterns of development; and the resultant impacts to ecosystems and the environment.

BIOL 2050 Plant Form and Function 3 (3) Introductory course for students majoring in plant sciences. Integrates lecture and laboratory and emphasizes fundamental structures and functions of higher plants. Preq: BIOL 1030 and BIOL1050.

BIOL 2060 Plant Form and Function Laboratory 1 (1) Laboratory for BIOL 2050. Preq or concurrent enrollment: BIOL 2050.

BIOL 2100 Evolution and Creationism 3 (3) Critical review of the scientific and technological basis for evolutionary theory compared to creationism explanations for the origin and diversity of life. Includes a historical survey of the impact that the evolution/creation debate has had on law, politics, education, and other important aspects of society. Credit toward a degree will be given for only one of BIOL 2100 or PHIL 2100; Preq: BIOL 1040 or BIOL 1110; and one of BIOL 1220 or BIOL 1230; and General Education Natural Science requirement.

BIOL 2110 Introduction to Toxicology 3 (3) Acquaints students with the field of toxicology, integrates the science of toxicology with regulatory policy, and demonstrates its impact on our daily lives. Preq: BIOL 1040 and BIOL 1060; or BIOL 1110.

BIOL 2200 Biology: Concepts, Issues, and Values 3 (3) Develops a thorough knowledge of basic biological concepts and issues and explores how these can be incorporated into a system of human values affecting technology, society, and life.

BIOL 2220 Human Anatomy and Physiology 4 (4) Basic introductory course in integrated human anatomy and physiology covering cells and tissues; integumentary, skeletal, muscular, and nervous systems; sensory organs. Physiology is stressed. Structured for Nursing and other health-related curricula. Preq: BIOL 1030 and BIOL 1050; or BIOL 1100; and CH 1010 or CH 1050. Coreq: BIOL 2221.

BIOL 2221 Human Anatomy and Physiology I Laboratory 0 (2) Non-credit laboratory to accompany BIOL 2220. Coreq: BIOL 2220.


BIOL 2231 Human Anatomy and Physiology II Laboratory 0 (2) Non-credit laboratory to accompany BIOL 2230. Coreq: BIOL 2230.

BIOL 2300 Emergency Medical Responder 3 (3) Students are prepared to provide emergency pre-hospital assessment and care for patients with a variety of medical conditions and traumatic injuries. Study areas include introduction to emergency medical services systems, EMT roles and responsibilities, anatomy and physiology, medical emergencies, trauma, and working in the pre-hospital setting. Preq: BIOL 1030 and BIOL 1040, and BIOL 1050 and BIOL 1060; or BIOL 1100 and BIOL 1110.

BIOL 3010 Insect Biology and Diversity 4 (3) Introduction to the study of insects, with emphasis on their structure, function, ecology, and behavior. Identification of commonly encountered species is highlighted. Relationships between insect and human populations are discussed. Control technologies are introduced, with emphasis on environmentally responsible tactics. Offered fall semester only. Coreq: BIOL 3011.

BIOL 3011 Insect Biology and Diversity Laboratory 0 (3) Non-credit laboratory to accompany BIOL 3010. Coreq: BIOL 3010.

BIOL 3020 Invertebrate Biology 3 (3) In-depth survey and comparison of free-living invertebrate animals emphasizing functional anatomy, development, and evolutionary relationships. Includes Honors sections. Preq: BIOL 1040 and BIOL 1060; or BIOL 1110. Preq or concurrent enrollment: BIOL 3060.

BIOL 3030 Vertebrate Biology 3 (3) Comprehensive survey of vertebrate animals, including their taxonomy, morphology, evolution, and selected aspects of the natural history and behavior. Includes Honors sections. Preq: BIOL 1040 and BIOL 1060; or BIOL 1110.

BIOL 3040 Biology of Plants 3 (3) Survey of the major groups of plants, their biology, diversity, and evolution. Includes Honors sections. Preq: BIOL 1040 and BIOL1060; or BIOL 1110. Preq or concurrent enrollment: BIOL 3060.

BIOL 3060 Invertebrate Biology Laboratory 1 (3) Survey and comparison of the biology of living invertebrates, examples of which are drawn primarily from the southeastern coast of the United States. Preq: Introductory two-semester biology sequence with laboratory. Preq or concurrent enrollment: BIOL 3020.

BIOL 3070 Vertebrate Biology Laboratory 1 (3) Comparative and phylogenetic study of the gross morphology of vertebrates. Preq or concurrent enrollment: BIOL 3030.

BIOL 3350 Evolutionary Biology 3 (3) Introduction to basic concepts and underlying principles of modern evolutionary biology. Topics include a historical overview of evolutionary theories, elementary population genetics, principles of adaptation, speciation, systematics and phylogenetic inference, fossil record, biogeography, molecular evolution, and human evolution. Preq: GEN 3000 or GEN 3020.

BIOL (PES) 3400 Medical Botany 3 (3) Study of use of compounds of plant and fungal origin as poisons, hallucinogens, and pharmaceuticals. May also be offered as PES 3400. Preq: BIOL 1040 and BIOL 1060 and CH 1020.

BIOL (ANTH) 3510 Biological Anthropology 3 (3) Study of humans as biological organisms. Examines human evolution, primate social behavior, human physiological variations and disease resistance, and human skeletal anatomy and forensics. May also be offered as ANTH 3510. Preq: ANTH 2010 or BIOL 1100.
BIOL (ANTH) 3530 Forensic Anthropology
3 (3) Introduction to forensic anthropology, the science that utilizes methods from skeletal biology and archaeology as tools in human identification in a medico-legal context. May also be offered as ANTH 3530. Prereq: Junior standing.

BIOL 3940 Selected Topics in Creative Inquiry I
3 (3) Disciplinary and multidisciplinary group research projects develop the student’s ability to discover, analyze, and evaluate data. Students are required to document their research activities in their portfolios. May be repeated for a maximum of six credits. Honors students must take at least six credits over a two-semester period with the same research advisor and write an honors thesis. These credits may include BIOL 3940, BIOL 4940 or both. Includes Honors sections. Prerequisite: Consent of instructor. Coreq: BIOL 3941.

BIOL 3941 Selected Topics in Creative Inquiry I
0 (6) Non-credit laboratory to accompany BIOL 3940. Coreq: BIOL 3940.

BIOL (ENT) 4000* Insect Morphology
4 (3) Study of insect structure in relation to function and of the variation of form in insects. Includes Honors sections. May also be offered as ENT 4000. Prereq: ENT 3010. Coreq: BIOL 4001.

BIOL (ENT) 4001* Insect Morphology Laboratory
0 (3) Non-credit laboratory to accompany BIOL 4000. May also be offered as ENT 4001. Coreq: BIOL 4000.

BIOL 4000* Plant Physiology
3 (3) Relations and processes pertaining to maintenance, growth, and reproduction of plants, including absorption of matter and energy, water relations of the plant, utilization of reserve products and liberation of energy. Includes Honors sections. Prereq: BIOL 1040 and BIOL 1060, or BIOL 1110; and CH 1020. Prereq or concurrent enrollment: BIOL 4020.

BIOL 4020* Plant Physiology Laboratory
1 (3) Laboratory exercises and experiments designed to indicate the relations and processes which pertain to maintenance, growth, and reproduction of plants, including absorption of matter and energy, water relations of the plant, utilization of reserve products, and liberation of energy. Prereq or concurrent enrollment: BIOL 4010.

BIOL 4030* Introduction to Applied Genomics
3 (3) Emphasizes the practical application of bioinformatic/genomic skills to solve biological problems. The course includes an introduction to the Linux operating system, the bash command line environment, principles of next-generation sequencing, genome assembly, gene prediction, annotation, databases, gene/genome clustering, recombinant detection, phylogenetics, transcriptomics, and metagenomics. Prereq: GEN 3000 or GEN 3020 or MCR 4150.

BIOL (GEN) 4050* Molecular Genetics of Eukaryotes
3 (3) Molecular genetic analyses of eukaryotes in relation to mutations and repair, complex phenotypes, biochemical pathways, short- and long-term regulation of gene expression, and evolution. May also be offered as GEN 4050. Prereq: one of the following combinations: BCHM 3010 or BCHM 3050, or GEN 3000 and GEN 3020.

BIOL 4060* Introductory Plant Taxonomy
3 (3) Introduction to the basic principles and concepts of plant systematics with emphasis on the plants of South Carolina. Includes Honors sections. Prereq: BIOL 1040 and BIOL 1060, or BIOL 1110. Coreq: BIOL 4070.

BIOL 4070* Plant Taxonomy Laboratory
1 (3) Introduction to basic techniques of plant taxonomy with laboratory and field emphasis on the flora of South Carolina. Coreq: BIOL 4060.

BIOL 4080* Comparative Vertebrate Morphology
3 (3) Phylogeny and diversity of vertebrates and study of their comparative morphology, leading to an understanding of the relationships and functioning of living organisms. Includes Honors sections. Prereq: BIOL 1040 and BIOL 1060, or BIOL 1110. Coreq: BIOL 4090.

BIOL 4090* Comparative Vertebrate Morphology Laboratory
2 (5) Comparative anatomy of representative vertebrates; methods used in preparing specimens for study and display. Includes Honors sections. Coreq: BIOL 4080.

BIOL 4100* Limnology
3 (3) Detailed introduction to the physical, chemical, and biological interrelationships that characterize inland water environments. A fundamental approach to the interactions of components of the environment is developed at a theoretical level. Prereq: BIOL 1040 and BIOL 1060, or BIOL 1110.

BIOL 4110* Limnological Analyses
2 (1) Examines a broad range of topics covered with both standing and running fresh waters. About one-third of the laboratory exercises address the major physical components of lakes and streams. The remainder provides rationale and methods for quantitative analyses of biota, as well as some integrated analyses of whole ecosystems. Includes Honors sections. Prereq or concurrent enrollment: BIOL 4100 or BIOL 4430. Coreq: BIOL 4110.

BIOL 4111* Limnological Analyses Laboratory
0 (2) Non-credit laboratory to accompany BIOL 4110. Coreq: BIOL 4110.

BIOL (ENT) 4130* Restoration Ecology
3 (3) Applies ecological principles to the restoration of disturbed terrestrial, wetland, and aquatic ecosystems. Includes the restoration of soils and waterways, of flora and fauna, and of natural ecological processes such as plant succession and nutrient cycling. May also be offered as ENR 4130. Prereq: BIOL (WFB) 3130 or BIOL 4410.

BIOL (AVS, MCR) 4240 Immunology Laboratory
2 (3) This course is designed to apply the knowledge gained in MICR 4140, Immunology lecture, in an applied setting. The experiments in this beginning immunology laboratory are designed to study both the innate and acquired immune systems. Experimentation into the formation, function and detection of antibodies provides students with skills in basic immunologic techniques. May also be offered as AVS 4240 or MCR 4240. Prereq or concurrent enrollment: MICR 4140.

BIOL (PLPA) 4250* Introductory Mycology
3 (3) Introduction to the biology of all the groups of fungi and some related organisms, with considerations of the taxonomy, morphology, development, physiology, and ecology of representative forms. May also be offered as PLPA 4250. Prereq: BIOL 1040 and BIOL 1060; or BIOL 1110. Prereq or concurrent enrollment: BIOL 4260 or PLPA 4260.

BIOL (PLPA) 4260* Mycology Practicum
2 (1) Application of the principles of mycological techniques, microscopic study of fungi. Examples from all major groups of fungi are included. May also be offered as PLPA 4260. Prereq or concurrent enrollment: BIOL 4250 or PLPA 4250. Coreq: BIOL 4261.

BIOL (PLPA) 4261* Mycology Practicum Laboratory
0 (2) Non-credit laboratory to accompany BIOL 4260. May also be offered as PLPA 4261. Coreq: BIOL 4260.

BIOL 4280* Quantitative Biology
4 (3) Applies quantitative methods to a wide range of biological problems. Main focus is on building modeling skills using population, physiological, genetic, and evolutionary problems. Also includes a review of statistical principles and introduces basic bioinformatics techniques. Prereq: BIOL 1040 and BIOL1060; or BIOL 1110; and MATH 1080 or MATH 1110. Coreq: BIOL 4281.

BIOL 4281* Quantitative Biology Laboratory
0 (3) Non-credit laboratory to accompany BIOL 4280. Coreq: BIOL 4280.

BIOL 4320* Animal Histology
3 (3) Structural and functional study of the basic tissues of animals and tissue makeup of organs. Emphasizes light microscopy level with selected tissue studied at the electron microscope level. Includes Honors sections. Prereq: BIOL 1040 and BIOL 1060; or BIOL 1110. Coreq: BIOL 4330.
BIOL 4330* Animal Histology Laboratory 2 (1) Microscopic examination of basic animal tissue types and the tissue makeup of organs which comprise systems. Includes Honors sections. Coreq: BIOL 4320 and BIOL 4331.

BIOL 4331* Animal Histology Laboratory 0 (2) Non-credit laboratory to accompany BIOL 4330. Coreq: BIOL 4330.

BIOL 4340 Biological Chemistry Laboratory Techniques 2 (1) Theory and application of some of the routine tools and techniques used in biological chemistry. Lectures introduce laboratory theory and provide additional laboratory instructions; discuss results; and conduct student evaluations. Laboratory periods are used to conduct each activity. Preq or concurrent enrollment: BCHM 3010 or BCHM 3050. Coreq: BIOL 4341.

BIOL 4341 Biological Chemistry Laboratory Techniques Laboratory 0 (3) Non-credit laboratory to accompany BIOL 4340. Coreq: BIOL 4340.

BIOL (ENT) 4360* Insect Behavior 3 (2) Fundamentals of insect behavior in an evolutionary and ecological perspective. Laboratory emphasizes generation and testing of hypotheses and observation, description, and quantification of insect behavior. May also be offered as ENT 4360. Preq: ENT 3010. Coreq: BIOL 4361.

BIOL (ENT) 4361* Insect Behavior Laboratory 0 (3) Non-credit laboratory to accompany BIOL 4360. May also be offered as ENT 4361. Coreq: BIOL 4360.

BIOL 4400* Developmental Animal Biology 3 (3) Events and mechanisms responsible for the development of multicellular animals. Gametogenesis, fertilization, embryonic development, cellular differentiation, morphogenesis, larval forms and metamorphosis, sexual reproduction, regeneration, malignancy, and aging are analyzed in terms of fundamental concepts and control processes. Includes Honors sections. Preq: BCHM 3010 or 3050.

BIOL 4410* Ecology Laboratory (Lecture Portion) 2 (1) Modern and classical approaches to the study of ecological problems discussed in BIOL 4410. Students are introduced to field, laboratory and computer-based analyses of plant and animal populations and communities. Includes Honors sections. Preq or concurrent enrollment: BIOL 4410. Coreq: BIOL 4451.

BIOL 4451 Ecology Laboratory 0 (2) Non-credit laboratory to accompany BIOL 4450. Coreq: BIOL 4450.

BIOL 4460* Plant Ecology 3 (3) Ecology of plants in relation to their biotic and abiotic environments. Individual organisms, populations, and communities are considered with an emphasis on seed plants in terrestrial environments. Includes Honors sections. Preq: BIOL 1040 and BIOL 1060; or BIOL 1110.

BIOL 4470* Plant Ecology Laboratory (Lecture Portion) 2 (1) Experimental and observational approach to addressing principles discussed in BIOL 4460. Students are introduced to field and laboratory methods involving individual organisms, populations, and communities. Includes Honors sections. Preq or concurrent enrollment: BIOL 4460. Coreq: BIOL 4471.

BIOL 4471* Plant Ecology Laboratory 0 (2) Non-credit laboratory to accompany BIOL 4470. Coreq: BIOL 4470.

BIOL 4500* Developmental Biology Laboratory (Lecture Portion) 2 (1) Examines a broad range of topics concerned with the development of multicellular animals such as gametogenesis, fertilization, embryonic development, cell differentiation, morphogenesis, larval metamorphosis, and regeneration. Laboratory exercises provide the rationale and methods for the descriptive and experimental analysis of development in representative invertebrates and vertebrates. Includes Honors sections. Preq or concurrent enrollment: BIOL 4400. Coreq: BIOL 4501.

BIOL 4501* Developmental Biology Laboratory 0 (2) Non-credit laboratory to accompany BIOL 4500. Coreq: BIOL 4500.

BIOL (ANTH) 4510 Biological Variation in Human Populations 3 (3) Provides an in-depth discussion of the most influential topics in human skeletal biology. Course explores the history and ethical implications of the field, and examines how biological anthropologists use skeletons to reconstruct patterns of diet, disease, demography and physical activity in human populations. May be offered as ANTH 4510. Preq: ANTH 2010.

BIOL (PLPA) 4540* Plant Virology 4 (3) Study of plant viruses: their morphology, biochemistry, purification, and transmission; symptoms resulting from virus infection; virus vector relationships. Serological and nucleic acid hybridization procedures. Diagnosis of viral diseases and the identification of causal agents. Replication of plant viruses, the interaction between viral host and plant genome. Control of plant viral diseases. May also be offered as PLPA 4540. Preq: BCHM 3010 or BCHM 3050 or MICR 3050. Coreq: BIOL 4541.

BIOL (PLPA) 4541* Plant Virology Laboratory 0 (3) Non-credit laboratory to accompany BIOL 4540. May also be offered as PLPA 4541. Coreq: BIOL 4540.

BIOL (MICR) 4560* Medical and Veterinary Parasitology 3 (3) Introduction to parasitism in the animal kingdom. Emphasizes basic and applied principles related to economically and medically important diseases. Classical and experimental approaches to the study of parasitism are examined in reference to protozoa, helminths, and arthropods. Includes Honors sections. May also be offered as MICR 4560. Preq: BIOL 1040 and BIOL 1060; or BIOL 1110. Coreq: BIOL 4570.

BIOL (MICR) 4570* Medical and Veterinary Parasitology Laboratory (Lecture Portion) 2 (1) Laboratory to reinforce material presented in BIOL 4560. Introduces students to both live and preserved human/animal parasites. Also introduces techniques used in collection, preservation, and examination of animal parasites. Includes Honors sections. May also be offered as MICR 4570. Coreq: BIOL 4560 and BIOL 4571.

BIOL 4571* Medical and Veterinary Parasitology Laboratory 0 (2) Non-credit laboratory to accompany BIOL 4570. Coreq: BIOL 4570.

BIOL 4580* Cell Physiology 3 (3) Study of the chemical and physical principles of cell function emphasizing bioenergetics and membrane phenomena. Includes Honors sections. Preq: BCHM 3010 or BCHM 3050.

BIOL 4590* Systems Physiology 3 (3) Physiological systems of vertebrates and their homeostatic controls. Describes the function of the major physiological systems in terms of anatomical structure and chemical and physical principles. Includes Honors sections. Preq: [BIOL 1040 and BIOL 1060; or BIOL 1110]; and [CH 1020; or PHYS 2080 and PHYS 2100; or PHYS 2210 and PHYS 2230.]

BIOL 4600* Systems Physiology Laboratory (Lecture Portion) 2 (1) Modern and classical experimental methods are used to demonstrate fundamental physiological principles discussed in BIOL 4590. Students are introduced to computer-aided data acquisition and computer simulations of physiological function. Preq or concurrent enrollment: BIOL 4590. Coreq: BIOL 4601.

BIOL 4601* Systems Physiology Laboratory 0 (2) Non-credit laboratory to accompany BIOL 4600. Coreq: BIOL 4600.

BIOL 4610* Cell Biology 3 (3) In-depth analysis of how and where intracellular and extracellular molecules control general and specific cellular functions such as gene expression, secretion, motility, signaling, cell-cycle control and differentiation. Taught and graded at a level where students are expected to infer from and integrate cellular events. Includes Honors sections. Preq: BCHM 3010 or BCHM 3050.

BIOL 4620* Cell Biology Laboratory (Lecture Portion) 2 (1) Laboratory to accompany BIOL 4610. Focuses on molecular and microscopic analysis of eukaryotic cells. Preq or concurrent enrollment: BIOL 4610. Coreq: BIOL 4621.

BIOL 4621* Cell Biology Laboratory 0 (2) Non-credit laboratory to accompany BIOL 4620. Coreq: BIOL 4620.

BIOL 4641* Mammalogy Laboratory 0 (3) Non-credit laboratory to accompany BIOL 4640. Coreq: BIOL 4640.

BIOL (ANTH) 4660* Evolution of Human Behavior 3 (3) Familiarizes students with the evolutionary basis of human behavior. Examines topics such as altruism, cooperation, mating systems, parental investment, and social systems using diverse examples, from hunter-gatherer to technological societies. May also be offered as ANTH 4660. Prq: ANTH 3510 or BIOL 3350 or BIOL 4700 or PSYC 2010.

BIOL 4670 Principles of Hematology 3 (3) Basic hemato logical principles as they relate to normal blood cell production, as well as in abnormal conditions that result in diseases of the hematological system. Clinical practice, ethics and controversies in hematology are discussed. Prq: BIOL 1040 and BIOL 1060; or BIOL 1110.

BIOL (WFB) 4680* Herpetology 4 (3) Physiology, functional morphology, ecology, evolution, biomechanics and current literature of amphibians and reptiles. Laboratory study examines morphology and identification of world families and United States genera, as well as southeastern species. Field trips are required. May also be offered as WFB 4680. Prq: BIOL 1040 and BIOL 1060; or BIOL 1110. Coreq: BIOL 4681.

BIOL (WFB) 4681* Herpetology Laboratory 0 (3) Non-credit laboratory to accompany BIOL 4680. May also be offered as WFB 4681. Coreq: BIOL 4680.

BIOL (ENT, WFB) 4690* Aquatic Insects 3 (1) Identification, life history, habitats, and interrelationships of aquatic insects; techniques of qualitative field collecting; important literature and research workers. Includes Honors sections. May also be offered as ENT 4690 or WFB 4690. Prq: ENT 3010. Coreq: BIOL 4691.

BIOL (ENT, WFB) 4691* Aquatic Insects Laboratory 0 (6) Non-credit laboratory to accompany BIOL 4690. May also be offered as ENT 4691 or WFB 4691. Coreq: BIOL 4690.

BIOL 4700* Behavioral Ecology 3 (3) Historical and modern developments in animal behavior emphasizing the evolutionary and ecological determinants of behavior. A synthesis of ethology and comparative psychology. Includes Honors sections. Prq: BIOL 1040 and BIOL 1060; or BIOL 1110.

BIOL 4710* Behavioral Ecology Laboratory (Lecture Portion) 2 (1) Laboratory exercises that explore the behavior of animals. Emphasizes behavioral observation and analysis and presentation of findings in a report format. Includes a semester-long independent research project. Prq or concurrent enrollment: BIOL 4700. Coreq: BIOL 4701.

BIOL 4711* Behavioral Ecology Laboratory 0 (2) Non-credit laboratory to accompany BIOL 4710. Coreq: BIOL 4710.

BIOL 4720* Ornithology 4 (3) Biology of birds: their origin and diversification, adaptations, phylogeny, classification, structure and function, behavior, ecology, and biogeography. Field identification is emphasized, and field trips are required. Prq: BIOL 1040 and BIOL 1060; or BIOL 1110. Coreq: BIOL 4721.

BIOL 4721* Ornithology Laboratory 0 (3) Non-credit laboratory to accompany BIOL 4720. Coreq: BIOL 4720.

BIOL 4730* History of Modern Biology 3 (3) Examines the intellectual and social factors defining the study of life from the scientific revolution of the 1600’s to the modern biological sciences. Investigates the historical origins of biological disciplines and explores the differing cultures, methodologies, and philosophical commitments of these communities. Prq: BIOL 1040 and BIOL 1060; or BIOL 1110.

BIOL (ANTH) 4740* Primatology 4 (3) Biology of nonhuman primates, including their evolution, taxonomy, physiology, life history, behavioral ecology and conservation. Three field trips are required, during which students conduct behavioral observations and later analyze their data and present it in report format. May also be offered as ANTH 4740. Prq: ANTH 3510; and either BIOL 1110 or both BIOL 1040 and BIOL 1060. Coreq: BIOL 4741.

BIOL (ANTH) 4741* Primatology Laboratory 0 (3) Noncredit laboratory to accompany BIOL 4740. May also be offered as ANTH 4741. Coreq: BIOL 4740.

BIOL 4750* Comparative Physiology 3 (3) Physiological systems of invertebrates and vertebrates emphasizing environmental adaptation. Physiological principles as they relate to metabolism, thermoregulation, osmoregulation, respiration, and neural and integrative physiology. Includes Honors sections. Prq: CH 1020; and either BIOL 1110 or both BIOL 1040 and BIOL 1060.

BIOL 4760* Comparative Physiology Laboratory (Lecture Portion) 2 (1) Modern classical experimental methods are used to demonstrate fundamental physiological principles discussed in BIOL 4750. Introduces students to computer-aided data acquisition and manipulation as well as computer simulations of physiological function. Includes Honors sections. Prq or concurrent enrollment: BIOL 4750. Coreq: BIOL 4761.

BIOL 4761* Comparative Physiology Laboratory 0 (2) Non-credit laboratory to accompany BIOL 4760. Coreq: BIOL 4760.

BIOL 4770* Ichthyology 3 (2) Systematics, life history, distribution, ecology, and current literature of fish. Laboratory study of morphology and identification of U.S. genera, as well as all southeastern species. Field trips are required. Prq: BIOL 1040 and BIOL 1060; or BIOL 1110. Coreq: BIOL 4771.

BIOL 4771* Ichthyology Laboratory 0 (3) Non-credit laboratory to accompany BIOL 4770. Coreq: BIOL 4770.

BIOL 4780 Exercise Physiology 3 (3) Introduction to the physiology of exercise. Focuses on the function and adaptations of body systems in response to exercise. Structured primarily for students interested in Prehabilitation Sciences. Prq: BIOL 2220 and BIOL 2230; or BIOL 3150 and BIOL 3160.

BIOL 4790 Kinesiology 3 (3) Introduction to the study of human movement. Focuses on the application of biomechanical and motor control principles to human motion, including daily living, sport, and work activities. Structured primarily for students interested in Prehabilitation Sciences. Prq: BIOL 2220 or BIOL 3150.

BIOL (AVS) 4800* Vertebrate Endocrinology 3 (3) Introduction to the basic principles of neuro-endocrine integration and homeostatic maintenance in vertebrates. Comparative morphology and physiology of various endocrine tissues and hormone chemistry and modes of action are considered. May also be offered as AVS 4800. Prq: BCHM 3030 or BCHM 3050.

BIOL (EDSC) 4820* Laboratory Techniques for Teaching Science 3 (1) Focuses on basic lab skills needed to plan, prepare, and conduct inquiry-based laboratories and to familiarize pre-service teachers with a variety of scientific equipment and their methodologies. Topics include ways to integrate technology into the classroom, lab safety, and the development of inquiry-based classroom activities. May also be offered as EDSC 4820. Prq: BIOL 1040 and BIOL 1060; or BIOL 1110. Coreq: BIOL 4821.

BIOL (EDSC) 4821* Laboratory Techniques for Teaching Science 0 (6) Non-credit laboratory to accompany BIOL 4820. May also be offered as EDSC 4821. Coreq: BIOL 4820.

BIOL 4830* Stem Cell Biology 3 (3) Stem cells are the focus of intense interest because of their utility for treating human diseases. This course provides a broad treatment of the biology of stem cells and assesses their current therapeutic capacity in clinical medicine. Prq: BIOL 4610.

BIOL 4840* Human and Comparative Vertebrate Embryology 3 (3) Study of human and comparative embryology with an introduction to related clinical correlations. Students develop an understanding of normal and abnormal human and comparative vertebrate embryonic development. Includes Honors sections. Prq: BIOL 1040 and BIOL 1060; or BIOL 1110.

BIOL 4860 Natural History 3 (3) Interdisciplinary examination, through readings and critical discussion, of concepts of nature and biodiversity in relation to human endeavors. Course seeks to achieve a balanced perspective from which to seek compromises between conflicting views of nature. Prq: BIOL 1040 and BIOL 1060; or BIOL 1110.

BIOL 4870* Electron and Optical Microscopy Theory 3 (2) Offers a theoretical and practical introduction to light and electron microscopy. Topics include Koehler illumination, polarization, interference, phase contrast, DIC, epifluorescence, laser scanning light microscopy, SEM, TEM, EDS, ultramicrotomy, tomography, and digital imaging. Prq: Consent of instructor. Coreq: BIOL 4871.

BIOL 4871* Electron and Optical Microscopy Laboratory 0 (2) Non-credit laboratory to accompany BIOL 4870. Coreq: BIOL 4870.

BIOL 4890 Clinical Applications and Medical Practice 3 (2) Explores the various fields, specialties, and subspecialties in medicine. Provides students with the opportunity to shadow physicians in a hospital and/or office setting and to discuss current issues and advances in medicine with practicing physicians and other health care professionals. Prq: Consent of instructor. Coreq: BIOL 4891.

BIOL 4891 Clinical Applications and Medical Practice Laboratory 0 (2) Non-credit laboratory to accompany BIOL 4890. Coreq: BIOL 4890.
BIOL 4910 Undergraduate Research in Biological Sciences 1-4 (1-6) Mentored research problems introduce undergraduate students to the planning and execution of research and the presentation of research findings. May be repeated for a maximum of eight credits. Honors students must take at least six credits under a single research advisor over two semesters and must write an honors thesis. Includes Honors sections. Preq: Consent of instructor.

BIOL 4920 Internship in Biological Sciences 0-4 (3-12) Preplanned internship at an advisor-approved facility to give students learning opportunities beyond their classroom experiences. Students submit a Student Internship Contract and a study plan before the internship and a comprehensive report within one week of the end of the internship. May be repeated for a maximum of six credits. To be taken Pass/Fail only. Preq: Consent of instructor.

BIOL 4930 Senior Seminar 2 (2) Capstone course engaging students in analysis and discussion of publications from the technical and non-technical literature in biological sciences and from current topics of biology appearing in other media. Students complete their undergraduate on-line digital portfolios. Emphasis is placed on ethical issues that arise as a result of biological research. Preq: Senior standing; COMM 1500 or COMM 2500 or ENGL 3140 or ENGL 3150.

BIOL (MICR) 4940 Selected Topics in Creative Inquiry II 2-3 (1) Disciplinary and multidisciplinary group research projects with the goal of developing the students' ability to discover, analyze, and evaluate data. Students are required to document their research activities in their portfolios. May be repeated for a maximum of six credits. Honors students must take at least six credits over a two-semester period with the same research advisor and write an honors thesis. These credits may include BIOL 3940, BIOL 4940 or both. Includes Honors sections. May also be offered as MICR 4940. Preq: Consent of instructor. Coreq: BIOL 4941.

BIOL (MICR) 4941 Selected Topics in Creative Inquiry II Laboratory 0-3 (0-6) Non-credit laboratory to accompany BIOL 4940. May also be offered as MICR 4941. Coreq: BIOL 4940.

BIOL 4950 Service Learning in Biology 2-4 (1-2) Combines service and academic learning while helping pre-college or college students learn about the fundamental aspects of science. Provides lecture and laboratory experiences as students learn to prepare and participate in supervised laboratory teaching for pre-college or college students. May be repeated for a maximum of six credits. Preq: Consent of instructor. Coreq: BIOL 4951.

BIOL 4951 Service Learning in Biology Laboratory 0 (3-9) Non-credit laboratory to accompany BIOL 4950. Coreq: BIOL 4950.

BIOL 4960 Selected Topics 1-4 (1-4) Lecture coverage of selected topics in cellular and developmental biology, ecology, behavior, evolutionary biology, molecular biology, physiology, systematics, and other topics in the biological sciences. May be repeated for a maximum of nine credits, but only if different topics are covered. Preq: Consent of instructor.

BIOL 4970 Special Topics Laboratory 1-3 (2-9) Specialized laboratory experiences in cellular and developmental biology, ecology, behavior, evolutionary biology, molecular biology, physiology, systematics, and other topics of interest in the biological sciences. May be repeated for a maximum of nine credits, but only if different topics are covered. Preq: Consent of instructor.

BIOMOLECULAR ENGINEERING

BMOL 4030* Biotransport Phenomena 3 (3) Analysis of single and multidimensional steady-state and transient problems in momentum, mass, and energy transfer in biological systems. Mathematical similarities and differences in these mechanisms are stressed, and mathematical descriptions of physiological and engineering systems are formulated. Preq: CHE 3300 and MATH 2080.

BMOL 4230* Bioseparations 3 (3) Study of principal methods of separation and purification of bioproducts, such as proteins, amino acids, and pharmaceuticals. Topics include analytical bioseparations, membrane separations, sedimentation, cell disruption, extraction, adsorption, chromatography, precipitation, crystallization, and drying. Preq: CHE 3300; and BCHM 3010 or BCHM 3050 or BCHM 4230.

BMOL 4250* Biomolecular Engineering 3 (3) Introduction to basic principles of biomolecular engineering: the purposeful manipulation of biological molecules and processes applied to problems and issues in the life sciences, biotechnology, and medicine. Topics include carbohydrates, proteins, nucleic acids, and lipids with emphasis on their biochemical pathways, amino acid sequences, and interactions between macromolecules in vivo. Preq: CHE 2300 and CHE 3190.

BMOL 4260* Biosensors and Bioelectronic Devices 3 (3) Development of methodologies used to design, fabricate, and apply biosensors and bioelectronic devices for the environmental, medical, and chemical industries. Application of the fundamentals of measurement science to optical, electrochemical, mass, and thermal means of signal transduction. Use of the fundamentals of surface science to interpret bio-immobilization and biomolecular-surface interactions. Preq: CHE 3300; and BCHM 3010 or BCHM 3050.

BMOL 4270* Membranes for Biotechnology and Biomedicine 3 (3) Students learn principles of membrane science and technology and study membrane applications in the biotechnology and biomedical industries. Advanced topics include surface modification of membranes, synthesis of porous membranes for biomedical applications such as tissue engineering, environmentally responsive membranes, and membrane-based biomedical devices. Preq: CHE 3300.

BUSINESS

Professor: M.A. McKnew; Senior Lecturers: E.B. De Iulio, S. Edge, J.G. Gaubert; Lecturers: R.A. Lucas, W.E. Tumblin

BUS 1010 Business Foundations 1 (1) Introduction to a variety of topics critical to student success, including an overview of Clemson business degrees, on-campus resources available to ensure success, academic advising, business ethics, internships, co-ops, study abroad programs, student organizations, ePortfolios, and Clemson history.

BUS 2910 Honors Seminar in International Business 1 (1) Introduction to the International Business Honors Program presented through a discussion of thesis expectations, study abroad experiences, and seminars given by returning senior International Business Honors students. To be taken Pass/No Pass only. Preq: Membership in Calhoun Honors College.

BUS 2990 Creative Inquiry—Business 1-4 (1-4) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of four credits.

BUS 3910 International Business Honors Thesis Research 1 (1) Students work with a Clemson advisor and an international advisor to develop a research topic for the senior thesis. Students work and conduct research while participating in an approved study abroad. To be taken Pass/No Pass only. Preq: BUS 2910.