BIOLOGY

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The biological sciences are rapidly expanding our understanding of the natural world, from the inner workings of cancer cells to the evolution of the human genome to the role that the oceans play in controlling the composition of the atmosphere. The faculty of the Biology Department seeks to share the excitement of these discoveries with students. Our goal is to educate students in biology to prepare for graduate school or for professions including those in education or allied health professions, as well as to become life-long learners and well-informed citizens.

The students and faculty of the Biology Department are a community of learners, using inquiry-based methods to investigate the breadth of biology, its connection to other disciplines, and its relevance to individuals and to society.

The department offers a popular major and minor, supports students in the Nursing, Biochemistry, Exercise and Health Science, and Nutrition majors, and provides courses that fulfill Integrations Curriculum requirements. Our major and minor introduce students to the breadth of biological studies while enabling them to focus on areas of particular interest for further study. Our courses feature bench and/or field labs allowing students to engage in the process of scientific investigation first-hand. We occupy two buildings furnished with extensive laboratory equipment including transmission and scanning electron microscopes, NanoDrop UV spectrophotometers, a flow cytometer, a DNA sequencer, high-speed refrigerated centrifuges, mammalian cell-culture facilities, an animal-care suite, walk-in environmental, metabolic, and cold chambers, and bright-field, dark-field, fluorescence, and inverted microscopes fitted with video and digital cameras. Extensive collections of plants, birds, and mammals help to acquaint students with the flora and fauna of central Minnesota. The rural setting of the two campuses is ideal for field studies, providing easy access to a variety of natural habitats including prairie, oak savanna, wetlands, coniferous and deciduous forests, ponds, and several lakes. The Melancon greenhouse, the Bailey Herbarium, the Saint John's Abbey Arboretum, and the SJU maple-sugar bush and sugar shack all provide excellent facilities for ecological and field research.

Assessment

The Biology Department has adopted a multifaceted approach to assessing the effectiveness of its curriculum. In addition to standard measures, such as monitoring performance on tests, the Biology Department requires the following:

1. Every student in an introductory course takes a post-test of basic information that they would be expected to gain from taking the course.
2. Seniors take a comprehensive exam during their last semester (BIOL XXX).
3. Students enrolled in an upper division biology course during their last semester take the "Annual Biology Department Assessment Survey".
4. The department surveys alumni at five-year intervals.

Majors

- Biology Major (https://catalog.csbsju.edu/catalog/academic-departments/biology/biology-major/)
- Biology Major - Secondary Education (https://catalog.csbsju.edu/catalog/academic-departments/biology/biology-major-secondary-education/)

Minors

- Biology Minor (https://catalog.csbsju.edu/catalog/academic-departments/biology/biology-minor/)

BIOL 100 Principles of Biology 1: Fundamentals of Living Things (4 Credits)
This course is about organisms at the cellular level – the structure of cells, how cells acquire energy and materials, and how they transform energy and materials to meet needs; as well, it introduces students to adaptive evolution. Topics include cells and their parts, major types of biological molecules, photosynthesis, the transfer of energy and organic carbon from one organism to another, cell division, the replication of DNA, how DNA is used to make proteins, and evolution, natural selection, and adaptation.
Prerequisites: None
Corequisites: BIOL 100L
Equivalent courses: BIOL 100Z, BIOL 101, BIOL 101Z
Attributes: Natural World (NW), Quantitative Reasoning (QR), Thematic Encounter1/2 - Truth

BIOL 100L BIOL 100 Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 100
Equivalent courses: BIOL 101L

BIOL 106 Plants and Humans (4 Credits)
An introduction to plant science featuring horticultural techniques and plants that have impacted society. Intended for non-majors. Lecture and laboratory.
Prerequisites: None

BIOL 107 Field Biology (4 Credits)
An introduction to the natural history of plants and animals with an emphasis on the ecosystems of Central Minnesota. The laboratory is field-oriented, concentrating on developing an understanding of basic ecological interactions. Intended for non-majors. Lecture and laboratory.
Prerequisites: None

BIOL 108 Microbes and Human Affairs (4 Credits)
An examination of the role microorganisms play in various aspects of human affairs. Consideration will be given to both the beneficial activities and the harmful effects of microbes. The laboratory emphasizes the morphological diversity and physiological activities of microorganisms. Intended for non-majors. Lecture and laboratory.
Prerequisites: None

BIOL 109 Environmental Science (4 Credits)
A survey of the scientific basis of human interactions with nature. Topics include global environmental problems, analysis of local and regional issues, population biology and conservation of ecological systems. Intended for non-majors. Lecture and laboratory.
Prerequisites: None

BIOL 110 Life Science (4 Credits)
Exploration of fundamental principles and processes of biology through their application to biological topics of interest to the liberal arts student. The concepts and topics examined will help students to interpret and understand important scientific events affecting society. Intended for non-majors. Lecture and laboratory.
Prerequisites: None

BIOL 112 Human Biology (4 Credits)
Human biology is a non-majors course that will explore the biology, evolution, and interactions that exist between humans and their environment. Structural components and how these elements change to trigger diseases such as cancer will be explored. Lecture and laboratory.
Prerequisites: None

BIOL 180 Summer Courses (2 Credits)
Biology courses offered specifically during the summer term.
Prerequisites: None

BIOL 200 Principles of Biology 2: Biological Response to Challenge (4 Credits)
This course builds on the material covered in BIOL 100, with a focus on how organisms coordinate life processes to respond to challenge/change. Topics include communication and sensation, locomotion, internal transport, reproduction, evolution, and ecology. In labs, students will practice applying their understanding of biological concepts and the scientific method to develop a fact-based opinion on a societally relevant issue.
Prerequisites: BIOL 100, Learning Foundations(LF), Cultural and Social Difference: Identity (CI). CI course may be taken prior to or concurrently with Focus Course.
Corequisites: BIOL 200L
Equivalent courses: BIOL 115, BIOL 121, BIOL 201
Attributes: Natural World (NW), Thematic Focus - Truth

BIOL 200L BIOL 200 Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 200
Equivalent courses: BIOL 201L

BIOL 202 Evolution in Action (4 Credits)
This course builds on the material covered in BIOL 101 and 201 by examining evolutionary processes, and some of the tools used to understand these processes, in the context of important biological themes. Laboratories provide opportunities to investigate these topics while building on the skills acquired in BIOL 101 and 201.
Prerequisites: (BIOL 101 or BIOL 101Z or BIOL 100) and (BIOL 201 or BIOL 200 or BIOL 201Z) or (BIOL 121 or BIOL 121Z and BIOL 221 or BIOL 221Z)
Corequisites: BIOL 202L
Equivalent courses: BIOL 115, BIOL 116, BIOL 222, BIOL 222Z

BIOL 202L Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 202

BIOL 212 Microbiology (4 Credits)
Survey of microorganisms emphasizing those that cause disease. Topics include morphology and physiology of microorganisms, sterilization, disinfection, and specific diseases and their causative agents. Laboratory work emphasizes aseptic technique. Intended for pre-nursing students.
Prerequisites: BIOL 101 or BIOL 101Z or BIOL 100
Corequisites: BIOL 212L
Restrictions: Enrollment is limited to students with a major in Nursing.

BIOL 212L Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 212

BIOL 216 Human Physiology (4 Credits)
This course is specifically designed to introduce nutrition and dietetics students to basic principles of human physiology from cellular processes, to the workings of organ systems, to homeostasis. The course will use a case study, problem-based learning approach to teach basic physiology from applied examples that students will likely be exposed to in their future clinical practice.
Prerequisites: BIOL 101 or BIOL 101Z or BIOL 100
Equivalent courses: BIOL 214

BIOL 271 Individual Learning Project (1-4 Credits)
Supervised reading or research at the lower-division level. Permission of department chair required. Does not count toward major requirements. Not available to first-year students.
Prerequisites: None

BIOL 277A Plants and Society (4 Credits)
An introduction to plant sciences and their role in human society, with a focus on food security, conservation, climate change, and Ojibwe and Dakota plant sciences. Labs will explore using the scientific method to answer justice-related questions regarding plant cultivation and conservation. Intended for nonmajors.
Prerequisites: Learning Foundations(LF), Cultural and Social Difference: Identity (CI). CI course may be taken prior to or concurrently with Focus Course. BIOL 277A Lab must be taken at the same time as BIOL 277A.
Corequisites: BIOL 277AL
Attributes: Natural World (NW), Quantitative Reasoning (QR), Thematic Focus - Justice

BIOL 277AL Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 277A

BIOL 300 Protist Diversity (2 Credits)
Protists are eukaryotic organisms that are not plants, animals, or fungi. They include algae, protozoans, slime molds, and countless diverse microbes. Protists play many important ecological roles, such as human parasites, primary producers, beneficial mutualists, plant pathogens. As the ancestors of all other eukaryotes, they experimented with cell structure, sex, multicellularity, and complex life cycles. Special attention given to their morphology, evolution, ecology, and importance to humans. Spring
Prerequisites: (BIOL 100 or BIOL 100Z or BIOL 101 or BIOL 101Z) and (BIOL 200 or BIOL 201)
Corequisites: BIOL 300L

BIOL 300L Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 300

BIOL 302 Fungal Diversity (2 Credits)
A survey of the various groups of organisms belonging to the kingdom Fungi. These organisms are important decomposers, plant pathogens, human parasites, and as mutualist with plants and algae. Special attention is given to their morphology, phylogeny, ecology, and importance to humans. Laboratories include examination of living and prepared specimens as well as experimental work with fungi. Prerequisite: BIOL 202. Spring.
Prerequisites: (BIOL 100 or BIOL 100Z or BIOL 101 or BIOL 101Z) and (BIOL 200 or BIOL 201)
Corequisites: BIOL 302L

BIOL 302L Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 302

BIOL 304 The Evolution of Terrestrial Plants (2 Credits)
An overview of the evolution of the major groups of terrestrial plants from their green algal ancestors. We will follow the changes that took place as these organisms have become better adapted to living on dry land, from mosses to ferns, conifers, and flowering plants. Special attention is given to their morphology, phylogeny, ecology and importance to humans. Laboratories entail the examination of living and prepared specimens. Spring.
Prerequisites: (BIOL 100 or BIOL 100Z or BIOL 101 or BIOL 101Z) and (BIOL 200 or BIOL 201)
Corequisites: BIOL 304L

BIOL 304L Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 304

BIOL 305 Invertebrate Zoology (4 Credits)
Classification, evolution, structure, life cycles and ecology of representative invertebrate animals. Laboratories include a study of representative species from major taxa. Spring.
Prerequisites: BIOL 201 or BIOL 200
Corequisites: BIOL 305L

BIOL 305L Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 305

BIOL 307 Biology of Microorganisms (4 Credits)
This course begins with introduction and comparison using structural, molecular, and physiological characteristics of the representative microbial groups. Special topics that students will research include host-parasite relationships, microbial genomics and synthetic microbiology, and the environmental impact of microorganisms. Laboratory will stress research design and student-based projects. Students will design experiments using microbiology techniques including different culturing methods, microscopy, and identification techniques. Fall.
Prerequisites: (BIOL 201 or BIOL 200) and (CHEM 125 or CHEM 125A or HONR 210E)
Corequisites: BIOL 307L

BIOL 307L Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 307

BIOL 308 Plant Systematics (4 Credits)
A study of the principles of identifying and classifying flowering plants, with a focus on plant species that are found on campus, exemplify conservation concerns, or are of special interest to human health and society. Labs will involve identifying plants on campus in order to answer conservation questions, analyzing data, and preparing herbarium specimens.
Prerequisites: BIOL 101 or BIOL 101Z or BIOL 100
Corequisites: BIOL 308L
Attributes: Natural World (NW), Thematic Encounter3 - Justice, Writing Requirement (WR)

BIOL 308L Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 308

BIOL 309 Biology of Insects (4 Credits)
Examination of the morphology, systematics, behavior, ecology, evolution and economic importance of major groups. Laboratory and field studies of local insects. Fall.
Prerequisites: (BIOL 100 or BIOL 100Z or BIOL 101 or BIOL 101Z) and (BIOL 200 or BIOL 201)
Corequisites: BIOL 309L

BIOL 309L Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 309

BIOL 311 Cell Biology (4 Credits)
A study of the organization and function of plant and animal cells, emphasizing the experimental basis of current concepts in cell biology. Laboratory work includes light and electron microscopy, cell culture, cytochemistry and other techniques of cellular investigation. Fall.
Prerequisites: (BIOL 201 or BIOL 200) and (CHEM 125 or CHEM 125A or HONR 210E) and (CHEM 250 or CHEM 250A) and (CHEM 201 or CHEM 201A) and (CHEM 202 or CHEM 202A)
Corequisites: BIOL 311L

BIOL 311L Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 311

BIOL 315 Virology (4 Credits)
Structure and chemical composition of viruses. Host-virus interactions with emphasis on bacterial and animal viruses, subviral particles and viral evolution. Laboratory focuses on techniques for culturing and characterizing bacterial viruses.
Prerequisites: BIOL 201 or BIOL 200
Corequisites: BIOL 315L

BIOL 315L Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 315

BIOL 316 General Genetics (4 Credits)
The principles and applications of gene transmission are a primary focus of this course. Gene and genome structure and function are also discussed in detail. The laboratory serves to introduce students to techniques and analytical approaches that are routinely used by practicing geneticists. Fall and spring.
Prerequisites: BIOL 201 or BIOL 200
Corequisites: BIOL 316L

BIOL 316L Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 316

BIOL 317 Biochemistry (4 Credits)
Lecture and laboratory study of the chemical characteristics of biological molecules with emphasis on bioenergetics, enzymes, metabolic pathways and integration, biological signals and membrane receptors. Fall and spring.
Prerequisites: (BIOL 201 or BIOL 200) and (CHEM 125 or CHEM 125A or HONR 210E) and (CHEM 250 or CHEM 250A) and CHEM 255 and (CHEM 201 or CHEM 201A) and (CHEM 202 or CHEM 202A) and CHEM 205
Corequisites: BIOL 317L
Equivalent courses: BCHM 317
Attributes: Writing Requirement (WR)

BIOL 317L Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 317

BIOL 318 Molecular Genetics (4 Credits)
Lecture and laboratory study of the structure, function, and organization of genetic material and the regulation of gene expression. Lecture topics explore modern applications including epigenetics, gene editing, and gene therapy. Laboratory techniques and applications include DNA and RNA manipulations, recombinant DNA technology, gene editing, and analysis of nucleic acid and protein sequence. Spring.
Prerequisites: (BIOL 201 or BIOL 200) and (CHEM 125 or CHEM 125A or HONR 210E) and (CHEM 250 or CHEM 250A) and (CHEM 201 or CHEM 201A) and (CHEM 202 or CHEM 202A)
Corequisites: BIOL 318L

BIOL 318L Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 318

BIOL 319 Immunology (4 Credits)
A study of the initiation and the biological/chemical aspects of the immune response. Emphasis is placed on the innate response, B and T cell development, T cell receptor and antibody protein and gene structure, and the adaptive response to an infection. Attention will be given to hypersensitivities (allergies), autoimmunity and tumor and transplant immunology.
Prerequisites: (BIOL 221 or BIOL 221Z or BIOL 200 or BIOL 201) and (CHEM 125 or CHEM 125A or HONR 210E)

BIOL 319L Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 319

BIOL 320 Neurobiology (4 Credits)
A reading, writing, and discussion-based investigation of neurobiological principles such as neuronal and circuit structure and function, cellular excitability, synaptic transmission, and the neurobiological basis of disease. Students will produce a critical analysis of a current neurobiological issue of their choice. Current experimental techniques are used to generate, analyze, and interpret data in laboratory and in class discussions. Spring.
Prerequisites: (BIOL 101 or BIOL 100 or BIOL 101Z) and (BIOL 201 or BIOL 200)
Corequisites: BIOL 320L
Equivalent courses: BIOL 373K
Attributes: Natural World (NW), Thematic Encounter3 - Truth

BIOL 320L Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 320

BIOL 322 Developmental Biology (4 Credits)
Mechanisms by which a fertilized egg becomes a mature organism are explored at both the molecular and cell-tissue level. These patterns and principles of development are considered for a variety of animal species. Laboratories include observation of normal development and experimental manipulations of the normal processes.
Prerequisites: BIOL 201 or BIOL 200
Corequisites: BIOL 322L

BIOL 322L Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 322

BIOL 323 Animal Physiology (4 Credits)
Structure, function and physiological adaptations in a variety of animals including humans. Metabolism, cardiovascular physiology, nerve and muscle function, salt and water balance, excretion, temperature regulation and endocrinology. Fall.
Prerequisites: BIOL 201 or BIOL 200
Corequisites: BIOL 323L
Attributes: Natural World (NW), Thematic Encounter3 - Movement

BIOL 323L Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 323

BIOL 325 Human Anatomy and Physiology I (4 Credits)
Integrated study of cells, tissues, organs, and systems of the human body, with emphasis placed on structure-function relationships. Major concepts stressed are how function at the cellular level governs events observable at the tissue, organ, or systemic tier, and physiological mechanisms necessary for homeostasis. Topics covered include excitable tissue, skeletal system, nervous system, muscular system, endocrine system. Laboratory component involves dissection exercises, study of human models, and inquiry-based investigations of muscle physiology and nervous system function. Fall.
Prerequisites: BIOL 201 or BIOL 212 or BIOL 200
Corequisites: BIOL 325L
Attributes: Natural World (NW), Thematic Encounter3 - Movement

BIOL 325L Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 325

BIOL 326 Human Anatomy and Physiology II (4 Credits)
Integrated study of cells, tissues, organs, and systems of the human body, with emphasis placed on structure-function relationships. Major concepts stressed are how function at the cellular level governs events observable at the tissue, organ, or systemic tier, and physiological mechanism necessary for homeostasis. Topics covered include the cardiovascular system, respiratory system, digestive system, urinary system, reproductive system and water, electrolyte and acid-base balance. Laboratory component involves dissection exercises, study of human models, inquiry-based investigations of cardiovascular, respiratory, and urinary system physiology, and a group independent research project. Spring.
Prerequisites: (BIOL 325
Corequisites: BIOL 326L
Attributes: Natural World (NW), Thematic Encounter3 - Truth

BIOL 326L Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 326

BIOL 327 Plant Physiology (4 Credits)
A study of how plants function and grow. Topics include metabolism, water relations, growth and development, gas exchange and responses to the environment. Laboratory provides a hands-on opportunity to work with plants and learn basic physiological techniques.
Prerequisites: BIOL 175 or 201. Learning Foundations(LF), Cultural and Social Difference: Identity (CI). CI course may be taken prior to or concurrently with Focus Course.
Corequisites: BIOL 327L
Attributes: Natural World (NW), Thematic Focus - Movement

BIOL 327L Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 327

BIOL 329 Histology and Technique (4 Credits)
Investigation of tissue characteristics, development, and interrelationships. Extensive laboratory experience in applicable microtechnique.
Prerequisites: (BIOL 221 or BIOL 221Z or BIOL 200 or BIOL 201)
Corequisites: BIOL 329L

BIOL 329L Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 329

BIOL 330 Comparative Anatomy of Vertebrates (4 Credits)
This course studies vertebrate anatomy in developmental and evolutionary contexts. We examine each of the body's major organ systems within the framework of vertebrate phylogeny so as to begin to understand how and why vertebrate structure has changed over time. Structures are illustrated and compared through dissection of representative vertebrates in the laboratory portion of the course. Fall.
Prerequisites: (BIOL 100 or BIOL 100Z or BIOL 101 or BIOL 101Z) and (BIOL 200 or BIOL 201)

BIOL 332 Natural History of Terrestrial Vertebrates (4 Credits)
Amphibians, reptiles (including birds), and mammals comprise the Tetrapoda, or terrestrial-vertebrate group. In this course we examine tetrapod anatomy, physiology, behavior, and evolution. Laboratories emphasize identification of, and field experience with, the tetrapods of central Minnesota. Spring.
Prerequisites: (BIOL 100 or BIOL 100Z or BIOL 101 or BIOL 101Z) and (BIOL 200 or BIOL 201)

BIOL 334 General Ecology (4 Credits)
An exploration of the historical, theoretical and empirical development of the science of ecology. Topics include dynamics of populations, interactions among species, and the organization and function of ecosystems. We devote special attention to the interplay between theoretical and empirical studies, with emphasis upon current research whenever possible. In the laboratory, students are expected to work in teams to design and implement a research project and present their findings in a public forum. Recommended prerequisite MATH 124. Fall.
Prerequisites: (BIOL 100 or BIOL 100Z or BIOL 101 or BIOL 101Z) and (BIOL 200 or BIOL 201)
Corequisites: BIOL 334L
Attributes: Natural World (NW), Thematic Encounter3 - Movement

BIOL 334L Laboratory (0 Credits)
Prerequisites: None

BIOL 336 Behavioral Ecology (4 Credits)
A study of animal behavior with emphasis on the ways in which the ecological circumstances surrounding animals help shape their behavior. Laboratory experience in the observation and analysis of behavior in living organisms. Spring.
Prerequisites: (BIOL 100 or BIOL 100Z or BIOL 101 or BIOL 101Z) and (BIOL 200 or BIOL 201)
Corequisites: BIOL 336L

BIOL 336L Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 336

BIOL 337 Aquatic Ecology (4 Credits)
This course offers an in-depth exploration of the ecology of lakes, streams, wetlands, and other aquatic ecosystems. We will examine how these bodies of water and their diverse inhabitants are integral to our landscape, serving as crucial habitats and resources. Key topics include the formation and seasonal dynamics of lakes, ecological interactions within lakes and streams, with a particular emphasis on native fish species, and strategies for effective lake management. Laboratory sessions will be conducted on campus lakes, along the shore, and in the lab.
Prerequisites: ENVR 175 or BIOL 201 or BIOL 200
Corequisites: BIOL 337L
Attributes: Natural World (NW), Thematic Encounter3 - Movement

BIOL 337L Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 337

BIOL 339 Evolution (4 Credits)
This course provides a historical and societal context for evolutionary theory, surveys the evidence for evolution, and emphasizes the processes of genetic change. The laboratory focuses on collaborative group projects and deepening students' appreciation for key components of the scientific process including: methodological troubleshooting, interacting with scientific literature, and technical writing.
Prerequisites: (BIOL 100 or BIOL 100Z or BIOL 101 or BIOL 101Z) and (BIOL 200 or BIOL 201)

BIOL 341 Tropical Marine Ecology of Belize (4 Credits)
This course combines on-campus instruction with an international field experience in Belize during Spring Break. Students are introduced to the ecology of tropical marine ecosystems with a focus on coral reefs, mangroves, seagrass beds, and associated fisheries along the Belize Barrier Reef. Topics include reef formation, marine organisms, human impacts on marine systems, and conservation and management of coastal resources. During the field experience, students conduct snorkeling-based observations and ecological data collection. After returning to campus, students analyze their data and complete a formal research paper and scientific poster, which may be presented at Scholarship and Creativity Day.
Prerequisites: (BIOL 100 or BIOL 100Z or BIOL 101 or BIOL 101Z) and (BIOL 200 or BIOL 201)
Equivalent courses: ENVR 341, GEOL 341

BIOL 347 Journal Club (1 Credits)
Preparation of a paper and a seminar presentation on a topic of current biological interest. Source materials will be the current research literature.
Prerequisites: None
Restrictions: Enrollment limited to students with a class of Junior or Senior.

BIOL 348 Biology Seminar Series (1 Credits)
This course consists of attendance at department sponsored seminars and seminar preparation sessions. At the preparation sessions students will familiarize themselves with the seminar topic through appropriate readings and discussion with faculty. Fall and Spring.
Prerequisites: None
Restrictions: Enrollment limited to students with a class of Junior or Senior.
Equivalent courses: BIOL 200

BIOL 371 Individual Learning Project (1-4 Credits)
Supervised reading or research at the upper-division level. Permission of department chair and completion and/or concurrent registration of 12 credits within the department required. Credits in 371 cannot be applied towards major requirements.
Prerequisites: None

BIOL 372 Biological Research (1-4 Credits)
Original research conducted under the supervision of a staff member. Students will design their own project in consultation with their moderator. Permission of department chair required. Credits in 372 may be applied towards major requirements.
Prerequisites: None

BIOL 373A Exploring Medicine (1-2 Credits)
Exploring Medicine 373A is a course designed for students interested in the health professions, particularly students seeking a career as a medical doctor, doctor of osteopathy, physician assistant, or nurse practitioner. Students will go, with their physician instructor, to the bedside of actual recorded patient encounters and experience how the process of diagnosis and treatment of disease actually works. Students will study selected systems of the body and learn the pathophysiology and treatment of a variety of human diseases and conditions, then apply that knowledge to selected patient scenarios. In addition, students will delve deeply into discussions of social and financial aspects that influence health. The purpose of this course is to help students see the relevance of their basic sciences, be better prepared for the MCAT, be better prepared for medical school, and be a step ahead in their decision to pursue a career in medicine. Credits in 373A cannot be applied toward major requirements.
Prerequisites: None

BIOL 373B Exploring Medicine II (1-2 Credits)
Like Exploring Medicine 373A, Exploring Medicine 373B is a course designed for students interested in the health professions, particularly students seeking a career as a medical doctor, doctor of osteopathy, physician assistant, or nurse practitioner. In order to be a doctor (or other medical provider) you need to learn to think like a doctor, and this course will introduce an entirely new set of exciting clinical experiences. In the fashion of Exploring Medicine 373A, we will go to the bedside of actual patients and review actual clinical cases. In this course, however, there will be a greater focus on the social determinants of health and aspects of wellness that are affected by elements beyond what we do as medical providers. Though we cannot directly control all obstacles to patient wellness, being aware of these encumbrances will allow us to better serve our patients and engage proper available resources. The purpose of this course, then, is to help students see the relevance of their basic sciences, be better prepared for the MCAT, be better prepared for medical school, and be a step ahead in their decision to pursue a career in medicine. Students do not need to take Exploring Medicine 373A before taking 373B; credits in 373B, like those in 373A, cannot be applied toward major requirements.
Prerequisites: None

BIOL 373F Bioinformatics (4 Credits)
This course provides an introduction to the field of bioinformatics. Topics will include sequences of DNA, RNA and proteins, comparing sequences, predicting sequences, predicting species; computational techniques such as substitution matrices, sequence databases, dynamic programming and bioinformatics tools. The course will have a seminar format.
Prerequisites: BIOL 121 or BIOL 121Z or BIOL 201 or BIOL 200
Equivalent courses: CSCI 317D

BIOL 373G Ecology and Evolution of the Galapagos Islands (4 Credits)
This course allows students to explore the following disciplines: evolutionary biology, terrestrial ecology, history of science, geology, oceanography and conservation biology. Thus, these islands represent an ideal place to study the interaction of multiple scientific disciplines in one of the most intellectually stimulating place on Earth (not to mention one of the most beautiful). The object of this program is to provide students with a hands-on field experience in conjunction with traditional classroom work. The ultimate goal: to obtain both an academic and an experiential understanding of an iconic ecosystem. Required ability to work well in groups, and a degree of physical fitness that allows for extensive snorkeling in cold water and hiking a minimum of five miles over rough terrain. Summer.
Prerequisites: (BIOL 100 or BIOL 100Z or BIOL 101 or BIOL 101Z) and (BIOL 200 or BIOL 201)

BIOL 373H The Omics of Medicine (2 Credits)
How will proteomics, genomics impact the study and practice of medicine? This course will use primary literature, real data, and hands-on student research projects to study the impact of modern day "omics" on the field of medicine. Discussions and topics include the role of proteomics and genomics in preventive medicine, diagnostics, and treatments. In addition, students will research the role of "omics" in understanding the evolution of infectious disease in terms of a pathogen's virulence (ability to cause disease) and the growing resistance to antibiotics. Independent group projects will be a component of the bench work to encourage and develop not only research skills but to also better understand its role in medicine. BIOL 317 or 318 is highly recommended as additional prerequisite. Spring AB mod.
Prerequisites: BIOL 201 or BIOL 200
Corequisites: BIOL 373HL

BIOL 373HL Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 373H

BIOL 373J Biological Illustration (1 Credits)
This course is a hands-on introduction to biological illustration theory and techniques. The class meets weekly. In the first five weeks students are introduced to some of the basic techniques of biological illustration. Students will be encouraged to work with techniques that fit well with their main interest area(s) in biology. Then, students will be required to apply this knowledge by designing and completing an independent project. This project will involve preparing a set of materials that illustrate a concept or topic of interest, and that can be used to help others understand the topic. Each student will be asked to work on an independent project that incorporates their illustrations in a real setting, whether preparing a poster for a research presentation, teaching a lesson, preparing a resource that others could use to teach a lesson, preparing an educational brochure for the Arboretum or a nature center, preparing posters for an elementary school science class, or other similar project. A student who successfully completes this course should have a basic understanding of the techniques and purposes of biological illustration and be able to use his or her knowledge to successfully convey significant biological information to a target audience. Spring AB mod.
Prerequisites: None

BIOL 373L Mathematical Modelling in Biology (4 Credits)
Traditional approaches to mathematical modelling in biology have relied primarily on differential equations models. However, new approaches have and are being developed that rely instead on discrete methods, such as those coming from graph theory, polynomial manipulation and elementary linear algebra. For example, gene regulatory networks have been successfully modelled using Boolean logic. The spread of tick-borne diseases and methods of control have been well described using agent-based models. Graph theoretic models have been used to explore aspects of neuronal network connectivity. This course will survey a variety of discrete modelling approaches, including Boolean models, polynomial dynamical systems, graph theory, agent based modelling, and hidden Markov models. Emphasis will be on examples and applications, which will be drawn from various areas of biology, including problems in gene regulation, population dynamics and neuroscience. The necessary mathematical background will be included in the course.
Prerequisites: MATH 119 or MATH 119Z
Equivalent courses: MATH 340A

BIOL 373O Exploring Neurobehavioral and Social Aspects of Medicine (1,2 Credits)
Exploring Medicine is a course designed for students interested in the health professions, specifically students seeking a career as a medical doctor, doctor of osteopathy, physician assistant, or nurse practitioner. Students will study various systems of the body and learn the pathophysiology and treatment of a variety of human diseases and conditions. The purpose of this course is to help students see the relevance of their basic sciences, to be better prepared for the MCAT, to help students prepare for medical school, and help them to be a step ahead in their decision to pursue a career in medicine.
Prerequisites: None

BIOL 373P The Art of Healing: A Practical & Benedictine Approach to Caring for Others (1 Credits)
Drawing from two decades of medical practice & centuries of literary, philosophical & scientific wisdom, this course hopes to speak to the transcendent art of healing. In a hurried world of pragmatism and efficiency, we still want our work to be meaningful. Now is the time to ignite the deeper sense of vocation in those aspiring to a career in health care (MD, RN, PA, NP, PT, OT, Pharm, etc.) or in those simply interested in finding enduring meaning in the career they will pursue.Cannot be applied towards major requirements.
Prerequisites: BIOL 101 or BIOL 101Z or BIOL 100

BIOL 373Q Ecology and Evolution of the Serengeti Ecosystem (4 Credits)
Students will study the ecologically and evolutionarily complex Serengeti Ecosystem of Tanzania. Using traditional classroom methods and field-based activities, we will explore the following disciplines: Evolutionary Biology, Terrestrial Ecology, History of Science, Nutrient Cycling, Animal Physiology, Wildlife Conflicts, Geology, Climate and Conservation Biology. Thus, the Serengeti Ecosystem represents and ideal place to study the interaction of multiple disciplines in one of the most intellectually stimulating place on Earth (not to mention one of the most beautiful). The object of this program is to provide students with both an in-class learning opportunity (C/D modules) and a hands-on field experience to the Serengeti (May) – with an ultimate goal for students to obtain both academic and an intellectual understanding of one of the most unique ecosystems on earth.
Prerequisites: (BIOL 101 or BIOL 100 or BIOL 100Z or BIOL 101Z) and (BIOL 201 or BIOL 200)
Attributes: Natural World (NW), Thematic Encounter3 - Justice

BIOL 373R Dark Side of Science: Experimental Procedures (2 Credits)
This course re-examines 'scientific' experimentation, bringing to light astonishing chapters in science history. While many assume science to be conducted in a morally neutral environment, that assumption is untenable. This course will help students to better assess and judge science's obligation to the citizens and society that it serves. Students will use writing and discussion to: • Recognize and comprehend how the basis of applied experimental medicine can lead to abuse of subjects especially those at a disadvantage when human subject protocols are violated. • Understand the potentially unwelcomed consequences of medical experimentation for both the medical as well as patient community when studies or treatment are conducted without restrictions and appropriate guidelines. • Raise the level of ethical consciousness in all those who in the future may be responsible for the use and care of patients undergoing experimental procedures. Credits in 373R cannot be applied towards major requirements
Prerequisites: None

BIOL 373S Biostatistics in R (4 Credits)
Learn how to process biological data using the programming language and environment of R. After covering key concepts in biostatistics, including measures of central tendency, common distributions, t-tests, linear regressions, and ANOVAs, students will apply their knowledge to produce graphs and test hypotheses using biological data. Students will build the skills necessary for their final project, which will include selecting data, importing it into R, performing an appropriately chosen statistical test, and representing the results in both graphical and written form.
Prerequisites: BIOL 201 or BIOL 200
Corequisites: BIOL 373SL
Attributes: Quantitative Reasoning (QR)

BIOL 373SL Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 373S

BIOL 373T Forest and Disturbance Ecology (4 Credits)
This course will cover the structure, function and dynamics of forest ecosystems at multiple scales, from trees to landscapes, and how they are impacted and shaped by disturbances, including human interactions. We will use the Abbey Arboretum as an outdoor classroom to explore how the concepts learned in lecture play out in different forest types.
Prerequisites: BIOL 200 or ENVR 275 or BIOL 201
Corequisites: BIOL 373TL

BIOL 373TL Laboratory (0 Credits)
Prerequisites: None
Corequisites: BIOL 373T

BIOL 374 Biological Techniques (1-2 Credits)
Independent work to develop expertise in special techniques such as electron microscopy, chromosome preparation, tissue culture, and the preparation of specimens of plants, insects or vertebrates. Does not count toward the biology major.
Prerequisites: None

BIOL 375 Natural History of Maple Syrup (1 Credits)
A springtime ritual throughout NE United States, including St. John's, is the production of maple syrup from the sap of the sugar maple tree. This course provides an introduction to the history of the process, methods for producing syrup, and the biological and chemical principles underlying the production of sap and syrup. Spring C mod.
Prerequisites: BIOL 221 or BIOL 221Z or BIOL 201 or BIOL 200
Equivalent courses: BIOL 379

BIOL 380A Pathophysiology and Epidemiology of Diseases Transmitted by Insect Vectors (2 Credits)
Student projects will focus on the transmission, pathophysiology, and treatment of human infectious diseases transmitted by insect vectors. Student teams will pick a particular disease and research the various aspects listed above. The bloodier and more bizarre, the better! Different levels of biology (i.e., cellular, organismal, ecological) should be addressed, allowing students with different backgrounds to contribute to each project.
Prerequisites: (MATH 124 or MATH 124Z) and (BIOL 100 or BIOL 100Z or BIOL 101 or BIOL 101Z) and (BIOL 200 or BIOL 201)
Attributes: Experiential Engagement (EX)

BIOL 380B A World of Unintended Consequences (2 Credits)
From hunting, gathering, and the ability to control fire, through domestication of plants and animals, long-distance voyages, industry, to the editing of genomes, humans have been interacting with the rest of the biosphere to varying degrees for thousands, perhaps millions, of years. Few, if any, locations on Earth are free from the influence of humanity, and many of the challenges our ecosystems and societies face result from unintended consequences of human activity. In this course, students will analyze biological legacies of past actions or predict biological outcomes of choices that currently face humanity. They will then make recommendations for addressing the biological and societal impacts (extant or anticipated) they document.
Prerequisites: (MATH 124 or MATH 124Z) and (BIOL 100 or BIOL 100Z or BIOL 101 or BIOL 101Z) and (BIOL 200 or BIOL 201)
Attributes: Experiential Engagement (EX)

BIOL 380C The Magic of Microorganisms (2 Credits)
Bacterial systems present a multitude of questions of biological interest given their competition for resources, adaptability to distinct environments, and propensity to evolve new biochemical capabilities. Students in this course isolate, identify and characterize bacterial samples from sites in and around CSB/SJU of personal interest or in conjunction with other studies currently underway. These projects will include some combination of library, laboratory and written work that hopefully ties together many of the levels of current biological inquiry. Additional prerequisites 307 & 317 strongly recommended.
Prerequisites: (MATH 124 or MATH 124Z) and (BIOL 100 or BIOL 100Z or BIOL 101 or BIOL 101Z) and (BIOL 200 or BIOL 201)
Attributes: Experiential Engagement (EX)

BIOL 380D Biological Extremophiles (2 Credits)
Life is amazing. Some organisms can tolerate extreme desiccation, radiation, heat, cold, acidity, alkalinity, pressure or salinity. How do they do it? The focus of this course will be the organisms capable of surviving extreme environmental conditions. Students will select a phenomenon to study, prepare a review paper about the topic, and then present their results in a public forum.
Prerequisites: (MATH 124 or MATH 124Z) and (BIOL 100 or BIOL 100Z or BIOL 101 or BIOL 101Z) and (BIOL 200 or BIOL 201)
Attributes: Experiential Engagement (EX)

BIOL 380E Climate Change (2 Credits)
During the coming decades, Earth's changing climate is likely to generate a diversity of disruptions ranging in severity from exasperating to existential. In this capstone, student teams will produce a research paper that explains the biological foundations for a projected consequence of climate change that interests them, and will also explain and evaluate adjustments that society might make to mitigate climate-associated challenges. Each team's research will be presented on Scholarship and Creativity Day.
Prerequisites: (MATH 124 or MATH 124Z or HONR 260A) and (BIOL 100 or BIOL 100Z or BIOL 101 or BIOL 101Z) and (BIOL 200 or BIOL 201)
Attributes: Experiential Engagement (EX)

BIOL 380F Genome Editing with CRISPR/Cas9 (2 Credits)
CRISPR/Cas9 is one of the most exciting advancements in modern biology. Students will learn about what CRISPR/Cas9 is, what is can be used for, and design/carry-out their own projects using CRISPR/Cas9 technology. Students will learn bioinformatics, and a number of wet-bench skills including molecular biology and biochemistry techniques to carry out their project. These projects will include some combination of library, laboratory, and written work that hopefully ties together many of the levels of current biological inquiry. Additionally, students will discuss the ethics implications of the variety of CRISPR/Cas9 applications and new developments in this rapidly evolving field.
Prerequisites: (MATH 124 or MATH 124Z)
Restrictions: Enrollment limited to students with a class of Senior.
Attributes: Experiential Engagement (EX)

BIOL 380G Feeding 10 Billion (2 Credits)
By the end of this century the population of this planet is projected to exceed 10 billion people. How will we feed them? The solutions to this problem may depend on our understanding of biology from molecular biology (as in genetic engineering) to ecology (as in agronomy).
Prerequisites: (MATH 124 or MATH 124Z) and (BIOL 100 or BIOL 100Z or BIOL 101 or BIOL 101Z) and (BIOL 200 or BIOL 201)
Attributes: Experiential Engagement (EX)

BIOL 380H Plants and Pollinators (2 Credits)
This course provides students with an opportunity to learn about prairie pollinators with a focus on the monarch butterfly/milkweed interaction. After a review of basic prairie pollinator ecology, students will review proper planning and implementation of a research project. Students will then develop a research question, design an in-the-field research effort, implement their study design (St. John's Abbey Arboretum), analyze the results and write a scientific paper based on their data results. Finally, they will present their results in a public forum. Course offered for A-F grading only. Offered in fall semester.
Prerequisites: (MATH 124 or MATH 124Z) and (BIOL 100 or BIOL 100Z or BIOL 101 or BIOL 101Z) and (BIOL 200 or BIOL 201)
Restrictions: Enrollment limited to students with a class of Senior.
Attributes: Experiential Engagement (EX)

BIOL 397 Internship (1-16 Credits)
Completed Application for Internship Form REQUIRED. See Internship Office Web Page.
Prerequisites: None
Attributes: Experiential Engagement (EX)