

# BIOLOGY

## Department Description

The Department of Biology endeavors to acquaint students with current biological principles, to educate them in the scientific approach to problems, to provide experience in laboratory and field methods of investigation, and to develop an appreciation for intellectual achievements in science. In addition, the courses are designed to prepare students concentrating in biology for research jobs, graduate study, teaching, or a career in a variety of medical areas. A semester of study abroad is feasible and recommended for four-year biology majors.

## Study Abroad

Saint Mary's has a long history of providing quality international programs as an essential part of our educational mission—forming women leaders who will make a difference in the world. As this world becomes increasingly interdependent, the College offers an expanding range of semester, year, semester break, and summer study and service programs in a wide variety of countries, and encourages students to take advantage of them. Learn more about the various Study Abroad opportunities (<https://catalog.saintmarys.edu/undergraduate/academic-life/international-programs/>).

## GRADUATE STUDY

By fulfilling the requirements for a Bachelor of Science degree in biology, the student also has sufficient course work in mathematics, chemistry, and liberal arts for admission to graduate school.

## Medical School and health professional programs

The Biology Department's coursework supports the preparation of pre-health students, including for the health professional exams such as the MCAT, DAT, OAT, and PACAT. Coursework provides the knowledge and skills to be successful in these graduate programs and in the medical field. (See Pre-Health Professions Page (<https://catalog.saintmarys.edu/undergraduate/programs/pre-med-pre-health-professions/>) for more information).

## Teacher Preparation

The Department of Biology, in conjunction with the Education Department, offers courses leading to state licensing for teaching sciences in secondary schools. This preparation includes successful completion of the degree in biology.

## International Programs

### Environments of Ecuador Summer Program

One of the most environmentally diverse countries in the world, Ecuador offers a unique opportunity to experience four distinct ecological settings. Witness 500-pound tortoises on the Galapagos Islands, hummingbirds in the cloud forest, alpacas of the Andes highlands, and Capuchin monkeys in the Amazon. Students will discover a fascinating world of unusual plants and animals. Open to students in all majors, the course (BIO 270 Environments of Ecuador) highlights the natural beauty of Ecuador in a 14-day travel experience during the summer in even years. Particular emphasis is placed on local conservation efforts,

the intersections between biology and culture, and the rich diversity of life. Offered alternative years with BIO 209 Marine Biology.

### Marine Biology Spring Break Program

The Marine Biology course brings students to an active marine biology research station in Belize for one week during Spring Break. Students study the physical and biological properties of marine systems with an emphasis on ecological interactions and human impact on the marine environment. Trip may not be taken without the required BIO 209 Marine Biology semester course. Open to all majors with the prerequisites. Offered alternative years with BIO 270 Environments of Ecuador.

## Programs in Biology

- Biology, Integrative, Bachelor of Science - BIO (<https://catalog.saintmarys.edu/undergraduate/programs/biology/integrative-biology-bachelor-science/>)
- Biology, Minor - BIO (<https://catalog.saintmarys.edu/undergraduate/programs/biology/biology-minor/>)
- Cellular/Molecular Biology Concentration, Bachelor of Science - CELL (<https://catalog.saintmarys.edu/undergraduate/programs/biology/cellular-molecular-biology-concentration-bachelor-science/>)
- Ecology, Evolution and Environmental Biology Concentration, Bachelor of Science - EEEB (<https://catalog.saintmarys.edu/undergraduate/programs/biology/ecology-evolution-environmental-biology-concentration-bachelor-science/>)

## Department Chair

Joel Ralston  
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## Faculty/Professional Specialists

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## Student Learning Outcomes

- The Saint Mary's biology major will demonstrate familiarity with current biological principles and practices.
- The Saint Mary's biology major will demonstrate an understanding of the scientific approach to problem solving.
- The Saint Mary's biology major will participate in laboratory and/or field experiences as methods of investigation.
- The Saint Mary's biology major will demonstrate a knowledge of and appreciation for scientific achievement in the world.

## Additional Student Learning Outcomes for each Concentration

### Integrated Biology Concentration

- The Saint Mary's biology major will demonstrate an understanding of basic biological principles. These include but are not limited to concepts related to the diversity of living organisms, the ecological and evolutionary implications of variations in form and function, eukaryotic cell structure, and functional aspects of the eukaryotic cell.
- The Saint Mary's biology major will be able to explain the genetic basis for variation among living organisms, the relationship between

genotypic and phenotypic expression, and the patterns of inheritance as a result of genetic crosses.

- The Saint Mary's biology major will demonstrate skills pertaining to and required by participation in environmental courses, courses dealing with organismal biology, and physiological/cellular courses.
- The Saint Mary's biology major will complete all learning objectives associated with the Senior Comprehensive.

### Cellular/Molecular Biology Concentration

- The Saint Mary's biology major will demonstrate an understanding of basic biological principles. These include but are not limited to concepts related to the diversity of living organisms, the ecological and evolutionary implications of variations in form and function, prokaryotic and eukaryotic cell structure and functional aspects of prokaryotic and eukaryotic cells.
- The Saint Mary's biology major will be able to explain the genetic basis for variation among living organisms, the relationship between genotypic and phenotypic expression, and the patterns of inheritance as a result of genetic crosses.
- The Saint Mary's biology major will demonstrate an in-depth understanding of cellular and molecular function.
- The Saint Mary's biology major will be able to explain how cellular and molecular mechanisms influence the whole organism.
- The Saint Mary's biology major will complete all learning objectives associated with the Senior Comprehensive.

### Ecology, Evolution, and Environmental Biology Concentration

- The Saint Mary's biology major will demonstrate an understanding of basic biological principles. These include but are not limited to concepts related to the diversity of living organisms, the ecological and evolutionary implications of variations in form and function, eukaryotic cell structure, and functional aspects of the eukaryotic cell.
- The Saint Mary's biology major will be able to explain the genetic basis for variation among living organisms, the relationship between genotypic and phenotypic expression, and the patterns of inheritance as a result of genetic crosses.
- The Saint Mary's biology major will demonstrate an in-depth understanding of environmental concepts.
- The Saint Mary's biology major will be able to explain how components of the environment influence all organisms and vice versa.
- The Saint Mary's biology major will complete all learning objectives associated with the Senior Comprehensive.

## Biology Courses

### BIO 107 Physiology of Women (3)

This course details the way women's physiology is unique. It includes the obvious ways women and men differ (e.g. the reproductive cycle and pregnancy) as well as less obvious ways a woman's physiology is distinctive (e.g. heart disease and responses to stress). The lens through which all assignments are viewed will be the gender of experimental subjects used in the basic research upon which course information is based. Offered fall semester; 3 hours of lecture per week; no prerequisites. This course is NOT appropriate for students majoring in science or minoring in Biology. No prerequisites.

### BIO 109 Introduction to Marine Biology (3,4)

This course is an introduction to marine biology. Topics include marine ecosystems, the diversity of marine organisms, interactions between marine organisms and their environment, and humans' involvement with the marine environment. In this course students will investigate fundamental marine biological principles, learn to apply the scientific method to investigate marine biological questions, and critically analyze marine biological issues facing humans in today's world. Students may enroll in the 3 -credit online summer course (without lab) or in the 4-credit fall semester course (with lab). Fall semester course: 3 hours of lecture and 2 hours of lab per week. This course is NOT appropriate for students majoring in science or minoring in Biology. Co-prerequisites: BIO 109L

### BIO 109L Introduction to Marine Biology Laboratory (0)

One lab per week. Corequisite: BIO 109.

### BIO 110 Understanding Women's Cancers (4)

Believe it or not, biology is all around us. From the food we eat, to the air we breathe, to the medicine we take when we are sick, it is all impacted by biology! A multitude of researchers are responsible for unveiling many of the biological mechanisms that have given us a clearer view of "how the disease works," but often times we take this for granted and there is so much left to learn! In Bio 110, we will learn about basic principles in cell biology, biotechnology, molecular biology, and physiology as we take an in depth look at cancers that impact women worldwide. Throughout this course, we will identify the contributions of many individuals who are responsible for major advances in our understanding of these biological principles of cancer as well as uncover questions that remain unanswered. Furthermore, we will explore and think about these processes in the context of life choices and/or current issues that face each student and our communities. Three hours lecture and one 2-hour lab each week. Offered fall semester. This course is NOT appropriate for students majoring in science or minoring in Biology. No prerequisites. A student cannot earn credit for both BIO 105 and BIO 110.

### BIO 110L Understanding Women's Cancers Laboratory (0)

One two hour lab per week. Corequisite: BIO 110.

### BIO 112 Evolution for Everyone (3)

This course will introduce students to the scientific method, major concepts in evolutionary biology, and will explore the many ways evolution shapes our daily lives. Our foods, relationships, personalities, beliefs, behaviors, and medical treatments are all influenced by natural selection. Evolutionary thinking can help students understand who we are as humans, how we interact in society, and what our place is in the natural world. Offered summers; online course; no prerequisites. This course is NOT appropriate for students majoring in science or minoring in Biology. No prerequisites.

### BIO 120 Human Genetics and Society (3)

This course is an overview of the importance of human genetics in the modern world based on the study of heritable patterns, biological causes, and social impact of genetic information. Particular emphasis placed on biomedicine, genetic diseases, modern technology, the role of genetic counseling, and the intersections between knowledge and application. Three hours lecture each week. This course is NOT appropriate for students majoring in science or minoring in Biology. No prerequisites.

**BIO 141 Human Anatomy and Physiology I (4)**

This course is the first of a two-part sequence for the intended nursing major that will cover the chemical basis of cells, cell microscopy, and tissue types as well as the integumentary system, skeletal system, muscular system, the cardiovascular system and blood. Course content will also include discussions about health/disease issues of concern as they pertain to the current course material. Laboratory content will include use of the scientific method as well as acquisition and application of knowledge pertaining to physiological processes as discussed in lecture. This class meets the NS LO1 Sophia Program Liberal Learning designations. Offered fall semester for first year intended nursing majors; 3 hours of lecture and 3 hours of lab per week; no prerequisites

**BIO 141L Human Anatomy and Physiology I Laboratory (0)**

One three hour lab per week. Corequisite: BIO 141.

**BIO 142 Human Anatomy and Physiology II (4)**

This course is the second of a two-part sequence for the intended nursing major that will cover the nervous system, lymphatics and immunity, respiratory system, digestive system, urinary system, endocrine system, and the reproductive system with some information about human development and heredity. Course content will also include discussions about health/disease issues of concern as they pertain to the current course material. Laboratory content will include use of the scientific method as well as acquisition and application of knowledge pertaining to physiological processes as discussed in lecture. This class meets the NS LO1 Sophia Program Liberal Learning designations. Offered spring semester for first-year intended nursing majors; 3 hours of lecture and 3 hours of lab per week. Prerequisite: C or better in BIO 141 recommended

**BIO 142L Human Anat & Phys II lab (0)**

One three hour lab per week. Corequisite: BIO 142.

**BIO 155 Foundations of Molecular Biology (2)**

A survey of foundational concepts in biology, with a focus on molecular biology. Part of the introductory Foundations of Biology courses for biology majors, but available to non majors as well. This course will cover an introduction to biochemistry, the organic molecules important for life, and classical Mendelian and modern genetics. A half semester course that must be taken with a lab. Two Foundation courses must be completed to complete Sophia learning outcomes. Intended for students majoring in science. 3 hours of lecture and 3 hours of lab per week. Second 1/2 of Fall Semester.

**BIO 155L Foundations of Molecular Biology Laboratory (0)**

Lab. Corequisite: BIO 155.

**BIO 156 Foundations of Ecology and Evolution (2)**

A survey of foundational concepts in biology, with a focus on ecology and evolution. Part of the introductory Biology Foundations courses for biology majors, but available to non majors as well. This course will cover how organisms interact with one another and their environment, the dynamic functioning of ecosystem, the origin and diversification of life on Earth, and the evolutionary forces that shape patterns of biodiversity within populations and across lineages. A half semester course that must be taken with a lab. Two foundation courses must be completed to complete Sophia learning outcomes. Intended for students majoring in science. 3 hours of lecture and 3 hours of lab per week. First 1/2 of Fall Semester.

**BIO 156L Foundations of Ecology and Evolution Laboratory (0)**

Lab Corequisite: BIO 156.

**BIO 157 Foundations of Cellular Biology (2)**

A survey of foundational concepts in biology, with a focus on cellular biology. Part of the introductory Biology Foundations courses for biology majors, but available to non majors as well. This course will cover basic structure of eukaryotic cells and the functioning of their organelles, the cell cycle and mitosis, and how cells produce and metabolize energy. A half semester course that must be taken with a lab. Two foundation courses must be completed to complete Sophia learning outcomes. Intended for students majoring in science. 3 hours of lecture and 3 hours of lab per week. First 1/2 of Spring Semester.

**BIO 157L Foundations of Cellular Biology Laboratory (0)**

Lab. Corequisite: BIO 157.

**BIO 158 Foundations of Form and Function (2)**

This course provides a survey of foundational concepts in biology, with a focus on organismal biology. This course is part of the Introductory Biology Foundations courses for biology majors. This course will cover the diversity of life on Earth with a focus on the relationship between form and function. Specifically, the course will explore the functions all organisms must accomplish, such as movement, feeding, and reproduction, and the compare the different ways organisms accomplish these functions. This course also includes a laboratory component, in which students will conduct both guided and independent research experiments investigating form and function across taxa. This is a half semester course that must be taken with a lab. Two foundation courses must be completed to complete Sophia learning outcomes. Intended for students majoring in science. 3 hours of lecture and 3 hours of lab per week.

**BIO 158L Foundations of Form and Function-lab (0)**

Lab Corequisite: BIO 158.

**BIO 160 Science Writing and Communication (3)**

This course introduces students to the fundamentals of science writing and communication to both a technical and non technical audience through written, oral and visual media. Students will develop technical writing skills, public communication confidence, and communication of science with the public skills. Through AEL experiences, students will share science with the community. Prerequisite: One semester of any science course or permission of instructor. Offered even years, fall semester.

**BIO 190 Special Topics (1-4)**

A variable format (e.g. lecture, lab or seminar) course permitting discussion and analysis of topics not normally covered in detail in regularly scheduled courses. The course content and format will be determined by student and faculty interests. May be repeated with different topic.

**BIO 201 Preparing to Serve a Multi-Cultural Society in Healthcare (1)**

This course is an introduction to the roles and responsibilities that exist in healthcare in the United States of America today. In this course, we will introduce the variety of professions that exist in health care in the context of this thematic question: What does it mean to serve in healthcare in a multicultural society? Through readings, assignments, professional panels, and assigned hands-on health care experience, we will explore the intricacies of the patient-provider relationship with a focus on developing cultural awareness necessary to serve others in society. Thirty (30) hours of field health care volunteer experience are required. Students must be available during working business hours (approximately 8am-5pm) once or twice a week for a total of 3 hours per week. Students are responsible for arranging their own transportation to and from their assigned placement.

**BIO 202 The Global Challenge of Infectious Diseases (3)**

This course introduces students to emerging infectious diseases and the ways in which they impact individuals, their societies and the world. Designed specifically for non-biology and non-nursing majors, this course aims to stimulate student interest in investigating the biological, environmental, cultural and other factors that contribute to the emergence and spread of diseases. This course also discusses bioterrorism and its effects, and the collective and individual approaches to control and prevent disease emergence. This course is offered in the fall on even years; and covers three hours of lecture per week. Prerequisites: Junior or Senior standing and non-biology and non-nursing majors/minors

**BIO 209 Marine Biology (4)**

A lecture, laboratory, and field-based introduction to marine systems. Topics include physical and biological properties of marine systems with emphasis on ecological interactions and human impact on the marine environment. (3 hour lecture, one 2 hour lab per week; includes a one week field trip to the Caribbean and additional fee for travel and expenses.) Spring semester. Pre-requisites: BIO 155, BIO 156, BIO 157, BIO 158

**BIO 209L Marine Biology Lab (0)**

One two hour lab per week. Corequisite: BIO 209.

**BIO 213 Introductory Human Anatomy (3-4)**

Introductory course applying a systemic approach to the study of human form and function. Laboratory will focus on the study of human osteology, human models, and mammal dissection. Intended for students with interest in health professions. For students majoring in areas other than biology. Offered odd years in the fall semester; 3 hours of lecture and 3 hours of lab per week. Prerequisites: BIO 156, BIO 158 and CHEM 118 or CHEM 121/122 or permission of instructor"

**BIO 213L Introductory Human Anatomy Laboratory (0)**

One three hour lab per week. Corequisite: BIO 213.

**BIO 216 Introduction to Microbiology (4)**

A general introduction to microorganisms, their cultivation, control and role in infectious disease with emphasis on the host-parasite relationship and the host's response to infection. For students majoring in areas other than biology. 3 hours of lecture and 3 hours of lab per week. Offered spring semester. Prerequisites: BIO 141, BIO 142, and CHEM 118.

**BIO 216L Introduction to Microbiology Laboratory (0)**

One three hour lab per week. Corequisite: BIO 216.

**BIO 221 Introduction to Genetics (4)**

An introduction to principles including: Mendelian analysis, chromosome structure and function, DNA expression and regulation, quantitative and population genetics, genomics, mutations, and recombinant DNA technology. The laboratory incorporates both classical transmission analysis and modern molecular techniques of DNA manipulation. Spring semester; 3 hours of lecture and 3 hours of lab per week. Prerequisites: BIO 155 and BIO 157; Co-regquisite CHEM 121 or permission of instructor.

**BIO 221L Introduction to Genetics Laboratory (0)**

One three hour lab per week. Corequisite: BIO 221.

**BIO 224 Introduction to Pathophysiology (3)**

This class is designed to give students an introduction to the basis of diseases, disorders, and syndromes. Disease pathogenesis (how a disease progresses) and etiology (the study of the cause of disease) will be emphasized. Common diseases and disorders of organ systems will be examined via lectures, case studies, outside research, and class discussions. Offered in the spring semester primarily for sophomore nursing majors. Three hours lecture per week. Prerequisites: CHEM 118 and BIO 141, BIO 142.

**BIO 228 General Physiology (4)**

Physiology encompasses the mechanisms and processes in cells, organs, and organ systems that work to maintain homeostasis in an organism. This course explores basic physiological principles and how they apply to different organ systems. Students will explore examples both in humans and other animals. Critical thinking, problem solving, and interactions among systems are emphasized throughout the course. Offered fall semester. 3 hours of lecture and 3 hours of lab per week.

**BIO 228L General Physiology Lab (0)****BIO 230 Molecular Cell Biology (4)**

A study of the structure and function of genes, their products and the interrelationship of these products in the cell. The experiments that led to our understanding of these processes and the molecular tools developed from these experiments will be emphasized. The lab provides students an opportunity to use these tools. Fall semester; 3 hours of lecture and 3 hours of lab per week. Prerequisite: BIO 221.

**BIO 230L Molecular Cell Biology Laboratory (0)**

One three hour lab per week. Corequisite: BIO 230.

**BIO 232 Animal Behavior (4)**

A study of historical and current topics in animal behavior. Classical experiments are stressed in labs. Offered even years, spring semester. 3 hours of lecture and 3 hours of lab per week. Prerequisites: BIO 155, BIO 156, BIO 157, BIO 158. Corequisite: BIO 232L.

**BIO 232L Animal Behavior Laboratory (0)**

One three hour lab per week. Corequisite: BIO 232.

**BIO 235 Foundations of Neuroscience (4)**

We learn about the components of the nervous system from single cells to complex networks. We will begin with an overview of the anatomy of the nervous system and then focus on how cells (neurons) within this system use electrical and chemical signals to communicate. This course will also cover early developmental events that result in the formation of the neural tube and subsequently the mature nervous system. We will then move to the sensorimotor systems where we will learn how sensory input dictates responses and how some inputs guide motor output (movement). Finally, we will investigate some of the physiological processes that are regulated by the brain. 3 hours of lecture and 3 hours of lab per week. Prerequisite: (BIO 155 and BIO 157) or PSYC 234 or permission of instructor.

**BIO 235L Foundations of Neuroscience Laboratory (0)**

Lab Corequisite: BIO 235.

**BIO 240 Cats' Paws and Catapults: Animal Biomechanics (3)**

This course examines how organisms work, which, admittedly, covers a lot of ground. There are lots of kinds of organisms, and we could approach questions about how they work from a variety of perspectives. We will focus our efforts in two areas in this course. Our primary focus will be on the physical world of organisms – how does shape, size, and stuff organisms are made of, as well as the environment in which they live, affect how they work? Since this is also, at its heart, a Biology course, we'll bear the evolutionary history of organisms in mind as we seek explanations for why organisms work the ways that they do. Prerequisites: BIO 156/BIO 158, or permission of instructor

**BIO 245 We Like to Move It (Move it): Introduction to Kinesiology (3)**

The course will introduce students to the academic discipline of Kinesiology, including fundamental components of fitness/exercise, health/wellness, and topics within sport/exercise science. In particular, we will focus on the study of the mechanics of human body movements, primarily as it relates to the interrelationships of bones, joints, and muscles. Offered fall semester in alternating years. Three hours of lecture per week; no lab. This course is primarily geared toward undergraduate students majoring in Exercise Science, Biology, or Nursing, and those preparing for entry into Masters of Athletic Training or Doctor of Physical Therapy programs. Prerequisites: BIO 158, BIO 141, or equivalent; or permission of instructor.

**BIO 248 Issues in Environmental Biology (1)**

Biological phenomena are found at the root of many major environmental problems; by understanding the biology, we can find new solutions for many issues. This one-hour seminar class will provide students an opportunity to explicitly connect current environmental problems to their biological underpinnings using primary literature, writing assignments, and in-class discussions. Prerequisites: BIO 155-158.

**BIO 270 Environments of Ecuador (3)**

In this travel course, students will explore the natural environments of Ecuador including the Andes Mountains, Amazon rainforest, and the Galápagos Islands. Topics include history and culture of Ecuador, native plant and animal diversity, evolutionary biology, environmental impact of human presence, and Ecuadorian efforts at conservation. Required pre-travel class sessions, two weeks of travel in Ecuador, and travel fees. Appropriate for both biology majors and non-majors. Offered summer, even years. Prerequisite: one semester of biology or permission of instructor.

**BIO 297 Independent Study (1-3)**

An opportunity for independent study for outstanding first and second-year students. Original research is encouraged. Consent of department chair required. May be repeated.

**BIO 308 Vertebrate Natural History (4)**

Survey of major groups of vertebrates, their characteristics, zoogeographic distributions, ecology, evolutionary history and adaptations. Emphasis on identification and field studies of Indiana species. Offered alternate years, spring semester. 3 hours of lecture and 3 hours of lab per week. Prerequisites: BIO 155, BIO 156, BIO 157, BIO 158, BIO 221

**BIO 308L Vertebrate Natural History Laboratory (0)**

One three hour lab per week. Corequisite: BIO 308.

**BIO 310 Teaching in Biology (0.5-3)**

Faculty-directed laboratory teaching experience for students majoring in biology. Includes preparation time for theory review and procedures, as well as time in the laboratory under faculty supervision. Application is required; final selection will be by faculty members concerned. Students may repeat up to three semester hours for electives. Graded S/U. Prerequisites: Application required

**BIO 312 Evolution (3)**

An examination of the theoretical and empirical framework of evolution, the most important unifying principle in modern biology; as evolutionary geneticist Theodosius Dobzhansky noted in 1973, "Nothing in biology makes sense except in the light of evolution." During the course, students will (1) develop and demonstrate a thorough understanding of the process and pattern of evolutionary change, and (2) develop and demonstrate the ability to analyze, interpret, and discuss recent research literature in evolutionary biology. Offered alternate years, fall semester. 3 hours of lecture per week. Prerequisites: either (BIO 155, BIO 156, BIO 157, BIO 158) or ENVS 171 or equivalent.

**BIO 313 Economic Botany (3)**

An examination of the origin and evolution of crop plants. Emphasis will be placed on the classification, origin, and use of major crops including cereals, roots, fruits, vegetables, spices, beverages, fibers, medicines, and hallucinogens. Three hours of lecture per week. Prerequisites: BIO 155, BIO 156, BIO 157, BIO 158, BIO 221.

**BIO 315 Statistical Methods for Biologists (3)**

This course focuses on experimental design in the biological sciences and application/interpretation of statistical methods. Topics covered include types of data, sampling strategies, data presentation and statistical hypothesis testing using both parametric and non-parametric procedures. Offered alternate years, fall semester. 2 hours of lecture and 3 hours of lab per week. Prerequisites: Junior or Senior standing and (MATH 131, MATH 132) or MATH 133.

**BIO 316 Conservation Biology (4)**

Conservation biology is a relatively new sub-discipline of biology concerned with exploring the underlying causes of biodiversity declines and potential solutions to these problems. During the semester, students enrolled in this course will (1) learn and demonstrate a basic understanding of ecological and evolutionary processes involved in species diversity, (2) identify and describe the root causes of biodiversity decline in a number of settings, and (3) assess existing conservation strategies and generating new conservation tools. Offered alternate years, fall semester; 3 hours of lecture and 3 hours of lab per week. Prerequisite: (BIO 155, BIO 156, BIO 157, BIO 158) or ENVS 171.

**BIO 316L Conservation Biology Laboratory (0)**

One three hour lab per week. Corequisite: BIO 316.

**BIO 317 Microbiology (4)**

A cellular/molecular study of microorganisms and their roles in infectious disease, the environment, and industry. The laboratory covers basic methods for the study of microbes including aseptic technique, microscopy, safety, control of infectious organisms, molecular techniques and the generation and interpretation of quantitative data. Offered fall semester. 3 hours lecture; one 2-hour and one 1-hour laboratory per week. Prerequisites: CHEM 121–122, BIO 221.

**BIO 317L Microbiology Laboratory (0)**

One two-hour lab and one onehour lab per week. Corequisite: BIO 317.

**BIO 318 Immunology (3)**

Cellular and molecular basis of immunity. The course emphasize how the healthy human immune system deals with infectious disease, and failures in that system including autoimmunity, immunodeficiency and allergy. Offered fall semester alternating with BIO 417: 3 hours of lecture per week. Prerequisites: BIO 221, CHEM 121; or BIO 141/142, BIO216, CHEM 118; or permission of instructor.

**BIO 320 Parasitology (4)**

Survey of parasitic protozoa, helminths and arthropods of medical and economic importance. Emphasis on host-parasite relations, life histories, pathology and control. Three hours lecture and one three-hour laboratory per week. Prerequisites: BIO 155, BIO 156, BIO 157, BIO 158, BIO 221.

**BIO 320L Parasitology Laboratory (0)**

One three hour lab per week. Corequisite: BIO 320.

**BIO 321 Comparative Vertebrate and Human Anatomy (4)**

Course Description: The student will develop an understanding of the evolution of the vertebrate body plan and how vertebrate animals, including humans, operate as highly integrated organisms. The student will also develop an appreciation of evolutionary vertebrate morphology as a dynamic field of research in modern biology. We will use the tools of comparative morphology and functional anatomy to explore the diversity of vertebrate form, and how the variety of structures and systems in vertebrates relates to the lifestyles and ancestry of these animals, including humans. We will use this knowledge to clarify our understanding of the coupling of form and function through almost 600 million years of vertebrate evolution. Offered spring semester. Three hours of lecture and one three-hour laboratory per week. Pre-requisites: BIO 156, BIO158, and BIO221, or permission of instructor. This course fulfills Anatomy requirements for most PT, PA, medical, and veterinary programs.

**BIO 321L Comparative Vertebrate and Human Anatomy Lab (0)**

One three hour lab per week. Corequisite: BIO 321.

**BIO 323 Ecology (4)**

A course emphasizing ecological principles through lecture presentations, laboratory exercises and field studies. Offered alternate years, fall semester. 3 hours of lecture and 3 hours of lab per week. Prerequisites: BIO 155, BIO 156, BIO 157, BIO 158, BIO 221.

**BIO 323L Ecology Laboratory (0)**

One three hour lab per week. Corequisite: BIO 323.

**BIO 330 Seminar in Molecular/Cellular Biology (1)**

A one-hour seminar examining the latest research in the fields of molecular and cellular biology through weekly student presentations of published research articles and discussion. Graded S/U. Prerequisite: BIO 230.

**BIO 331 Biotechnology (4)**

A study of the current topics in biotechnology, and its impact on society, focusing on the techniques and methods used to discover the function of genes and their products. 3 hours of lecture and 3 hours of lab per week. Prerequisite: BIO 230.

**BIO 331L Biotechnology Laboratory (0)**

One three hour lab per week. Corequisite: BIO 331.

**BIO 332 Ornithology (3)**

A study of the basics of avian biology stressing classification, morphology, physiology, behavior and ecology. Field experience emphasized. Offered alternate years, spring semester. 2 hours of lecture and 3 hours of lab per week. Prerequisites: BIO 155, BIO 156, BIO 157, BIO 158, BIO 221.

**BIO 332L Ornithology Lab (0)**

One three hour lab per week. Corequisite: BIO 332.

**BIO 335 Plant Animal Interactions (4)**

The characteristics of all organisms are greatly shaped by their interactions with their environment, particularly other organisms. Our primary objectives in this class are to use plant-animal interactions as a framework to examine the morphology, physiology, ecology, and evolution of plants. Spring semester. 3 hours of lecture and 3 hours of lab per week. Prerequisites: BIO 155, BIO 156, BIO 157, BIO 158, BIO 221.

**BIO 335L Plant Animal Interactions Laboratory (0)**

One three hour lab per week. Corequisite: BIO 335.

**BIO 340 Medical Terminology (2)**

This course is designed for students who need a medical terminology course for admission into a graduate or professional program. All body systems are covered as students learn the appropriate terms by studying the root words, prefixes, and suffixes used in medically-related fields. 2 hours of lecture per week. Offered fall semesters. Prerequisites: Junior standing, BIO 155, BIO 156, BIO 157, BIO 158, BIO 221.

**BIO 375 Problem Solving and Preparation for MCAT, DAT, OAT, PA-CAT (2)**

The focus of this course is to take skills learned across the curriculum in the Arts and Sciences at Saint Mary's and integrate these skills to develop a deeper understanding of biological principles. Having the ability to integrate and analyze information from different disciplines in the arts and sciences is critical for success in graduate school, professional school, and beyond in the sciences and in healthcare. This course focuses on these natural phenomena and applying these skills to understand and analyze biological principles, common skills that are necessary for success on professional programs entrance exams. This course is heavily geared towards students taking entrance exams to enter professional programs. Students looking to apply to these health professional programs need to take their respective entrance exams [DO (MCAT), MD (MCAT), Podiatric Medicine (MCAT), Dental (DAT), Optometry (OAT), and Physician Assistant (PA-CAT)]. All students applying to these programs should plan to take this course as a Junior or Senior at Saint Mary's before taking their entrance exam. Furthermore, this course will teach students "next level" study strategies and time management skills required to be successful in professional school. Prerequisites: BIO 155, BIO 156, BIO 157, BIO 158, or BIO 141 and BIO 142; CHEM 121, CHEM 122, CHEM 221; MATH 104 or higher (math course needed for professional program should have been taken).

**BIO 385 Introduction to Research (2)**

Designed specifically for biology majors of junior standing in preparation for the required senior project. Includes critical reading of scientific literature, discussion of research methods and data analysis, compiling a bibliography, and writing a literature review and a proposal. Part of Advanced Writing requirement. Includes class meetings and conferences with advisors. Offered spring semester. Prerequisites: Junior standing and major.

**BIO 410 Pathophysiology (3)**

Pathophysiology uses case studies to acquaint students with the abnormal physiology associated with states of disease. All organ systems are covered within the semester. Heavily grounded in knowing normal physiology, this class develops critical thinking skills through detailed analysis of alterations in normal mechanisms within the human body. Offered spring semester. 3 hours of lecture per week. Prerequisite: Junior or senior standing; Pre/corequisite: BIO 214 or BIO 328.

**BIO 412 Emerging Infectious Diseases and Their Impact on Global Health (3)**

This course will investigate the factors that drive the emergence of infectious diseases and the effects of emerging diseases on global human health. The course will also address the impact of emerging diseases on the health of wildlife and plant populations. Additionally, the course will discuss the deliberate initiation of emerging infectious diseases; the mechanisms used to mitigate the impact of emerging infectious diseases; and the strategies used to control disease emergence. Offered alternate years, fall semester; 3 hours of lecture per week. Prerequisites: BIO 216 or BIO 317.

**BIO 413 Histology (4)**

This course will introduce students to the process by which tissues are prepared (paraffin embedding, sectioning, staining) for viewing using a light microscope. The laboratory portion of the course will provide students with the opportunity to refine their skills in microscopy and visual identification of cells, tissues, and organs. Three hours of lecture and 3 hours of lab per week. Prerequisites: Junior standing, BIO 155, BIO 156, BIO 157, BIO 158, BIO 213 or BIO 220 highly recommended.

**BIO 413L Histology Laboratory (0)**

Lab. Corequisite: BIO 413.

**BIO 416 Cellular Physiology (4)**

Welcome to Cellular Physiology! This course will be designed for the advanced undergraduate student and will take a deeper look into the biology of behind the necessary every day functions of a cell for survival. Therefore, this course will focus will be the study of membrane structure and properties, membrane trafficking, cellular metabolism, cell death mechanisms, and cell signaling. The course is designed to prepare the advanced undergraduate student for graduate and professional school study. 3 hours of lecture and 3 hours of lab per week Prerequisite: BIO 230.

**BIO 416L Cellular Physiology Laboratory (0)**

Lab. Corequisite: BIO 416.

**BIO 417 Cancer Biology (3)**

Molecular, cellular, and epidemiologic approaches to the study of cancer causation, prevention, and treatment. Offered alternate years, fall semester. 3 hours of lecture per week. Prerequisites: BIO 221, CHEM 121; or BIO 141/142, BIO216, CHEM 118; or permission of instructor.

**BIO 485 Research in Biology (2)**

Independent research leading to the required Senior Comprehensive. Offered fall semester. Prerequisites: BIO 385, senior standing; and BIO 209, BIO 230, BIO 232, BIO 316, BIO 323, or BIO 335.

**BIO 490 Special Topics in Biology (1-4)**

A variable format (e.g. lecture, lab or seminar) course permitting discussion and analysis of topics not normally covered in detail in regularly scheduled courses. The course content and format will be determined by student and faculty interests. Prerequisites: Junior standing and permission of the instructor. May be repeated with different topic.

**BIO 490L Special Topics Lab (0)**

Lab

**BIO 497 Independent Study (1-3)**

An opportunity for independent study for outstanding Junior and Senior students. Original research encouraged. Prerequisite: Permission of faculty advisor and department chair required. May be repeated.

**BIO 499 Internship (1-3)**

Practical off-campus experience with an approved medically or biologically related organization. Jointly supervised by a faculty member and a representative from the sponsor. Graded S/U. Prerequisites: Junior standing and permission of department chair. May be repeated.

## Four Year Plans in Biology

Students who major in Biology at Saint Mary's College can choose from three different concentrations:

- Integrative
- Cellular/Molecular Biology
- Ecology, Evolution, and Environmental Biology

The sample Four-Year Plans presented here are for the Integrative Concentration and show how one might progress through the major if they are:

(A) Math Ready (p. 7) – ready to enter directly into Calculus

(B) Math Ready and Studying Abroad (p. 8) – you CAN study abroad as a Biology major! We recommend going during Sophomore Year Spring or Junior Year Fall for Biology majors; the example shown is for study abroad Junior Year Fall.

(C) Math Wait (p. 9) – the student delays the start of calculus by choice or due to need to take additional math courses to prepare for calculus

Students in Biology generally complete their Sophia LO2 (other than the CTS course) and LO3 requirements outside of the major, although some of our upper level Biology course options include Global Learning, Social Responsibility, Women's Voices, or Academic Experiential Learning attributes.

Students interested in Individualized Advising or Four-Year Plans for the other concentrations in Biology should contact the Chair of the Biology Department.

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**Proposed Four-Year Plan for Biology Majors – Integrative Concentration (Math Ready)**

**Total credits must equal at least 60 credit hours**

Course	Title	Credits
<b>First Year</b>		
<b>First Semester</b>		
BIO 155 & BIO 156	Foundations of Molecular Biology and Foundations of Ecology and Evolution (Sophia Natural Science)	4
CHEM 121	Principles of Chemistry I (Sophia CTS and Natural Science)	4
MATH 131	Calculus I (Sophia Mathematical Arts)	4
Sophia Language I (4cr)		
<b>Credits</b>		<b>12</b>
<b>Second Semester</b>		
BIO 157 & BIO 158	Foundations of Cellular Biology and Foundations of Form and Function	4
CHEM 122	Principles of Chemistry II	4
MATH 132	Calculus II	4

Sophia Language II (4cr)		12
<b>Credits</b>		<b>12</b>
<b>Second Year</b>		
<b>First Semester</b>		
BIO 221	Introduction to Genetics	4
CHEM 221 & 221L	Organic Chemistry I and Organic Chemistry I Laboratory	4
Sophia W (Literature recommended – 4cr)		
Sophia (3cr)		
Elective (0-4cr)		
<b>Credits</b>		<b>8</b>
<b>Second Semester</b>		
Biology Course (4cr)		3-4
CHEM 222 & 222L	Organic Chemistry II and Organic Chemistry II Laboratory	4
Sophia (3cr)		
Sophia (3cr)		
Elective (0-4cr)		
<b>Credits</b>		<b>7-8</b>
<b>Third Year</b>		
<b>First Semester</b>		
Biology course (3-4cr)		3-4
Sophia (3cr)		
Sophia (3cr)		
Sophia (3cr)		
Elective (0-4cr)		
<b>Credits</b>		<b>3-4</b>
<b>Second Semester</b>		
BIO 385	Introduction to Research	2
Biology course (3-4cr)		3-4
Sophia (3cr)		
Sophia (3cr)		
Elective (0-4cr)		
<b>Credits</b>		<b>5-6</b>
<b>Fourth Year</b>		
<b>First Semester</b>		
BIO 485	Research in Biology	2
Biology Course (3-4cr)		3-4
Sophia course (3cr)		
Elective (0-4cr)		
Elective (0-4cr)		
<b>Credits</b>		<b>5-6</b>
<b>Second Semester</b>		
Biology Course (3-4cr)		3-4
Biology Course (3-4cr)		3-4
Elective (0-4cr)		
Elective (0-4cr)		
Elective (0-4cr)		
<b>Credits</b>		<b>6-8</b>
<b>Total Credits</b>		<b>58-64</b>

### Proposed Four-Year Plan for Biology Majors – Integrative Concentration (Math Ready and Study Abroad)

**TOTAL CREDITS MUST EQUAL AT LEAST 60 CREDIT HOURS**

Course	Title	Credits
<b>First Year</b>		
<b>First Semester</b>		
BIO 155 & BIO 156	Foundations of Molecular Biology and Foundations of Ecology and Evolution (Sophia Natural Science)	4
CHEM 121	Principles of Chemistry I (Sophia CTS and Natural Science)	4
MATH 131	Calculus I (Sophia Mathematical Arts)	4
Sophia Language I (4cr)		
<b>Credits</b>		<b>12</b>
<b>Second Semester</b>		
BIO 157 & BIO 158	Foundations of Cellular Biology and Foundations of Form and Function	4
CHEM 122	Principles of Chemistry II	4
MATH 132	Calculus II	4
Sophia Language II (4cr)		
<b>Credits</b>		<b>12</b>
<b>Second Year</b>		
<b>First Semester</b>		
BIO 221	Introduction to Genetics	4
CHEM 221 & 221L	Organic Chemistry I and Organic Chemistry I Laboratory	4
Sophia W (Literature recommended – 4cr)		
Sophia (3cr)		
Elective (0-4cr)		
<b>Credits</b>		<b>8</b>
<b>Second Semester</b>		
Biology Course (4cr)		4
CHEM 222 & 222L	Organic Chemistry II and Organic Chemistry II Laboratory *	4
Sophia (3cr)		
Sophia (3cr)		
Elective (0-4cr)		
<b>Credits</b>		<b>8</b>
<b>Third Year</b>		
<b>First Semester</b>		
Biology course (3-4cr)		3-4
Sophia (3cr)		
Sophia (3cr)		
Sophia (3cr)		
Elective (0-4cr)		
<b>Credits</b>		<b>3-4</b>
<b>Second Semester</b>		
BIO 385	Introduction to Research	2
Biology course (3-4cr)		3
Sophia (3cr)		
Sophia (3cr)		
Elective (0-4cr)		
<b>Credits</b>		<b>5</b>



**Fourth Year****First Semester**

BIO 485	Research in Biology	2
Biology Course (3-4cr)		3
Sophia course (3cr)		
Elective (0-4cr)		
Elective (0-4cr)		
<b>Credits</b>		<b>5</b>

**Second Semester**

Biology Course (3-4cr)		3
Biology Course (3-4cr)		3
Elective (0-4cr)		
Elective (0-4cr)		
Elective (0-4cr)		
<b>Credits</b>		<b>6</b>

**Total Credits** 59-60

\* CHEM 222 Organic Chemistry II taken if graduate or professional school requires a second semester of organic chemistry.

**Proposed Four-Year Plan for Biology Majors – Integrative Concentration (Math Wait\*\*)****TOTAL CREDITS MUST EQUAL AT LEAST 60 CREDIT HOURS**

Course	Title	Credits
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**First Year****First Semester**

BIO 155 & BIO 156	Foundations of Molecular Biology and Foundations of Ecology and Evolution (Sophia Natural Science)	4
CHEM 121	Principles of Chemistry I (Sophia CTS and Natural Science)	4
Sophia Language I (4cr)		
Sophia (3cr)		
<b>Credits</b>		<b>8</b>

**Second Semester**

BIO 157 & BIO 158	Foundations of Cellular Biology and Foundations of Form and Function	4
CHEM 122	Principles of Chemistry II	4
Sophia Language II (4cr)		
Sophia W (Literature recommended - 4cr)		
<b>Credits</b>		<b>8</b>

**Second Year****First Semester**

BIO 221	Introduction to Genetics	4
CHEM 221 & 221L	Organic Chemistry I and Organic Chemistry I Laboratory	4
MATH 131	Calculus I (Sophia Mathematical Arts)	4
Sophia (3cr)		
Sophia (3cr)		
<b>Credits</b>		<b>12</b>

**Second Semester**

Biology Course (4cr)		4
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CHEM 222 & 222L	Organic Chemistry II and Organic Chemistry II Laboratory *	4
MATH 132	Calculus II	4
Sophia (3cr)		
Sophia (3cr)		

**Credits** 12

**Third Year****First Semester**

Biology Course (3-4cr)		3
Sophia (3cr)		
Sophia (3cr)		
Elective (0-4cr)		
Elective (0-4cr)		

**Credits** 3

**Second Semester**

BIO 385	Introduction to Research	2
Biology Course (3-4cr)		3
Sophia (3cr)		
Elective (0-4cr)		
Elective (0-4cr)		

**Credits** 5

**Fourth Year****First Semester**

BIO 485	Research in Biology	2
Biology Course (3-4cr)		3-4
Sophia course (3cr)		
Elective (0-4cr)		
Elective (0-4cr)		

**Credits** 5-6

**Second Semester**

Biology Course (3-4cr)		3
Biology Course (3-4cr)		3
Elective (0-4cr)		
Elective (0-4cr)		
Elective (0-4cr)		

**Credits** 6

**Total Credits** 59-60

\* CHEM 222 Organic Chemistry II taken if graduate or professional school requires a second semester of organic chemistry.

\*\* Students who place into Pre-Calculus are encouraged to replace the non-language Sophias listed in the first year with MATH 103 Precalculus in the fall and MATH 131 Calculus I in the spring. They would then take MATH 132 Calculus II in the fall of Sophomore year and make up the two displaced Sophia courses in the remaining semesters in place of electives.