

Biology

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FACULTY/PROFESSIONAL SPECIALISTS

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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 foreign study is feasible and recommended for four-year biology majors.

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.

ADVANCED WRITING PROFICIENCY

This proficiency is demonstrated by the approval of 4 scientific pieces of writing based on a directed research project. It also includes successful completion of BIO 385 and BIO 485.

SENIOR COMPREHENSIVE

The Senior Comprehensive requirement in Biology is fulfilled by successful completion of BIO 385 and BIO 485. It also involves completion of a committee-approved paper and an oral presentation to the department.

BIOLOGY DEPARTMENT LEARNING OBJECTIVES

- 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 field courses, courses dealing with morphology, physiological/molecular courses, botanical courses, and zoological 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, 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 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.

PROGRAM IN BIOLOGY

Bachelor of Science, Major in Biology, Integrative Biology—BIO (60 hours)

Thirty seven (37) hours must be in biology.

All of the following:

BIO 155	Foundations of Molecular Biology	lab	2 hours
BIO 156	Foundations of Ecology and Evolution	lab	2 hours
BIO 157	Foundations of Cellular Biology	lab	2 hours
BIO 158	Foundations of Form and Function	lab	2 hours
BIO 221	Introduction to Genetics	lab	4 hours
BIO 385	Introduction to Research		2 hours
BIO 485	Research in Biology		2 hours

One from each of the following areas:

Cellular/Physiological Course

BIO 230	Molecular Cell Biology	lab	4 hours
BIO 317	Microbiology	lab	4 hours
BIO 328	General Physiology	lab	4 hours
BIO 413	Histology	lab	4 hours

Field Course

BIO 209	Marine Biology	lab	4 hours
BIO 301	Field Biology	lab	3 hours
BIO 308	Vertebrate Natural History	lab	4 hours
BIO 316	Conservation Biology	lab	4 hours
BIO 323	Ecology	lab	4 hours
BIO 324	Field Botany	lab	4 hours
BIO 332	Ornithology	lab	3 hours

Organismal Course

BIO 213	Introductory Human Anatomy	lab	4 hours
BIO 220	Comparative Vertebrate and Human Anatomy	lab	4 hours
BIO 308	Vertebrate Natural History	lab	4 hours
BIO 320	Parasitology	lab	4 hours
BIO 332	Ornithology	lab	3 hours

Botanical Course

BIO 313	Economic Botany		3 hours
BIO 324	Field Botany	lab	4 hours
BIO 335	Plant-Animal Interactions	lab	4 hours

Electives to total 37 hours in Biology. Up to three hours of non-traditional (nt) credits and a maximum of two non-lab courses of three hours each may be counted toward the required elective hours in biology.

BIO 160	Science Writing and Communication		3 hours
BIO 209	Marine Biology	lab	4 hours
BIO 213	Introductory Human Anatomy	lab	4 hours
BIO 220	Comparative Vertebrate and Human Anatomy	lab	4 hours
BIO 230	Molecular Cell Biology	lab	4 hours
BIO 232	Animal Behavior	lab	4 hours
BIO 248	Issues in Environmental Biology		1 hour
BIO 270	Environments of Ecuador		3 hours
BIO 301	Field Biology	lab	3 hours
BIO 308	Vertebrate Natural History	lab	4 hours
BIO 310	Teaching in Biology (3 hours max)	nt	1–3 hours
BIO 312	Evolution		3 hours
BIO 313	Economic Botany		3 hours
BIO 315	Statistical Methods for Biologists	lab	3 hours
BIO 316	Conservation Biology	lab	4 hours
BIO 317	Microbiology	lab	4 hours

BIO 318	Immunology		3 hours
BIO 320	Parasitology	lab	4 hours
BIO 323	Ecology	lab	4 hours
BIO 324	Field Botany	lab	4 hours
BIO 326	Developmental Biology	lab	4 hours
BIO 328	General Physiology	lab	4 hours
BIO 332	Ornithology	lab	3 hours
BIO 333	Biomedical Technology, Ethics, and Decision Making		3 hours
BIO 335	Plant-Animal Interactions	lab	4 hours
BIO 340	Medical Terminology		2 hours
BIO 410	Pathophysiology		3 hours
BIO 412	Emerging Infectious Diseases and Their Impact on Global Health		3 hours
BIO 417	Cancer Biology		3 hours
BIO 497	Independent Study	nt	1–3 hours
BIO 499	Internship	nt	1–3 hours

Required Supporting Courses

All of the following:

CHEM 121-122	Principles of Chemistry I, II		8 hours
CHEM 221	Organic Chemistry I		4 hours

One of the following sequences for two semesters of Math:

MATH 131-132	Calculus I, II		8 hours
MATH 133, 114	Theory and Application of Calculus/Introduction to Statistics		7 hours
MATH 133, 225	Theory and Application of Calculus/Foundations of Higher Mathematics		7 hours

Additional math and/or science courses to bring the total to 60 hours if needed.

Bachelor of Science, Major in Biology, Concentration in Cellular/Molecular Biology—BICM (60 hours)

Thirty seven (37) hours must be in biology.

All of the following:

BIO 155	Foundations of Molecular Biology	lab	2 hours
BIO 156	Foundations of Ecology and Evolution	lab	2 hours
BIO 157	Foundations of Cellular Biology	lab	2 hours
BIO 158	Foundations of Form and Function	lab	2 hours
BIO 221	Introduction to Genetics	lab	4 hours
BIO 230	Molecular Cell Biology	lab	4 hours
BIO 317	Microbiology	lab	4 hours
BIO 328	General Physiology	lab	4 hours
BIO 330	Seminar in Molecular/Cellular Biology		1 hour
BIO 331	Biotechnology	lab	4 hours
BIO 385	Introduction to Research		2 hours
BIO 416	Cellular Physiology (Spring)	lab	4 hours
BIO 485	Research in Biology		2 hours

Electives to total 37 hours in Biology. Up to three hours of non-traditional (nt) credits and a maximum of two non-lab courses of three hours each may be counted toward the required elective hours in biology.

BIO 160	Science Writing and Communication		3 hours
BIO 209	Marine Biology	lab	4 hours
BIO 213	Introductory Human Anatomy	lab	4 hours
BIO 220	Comparative Vertebrate and Human Anatomy	lab	4 hours
BIO 232	Animal Behavior	lab	4 hours
BIO 248	Issues in Environmental Biology		1 hour
BIO 270	Environments of Ecuador		3 hours
BIO 301	Field Biology	lab	3 hours

BIO 308	Vertebrate Natural History	lab	4 hours
BIO 310	Teaching in Biology (3 hours max)	nt	1–3 hours
BIO 312	Evolution		3 hours
BIO 313	Economic Botany		3 hours
BIO 315	Statistical Methods for Biologists	lab	3 hours
BIO 316	Conservation Biology	lab	4 hours
BIO 318	Immunology		3 hours
BIO 320	Parasitology	lab	4 hours
BIO 323	Ecology	lab	4 hours
BIO 324	Field Botany	lab	4 hours
BIO 326	Developmental Biology	lab	4 hours
BIO 332	Ornithology	lab	3 hours
BIO 333	Biomedical Technology, Ethics, and Decision Making		3 hours
BIO 335	Plant-Animal Interactions	lab	4 hours
BIO 340	Medical Terminology		2 hours
BIO 410	Pathophysiology		3 hours
BIO 412	Emerging Infectious Diseases and Their Impact on Global Health		3 hours
BIO 413	Histology	lab	4 hours
BIO 416	Cellular Physiology	lab	4 hours
BIO 417	Cancer Biology		3 hours
BIO 497	Independent Study	nt	1–3 hours
BIO 499	Internship	nt	1–3 hours

Required Supporting Courses

All of the following:

CHEM 121-122	Principles of Chemistry I, II		8 hours
CHEM 221	Organic Chemistry I		4 hours

One of the following sequences for two semesters of Math:

MATH 131-132	Calculus I, II		8 hours
MATH 133, 114	Theory and Application of Calculus/Introduction to Statistics		7 hours
MATH 133, 225	Theory and Application of Calculus/Foundations of Higher Mathematics		7 hours

Additional math and/or science courses to bring the total to 60 hours if needed.

Bachelor of Science, Major in Biology, Concentration in Ecology, Evolution and Environmental Biology—EEEB (60 hours)

Thirty seven (37) hours must be in biology.

All of the following:

BIO 155	Foundations of Molecular Biology	lab	2 hours
BIO 156	Foundations of Ecology and Evolution	lab	2 hours
BIO 157	Foundations of Cellular Biology	lab	2 hours
BIO 158	Foundations of Form and Function	lab	2 hours
BIO 221	Introduction to Genetics	lab	4 hours
BIO 248	Issues in Environmental Biology		1 hour
BIO 312	Evolution		3 hours
BIO 315	Statistical Methods for Biologists	lab	3 hours
BIO 323	Ecology	lab	4 hours
BIO 385	Introduction to Research		2 hours
BIO 485	Research in Biology		2 hours

Two of the following:

BIO 209	Marine Biology	lab	4 hours
BIO 301	Field Biology	lab	3 hours
BIO 308	Vertebrate Natural History	lab	4 hours

BIO 316	Conservation Biology	lab	4 hours
BIO 324	Field Botany	lab	4 hours
BIO 332	Ornithology	lab	3 hours
BIO 335	Plant-Animal Interactions	lab	4 hours

Electives to total 37 hours in Biology. Up to three hours of non-traditional (nt) credits and a maximum of two non-lab courses of three hours each may be counted toward the required elective hours in biology.

BIO 160	Science Writing and Communication		3 hours
BIO 209	Marine Biology	lab	4 hours
BIO 213	Introductory Human Anatomy	lab	4 hours
BIO 220	Comparative Vertebrate and Human Anatomy	lab	4 hours
BIO 230	Molecular Cell Biology	lab	4 hours
BIO 232	Animal Behavior	lab	4 hours
BIO 270	Environments of Ecuador		3 hours
BIO 301	Field Biology	lab	3 hours
BIO 308	Vertebrate Natural History	lab	4 hours
BIO 310	Teaching in Biology (3 hours max)	nt	1–3 hours
BIO 313	Economic Botany		3 hours
BIO 316	Conservation Biology	lab	4 hours
BIO 317	Microbiology	lab	4 hours
BIO 318	Immunology		3 hours
BIO 320	Parasitology	lab	4 hours
BIO 324	Field Botany	lab	4 hours
BIO 326	Developmental Biology	lab	4 hours
BIO 328	General Physiology	lab	4 hours
BIO 332	Ornithology	lab	3 hours
BIO 333	Biomedical Technology, Ethics, and Decision Making		3 hours
BIO 335	Plant-Animal Interactions	lab	4 hours
BIO 340	Medical Terminology		2 hours
BIO 410	Pathophysiology		3 hours
BIO 412	Emerging Infectious Diseases and Their Impact on Global Health		3 hours
BIO 413	Histology	lab	4 hours
BIO 417	Cancer Biology		3 hours
BIO 497	Independent Study	nt	1–3 hours
BIO 499	Internship	nt	1–3 hours

Required Supporting Courses

All of the following:

CHEM 121-122	Principles of Chemistry I, II		8 hours
CHEM 221	Organic Chemistry I		4 hours

One of the following sequences for two semesters of Math:

MATH 131-132	Calculus I, II		8 hours
MATH 133, 114	Theory and Application of Calculus/Introduction to Statistics		7 hours
MATH 133, 225	Theory and Application of Calculus/Foundations of Higher Mathematics		7 hours

Additional math and/or science courses to bring the total to 60 hours if needed.

Minor in Biology—BIO (17–20 hours)

Five (5) 3-4 hour courses in biology, 3 must have a laboratory component; 3 must be above the 100 level:

BIO 107	Physiology of Women		3 hours
BIO 110	Understanding Women's Cancers	lab	4 hours
BIO 120	Human Genetics and Society		3 hours
BIO 141	Human Anatomy and Physiology I	lab	4 hours
BIO 142	Human Anatomy and Physiology II	lab	4 hours
BIO 155-156	Foundations of Molecular Biology/		

BIO 157-158	Ecology and Evolution	lab	4 hours
	Foundations of Cellular Biology/		
	Form and Function	lab	4 hours
BIO 160	Science Writing and Communication		3 hours
BIO 209	Marine Biology	lab	4 hours
BIO 213	Introductory Human Anatomy	lab	4 hours
BIO 214	Human Physiology	lab	4 hours
BIO 216	Introduction to Microbiology	lab	4 hours
BIO 220	Comparative Vertebrate and Human Anatomy	lab	4 hours
BIO 221	Introduction to Genetics	lab	4 hours
BIO 224	Introduction to Pathophysiology	lab	3 hours
BIO 230	Molecular Cell Biology	lab	4 hours
BIO 232	Animal Behavior	lab	4 hours
BIO 235	Foundations of Neuroscience	lab	4 hours
BIO 270	Environments of Ecuador		3 hours
BIO 301	Field Biology	lab	3 hours
BIO 308	Vertebrate Natural History	lab	4 hours
BIO 312	Evolution		3 hours
BIO 313	Economic Botany		3 hours
BIO 315	Statistical Methods for Biologists	lab	3 hours
BIO 316	Conservation Biology	lab	4 hours
BIO 317	Microbiology	lab	4 hours
BIO 318	Immunology		3 hours
BIO 320	Parasitology	lab	4 hours
BIO 323	Ecology	lab	4 hours
BIO 324	Field Botany	lab	4 hours
BIO 326	Developmental Biology	lab	4 hours
BIO 328	General Physiology	lab	4 hours
BIO 331	Biotechnology	lab	4 hours
BIO 332	Ornithology	lab	3 hours
BIO 333	Biomedical Technology, Ethics, and Decision Making		3 hours
BIO 335	Plant-Animal Interactions	lab	4 hours
BIO 410	Pathophysiology		3 hours
BIO 412	Emerging Infectious Diseases and Their Impact on Global Health		3 hours
BIO 413	Histology	lab	4 hours
BIO 417	Cancer Biology		3 hours
BIO 497	Independent Study	nt	1-3 hours
BIO 499	Internship	nt	1-3 hours

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.

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) highlights the natural beauty of Ecuador in a 15-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.



BIOLOGY COURSES (BIO)

107 Physiology of Women (3)

This course, designed for the non-science major, 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.

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).

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.

112 Evolution for Everyone (3)

This course is designed for nonscience majors and 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.

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.

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, and nervous system (including special senses). 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.

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 cardiovascular system, blood, 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.

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 nonmajors 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.

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 nonmajors 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.

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 nonmajors 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.

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, but also available to nonmajors. 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.

160 Science Writing and Communication (3)

This course introduces students to the fundamentals of science writing and communication to both a technical and nontechnical 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.

Note: Unless otherwise noted, all 200-level biology courses require either BIO 153-154 or BIO 155, 156, 157, 158.

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. (Three hours lecture, one two-hour laboratory; includes a one week field trip to the Caribbean and additional fee for travel and expenses.) Offered alternate years with BIO 320, spring semester.

213 Introductory Human Anatomy (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, regardless of major. Fall semester; three hours lecture and one three-hour laboratory per week. Prerequisites: one semester of introductory biology or permission of instructor.

214 Human Physiology (4)

Concepts of human physiology built upon a strong understanding of human anatomy. For students majoring in areas other than biology. (Three hours lecture and one three-hour laboratory) Offered fall semester. Prerequisite: one semester each of biology and chemistry.

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. (Three hours lecture and three hours of laboratory) Offered spring semester. Prerequisites: BIO 141, 142, and CHEM 118.

220 Comparative Vertebrate and Human Anatomy (4)

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 in alternating years. This course is appropriate for Biology majors and students interested in pre-health (PT, PA, medical), and veterinary programs. Three hours lecture and one three-hour laboratory per week. Prerequisites: BIO 156, 158 or permission of instructor.

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. Fall semester; three hours lecture and one three-hour laboratory per week. Prerequisites: CHEM 121-122 or permission of instructor.

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 fall semester primarily for sophomore nursing majors and in the summer for nursing students planning to study abroad in the fall of their sophomore year. Three hours lecture per week. Prerequisites: BIO 141, 142, and CHEM 118.

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. Spring semester; three hours lecture and one three-hour laboratory per week. Prerequisite: BIO 221.

232 Animal Behavior (4)

A study of historical and current topics in animal behavior. Classical experiments are stressed in labs. Offered alternate years, spring semester: three hours lecture and one three-hour laboratory.

235 Foundations of Neuroscience (4)

The human brain is the most complex thus fascinating organ (machine) in the body. How is this system built? How does this system work? How does the brain respond to the environment and regulate movement? How does the body regulate physiological processes? These are the main questions that we will explore in this course. We will address these questions by learning 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 sensory and 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. Prerequisite: BIO 153 or BIO 155 and 157 or PSYC 234 or permission of instructor.

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.

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, alternate years. Prerequisite: one semester of biology or permission of instructor.

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.

Note: Unless otherwise noted, all 300-level biology courses require either BIO 153-154 or BIO 155, 156, 157, 158 and BIO 221.

301 Field Biology (3)

An intensive field course concerned with techniques for studying plants and animals in a natural setting. Offered summers, occasionally.

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. Three hours lecture and one three-hour laboratory per week.

310 Teaching in Biology (.5-3)

Faculty-supervised lecture or laboratory assistance experience for biology majors. Includes preparation time for theory review and procedures as well as peer mentoring in the laboratory and/or lecture under faculty supervision. Application is required: final selection will be by faculty member directing the experience. Variable credit from .5-3 semester hours. Learning contract required. Graded S/U.

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. Fall semester. Prerequisites: either BIO 155-158 or ENVS 171 or equivalent.

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. Offered alternate years with BIO 315, fall semester: three hours lecture.

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 with BIO 313, fall semester. Two hours lecture and one three-hour laboratory per week. Prerequisites: Junior standing and MATH 131–132 or equivalent.

316 Conservation Biology (4)

Conservation biology is a relatively new sub-discipline of biology concerned with exploring the under-lying 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. Fall semester; three hours lecture and one three-hour laboratory per week. Prerequisite: BIO 155-158 or ENVS 171.

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: three hours lecture; one two-hour and one one-hour laboratory per week. Prerequisites: CHEM 121–122, 221.

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: three hours lecture. Prerequisites: BIO 155, 157, and 221 or permission of instructor.

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. Spring semester: three hours lecture and one three-hour laboratory per week.

323 Ecology (4)

A course emphasizing ecological principles through lecture presentations, laboratory exercises and field studies. Offered alternate years with BIO 324, fall semester. Three hours lecture and one three-hour laboratory per week.

324 Field Botany (4)

A study of flowering plant taxonomy with an emphasis on principles of classification, sources of taxonomic data and global diversity. Laboratory sessions emphasize the use of keys to identify plants in the local flora. Offered alternate years with BIO 323, fall semester. Three hours lecture and one three-hour laboratory per week.

328 General Physiology (4)

Mechanisms and processes in cells, organs, and organ systems that work to maintain homeostasis in the organism. Basic physiological principles are the primary emphasis while all organ systems are discussed

in order that students may learn to apply the information in any type of setting or in any organism. Critical thinking, problem solving, and understanding interactions among systems are emphasized throughout the course. Spring semester; three hours lecture and one three-hour laboratory per week. Prerequisites: Junior standing, CHEM 121–122, 221.

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.

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. Three hours lecture and one three-hour laboratory per week. Prerequisite: BIO 230.

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: two hours lecture and one three-hour laboratory per week.

333 Biomedical Technology, Ethics, and Decision Making (3)

An overview of recent advances in biomedical technology and the ethical issues encountered by consumers when faced with the opportunity to utilize these technological advances. Using case studies, students will review the basic science supporting each new technology, its intended use, and subsequent risks and benefits. Offered spring semester: three hours lecture per week. Junior standing required.

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: three hours lecture and one three-hour lab per week.

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. Offered fall semesters. Junior standing required.

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.

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. Prerequisite (or corequisite with permission of instructor): Junior or senior standing, BIO 214 or 328.

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 fall semester; three hours of lecture per week. Prerequisite: BIO 216 or 317.

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. Spring Semester every other year: three hours of lecture and three-hour laboratory each week. BIO 155-158 and junior standing required. BIO 213 or 220 highly recommended.

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. Prerequisite: BIO 155-158, 221, 230.

417 Cancer Biology (3)

Molecular, cellular, and epidemiologic approaches to the study of cancer causation, prevention, and treatment. Offered alternate years, fall semester: Three hours lecture.

Prerequisites: BIO155, 157, 121 or permission of instructor.

485 Research in Biology (2)

Independent research leading to the required Senior Comprehensive. Offered fall semester.

Prerequisites: BIO 385, senior standing.

490 Special Topics in Biology (1-3)

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.

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.

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.