

## Accounting

(See description of Accounting courses in the Business section, p. 37)

## Athletics

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WJU is committed to offering its students a strong liberal arts education. A physical education program will help them maintain a high level of fitness in their lives. There are obvious and increasingly recognized health reasons why physical conditioning is important.

## Biology

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The following major programs are offered in Biology:

1. Biology
2. General Science (Biology)

### Core Fulfilling Courses

- BIO 105 The Process of Biology
- BIO 107 Evolution and Ecology
- BIO 108 Form and Function
- BIO 109 Cells and Chromosomes
- BIO 128 Human Anatomy and Physiology I

Biology is the study of life. The biology curriculum is designed to awaken the student's interest in the living world; develop scientific habits and methods in the pursuit of knowledge; and train the student in preparation for careers in medicine, dentistry, pharmacy, research, teaching and other technical or biological vocations.

Biology majors must have a grade point average in biology at or above 2.0 to graduate with a B.S. degree in biology. Additionally, all biology majors must have a grade point average at or above 2.0 in the sciences (biology, chemistry, math and physics) at the completion of their 200-level courses in order to take upper level (300-level and above) courses in biology.

### Requirements for Biology Major Bachelor of Science Degree

Upon the completion of the biology program, students will demonstrate proficiency in:

1. Understanding the principles & concepts fundamental to biology
2. Performing laboratory techniques appropriate for entry-level biologists

3. Problem-solving and analytical thinking

4. Oral and written communication

In addition to completing the core curriculum requirements, biology majors must complete the following courses:

BIO 107	Evolution and Ecology	3 crs
BIO 108	Form and Function	3 crs
BIO 109	Cells and Chromosomes	3 crs
BIO 121, 122	General Biology Labs	1 cr ea
BIO 205, 221	Ecology and Lab	3 and 1 crs
BIO 210, 222	Genetics and Lab	3 and 1 crs
BIO 320, 321	Vertebrate Biology and Lab	3 and 1 crs
BIO 330, 331	Developmental Biology and Lab	3 and 1 crs
BIO 340, 341	Cell & Molecular Biology and Lab	3 and 1 crs
BIO 375, 376, 475	Student Research	1 cr ea
BIO 424, 426	Advanced Physiology Lab, Molecular Biology Lab	1 cr ea
BIO 480, 482	Biology Seminar, Research Seminar	3 crs
400-Level BIO. Electives (2)	Advanced Biology Electives	3 or 4 crs ea
CHE 110, 120	General Chemistry I, II	4 crs ea
CHE 121, 122	General Chemistry Labs I, II	1 cr ea
CHE 221, 222	Organic Chemistry	4 crs ea
CHE 231, 232	Organic Chemistry Labs	1 cr ea
PHY 110, 120	Physics I, II	4 crs ea
PHY 121, 122	Physics Labs I, II	2 cr ea
MAT 108 or 111	Precalculus or Calculus	3 or 4 crs
MAT 204	Statistics	3 crs
		83-85 crs



**Requirements for General Science Major Bachelor of Science Degree**

Upon the completion of the General Science (Biology) program, students will be able to demonstrate the ability to:

1. Understand the principles and concepts fundamental to science, with an emphasis in biology.
2. Utilize laboratory techniques appropriate for a person who is knowledgeable in science.
3. Develop problem-solving skills in science and other areas of inquiry.
4. Communicate effectively in speech and writing.

The General Science Biology major is designed to complement the Teacher Preparation Program by providing an excellent background in science, particularly biology. This major may also be successfully combined with a marketing or professional writing major to provide training for success in non-traditional, science-related careers such as technical writing or the marketing of biotechnology.

General Science Biology majors must have a grade point average in Biology at or above 2.0 to graduate with a B.S. degree in General Science Biology. Additionally, all General Science Biology majors must have a grade point average at or above 2.0 in the Sciences (biology, chemistry, math and physics) at the completion of their 200-level courses in order to take upper level (300 level and above) courses in Biology.

The General Science Biology major does not meet the requirements for traditional biology or health-related careers and is not intended to serve as a substitute in these areas.

In addition to completing the core curriculum requirements, biology majors must complete the following courses:

BIO 107	Evolution and Ecology	3 crs
BIO 108	Form and Function	3 crs
BIO 109	Cells and Chromosomes	3 crs
BIO 121, 122	General Biology Labs	1 cr ea
BIO 205, 221	Ecology and Lab	3 and 1 crs
BIO 210, 222	Genetics and Lab	3 and 1 crs
BIO 320, 321	Vertebrate Biology & Lab	3 and 1 crs
BIO 330	Developmental Biology	3 crs
BIO 340, 341	Cell & Molecular Biology and Lab	3 and 1 crs
BIO 480	Biology Seminar	1 cr
CHE 110, 120,	General Chemistry I and II	4 crs ea
CHE 121, 122	General Chemistry Labs I and II	1 cr ea
CHE 221, 222	Organic Chemistry	4 crs ea
PHY 110, 120,	Physics I, II	4 crs ea
PHY 121, 122	Physics Lab I, II	2 crs ea
		61 crs

BIOLOGY - Recommended Course Sequence								
		Freshman	Sophomore	Junior		Senior		
FALL	BIO 107 or 108	3	BIO 109	3	BIO 340 & 341	4	RST elective	3
	BIO 121	1	BIO 205 & 221	4	LIT 250	3	BIO 475	1
	MAT 108 or 111	3	CHE 221 & 231	5	PHY 110 & 121	5	MOL 111	2
	FYS 101	1	ENG 105 or 110	3	BIO 375	1	BIO 480	1
	HIS 110	3	FAS elective	3	RST 106/107	3	BIO 424	1
	CHE 110 & 121	5					BIO elective	3 or 4
						PHI 205	3	
	Semester total	16		18		16		15-16
SPRING	BIO 107 or 108	3	BIO 210 & 222	4	BIO 330 & 331	4	BIO 482	2
	CHE 120 & 122	5	CHE 222 & 232	5	MOL 102	3	RST/PHI 305	3
	BIO 122	1	LIT 120	3	PHY 120 & 122	5	Global Persp.	3
	HIS 120	3	BIO 320 & 321	4	MAT 204	3	BIO 426	1
	PHI 105	3			BIO 376	1	BIO elective	3 or 4
							SSC elective	3
	Semester total	15		16		16		15-16
	Total Credits	31		34		32		30-32 127-129

**Requirements for a Minor in Biology**

Biology minors must complete the following courses:

BIO 107	Evolution and Ecology	3 crs
BIO 108	Form and Function	3 crs
BIO 109	Cells and Chromosomes	3 crs
BIO 121, 122	General Biology Labs	1 cr ea
BIO 205, 221	Ecology and Lab	3 and 1 crs
BIO 210, 222	Genetics and Lab	3 and 1 crs
BIO 320, 321	Vertebrate Biology & Lab	3 and 1 crs
BIO 330	Developmental Biology	3 crs
BIO 340, 341	Cell & Molecular Biology and Lab	3 and 1 crs
		30 crs

**Course Descriptions****BIO 105 The Process of Biology (3 crs)**

*(meets the first core science requirement).*

An introduction to biology as a way of knowing and communicating about living systems. The themes are how living systems process energy and information, ecologically relate to their environments and evolve over time. The goal of this course is for the student to gain an increased level of proficiency in scientific literacy; including theory application, evaluating evidence and manipulating concepts.

**BIO 107 Evolutionary and Ecological Biology: The Dynamic Environment (3 crs)**

An exploration of how living things relate to each other in both space (ecology) and time (evolution). Included is an overview of the history and diversity of life on earth, an examination of representatives of various taxonomic groups as well as a study of taxonomy itself. *(BIO 107, 108 and 109 are required for Biology majors, and may be completed in any order.)*

**BIO 108 The Form & Function of Biological Organisms (3 crs)**

An overview of the anatomy and physiology of plants and animals, with an emphasis on human structures. The inter-relationships of the hierarchical levels of biological organization will be discussed. *(BIO 107, 108 and 109 are required for Biology majors, and may be completed in any order.)*

**BIO 109 Cells and Chromosomes (3 crs)**

An exploration of variations on the themes of biology at the cellular level, including subcellular architecture and ultrastructure; metabolism; molecular biology; cell signaling; cellular reproduction; and an introduction into the concepts of genetics and development. Since this course will involve the examination of living systems at the molecular level, this course should only be taken after students have had at least one semester of college-level chemistry. Prerequisite: one semester of college-level chemistry. *(Students should have had a successful experience in chemistry at the college level prior to taking BIO 109. BIO 107, 108 and 109 are required for Biology majors, and may be completed in any order.)*

**GENERAL SCIENCE (BIOLOGY) - Recommended Course Sequence**

	Freshman		Sophomore		Junior		Senior	
<b>FALL</b>	BIO 107 or 108	3	BIO 109	3	BIO 330 & 331	4	RST Elective	3
	CHE 110 & 121	5	BIO 205 & 221	4	BIO 480	1	SSC Elective	3
	ENG 105 or 110	3	CHE 221	4	RST 106/107	3	Electives	6
	FYS 101	1	MAT 108 or 111	3	PHY 110 & 121	5	MOL 111	3
	HIS 110	3	FAS elective	3	LIT 250	3		
	BIO 121	1						
	Semester total	16		17		16		15
<b>SPRING</b>	BIO 107 or 108	3	BIO 320 & 321	4	BIO 340 & 341	4	SSC POS Elective	3
	CHE 120 & 122	5	CHE 222	4	PHY 120 & 122	5	RST/PHI 305	3
	PHI 105	3	BIO 210 & 222	4	PHI 205	3	Glob. Persp.	3
	HIS 120	3	LIT 120	3	MOL 102	3	Electives	6
	BIO 122	1						
		Semester total	15		15		15	
	Total Credits	31		32		31		30 124

**BIO 110 Biology of Reproduction (3 crs)**

Reproduction is an impelling force in all biological organisms. This course investigates the processes and strategies of propagation, with major emphases on its evolution and meaning in the human race.

**BIO 121 The Methods of Biology (1 cr)**

*(Should be taken by all biology majors in conjunction with BIO 107, 108 or 109)*

This fall semester lab is meant to accompany the general biology lectures. The lab is designed to provide intensive training in laboratory techniques that are involved in cell biology. Laboratory exercises include microscopy, genetics, enzymology, biological chemistry and animal behavior. Students will also gain experience in developing critical thinking skills, scientific writing, computer applications and statistical analysis of data.

**BIO 122 General Biology II Laboratory (1 cr)**

*(Should be taken by all biology majors in conjunction with BIO 107, 108 or 109)*

This is the spring semester lab that is meant to accompany biology lectures. Topics include numerous dissections, taxonomic identifications, a systematic survey of the five kingdoms and ecological studies.

**BIO 127 Anatomy Lab (1 cr)**

This lab features dissection of the organ systems of the cat, with supporting dissections of some other animal organs, including the heart, brain and kidney. Structures of the organs and systems will be correlated with human structures. Corequisite: BIO 128.

**BIO 128 Human Anatomy and Physiology I (3 crs)**

The first course in a two course sequence that examines the anatomy and physiology of the human body. This course begins with the study of the levels of structural organization and proceeds with an in-depth study of the integumentary, musculoskeletal, nervous and endocrine systems.

**BIO 129 Human Anatomy and Physiology II (3 crs)**

This is the second course in a two-course sequence that examines the anatomy and physiology of the human body. This course provides an in-depth study of the cardiovascular, respiratory, digestive, urinary and reproductive systems. Prerequisite: BIO 128

**BIO 205 Ecology (3 crs)**

Ecology is an introduction to biological organization at the population, community, and ecosystem level. This course explores the interrelatedness of the biological, chemical, and physical world. Topics include experimental design, mathematical modeling, climate, water balance, energy flow, nutrient cycling, adaptation, community succession, and symbiosis. Prerequisite: any other biology course.

**BIO 221 Ecology Laboratory (1 cr)**

Ecology Laboratory involves the practice of designing field experiments for measuring plant and animal communities. In this course students will compile databases, conduct statistical analyses, and present the results of field experiments in both written and oral formats. Field trips and field work are required. Corequisite: BIO 205. Prerequisite: Any other biology course.

**BIO 210 Genetics (3 crs)**

A thorough familiarization with the principles of classical genetics of representative organisms in all kingdoms, with special emphasis on humans. The function of genes in developmental systems is emphasized. Special topics include consideration of ethical issues. Prerequisite: Successful completion of a core course in mathematics and any other biology course.

**BIO 222 Genetics Laboratory (1 cr)**

A hands-on, practical series of experiments and computer simulations in the analysis of heredity.

**BIO 234 (CLS 234) Pathophysiology (3 crs)**

A survey of the disease processes which affect the tissues, organs or the body as a whole. Special emphasis is placed on infectious diseases, their causes, prevention and treatment.

Prerequisites: BIO 128 and BIO 129.

**BIO 242 Cardiopulmonary Physiology (3 crs)**

Advanced physiology of the cardiovascular and pulmonary systems. Topics include connective tissues of the heart, ECG interpretation, blood pressure regulation, gas exchange and transport, breathing regulation, respiratory insufficiency and congenital abnormalities.

Prerequisites: BIO 128 and BIO 129.

**BIO 320 Vertebrate Biology (3 crs)**

An in-depth study of the comparative anatomy and systematic physiology of the vertebrate organisms, with emphasis on evolutionary relatedness. Prerequisite: Any 200-level biology course.

**BIO 321 Vertebrate Biology Laboratory (1 cr)**

Experimental, observational and comparative studies of the structure and function of organ systems in vertebrates. Corequisite: BIO 320.

**BIO 330 Developmental Biology (3 crs)**

A detailed study of the mechanisms of development, from gametogenesis through organogenesis, with particular emphasis on gene action, induction, cell movements, adhesion and pattern development. Special topics include regeneration and cancer.

Prerequisite: Any 200-level biology course.

**BIO 331 Developmental Biology Laboratory (1 cr)**

Experimental study and embryology of the principles of development in selected invertebrates, amphibians, avians and mammals. Corequisite: BIO 320.

**BIO 340 Cellular and Molecular Biology (3 crs)**

A detailed exploration of the physical and chemical processes and the ultrastructure underlying the functional activities of cells; aspects of molecular biology, immunology, programmed cell death, signaling systems and gene regulation in prokaryotes and eukaryotes. Prerequisite: BIO 107, BIO 108, BIO 109, CHE 222.

**BIO 341 Cellular and Molecular Biology Laboratory (1 cr)**

Extensive use of basic and advanced instrumentation and the development of laboratory skills in the physiological and biochemical study of the activities of cells and organelles. Topics include subcellular fractionation, techniques used in cell and tissue culture research, and the isolation, purification and characterization of biological macromolecules. Special emphasis is placed on the evaluation and interpretation of lab data, correlation with library research and presentation of data in a scientific report format. Corequisite: BIO 340.

**BIO 375 Student Research I: Biostatistics and Experimental Design (1 cr)**

The first part in a four-part series of student directed research courses. Topics include preparation for an independent research project, conducting a literature search and a thorough review of the pertinent literature, organization and development of a laboratory protocol with planned statistical treatment of data, preparation of a research budget and seminar participation. Students will select a project with the consent and guidance of a faculty mentor. Prerequisite: Junior standing.

**BIO 376 Student Research II: Instrumentation and Data Acquisition (1 cr)**

The second part in a four-part series of student directed research courses. Topics include modifications of protocols, methods and testing materials; data collection and seminar participation. Prerequisite: BIO 375.

**BIO 414 Biochemistry (3 cr)**

An intermediate-level course in the description of macromolecular structure and function. Topics include an in-depth study of the four classes of Biological macromolecules, enzyme kinetics and metabolic pathways. Emphasis is placed on metabolic processes, their regulation and integration in living systems. Prerequisite: CHE 222.

**BIO 420 Toxicology (3 crs)**

General principles of toxicology, including dose-response mechanisms, metabolism, distribution and the elimination of toxicants. Emphasis is placed upon various mechanisms of toxicity in a diverse representation of chemical substances, carcinogens, mutagens and teratogens. Prerequisite: BIO 340.

**BIO 424 Advanced Physiology Laboratory (1 cr)**

An application of physiologic principles and the use of equipment commonly used in medical and allied health professions. Prerequisites: BIO 320, BIO 340.

**BIO 426 Advanced Molecular Biology Laboratory (1 cr)**

Students will use advanced experimental techniques in the areas of molecular biology and biochemistry. Topics include gene cloning; DNA isolation, electrophoresis and restriction mapping; gene amplification using the polymerase chain reaction; the isolation and characterization of recombinants; the creation of recombinant fusion proteins and their expression in bacteria. Prerequisite or Corequisite: BIO 341.

**BIO 430 Advanced Animal Physiology (3 crs)**

Advanced electrophysiology of selected animal types with emphasis on renal, neural and cardiopulmonary physiology. Prerequisite or Corequisite: BIO 320.

**BIO 432 Histology (3 crs)**

Microscopic anatomy of vertebrate tissues and structure/function relationships, with an emphasis placed on the tissues of mammals. Prerequisite: BIO 320

**BIO 436 Physiological Ecology (3 crs)**

The application of ecological principles to problem solving at the organismal, population and ecosystem levels. Emphasis is placed on human interactions. Topics include organismal responses to stressors, human population dynamics, ecosystem responses to disturbances and global environmental change. Prerequisites: BIO 205 and BIO 221.

**BIO 437 Physiological Ecology Laboratory (1 cr)**

Field and laboratory training in the measurements of the chemical, physical and biological attributes of ecosystems. The ecosystems studied include forests, streams, lakes, wetlands and mesocosm ecosystems. One weekend field trip is required in addition to regularly scheduled outings. Students are also required to design and conduct an individual research project. Prerequisite: BIO 221.

**BIO 438 Parasitology (3 crs)**

A survey of common human parasites from the phyla protozoa, platyhelminthes and nematoda. Important aspects of their anatomy, physiology, life cycles, epidemiology and control will be discussed. Prerequisites: Any 200 level BIO course. Corequisite: BIO 439.

**BIO 439 Parasitology Laboratory (1 cr)**

Laboratory identification of common human parasites that are representative of the various genera discussed in the lecture. Prerequisite: Any 200-level BIO course. Corequisite: BIO 438

**BIO 440 Microbiology (3 crs)**

The focus of this course is the classification and major characteristics of bacteria, viruses and microscopic eukaryotes. Emphasis will be placed upon microbes that are responsible for infectious diseases in humans. Topics include microbial metabolism and genetics, basic concepts of epidemiology and immunology. Corequisite: BIO 441. Prerequisite: Any 200-level BIO course.

**BIO 441 Microbiology Laboratory (1 cr)**

A practical, hands-on course that provides training in commonly used techniques of microbe identification and microbiology research. Laboratory sessions include training in preparing sterile media, aseptic technique in the culturing of microbial cultures, the use of biochemical techniques to identify bacteria, microscopy and staining techniques, and fermentation in food and beverages. Corequisite: BIO 440. Prerequisite: Any 200-level BIO course.

**BIO 444 Instructional and Research Techniques (3 crs)**

An intensive laboratory course that uses state of the art equipment and techniques commonly encountered in various disciplines of biological research. Students will also learn general laboratory maintenance, preparation of reagents and solutions, and techniques for obtaining and analyzing data. Prerequisite: Any 200-level BIO course.

**BIO 450 Molecular Genetics (3 crs)**

The gene as a biochemical entity is examined with regard to its composition and action. Recent evidence from viruses, bacteria and eukaryotes is studied and interpreted to provide an understanding of the genetic regulation of life's processes. Prerequisite: BIO 340.

**BIO 455 Population Genetics (3 cr)**

The genetic analysis of population ecology. The concepts of polymorphisms, speciation, mutation, inbreeding, migration and selection are considered in light of evolutionary changes. Emphasis is placed on quantitative models and their analysis in the gene pool. Prerequisite: BIO 210.

**BIO 473 Plant Morphology and Physiology (3 crs)**

A study of the structure and function of selected types of plants. Included propagation techniques such as plant tissue culture. Prerequisite: Any 200-level BIO course.

**BIO 475 Student Research III: Data Analysis (1 cr)**

A continuation of the four course sequence of independent student research. Topics and activities include the completion of testing and the statistical analysis of data, the preparation of a rough draft of the entire project, a poster presentation of the student's project and seminar participation. Prerequisite: BIO 376.

**BIO 480 Literature Seminar (1 cr)**

The focus of this course is the presentation of research in a seminar format. Students will present a primary literature article related to their research project, and gain experience in evaluating and critiquing research articles. Participation in all seminars are mandatory. Prerequisite: junior or senior standing.

**BIO 482 Research Seminar (2 crs)**

This is the final course in the four-course sequence of student research. Students will present their data to the class in a seminar form and a written report, in scientific format, on their original research project. Additionally, students are required to present their project at a research symposium. Participation in all seminars is mandatory. Prerequisite: BIO 480.

**BIO 490 Neuroanatomy and Physiology (3 crs)**

This is an advanced course focusing on basic and applied neuroscience. It includes the basic structure of the nervous system including the structure and morphology of the neuron. Emphasis is placed on the functional significance of the central, peripheral, and autonomic nervous systems from development to disease. Prerequisite: BIO 109 or junior or senior standing as a BIO major.

**BIO 401 Animal Behavior (3 crs)**

An evolutionary approach to the study of animal behavior. The course will address the adaptive significance of animal behavior focusing on how and why various behaviors have developed.

**BIO 403 Animal Behavior Laboratory (1 cr)**

A study of animal behavior in the laboratory and field. This course, designed to accompany Animal Behavior 401, will provide students with hands-on experience in studying animal behavior from a non-anthropomorphic point of view. The course will include field trips, laboratory studies, and a personal research project. Regular laboratory reports will be required.

