BIOLOGY

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Biology is in the midst of revolutionary changes that are reshaping how we study and understand life. The Biology Department embraces these changes, which are reflected in our curriculum.

Our mission is to provide the highest quality education to our students so they achieve their greatest potential. We endeavor to give students relevant, authentic experiences and to encourage their development as scientists. We highly value mentoring undergraduate researchers and student involvement in civic engagement and outreach. Although we serve many pre-health professions students, we care deeply about providing a broad biology education in a liberal arts context

Our curriculum is guided by these goals:

1. Students will demonstrate deep understanding of five core concepts in biology: evolution; pathways and transformations of energy and matter; information flow, exchange, and storage; structure and function; and biological systems.
2. Students will use the standard skills and methodologies of biology to answer scientific questions.
3. Students will apply the scientific method, reasoning and appropriate mathematics to describe, explain and understand biological systems.
4. Students will use interdisciplinary approaches (applying chemistry, physics, and mathematics to biology) to work on biological problems.
5. Students effectively will read, write, speak and understand scientific material.
6. Students will collaborate and communicate within biology and across disciplines.
7. Students will apply science to issues facing our society.

Students may not receive a degree in both biology and environmental science with a biology emphasis.

Biology: Requirements for the Major
Though not a requirement for a Biology major, it is strongly recommended that Biology majors include CS 130; a statistics course and independent research is highly recommended for students planning to pursue graduate studies in biology.

Take all of the following: 36 credits

BIOL 200	Intro Biology: Flow of Energy	4 credits
BIOL 200 L	Intro Biology: Flow of Energy Lab	0 credits
BIOL 201	Intro Biology: Flow of Biology Information	4 credits
BIOL 201 L	Intro Biology: Flow of Biology Information	0 credits
BIOL 312	Genetics and Evolution	4 credits
BIOL 313	Cell and Molecular Biology	4 credits
BIOL 314	Molecular Genetics Lab	2 credits
BIOL 490	Senior Capstone Experience	2 credits
BIOL 489	Advanced Research Methods	4 credits
CHEM 220	General Chemistry I	4 credits
CHEM 230	General Chemistry II	4 credits
CHEM 300	Organic Chemistry	4 credits

Take eight credits from the following: 8 credits

BIOL 316	Plant Biology
BIOL 350	Principles of Developoment
BIOL 420	Vertebrate Zoology
BIOL 430	Plant Systemataics
BIOL 305	Ecology
BIOL 340	Animal Behavior
BIOL 445	Marine Biology
BIOL 450	Tropical Rainforest Biology

Take eight additional upper-division BIOL credits (excluding BIOL 475) 8 credits

Up to 2 credits of BIOL 495 may be used toward elective credits.
Up to 4 credits of CHEM 380, ENV 325, or ENV 301 may be used toward elective credits.

Take two upper-division 0-credit labs, indicated by L in the course number. 0 credits

Take one course from each of the following pairs:			8 credits
PHY 202	Introductory Physics I	4 credits	
OR			
PHY 232	General Physics I: Workshop Physics I	4 credits	
PHY 204	Introductory Physics II	4 credits	
OR			
PHY 242	General Physics II: Workshop Physics II	4 credits	
TOTAL:			**60 credits**

Restrictions: Upper division biology coursework taken during study abroad may be applied ot the major but must be approved by the department.

Biology: Requirements for the Minor

BIOL 200	Intro Biology: Flow of Energy	4 credits
BIOL 200 L	Intro Biology: Flow of Energy Lab	0 credits
BIOL 201	Intro Biology: Flow of Biology Information	4 credits
BIOL 201 L	Intro Biology: Flow of Biology Information	0 credits
CHEM 220	General Chemistry I	4 credits
CHEM 230	General Chemistry II	4 credits
Biology electives		12 credits total

Three additional upper-division biology classes (excluding BIOL 475, 490 and 495), including at least one upper division lab. Up to 4 credits of CHEM 380, ENV 325, or ENV 301 may be used toward elective credits.

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TOTAL: 28 credits

Restrictions: To receive a Biology minor from Pacific University, a student must complete three upper-division courses toward the biology minor on campus.

COURSES

BIOL-110 Human Biology
An introduction to basic anatomy and physiology of the human organism. This course is designed for non-science majors. Laboratory is integrated with lecture. Students cannot receive credit for BIOL-110 and any combination of BIOL 224, BIOL 240, BIOL 300, or BIOL 302. Does not count toward a Biology major or minor. 4 credits.

BIOL-145 Marine Biology for Nonscience Majors
An introduction to organisms and processes in the marine environment. Organismal adaptations and interactions of organisms with the environment are stressed. Includes some aspects of environmental and economic issues as they relate to biology of the ocean. Some weekend field trips required. Additional fee required. Does not count toward a Biology major or minor. 4 credits.

BIOL-155 Special Topics
See department for course description. Credit varies.

BIOL-160 Selected Topics for Non-Science Majors
Study of a particular field of biology selected by the instructor and approved by the Biology department. Lab activities may be a part of the course. This course is designed for non-science majors. Some topics may require the instructor's consent. Refer to the online course schedule to verify if instructor consent is required for the offered topic. May be repeated for credit when topic varies. 2 or 4 credits.

BIOL-170 Human Genetics
This course introduces students to the study of inheritance in all of its manifestations, from the distribution of human traits in a family pedigree to the biochemistry of the genetic material in our chromosomes, DNA. The course examines the inheritance of traits in individuals and families, how traits evolve and are maintained in human populations, the molecular basis for those traits, and the Human Genome Project. Does not count toward a Biology major or minor. 4 credits.

BIOL-195 Independent Study
See department for details. Independent study contract required. Credit varies.

BIOL-200 Intro Biology: Flow of Energy
This course will emphasize the flow of energy in biological systems, and integrate across all levels of biological organization. Topics include: macromolecules, thermodynamics and energy, metabolism, photosynthesis and cellular respiration, homeostasis, physiology, ecology and trophic interactions, and ecosystem dynamics. Math placement into Calculus I is required to take this course in fall of the freshman year. Corequisite: BIOL 200L. 4 credits.

BIOL-200L Intro Biology: Flow of Energy Lab
This laboratory will examine concepts from BIOL 200 in a laboratory setting. Corequisite: BIOL 200. 0 credits.

BIOL-201 Intro Biology: Flow of Biol Information This course will emphasize the flow of information in biological systems, and integrate across all levels of biological organization. Topics include: DNA, Mendelian genetics, microevolution and macroevolution, development, organization of systems, and behavior. Math placement into Calculus I is required to take this course in fall of the freshman year. Corequisite: BIOL 201L. 4 credits.

BIOL-201L Intro Biology: Flow of Biol Info Lab
This laboratory will examine concepts from BIOL 201 in a laboratory setting. Corequisite: BIOL 201. 0 credits.

BIOL-202 General Biology I
A survey of ecology, evolution, the diversity of life on earth, and the structure of plants and animals. Laboratory is integrated with lecture. NOTE: There are no prerequisites for this course. However, BIOL 204, has prerequisites of CHEM 220, CHEM 230, and BIOL 202 all with a minimum grade of C-. 4 credits.

BIOL-204 General Biology II
Basic principles of cell and molecular biology for both prokaryotes and eukaryotes. The course includes cell structures and functions, metabolism, classical genetics, and molecular genetics. Laboratory experiences are integrated in the course. Prerequisite: BIOL 202, CHEM 220, and CHEM 230 all with a minimum grade of C-. 4 credits.

BIOL-224 Human Anatomy
An examination of gross and histological structure of the systems of the human body. Laboratory is an integrated part of the course. Prerequisite: BIOL 202 with a minimum grade of C-. 4 credits.

BIOL-230 Human Anatomy & Physiology I
Human Anatomy and Physiology is a year long course that explores the structure and function of the human body in an integrated fashion. We will cover the 11 anatomical systems and understand how the structure of the human body relates to and defines its function. Emphasis will be placed on integration of systems and information flow. Human Anatomy and Physiology I introduces cytology and histology while surveying the skeletal, nervous, muscular, endocrine and reproductive systems. Prerequisite: BIOL 202 with a minimum grade of C-. 4 credits.

BIOL-231 Human Anatomy & Physiology II
Human Anatomy and Physiology is a year long course that explores the structure and function of the human body in an integrated fashion. We will cover the 11 anatomical systems and understand how the structure of the human body relates to and defines its function. Emphasis will be placed on integration of systems and information flow. Human Anatomy and Physiology II emphasizes sensory physiology, circulatory, lymphatic, immune, respiratory, digestive and urinary systems. Prerequisite: BIOL 230 with a minimum grade of C-. 4 credits.

BIOL-240 Human Physiology
A study of the physiological phenomena of the human body from the molecular level of cellular metabolic functions to the operation of primary and specialized organ systems. Laboratory experiences are integrated in the course. Prerequisite: BIOL 224 with a minimum grade of C-. 4 credits.

BIOL-255 Special Topics
See department for course description. Credit varies.

BIOL-275 Internship
See department for details. Internship contract required. Credit varies.

BIOL-295 Independent Study
See department for details. Independent study contract required. Credit varies.

BIOL-304 Research Methods
This course utilizes a hands-on, application- oriented approach to enhance student understanding of: framing scientific questions based on primary scientific literature; designing appropriate experiments; analyzing data statistically and graphically; writing technical reports; and presenting seminars. Course culminates in a student proposed, designed, and conducted independent research project. Prerequisite: Sophomore standing or above (30 or more completed credits), BIOL 204 with a minimum grade of C-, and declared Biology major. 4 credits.

BIOL-305 Ecology
An introduction to the basic principles and fundamentals influencing interactions between plants and animals and their environment. Includes laboratory and field experiences. Includes a required three day field trip. Additional fee required. Prerequisite: BIOL 204 with a minimum grade of C-. 4 credits.

BIOL-308 Microbiology
A study of the structure, biochemistry, physiology, energy generation, genetics and diversity of prokaryotic organisms. Laboratory experiences are integrated into the course. Prerequisite: BIOL 204 with a minimum grade of C-. 4 credits.

BIOL-312 Genetics and Evolution
This course will introduce you to inheritance of genes and chromosomes in eukaryotic organisms. This course covers Mendelian genetics, exceptions to Mendelian genetics, and population genetics (with a focus on evolutionary genetics). An emphasis is placed upon on numerical analysis of inheritance. Prerequisite: BIOL 200, BIOL 201, CHEM 220. Corequisite: CHEM 230. 4 credits.

BIOL-313 Cellular & Molecular Biology
This course explores the molecular aspects of cellular biology and cellular evolution. We will compare gene expression in prokaryotes and eukaryotes and aspects of gene regulation. We will examine eukaryotic molecular and cellular events including: enzyme kinetics and regulation, membrane dynamics and endomembrane system, signal transduction, regulation of the cell cycle, intracellular transport and intercellular adhesion. This in-depth examination illuminates critical processes for organism function. Our understanding of these events currently permeates into virtually all aspects of biology, such as organismal, population, and ecosystem levels. Prerequisite: BIOL 200, BIOL 201, CHEM 220. Corequisite: CHEM 230. 4 credits.

BIOL-314 Molecular Genetics Laboratory
This course includes several in depth experiments exploring molecular genetics experiments and techniques, such as DNA extractions, polymerase chain reaction (PCR), gel electrophoresis, and genetic crosses of the fruit fly Drosophila melanogaster. The hands-on work illustrates principles presented in BIOL 312 and/or BIOL 313 lecture and teaches students elements of experimental design as well as the analysis and presentation of scientific results. Prerequisite: BIOL 200, BIOL 201, and CHEM 220 with a minimum grade of C-; CHEM 230 and either BIOL 312 or BIOL 313 (may be taken concurrently). 2 credits.

BIOL-316 Plant Biology
Fundamental principles of plant biology with emphasis on morphology, anatomy, taxonomy, physiology and evolution of algae, non-vascular and vascular plants. Includes laboratory and field experiences. Prerequisite: BIOL 204 with a minimum grade of C-. 4 credits.

BIOL-320 Cell Biology
A study of the functions of biological systems from the molecular to the tissue level. The molecular biology of cells and the regulatory mechanisms for physiological processes are emphasized. Laboratory experiences are integrated in the course. Prerequisite: BIOL 204 and organic chemistry (CHEM 240/241 or CHEM 320/321 or CHEM 300) all with a minimum grade of C-. 4 credits.

BIOL-325 Conservation Biology
This course will examine the historical and ethical background of the conservation movement and trace the development of the science of conservation biology. We will be making connections between society and the natural world, relating human impacts on plants and wildlife to the goals of the practicing conservation biologist. We will learn quantitative methods to determine and predict the status of plant and animal populations. This is a lab/field course with opportunities to learn from conservation efforts around the Portland metropolitan area. Also listed as ENV 325. Prerequisite: BIOL 200 and BIOL 201 with a minimum grade of C-, or BIOL 204 with a minimum grade of C-. CS 130 or MATH 226 recommended. 4 credits.

BIOL-330 Genetics
A study of the principles of heredity with emphasis upon transmission genetics, quantitative inheritance, the molecular basis of inheritance, and population genetics. Laboratory experiences are integrated in the course. Prerequisite: BIOL 204 with a minimum grade of C-. 4 credits.

BIOL-335 Cancer Biology
An overview of the field of cancer biology with emphasis in the cellular and molecular mechanisms of tumor progression. Topic discussed include environmental carcinogens, current treatments and therapies, disease frequencies and epidemiology, drug discovery and design, and cancer prevention. Prerequisite: BIOL 204 with a minimum grade of C-. 4 credits.

BIOL-340 Animal Behavior
A study of the ecology and evolution of animal behavior, including such topics as foraging strategies, predator-prey interactions, contests, mating systems, sexual selection, communication and the application of animal behavior to conservation. Mechanisms of animal behavior (including endocrinology, genetics and neurobiology) are also discussed. Investigative laboratory and field experiences are integrated in the course. Prerequisite: BIOL 204 with a minimum grade of C-. 4 credits.

BIOL-345 Marine Biology
A study of life and processes in the marine environment. Organismal adaptations and interactions of organisms with the environment are stressed, with field trips to the marine intertidal zones. Includes some aspects of environmental issues as they relate to biology of the ocean. Some weekend field trips required. Laboratory experiences are integrated in the course. Additional fee required. Prerequisite: BIOL 204 with a minimum grade of C-. 4 credits.

BIOL-350 Principles of Development
A study of molecular and cellular aspects of development and embryological differentiation of selected species. Laboratory experiences are integrated in the course. Prerequisite: BIOL 204 with a minimum grade of C-. 4 credits.

BIOL-355 Special Topics
See department for course description. Prerequisite: BIOL 204 with a minimum grade of C-. Credit varies.

BIOL-360 Selected Topics in Biology
Study of a particular field in biology selected by the instructor and approved by the Biology Department. May or may not include a lab. Prerequisite: BIOL 204 with a minimum grade of C-; additional prerequisites may apply depending on the topic. Some topics may require the instructor's consent. Refer to the online course schedule to verify if instructor consent is required for the offered topic. May be repeated for credit when topic varies. 2-4 credits.

BIOL-385 Junior Seminar
The Junior Seminar is designed to introduce majors to the primary biological literature, improve their oral communication skills, and highlight recent advances in the field. Students will read, present and discuss primary research papers in the biological sciences. Topics will vary each semester but have an interdisciplinary theme. Prerequisites: Junior standing or above (60 or more completed credits), one upper division BIOL course (4 credits) with a minimum grade of C- and declared Biology major. 1 credit.

BIOL-395 Independent Study
See department for details. Independent study contract required. Credit varies.

BIOL-400 Molecular Biology
A laboratory-intensive course focusing on nucleic acid biology, recombinant DNA and biotechnology. Prerequisite: BIOL 204 and CHEM 300, each with a minimum grade C-. 4 credits.

BIOL-405 Immunology
A study of the mammalian immune system covering the molecules and mechanisms used to fight infection. The development of B and T cells and their role in the human immune response will be emphasized. The relationship of the immune system to human biology will also be covered, for example infectious disease, vaccines, allergies, and autoimmune disorders. Prerequisite: BIOL-204 with a minimum grade of C-. Alternate years. 4 credits.

BIOL-410 Invertebrate Zoology
A study of invertebrate organisms including their systematics, morphology and ecology. Laboratory experiences are integrated in the course. Some weekend field trips required. Additional fee required. Prerequisite: BIOL 204 with a minimum grade of C-. 4 credits.

BIOL-420 Vertebrate Zoology
A study of the vertebrates, including their systematics, life histories, morphological and physiological adaptations, behavior and conservation. Laboratory work (including investigative and observational studies as well as taxonomy and comparative morphology) and field experiences (to local wetlands, streams and forests) are integrated in the course. Prerequisite: BIOL 204 with a minimum grade of C-. 4 credits.

BIOL-430 Plant Systematics
Identification and classification of the vascular plants represented in the flora of the Pacific Northwest. Includes laboratory and field experiences. Some weekend field trips required. Additional fee required. Prerequisite: BIOL 204 with a minimum grade of C-. 4 credits.

BIOL-444 Evolution
An introduction to the history, methods, and current questions in evolutionary biology. This course will examine the evidence for evolution beginning with Darwin and ending with our current understanding of the human genome. The course will cover the theory of natural selection, the basis of heredity and variation, population structures and genetics, and the mechanisms of speciation. Special topics include human evolution, molecular evolution, and the relationship of evolution to society, philosophy, and religion. Prerequisite: BIOL 204 with a minimum grade of C-. 4 credits.

BIOL-450 Tropical Rainforest Biology
A study of tropical rainforest ecology and natural history, and current biological research in tropical rainforests. The course meets once a week during the Fall semester for two credits, during which students gain the background required for the field component held in Costa Rica during Winter term for two credits. Additional fee required. Prerequisite: BIOL 204 with a minimum grade of C-. Instructor's consent required. Counts toward core requirement: International Perspectives. Offered alternate years. 2 credits.

BIOL-455 Special Topics
See department for course description. Credit varies.

BIOL-466 Genome Analysis Workshop
The course investigates the genetic information at the gene and genome level. Analysis of the complete genome is an important new tool in understanding the biology of organisms. Students learn to use computer programs to identify and study genes in a bacterial genome. The course is part of a collaboration between JGI (Joint Genome Institute) and colleges nationwide to annotate microbial genomes that provide data to public databases. Prerequisite: BIOL 204 with minimum grade C-. 4 credits.

BIOL-470 Animal Physiology
The study of physiological function (molecular, cellular, and organ systems) in animals. The focus will be on the diversity of mechanisms used by animals for: water and solute regulation, gas exchange and transport, temperature regulation and tolerance, circulation, feeding and digestion, metabolism, excretion, neural control and integration, senses, and locomotion. Laboratory experiences are integrated in the course. Prerequisite: BIOL 204 with a minimum grade of C-; and CHEM 300 with minimum grade C- (or concurrent enrollment). 4 credits.

BIOL-475 Internship
See department for details. Internship contract required. Credit varies.

BIOL-489 Advanced Research Methods
Teams of students carry out original research in collaboration with a member of the Biology faculty. Course involves critically reading, analyzing, and synthesizing primary literature in the research area; generating a novel data set (via experiments, studies, or data mining of large public data sets); and analyzing and interpreting the data. Research area will vary, and depends on faculty expertise. Prerequisites: Senior standing (90 completed credits), BIOL 312, 313, 314 with a C- or better, 8 additional upper division BIOL credits and declared biology major. 4 credits.

BIOL-490 Senior Capstone Experience
This course is designed for senior Biology majors in which students develop a capstone paper and present a capstone seminar on an approved topic of their choice. The course requires that students integrate information from the primary and secondary biological literature as well as from their biological knowledge. Research, internship, and literature review options are offered. Students will present on Senior Projects Day. Prerequisite: Senior standing (90 or more completed credits), declared Biology major, and BIOL 385 and at least two additional upper division Biology lecture (8 credits, with or without lab) courses each with a minimum grade of C-. 2 credits.

BIOL-495 Research
Faculty supervised, student-conducted, individual research project. Prerequisite: BIOL 204 with a minimum grade of C- and declared Biology major. Instructor's consent required. May be repeated for credit. Credit varies.