

Biology

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Requirements for a Biology Major, B.A. (39)

BI 150	Cell Biology	2
BI 152	Animal Biology	2
BI 153	Plant Biology	2
BI 154	Microbial Biology	2
One of the following:		3
BI 230	Introductory Biochemistry	
CH 401W	Biochemistry I	

Approved upper-division biology electives*	24
(For teacher certification, 4-12 endorsement, BI 363 and 345 must be included.)	
CH 161 Principles of Chemistry I	3
CH 161L Principles of Chemistry I Lab	1

*One writing-intensive course required.

For teacher certification (4-12 endorsement) the following additional courses are also required:

EDU455 Methods of Teaching Science: Secondary	2
CO 350 Western Civilization III: The Scientific Tradition	4

Requirements for a Biology Major, B.S. (54)

BI 150 Cell Biology	2
BI 152 Animal Biology	2
BI 153 Plant Biology	2
BI 154 Microbial Biology	2
BI 345 Ecology	4
BI 363 Genetics	4
One of the following:	4
BI 323 Animal Physiology	
BI 331 Plant Physiology	
One of the following:	3
BI 399W Molecular Biology	
BI 412W Advanced Cell Biology	
One of the following:	3
BI 230 Introductory Biochemistry	
CH 401W Biochemistry I	

Approved upper-division biology electives: 12
 (No more than 4 credits of internships or cooperative studies, no more than 2 credits of teaching assistantships, and no more than 4 credits of BI 400 - Biological Research will apply to the degree program.)

CH 161 Principles of Chemistry I	3
CH 161L Principles of Chemistry I Lab	1
CH 271 Principles of Organic Chemistry	3
CH 271L Principles of Organic Chemistry Lab	1
PS 151** General Physics I	4
PS 153** General Physics II	4

**Note: PS 151 has a prerequisite of Math 110 (Calculus I) and PS 153 has a prerequisite of MA 111 (Calculus II).

For teacher certification (4-12 endorsement) the following additional courses are also required:

EDU455 Methods of Teaching Science: Secondary	2
CO 350 Western Civilization III: The Scientific Tradition	4

Requirements for a Minor or Supporting Endorsement in Biology (20)

BI 150 Cell Biology	2
BI 152 Animal Biology	2
BI 153 Plant Biology	2
BI 154 Microbial Biology	2

Approved upper-division biology electives 12

For teacher certification, supporting endorsement, BI 363 and 345 must be included and the following additional courses are required:

EDU455 Methods of Teaching Science: Secondary	2
CO 350 Western Civilization III: The Scientific Tradition	4

Requirements for a Science Primary Endorsement for Majors in Biology, Chemistry, or Physics

BI 150	Cell Biology	2
BI 152	Animal Biology	2
BI 153	Plant Biology	2
BI 154	Microbial Biology	2
CH 161/162	Principles of Chemistry I	3
CH 161L	Lab: Principles of Chemistry I	1
One of the following:	4
CH 271	Organic Chemistry plus Lab	
CH 281	Principles of Chemistry II plus Lab	
PS 151*	General Physics I	4
PS 153*	General Physics II	4
*Note: PS 151 has a prerequisite of Math 110 (Calculus I), and PS 153 has a prerequisite of MA 111 (Calculus II).		
One of the following:	4
GL 131	Understanding Earth	
GL 139	Environmental Geology	
PS 141	Introduction to Astronomy	
EDU455	Methods of Teaching Science: Secondary	2
CO 350	Western Civilization III: The Scientific Tradition	4

Requirements for an Environmental Studies Minor (18)

Introductory Courses

One course from each group is required	6
Group 1. Introductory Physical Science (3 credits minimum)	
GL 131	Understanding Earth (4)
GL 139	Environmental Geology (4)
CH 112	Chemistry and Health (3)
CH 122	Chemistry in Modern Living (3)
CH 161	(Honors) Principles of Chemistry I (3)
	Plus CH 161L Lab (1)
Group 2. Introductory Life Science (3 credits minimum)	
BI 104	Human Ecology (3)
BI 105	Plants in Culture (3)
BI 111	Marine Biology (3)
BI 345	Ecology (4)

Supporting Science Coursework

One of the following 3 credits minimum
(Courses used to fulfill this requirement may not also be used to complete requirements of a science major.)

BI 235, 335	Conservation Biology (3)
BI 335L	Conservation Biology Lab (1)
BI 340	Field Ecology/Tropical (4)
BI 342	Marine Ecology (3)
BI 337	Field Botany (4)
CH 271	Organic Chemistry (3)
CH 335W	Analytical Chemistry (3)
CH 335L	Analytical Lab (1)
CH 336	Spectroscopic Analysis (3)
CH 336L	Spectroscopic Analysis Lab (1)

Supporting Humanities Coursework

One of the following:	3 credits minimum
RE 308, ES 309	Ecology and Religion (3)
PH 309, ES 309	Environmental Ethics (3)
PH 321	Ethics (3)

Supporting Social Science Coursework

One of the following: 3 credits minimum

- EC 210 Principles of Microeconomics (3)
- HI 384W Pacific Northwest History (3)
- PO 433W The Third World: Political Change (3)
- SO 275 Population and Society (3)
- SO 305 Social Stratification: Power, Prestige and Wealth (3)

Practical Experience

One or more of the following: 3 credits minimum

- ES 290, 490 Environmental Internship (1-4)
- ES 400 Environmental Research (1-4)
- BI 290, 490 Internship (1-4)
- BI 400 Biology Research (1-4)
- CH 290, 490 Internship (1-4)
- CH 494 Chemistry Research (1-4)
- CH 496 Chemistry Research Off Campus (1-4)

Natural Science Courses

NS 202 Inquiry Science: Life Science 2

Course provides life science content and models hands-on science instruction in an inquiry-based format. Focus is on scientific inquiry, science fact, and how to ask and answer questions in the biological sciences. Designed for students with an interest in elementary education. Prerequisite: elementary education major. Periodic offering.

Biology Courses

BI 101 Life Science 3

Contemporary understanding of the basic organization and function of biological systems, and the nature and interdependence of living organisms. Emphasis on ecological balance, evolutionary change, and biological diversity. No lab. For non-science majors. Meets three semester credits of the natural science/math requirement. Periodic offering.

BI 104 Human Ecology 3

Nature, dynamics and interdependence of ecosystems in relation to the human biological and cultural niche. The ecological principles of energy flow, nutrient cycling, succession, limiting factors, species diversity and symbioses are utilized to diagnose global environmental problems such as global warming, acid precipitation, ozone depletion, desertification, species extinction, deforestation and resource depletion. No lab. For non-science majors. Meets three semester credits of the natural science/math general requirement. Periodic offering.

BI 105 Plants in Culture 3

Basic structures and life processes in plants. Survey of historical and contemporary uses of plants. Focus on ways in which human life is physically dependent on plants, and on the many ways in which human cultures reflect the specific plants available to them. No lab. For non-science majors. Meets three semester credits of the natural science/math general requirement. Periodic offering.

BI 106 Biology of Women 3

Structure, function and development of the human female. Comparison of male and female biology. Consideration of genetic, hormonal and neurological influences in development of form and function. Critique of cultural images of women using biological data. No lab. For non-science majors. Meets three semester credits of the natural science/math general requirement. Periodic offering.

BI 111 Marine Biology 3

Introduction to life in the sea. Emphasis on the diversity of marine organisms and adaptations to marine habitats, marine ecosystems and food webs. Three-hour lecture per week. No lab. For non-science majors. Meets three semester credits of the natural science/math general requirement. Periodic offering.

- BI 150 Cell Biology** 2
Organization of living matter, emphasizing molecular structures, biochemical processes and cellular features that unify living things. Lab. Half-semester course. Fall semester.
- BI 152 Animal Biology** 2
Evolutionary origin, taxonomic classification and unique anatomical, physiological and behavioral adaptations of the metazoans, including the Radiata, Acoelomata, Pseudocoelomata, Mollusca, Annelida, Arthropoda, Echinodermata and Chordata. Lab. Half-semester course. Fall semester.
- BI 153 Plant Biology** 2
Photosynthetic organisms – cyanobacteria, algae and land plants. Survey of structural and functional adaptations related to water retention and distribution, gas exchange, mineral nutrient acquisition, light absorption and energy conversion, support, reproduction, dispersal and resistance. Lab focuses on structural diversity. Half-semester course. Prerequisites recommended: BI 150, 152. Spring semester.
- BI 154 Microbial Biology** 2
Systematic survey of selected microbial taxa, emphasizing the distinguishing characteristics, structural and functional adaptations, metabolic specializations and life histories of eubacteria, archaeobacteria, protozoans and fungi. Lab activities focus on basic methods for isolating, growing, identifying and studying microorganisms. Half-semester course. Prerequisites recommended: BI 150, 152. Spring semester.
- BI 196 Topics in Biology** 3
One-time offerings for lower-division students or for non-science majors.
- BI 204 Medical Microbiology** 4
Microorganisms, especially bacteria and viruses of medical importance. Basic structure and physiology of microorganisms, principles and control of growth, antibiotics, a survey of infectious disease. Lab emphasizes the use of aseptic technique and the culture and identification of bacteria. Prerequisite: CH 163 or sophomore standing. Spring semester.
- BI 220 Anatomy and Physiology I** 4
Gross anatomy and physiological applications of the integumentary, skeletal, muscular, respiratory, and nervous systems of the human body. Emphasis given to the relationship of major organs to health and disease. Lab component provides practical application in the location and isolation of anatomical parts. Designed for students in nursing, sports medicine/athletic training, and kinesiology as well as other allied health programs. Fee. Prerequisite: sophomore standing. Fall semester.
- BI 221 Anatomy and Physiology II** 4
Gross anatomy and physiological applications of the cardiovascular, lymphatic, endocrine, digestive, urinary, and reproductive systems of the human body. Emphasis given to the relationship of major organs to health and disease. Lab component provides practical application in the location and isolation of anatomical parts and physiological assessments. Designed for students in nursing, sports medicine/athletic training, and kinesiology as well as in other allied health programs. Fee. Prerequisite: BI 220. Spring semester.
- BI 230 Introductory Biochemistry** 3
Introduction for biology majors to biopolymers and metabolism. Focus on energy flow and chemical processes in living systems. No lab. Prerequisite: BI 150-154, CH 161, CH 271, or instructor's approval. Spring semester.
- BI 303 Plant Taxonomy** 4
History, theories and methods of classification, identification, nomenclature and description. Role of taxonomy as a biological discipline. Types of taxonomic evidence. Descriptive terminology. Survey of selected families. Lab focuses on use and construction of diagnostic keys, identification of local flora, preparation of field data records and herbarium specimens. Lab. Prerequisite: BI 150-154. Spring semester, even years.

BI 323 Animal Physiology 4

Anatomical, physiological and behavioral adaptations of animals to their particular habitats. Lectures focus on respiration in air and water, circulation, metabolism, temperature limits and thermoregulation, osmotic adaptations and excretion, and amoeboid, flagellar, ciliary and muscular movement. Lab. Prerequisites: BI 150-154; CH 270. Fall semester, odd years.

BI 325 Invertebrate Biology 4

A survey of multicellular invertebrate animals, with emphasis on diversity, structure and function, ecology and evolution. Lab. Prerequisites: BI 150-154. Fall semester, even years.

BI 331 Plant Physiology 4

Water relations, mineral absorption and nutrition, translocation mechanisms, respiration, photosynthesis, nitrogen metabolism, growth regulators, photomorphogenesis, senescence and stress physiology. Focus on vascular plants. Lab emphasizes whole organism responses. Prerequisites: BI 150-154, BI 230, CH 271. Spring semester, odd years.

BI 333 Evolutionary Biology 3

Study of the evolutionary paradigm that unifies the science of biology. Origin, refinement and the contemporary form of evolutionary theory, with the objective of understanding its use in organizing the data, ideas and research of the biological sciences. The study will critique some of the popular caricatures of the evolutionary paradigm. No lab. Prerequisites: BI 150-154, BI 363; junior standing recommended. Periodic offering.

BI 235, 335 Conservation Biology 3

Application of biological concepts from fields such as ecology and genetics to conservation of biodiversity of species and ecosystems. Topics include protection and restoration of endangered species and habitats, forest fragmentation, overharvest of wild species, loss of wetlands, maintaining genetic diversity and design of nature reserves. No lab. Prerequisites for BI 235: Sophomore standing and one science course. Prerequisites for BI 335: BI 150-154. Fall semester, odd years.

BI 335L Conservation Biology Lab 1

Field and laboratory exercises in evaluating biodiversity and human impact on natural ecosystems. Co-requisite: BI 335. Fall semester, odd years.

BI 337 Field Botany 2-3

Field, laboratory study of flora of selected regional habitats. Field trips and collection. Students work individually in the field in addition to group trips. Field journal required. Habitat and organisms of focus will vary. Prerequisites: BI 150-154. Summer, odd years.

BI 342 Marine Ecology 3

Field-based course designed to explore the interactions of temperate marine organisms with their living and non-living environment. Students explore life histories and ecology of intertidal marine life in rocky shore, sand, mud flat, and planktonic communities. The class will be stationed at the Friday Harbor Marine Laboratory on San Juan Island, Puget Sound, Washington. Prerequisites: BI 150-154, BI 345. Jan Term, odd years.

BI 343 Symbiotic Biology 3

Major categories of symbiotic associations involving partners in all five kingdoms. Mechanisms by which symbioses are established, maintained and propagated, along with structural, physiological and behavioral modifications characteristic of the symbionts and the ecological and evolutionary significance of such relationships. Focus on experimental approaches used to study symbioses. Substantial literature review required. Prerequisites: BI 150-154, BI 230; junior standing recommended. Periodic Jan Term offering.

BI 345 Ecology 4

Fundamental relationships and processes by which organisms interact with each other and their physical environment. Focus on physiological adaptations, population growth and regulation, community and ecosystem structure and function, and biogeography. Lab. Prerequisites: BI 150-154. Spring semester.

- BI 347 Advanced Microbiology** 4
Ultrastructure, metabolic variations, genetics, ecology and evolution of prokaryotic organisms. Structure and genetics of viruses. Emphasis on the importance of bacteria in the study of various biological processes, as well as on the practical and technological importance and ecological significance of bacteria. Two labs per week focus on techniques for isolating, culturing, and identifying bacteria, and on characterizing and studying their genetic and metabolic processes. Prerequisites: BI 150-154 and CH 271 or consent of instructor. Fall semester, even years.
- BI 354 Developmental Biology** 4
Developmental processes and patterns of form and function in multicellular organisms, particularly animals. Emphasis on molecular, cellular and environmental factors regulating gene activity, cellular differentiation, and pattern formation during various developmental sequences. Descriptive, comparative and experimental lab activities focus on chordate embryology, specifically gametogenesis, fertilization, cleavage, gastrulation and organogenesis. Prerequisites: BI 150-154 and BI 230 or consent of instructor; junior standing. Spring semester, even years.
- BI 363 Genetics** 4
Mechanisms that contribute to and maintain intraspecific diversity: meiosis, allelic segregation, chromosomal assortment, dominance-recessive allelic relationships, hybridization, multiple alleles, epistasis, linkage and recombination, polygenic inheritance and mutation. Population genetics, especially the factors that alter relative frequencies of gene pool alleles. Genetic molecules and the processes by which they are replicated, mutated and expressed. Human genetic diseases. Lab. Prerequisites: BI 150-154 and CH 271 or consent of instructor. Fall semester.
- BI 396 Topics in Biology** 3
Occasional and one-time offerings for upper-division students; such topics as plant anatomy, comparative vertebrate anatomy and mycology will be covered.
- BI 399W Molecular Biology** 3
Contemporary molecular genetics; the organization, storage, retrieval and transfer of genetic information at the molecular level. Topics include the chemical and physical properties of nucleic acids, DNA replication, transcription, translation, mutagenesis, DNA repair, gene regulation and expression, techniques of experimental molecular biology and applications to biotechnology. Viral, prokaryotic, and eukaryotic systems examined. No lab. Prerequisites: BI 150-154, BI 230 and BI 363 or consent of instructor; junior standing. Spring semester, odd years.
- BI 399L Molecular Biology Lab** 1
Techniques for manipulation and study of DNA. Co-requisite: BI 399W. Spring semester, odd years.
- BI 400 Biological Research** 1-4
Individual student experimental laboratory or field research projects. Projects to be approved by departmental faculty. Prerequisites: BI 150-154; BI 230; upper-division coursework in biology and other sciences pertinent to research project. Fall and spring semesters, January Term and summer.
- BI 401 Seminar** 1
Presentation and discussion of results of literature and laboratory investigations of biological phenomena. Departmental sessions. Prerequisites: 12 credits of 300- or 400-level biology courses. Fall and spring semesters.
- BI 412W Advanced Cell Biology** 3
Cell ultrastructure and molecular aspects of cell function. Emphasis on structural and molecular organization of eukaryotic cells and organelles, the regulation and compartmentalization of metabolic activities, cell cycles and reproduction, cellular differentiation and cell interactions. No lab. Prerequisites: BI 150-154 and BI 230 or consent of instructor; junior standing. Fall semester, odd years.

BI 412L Advanced Cell Biology Lab**1**

Microscopic and biochemical techniques for studying cell structure. Co-requisite: BI 412W. Fall semester, odd years.

Directed Studies

Independent Studies (191, 291, 391, 491); Readings (386, 486); Internships (290, 490); Field Studies (280, 480); and Teaching Assistantships (395, 495); See Page 169 for details.

Environmental Studies Courses

(Environmental Studies courses do not apply to a biology major or biology minor.)

ES 308 Ecology and Religion**3**

Contemporary and historic Christian perspectives on ecological life science. Interactions between world religions and recent religious movements and ecology. Also listed as RE 308. Spring semester.

ES 309W Environmental Ethics**3**

Basic concepts such as intrinsic value, rights of nature and Christian stewardship of the environment. Case studies will include oil spills, the international agreements concerning the ozone layer, deforestation and recent environmental congresses. Cross-listed with PH 309.

ES 400 Environmental Studies Research**1-4**

Individual student research projects. Projects to be approved by Biology Department faculty for credit toward environmental studies minor. Prerequisites: Upper-division standing and coursework in science and environmental studies pertinent to research project. Fall and spring semesters, January Term and summer.

Au Sable Institute

The Au Sable Institute is a Christian environmental stewardship institute whose mission is to work to bring healing and wholeness to the biosphere and the whole creation through academic programs, research projects and educational outreach. Whitworth College is a participating member of the institute. Coursework taken through the institute can be counted as elective credit toward completion of a biology degree or an environmental studies minor. The following courses (this is a partial list) are offered during the summer at the Au Sable Pacific Rim campus (on Puget Sound near Seattle). Other courses are offered at the following campuses: Au Sable Great Lakes (in the Great Lakes Forest, Michigan), Au Sable East (on the Chesapeake Bay, Virginia), Au Sable Africa (near Nairobi, Kenya), and Au Sable India (in Tamil Nadu, South India). A full listing of Au Sable courses is available in the Biology Department.

Bio 266 Natural History of the Pacific Northwest**3**

Biology and environment of plants and animals, nature of the physical environment, and biogeography of the Pacific Rim, in a stewardship perspective. (Applies to environmental studies minor only.)

Bio 311 Field Botany**4**

Field identification and ecology of vascular plants as components of natural communities. Emphasis is placed upon on-site examination of plants in communities of the region. Ecological features such as community stratification and plant zonation along ecological gradients are examined. Prerequisites: one year of introductory biology or one semester of botany.

Bio 324 Natural Resources Practicum**4**

Environmental analysis and natural resources in relation to people and policy in the Pacific Rim. The focus is on local and regional environmental issues and policy in the context of environmental stewardship. It deals with the topics of old-growth forests, endangered species, fisheries issues, conservation of wild nature, international environmental issues in the Pacific Rim, land tenure and environmental stewardship. (Applies to environmental studies minor only.)

- Bio 359 Marine Mammals** 4
Biology, behavior, ecology, identification, and conservation of the marine mammals of the Pacific Rim. Work covers some of the major habitats in Puget Sound, with particular attention to the diving physiology, social behavior, and communications of whales and seals. Prerequisite: one year of general biology or one semester of zoology.
- Bio 417 Marine Stewardship** 4
Stewardship of marine habitats and marine organisms in the context of environmental issues and policy. Includes developing an understanding of the structure, function, and conservation issues regarding biotic communities and ecosystems of coastal zone, estuaries, islands, and the sea. Prerequisites: one year of general biology. (Applies to environmental studies minor only.)
- Bio 477 Plant Ecology** 4
Interrelationships between plants and their physical and biotic environments; plant-animal interactions; plant community composition and development; and modern methods of ordination and quantitative analysis with applications to conservation and stewardship. Prerequisites: one year of biology and one course in ecology.
- Bio 499 Biological Research** 1-6
Participation in an ongoing research project of the institute or a research project conducted concurrently with an advanced course. Prerequisite: permission of professor or concurrent enrollment in an advanced course.