Biology

The Whitworth Biology Department desires to broadly educate students in the fundamentals of biological processes and organismal diversity, to train students in the practice of science, and to instill an ethic of scientific responsibility in a complex world. Ultimately, this experience will inform their worldviews, their understanding of God, and their roles in society.

The learning outcomes of this major prepare students in the following areas:

Content

Graduates should have a broad base of factual information and principles in biology, including basic knowledge of all major organismic groups, biochemistry and metabolism, as well as the structural and functional components at all levels of biological organization. In addition, they should have reasonable depth in one subdiscipline of biology.

Synthesis: Graduates should be able to integrate and synthesize material from different subdisciplines of biology. This goes beyond simply having knowledge of different areas and should integrate subdisciplines of biology, relating biological processes at various levels of organization.

Communication

Biology graduates should be able to communicate with professional and lay audiences about biology. This skill includes the ability to communicate coherently in both oral and written forms, in plain language, about biological matters, and the ability to use discipline-specific formats, as appropriate, for professional audiences.

Critical Thinking

Graduates should be able to interpret biological research reports and journal articles and to analyze data. They should have the ability to design a useful, workable experiment to address a particular biological question and should be able to use problem-solving skills to modify a planned experimental approach.

Faith and Learning

Graduates will be able to express how their faith and/or worldview informs their practice of biology such that they are equipped to engage in a complex world with an ethic of scientific responsibility.

Technical Proficiencies

Graduates should demonstrate basic laboratory "bench" skills common to the discipline (e.g., using a microscope, performing dilutions, operating a spectrophotometer); be familiar with field techniques such as sampling, habitat analysis, and collecting and preserving samples; follow and use experimental protocols, including recording and maintaining accurate data records; and understand the factors involved in maintaining and handling organisms – plants, animals and microbes – for study.

Research

The ability to conduct a research experiment incorporates many of the goals the faculty would like students to achieve – knowledge of content, synthesis, technical proficiencies and communication skills.

Requirements for a Biology Major, B.A. (47)

BI 140	General Biology I: Genes, Cells and Evolution	4
BI 143	General Biology II: Ecology and Evolution	4
BI 240	General Biology III: Organismal Diversity	4
CH 161	General Chemistry I	3
CH 161L	General Chemistry I Lab	1
CH 181	General Chemistry II	3
CH 181L	General Chemistry II Lab	1
CH 271	Organic Chemistry I	3
CH 271L	Organic Chemistry I Lab	1
One of the following:		3
BI 311	General Biochemistry	

Approved upper-division biology electives

Students must take one course that fulfills the Biology "Faith and Learning (FL)" requirement, and one course that fulfills the Writing Intensive (W) requirement. W courses are offered with permission of the instructor for most 3-4 credit, upper division, semester-long courses.

- Faith and Learning (FL) courses include course material that culminates in an assignment which asks students to reflect and write about an area of faith or worldview of relevance to the course. The following courses will satisfy the (FL) requirement for B.A. (one course required): BI-308, BI-323, BI-347, BI-350, BI-354, BI-405.
- Writing Intensive (W) courses require instruction in writing specific to the discipline of biology, with at least two types of writing assignments, at least 12-15 pages of final-draft writing, and the opportunity to revise. The following courses may be taken as writing intensive: BI-307, BI-308, BI-321, BI-323, BI-331, BI-345, BI-347, BI-350, BI-354, BI-355, BI-371, BI-399, BI-404, BI-405, BI-412.
- Courses taken for a W in Biology cannot be added through Self-Service during registration. Instructor permission is required for registration using the Add/Drop form.

No more than four credits of internships, independent study or cooperative studies, no more than two credits of teaching assistantships, no more than four credits of BI-400 – Biological Research, and no more than 6 total credits for any combination of the above will apply to the degree program.

For teacher certification: Although there are no specific courses required for the certification in Biology, the Whitworth University School of Education adheres to the Washington State Educator Standards Board which follows a competency-based system outlined in the Next Generation Science Standards (NGSS). To meet these competencies, students pursuing secondary education teacher certification in the area of Biology should consult with an advisor in the Department of Biology when planning biology courses.

All endorsements subject to change; see School of Education for updated requirements.

Requirements for a Biology Major, B.S. (63-67)

BI 140	General Biology I: Genes, Cells and Evolution	4
BI 143	General Biology II: Ecology and Evolution	4
BI 240	General Biology III: Organismal Diversity	4
CH 161	General Chemistry I	3
CH 161L	General Chemistry I Lab	1
CH 181	General Chemistry II	3
CH 181L	General Chemistry II Lab	1
CH 271	Organic Chemistry I	3
CH 271L	Organic Chemistry I Lab	1
MA 171	Calculus I	4
MA 172	Calculus II	4
PS 151	General Physics I	3
PS 151L	General Physics I Lab	1
PS 153	General Physics II	3
PS 153L	General Physics II Lab	1
or PS 154L	Near Space Research Project	
One of the following:		3
BI 311	General Biochemistry	
CH 401	Biochemistry I	
One of the following (C	ell/Molecular):	3-4
BI 333	Evolutionary Biology	
BI 354	Developmental Biology	
BI 355	Introduction to Genomics	
BI 363	Genetics	

BI 365	Ecological Developmental Biology	
BI 399	Molecular Genetics	
BI 412	Cell Physiology	
Two of the follow	ving (Organismal - must include one *course not focused exclusively	6-8
on vertebrate org	anisms)	
BI 303	Field Botany (*)	
BI 306	Medical Microbiology (*)	
BI 307	Entomology (*)	
BI 308	Biology of HIV/AIDS (*)	
BI 321	Marine Invertebrates/Symbiosis (*)	
BI 323	Animal Physiology	
BI 324	Animal Behavior	
BI 331	Plant Physiology (*)	
BI 350	Comparative Vertebrate Anatomy	
BI 369	Mycology (*)	
BI 370	Bacterial Pathogenesis (*)	
BI 404	Neurophysiology	
BI 447	Microbial Physiology (*)	
One of the follow	ving (Ecosystem):	3-4
BI 305	Landscape Ecology	
BI 341	Central American Field Ecology	
BI 345	Ecology	
BI 346	Field Parasitology	
BI 347	Global Change Ecology	
BI 405	Ecological Measures	
Approved upper-	division biology electives	8

Students must take one course that fulfills the Biology "Research (R)" requirement, one course that fulfills the Biology "Faith and Learning (FL)" requirement, and one course that fulfills the Writing Intensive (W) requirement. W courses are offered with permission of the instructor for most 3-4 credit, upper division, semester-long courses.

- Research (R) courses require a semester-long, student driven research project including the posing
 of a hypothesis or research question, data collection, analysis, and reporting. The following
 courses will satisfy the (R) requirement for BS: ONE COURSE REQUIRED: BI-323LR,
 BI-331, BI-342, BI-363, BI-399.
- Faith and Learning (FL) courses include course material that culminates in an assignment which asks students to reflect and write about an area of faith or worldview of relevance to the course. The following courses will satisfy the (FL) requirement for BS: ONE COURSE REQUIRED: BI-308, BI-323, BI-347, BI-350, BI-354, BI-405.
- Writing Intensive (W) courses require instruction in writing specific to the discipline of biology, with at least two types of writing assignments, at least 12-15 pages of final-draft writing, and the opportunity to revise. Courses taken for a W in Biology satisfy the same requirements as the non-W version of the same course. The following courses will satisfy the W requirement for BA and BS Biology major: BI-307, BI-308, BI-321, BI-323, BI-331, BI-345, BI-347, BI-350, BI-354, BI-355, BI-371, BI-399, BI-404, BI-405, BI-412.
- Courses taken for a W in Biology cannot be added through Self-Service during registration. Instructor permission is required for registration using the Add/Drop form.

No more than four credits of internships, independent study or cooperative studies, no more than two credits of teaching assistant-ships, no more than four credits of BI 400 – Biological Research, and no more than six total credits for any combination of the above will apply to the degree program.

For teacher certification: Although there are no specific courses required for the certification in Biology, the Whitworth University School of Education adheres to the Washington State Educator Standards Board which follows a competency-based system outlined in the Next Generation Science Standards (NGSS). To meet these competencies, students pursuing secondary education teacher certification in the area of Biology should consult with an advisor in the Department of Biology when planning biology courses.

All endorsements subject to change; see School of Education for updated requirements.

The Whitworth Neuroscience Program builds upon the interdisciplinary nature of the field by integrating the strengths of a liberal arts education. Coursework in STEM will prepare students to engage in breaking research on the brain and central nervous system, while electives in the humanities will develop their faith-science integration. Students will engage in research and/or practice that equip them for future graduate/professional school or work in the community, providing a firm foundation for critical thinking and service to humanity in a number of venues.

Requirements for a Neuroscience Major, B.S. (54-55)

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BI 140 & 140L	General Biology I: Genes, Cells and Evolution and General Biology I: Genes, Cells and Evolution Lab	4
BI 143 & 143L	General Biology II: Ecology and Evolution and Ecology and Evolution Lab	4
CH 161 & 161L	General Chemistry I and General Chemistry I Lab	4
CH 181 & 181L	General Chemistry II and General Chemistry II Lab	4
CH 271 & 271L	Organic Chemistry I and Organic Chemistry I Lab	4
MA 171	Calculus I	4
PS 151 & 151L	General Physics I and General Physics I Lab	4
PY 101	Introductory Psychology	3
NE 101	Introduction to Neuroscience	3
NE 201	Neurobiology	1
NE 201L	Neuroscience Laboratory & Imaging Techniques	1
NE 403W	Neuroscience Capstone	1
Choose 1 of the follow	wing:	3
BI 311	General Biochemistry	
or CH 401	Biochemistry I	
Choose 1 of the follow	wing:	3
BI 381	Statistical Applications for Biology	
or PY 201	Psychological Statistics	
Choose 1 of the follow	wing:	2
NE 400H	Neuroscience Community Outreach	
NE 401H	Neuroscience Internship	
NE 402H	Neuroscience Research	
Electives: Pick one co categories. One comp psychology category,	pures in each of the biology, psychology, and humanities puter science offering could substitute for either the biology or but require pre-reqs.	
Biology electives		3-4
BI 354 & 354L	Developmental Biology and Lab: Developmental Biology	
BI 404	Neurophysiology	
Psychology electives		3
PY 225	Cognitive Psychology	
PY 335	Exploring Central Nervous System Disorders	
PY 376	Health Psychology	
PY 336	Drug Use and its Effects	
Humanities electives	(cannot substitute from CS)	3
EL 267	Introduction to Critical Strategies	

	EL 276	Medical Humanities	
	EL 355	Introduction to Linguistics	
	PH 255	Faith, Philosophy and Science	
	PH 302	Medical Ethics	
	PH 425	Philosophy of Mind	
	TH 369	Science and Faith	
	TH 393	Christian Spirituality	
Co pro	Computer Science (one of these could substitute for Bio or Psych elective, but need ore-reqs)		
	CS 344	Human-Computer Interaction	
	CS 457	Artificial Intelligence	

Environmental Science & Environmental Studies Majors

Requirements for the environmental studies majors are listed on the environmental studies page (http://catalog.whitworth.edu/undergraduate/interdisciplinarystudies/environmental_studies/).

Requirements for a Biology Minor (20)

All endorsements subject requirements.	to change; see School of Education for updated	
BI 140	General Biology I: Genes, Cells and Evolution	4
BI 143	General Biology II: Ecology and Evolution	4
BI 240	General Biology III: Organismal Diversity	4
Gen Bio Ill: Organismal Diversity (same course as BI 141)		
Approved upper-division biology electives		8

For Washington state endorsement in biology, BI 333, BI 363 and BI 345 must be included and the following additional courses are required:

* If used to meet this requirement, cannot be used to meet upper-division elective requirement.

MA 256	Elementary Probability and Statistics	3
EDU 455W	Science in Secondary School	2

The Whitworth Neuroscience Program builds upon the interdisciplinary nature of the field by integrating the strengths of a liberal arts education. Coursework in STEM will prepare students to engage in breaking research on the brain and central nervous system, while electives in the humanities will develop their faith-science integration. Students in the minor will develop a deeper understanding of how our brain influences behavior, thought, and human interaction.

Requirements for a Minor in Neuroscience (19)

BI 140	General Biology I: Genes, Cells and Evolution	4	
PY 101	Introductory Psychology	3	
NE 101	Introduction to Neuroscience	3	
Electives: Three of from humanities.	courses from the following with at least one from psychology and one	9	
Psychology electi	ve (at least one of the following):		
PY 225	Cognitive Psychology		
PY 335	Exploring Central Nervous System Disorders		
PY 376	Health Psychology		
PY 336	Drug Use and its Effects		
Humanities elective (at least one of the following):			
EL 267	Introduction to Critical Strategies		
EL 276	Medical Humanities		
EL 355	Introduction to Linguistics		

PH 255	Faith, Philosophy and Science
PH 302	Medical Ethics
PH 425	Philosophy of Mind
TH 369	Science and Faith
TH 393	Christian Spirituality
Other electives:	
BI 354	Developmental Biology
BI 404	Neurophysiology
CS 344	Human-Computer Interaction
CS 457	Artificial Intelligence

Environmental Studies Minor (21-23)

Requirements for the environmental studies minor are listed on the environmental studies page (http://catalog.whitworth.edu/undergraduate/interdisciplinarystudies/environmental_studies/).

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 is a participating member of the institute. Coursework taken through the institute can be counted as elective credit toward completion of a biology degree. 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, Mich.), Au Sable East (on the Chesapeake Bay, in 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, from a stewardship perspective.

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. Prerequisite: 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.

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. Prerequisite: one year of general biology.

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 or ordination and quantitative analysis with applications to conservation and stewardship. Prerequisite: 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.

Interdisciplinary Courses

STEM 126 Seminar for Health Professions

A seminar to introduce students to the pre-health,fields. Visiting speakers will represent medical,,dental, pharmacy, and veterinary fields. This,course will cover the specifics of courses,,majors, and other issues related to pre-health,fields. Students will also reflect on the,importance of the connections between academic,disciplines as they consider future vocational,options. Recommended for pre-health professional,students interested in the fields listed above,,This seminar fulfills the SC 126 Shared Curriculum,requirement. Spring semester.

STEM 351 Preparatory Seminar: Health Professions

A cross-disciplinary course focusing on synthesis,of general biology, general chemistry,,general physics, organic chemistry, physiology,,NMR and IR spectroscopy. Strategic,course for learning to apply introductory,science/math knowledge to questions involving,higher-order content. Intended for students,planning to take the Medical College,Admissions Test, Dental Aptitude Test, or,veterinary-school entrance exams. Intended,primarily for students in their junior or,senior year. Students will prepare for health,professions both in terms of the entrance exams, and by researching each school's focus, and prerequisites. Prerequisites: BI 140, BI 143,,CH 161, CH 181, CH 271, CH 278, PS 151 & 153 or PS,131 & 133.

Courses

BI 102 Introductory Biology

This course introduces the biological sciences to,non-science majors. The course presents a,contemporary understanding of the basic,organization and function of biological systems, and the nature and interdependence of living,organisms. The course goals will be accomplished, using lecture-free teaching, and class time will,primarily be spent on inquiry-based, active-learning exercises that require students to,think critically about real-world biological,problems. Laboratory exercises will be interwoven, with the course content, and consist of team-based, research projects. Meets the Natural Science, requirement in the Shared Curriculum.

BI 105 Plants in Culture

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 natural science requirement. Also,listed as ENS 105. Periodic offering.

BI 108 Biology of Sex & Gender

Investigation of the biological basis of gender, variation, sexual identity, reproduction and, sexual development. Emphasis given to the, developmental biology, neurobiology, endocrinology, and physiology underlying human male and female, form and function. No lab. For non-science, majors. Meets natural science general, requirement, Also listed as WGS 108. Periodic Jan Term, offering.

BI 110 Introduction to Human Genetics

Mechanisms of inheritance which account for the,vast genetic diversity within the human species,,hereditary disease and genetic therapy, genetic,technologies. No lab. For non-science majors,,Periodic offering. Meets natural science,requirement.

BI 111 Marine Biology

Introduction to life in the sea. Emphasis on the,diversity of marine organisms and adaptations to,marine habitats, marine ecosystems and food webs.,No lab. For non-science majors. Meets natural,science requirement. Also listed as ENS 111. Jan,Term. Periodic offering.

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BI 114H Resurrection Science

This course will cover basic topics such as: how, the genome (DNA) instructs cells to become a,living organism, genome editing (mutations),,de-extinction (bringing back extinct species), as,well as the critical connection between our DNA, and our health. We will also examine the, important nature of communicating science in a,digital world full of a wide variety of,audiences. An important aspect of the course will, address the ethical decisions we face regarding, the use of genome editing technologies and how, they should be regulated. These decisions will be, especially examined within the Christian, faith-based framework from which many students on, campus come from. However, we will make sure to, take time to ensure that non-Christian viewpoints, are heard as well.

BI 120 Introduction to Environmental Science

Overview of how science informs our approach to, environmental concerns, with application to,specific current environmental challenges,,including water resources, energy, land use,,biodiversity, and global change. Also discussed, how faith integrates with science to shape our, approach to the environment. Meets natural, science requirement. Also listed as ENS 120., Spring semester.

BI 120H Introduction to Environmental Science

Overview of how science informs our approach to, environmental concerns, with application to,specific current environmental challenges,,including water resources, energy, land use,,biodiversity, and global change. Also discussed, how faith integrates with science to shape our, approach to the environment.

BI 140 General Biology I: Genes, Cells and, Evolution

Introduces cells as the structural and functional, units of living systems, emphasizing molecular, characteristics of cellular and biochemical, processes in the context of cellular and, subcellular organization. Topics covered include, basic biological chemistry, cell and virus, structure, energy utilization and metabolism, viral and cellular reproduction, genetics,,evolutionary theory, systematics and phylogeny.,In the laboratory portion of the course, students, investigate cell structure, function, and, genetics. This course is part of the introductory, sequence of courses designed to assist students, in developing critical reasoning skills and the, necessary conceptual framework for advanced study, in biology. Meets natural science requirement., Co-requisite: BI 140L. Fall semester.

BI 140L General Biology I: Genes, Cells and, Evolution Lab

BI 143 General Biology II: Ecology and, Evolution

Explores the ecological and evolutionary context, of biological organisms. First half builds on, genetic and evolutionary concepts by exploring the, evidences, mechanisms, and ramifications of, evolutionary processes. Second half focuses on, how organisms and populations interact with one, another and with the biotic and abiotic context in, which they are found. Emphasizes an understanding, of how evolutionary and ecological principles, influence the way in which we engage with the, world. Lab. Prerequisite: BI-140. Corequisite Lab, BI 143L included.

BI 143L Ecology and Evolution Lab

Included in corequisite lecture, BI-143.

BI 240 General Biology III: Organismal, Diversity

Evolutionary origin, taxonomic classification and, unique anatomical, physiological and behavioral,adaptations of protists, fungi, green plants, and,animals. Lab. Restricted to BI majors and minors, only. Prerequisite: BI 140 BI 143. Corequisite lab, BI 240L included.

BI 240L Gen Bio III Lab: Organismal Diversity

Included in corequisite lecture, BI-240.

BI 303 Plant Taxonomy

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., Prerequisites: BI 140 BI 143 BI 240. Spring, semester, even years.

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BI 303L Lab: Plant Taxonomy

BI 304 Ecological Measures

This course will explore a number of fields of,ecological research and management, focusing,first on the reasons for measuring ecosystem,attributes pertinent to each field, as well as,covering sampling design, analysis, and common,measurement techniques. Three required Saturday,field trips. Prerequisite: BI 140, BI 143, BI 240.,Also listed as BI 304W and ENS 304. Fall semester.

BI 304W Ecological Measures

This course will explore a number of fields of,ecological research and management, focusing,first on the reasons for measuring ecosystem,attributes pertinent to each field, as well as,covering sampling design, analysis, and common,measurement techniques. Three required Saturday,field trips. Prerequisite: BI 345. Also listed as,BI 304. Fall semester.

BI 304L Lab: Ecological Measures

BI 306 Medical Microbiology

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. Prerequisite: CH 102. Spring semester., For nursing majors only or by instructor, permission.

BI 306L Medical Microbiology Lab

BI 307 Entomology

Biology of insects. Course focuses on the, evolution, diversity, and ecology of insects, as, well as the basics of their physiology,, development, and behavior. Important ways insects, affect human life are emphasized.

BI 307W Entomology

Biology of insects. Course focuses on the, evolution, diversity, and ecology of insects, as, well as the basics of their physiology,, development, and behavior. Important ways insects, affect human life are emphasized.

BI 307L Entomology Lab

See BI 307

BI 308 Biology of HIV/AIDS

Explores the biological, socioeconomic, political, and religious factors that influence the, transmission, life cycle, pathogenesis and, treatment of the human immunodeficiency virus, (HIV). No lab. Prerequisites: BI 140 and BI-143., Jan Term, periodic offering.

BI 310 Mentoring in the Biosciences

Students learn mentoring skills and practice those, skills as they help other students at Whitworth, succeed. The course also covers life skills that, will be as students pursue their education and, vocation in the bioscience fields, including, strategies for well-being, interpersonal, interactions, goal setting and personal, reflection.

BI 311 General Biochemistry

General biochemistry course for biology majors., Focus on biopolymers, energy flow and chemical, processes in living systems. No lab., Prerequisites: BI 143 and CH 271. Every semester.

BI 312 Vocational Preparation for Biology Grad, School

This course focuses on how to apply successfully,to a biology graduate program suited to the,students future vocational goals. Improving,skills that engage primary literature is also,addressed. Various speakers will share,information about graduate programs and their,personal professional trajectories.

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BI 321 Marine Invertebrates/Symbiosis

Invertebrate Biology takes a thematic,,non-phylogenetic approach to invertebrate,animals, the various phenomena they exhibit, and,appreciation for the diversity of solutions they,employ in the common challenges of life. ,Symbiotic biology examines the major categories,of interdependent associations involving partners, in all five kingdoms. Mechanisms by which,symbioses are established, maintained and,propagated, and the ecological and evolutionary,significance of such relationships are examined.,Prerequisites: BI 140, BI 143, and BI 240.,Periodic Offering.

BI 323 Animal Physiology

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,140, BI 143, BI 240, CH 271 and BI 311 or CH 401.,Junior standing or by permission of instructor.

BI 323L Lab: Animal Physiology

BI 323LR Research Lab for Animal Physiology

BI 324 Animal Behavior

The study of the mechanisms and evolution of,animal behavior. Topics include methods of,observation and quantification of behavior, natural selection, sexual selection, evolution of,animal choice, and the biological basis of all,social interactions. Lab. Prerequisites: BI 140,,BI 143, and BI 240. Also listed as ENS 324. Also,listed as BI 324W. Fall semester, odd years.

BI 324L Lab: Animal Behavior

Corequisite: Take BI-324, BI-324W, or ENS-324.

BI 331 Plant Physiology

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 140, BI 143, BI 240, BI 311 or,CH 401, and CH 271. Also listed as BI 331W and ENS,331. Spring semester, odd years.

BI 331L Plant Physiology Lab

BI 332 Plant-Animal Interactions

Ecology and evolution of interactions between, plants and animals, including herbivory, pollination, seed dispersal, and plant carnivory., Focus on reciprocal adaptations of plants and, animals, as well as ecological drivers of, plant-animal interactions at multiple scales., Implications of plant-animal interactions for, conservation, natural resource management, and, human health are emphasized.

BI 332W Plant-Animal Interactions

Ecology and evolution of interactions between, plants and animals, including herbivory, pollination, seed dispersal, and plant carnivory., Focus on reciprocal adaptations of plants and, animals, as well as ecological drivers of, plant-animal interactions at multiple scales., Implications of plant-animal interactions for, conservation, natural resource management, and, human health are emphasized.

BI 339 Intro to Field Studies

Theoretical and logistical preparation for the,field study tour the following Jan Term.,Activities will prepare students for field work,at an off campus location. Permission of,instructor only. Limited enrollment. ,Prerequisites: BI 140, BI 143 and BI 240. Fall,semester.

BI 341 Central American Field Ecology

Field-based course that provides a unique context,to perform student designed research in three, Central American ecosystems in Costa Rica. Course, will focus on field data collection, analysis, and, reporting for ecological systems. Requires, extensive time outdoors in conditions ranging from, wet and cold to hot and dry. Also listed as ENS,341.

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Biology 11

BI 342 Ecological Analysis and Presentation

Provides students with skills in analyzing,,summarizing and reporting on data collected as a,part of a field-based ecological research project.

BI 345 Ecology

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 140, BI,143, and BI 240. Spring semester.

BI 345L Lab: Ecology

BI 346 Field Parasitology

Field-based course exploring the interaction, between parasites and hosts. Parasites in, Northeastern Washington will be studied in, relation to prevalence, location and affect upon, the host. Organisms in the animal, plant, fungi,, and protista kingdoms will be considered. Lab., Prerequisites: BI 140, BI 143, BI 240. By, permission of instructor. Periodic Jan Term, offering.

BI 347 Global Change Ecology

This course will explore global-scale changes and,the interplay of ecosystems with these changes. ,Topics will explore how changes such as global,warming, invasive species and land degradation,influence global nutrient and energy cycling,,inter- and intra-species interactions, and,feedbacks in the earth system.

BI 347W Global Change Ecology

This course will explore global-scale changes and,the interplay of ecosystems with these changes.,Topics will explore how changes such as global,warming, invasive species and land degradation,influence global nutrient and energy cycling,,inter- and intra-species interactions, and,feedbacks in the earth system.

BI 347L Lab:Global Change Ecology

BI 350 Comparative Vertebrate Anatomy

Variations of the basic vertebrate theme that,enable the species within the group to exploit the,particular environment. Evolutionary development,of major organ systems within vertebrate classes.,Anatomical features of carnivore, herbivore and,omnivore mammals will be discussed in detail. Lab.,Prerequisites: BI 140, BI 143, and BI 240, or by,permission of instructor. Spring semester.

BI 350L Lab: Comparative Vertebrate Anatomy

BI 354 Developmental Biology

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 140, BI 143. Prerequisite or,corequisite: BI 311 or CH 401. Corequisite: BI,354L. Junior standing.

BI 354L Lab: Developmental Biology

BI 355 Introduction to Genomics

This course will cover how we can use information, from the genome, including organization and, output, to analyze varying biological conditions,, such as different states of development or, health. The focus will be on learning about the, wide array of techniques that use large data sets, collected in vivo (live organism) and analyze, them in silico (computer based algorithms)., Analyses will be accomplished utilizing various, online databases and tools to demonstrate the, power within the genomics toolbox. Spring term,, even years.

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BI 362 Biotechnology Entrepreneurship

This interdisciplinary course offers an exciting,look into the world of biotechnology,entrepreneurship targeted at business and biology,majors. Students will examine how biotech,companies are formed and run based on major,problems in human health and agriculture. We will,emphasize how biotechnology entrepreneurs frame, their unique value propositions for potential,investors, and in teams, students will create,original biotech solutions which will be formally,pitched to a panel of biotech industry experts.,The course experience offers a unique view of,science for business students and important,exposure to the business side of science for,biology majors.

BI 363 Genetics

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 140, BI 143, BI 240, and CH 271.

BI 363L Lab: Genetics

BI 365 Ecological Developmental Biology

Developmental processes as they are influenced by,their environmental context including: predators,,competitors, toxic compounds, changes in,temperature and humidity, availability of,nutritional resources, and other factors. The,influence of epigenetics and evolutionary,adaptation on developmental plasticity will also,be examined. Additionally, the course will,explore insights gained into human health and,disease by examining topics mentioned above.,Prerequisite: Take BI-240. Corequisite: Take,BI-365L. Corequisite or prerequisite: Take BI-311,or CH-401. Spring term, odd years.

BI 365L Lab: Ecological Development

Lab for BI-365.

BI 371WH Microbial Agents of Disease

This course explores the mechanisms by which, bacterial pathogens cause infection and disease in, humans. The focus is on the underlying, similarities in pathogenesis among bacterial, agents of disease, and their intimate relationship, with the human immune system. Students will, explore these mechanisms through a combination of, lecture, theoretical problem solving, and directed, laboratory research projects. Prerequisites; BI240.

BI 381 Statistical Applications for Biology

Introduction to collection, management,,statistical analysis, and visualization of,biological data. Students will learn to use the R,programming language.

BI 399 Molecular Genetics

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. Prerequisites: BI 140, BI 143.,Must be taken as co-requisite or prerequisite: BI,311 or CH 401. Must be taken as co-requisite: BI,399L. Junior standing. Fall semester.

BI 399L Molecular Genetics Lab

Techniques for manipulation and study of DNA., Co-requisite: BI 399 or BI 399W.

BI 400 Biological Research

Individual student experimental-laboratory or,field-research projects. Projects to be approved,by department faculty. Prerequisite: BI 140, BI,143, BI 240, and BI 311 and upper-division,coursework in biology and other sciences pertinent,to research project. Fall and spring semesters,,Jan Term and summer.

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BI 404 Neurophysiology

Structural and functional aspects of the central,nervous system of mammals. Basic neuroanatomy,,nerve transmission, synaptic function and,neuronal control mechanisms. Current research and,contemporary topics related to central nervous,system function will be investigated.,Prerequisite: BI 140, BI 143, and BI 311 or CH,401.

BI 405 Ecological Measures

This course will explore a number of fields of,ecological research and management, focusing first, on the reasons for measuring ecosystem attributes, pertinent to each field, as well as covering, sampling design, analysis, and common measurement, techniques. Three required Saturday field trips. ,Fall semester.

BI 405W Ecological Measures

This course will explore a number of fields of,ecological research and management, focusing first, on the reasons for measuring ecosystem attributes, pertinent to each field, as well as covering, sampling design, analysis, and common measurement, techniques. Three required Saturday field trips. ,Also listed as BI 405. Fall semester.

BI 405L Lab: Ecological Measures

Lab associated with BI 405.

BI 412 Cell Physiology

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 140, BI,143, BI 311 or CH 401. Junior standing.

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