# 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 | |

| | | |
|---|---|---|
| CH 401 | Biochemistry I | |
| Approved upper-division biology electives | | 20 |

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 require a reading or experience that culminates in a major assignment which asks students to reflect and write about an area of faith or worldview of relevance to the course
- 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

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 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 (Cell/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 following (Organismal - must include one *course not focused exclusively on vertebrate organisms) | | 6-8 |

| | | |
|---|---|---|
| BI 303 | Plant Taxonomy (*) | |
| BI 306 | Medical Microbiology (*) | |
| 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 following (Ecosystem): | | 3-4 |
| BI 304 | Ecological Measures | |
| BI 305 | Landscape Ecology | |
| BI 341 | Central American Field Ecology | |
| BI 345 | Ecology | |
| BI 346 | Field Parasitology | |
| BI 347 | Global Change Ecology | |
| BI 448 Environmental Microbiology - new course | | |
| 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
- 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
- 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

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.

## 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 to change; see School of Education for updated requirements. | | |
| 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 lll: 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 |

## 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** **1**

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** **1**

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** **3**

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

**BI 107 Infectious Diseases** **3**

Introduction to the structure, function and diversity of microorganisms that cause human disease. Microbial infections that complicate exposure to vacation climates, pets, recreational activities and exotic cuisine will be emphasized. For non-science majors. Meets natural science requirement. Periodic offering.

**BI 108 Biology of Sex & Gender** **3**

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** **3**

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** **3**

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.

**BI 114 Resurrection Science** **3**

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 114H Resurrection Science** **3**

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** **3**

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** **3**

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** **4**

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** **0**

**BI 143 General Biology II: Ecology and Evolution** **4**

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** **0**

Included in corequisite lecture, BI-143.

**BI 240 General Biology III: Organismal Diversity** **4**

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** **0**

Included in corequisite lecture, BI-240.

**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.Prerequisites: BI 140 BI 143 BI 240. Also listed as BI 303W and ENS 303. Spring semester, even years.

**BI 303L Lab: Plant Taxonomy** **0**

**BI 304 Ecological Measures** **4**

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 304L Lab: Ecological Measures** **0**

**BI 306 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. Prerequisite: CH 102. Spring semester. For nursing majors only or by instructor permission.

**BI 306L Medical Microbiology Lab** **0**

**BI 307 Entomology** **4**

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** **4**

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** **0**

See BI 307

**BI 308 Biology of HIV/AIDS** **3**

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 311 General Biochemistry** **3**

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** **1**

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.

**BI 321 Marine Invertebrates/Symbiosis** **3**

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** **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 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** **0**

**BI 323LR Research Lab for Animal Physiology** **0**

**BI 324 Animal Behavior** **4**

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** **0**

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

**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 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** **0**

**BI 332 Plant-Animal Interactions** **4**

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** **4**

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** **1**

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** **3**

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.

**BI 342 Ecological Analysis and Presentation** **1**

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** **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 140, BI 143, and BI 240. Also listed as BI 345W and ENS 345. Spring semester.

**BI 345L Lab: Ecology** **0**

**BI 346 Field Parasitology** **3**

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** **4**

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** **0**

**BI 350 Comparative Vertebrate Anatomy** **4**

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. Also listed as BI 350W. Spring semester.

**BI 350L Lab: Comparative Vertebrate Anatomy** **0**

**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 140, BI 143. Prerequisite or corequisite: BI 311 or CH 401. Corequisite: BI-354L. Junior standing. Also listed as BI 354W.

**BI 354L Lab: Developmental Biology** **0**

**BI 355 Introduction to Genomics** **3**

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.

**BI 362 Biotechnology Entrepreneurship** **3**

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** **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 140, BI 143, BI 240, and CH 271. Also listed as BI 363W.

**BI 363L Lab: Genetics** **0**

**BI 365 Ecological Developmental Biology** **4**

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** **0**

Lab for BI-365.

**BI 371WH Microbial Agents of Disease** **3**

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** **3**

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

**BI 399 Molecular Genetics** **4**

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 corequisite or prerequisite: BI 311 or CH-401. Must be taken as corequisite: BI-399L. Junior standing. Also listed as BI 399W. Fall semester.

**BI 399L Molecular Genetics Lab** **0**

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

**BI 400 Biological Research** **1-4**

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.

**BI 404 Neurophysiology** **3**

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 412 Cell Physiology** **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 140, BI 143, BI 311 or CH 401. Junior standing. Also listed as BI 412W.