### B.A. IN BIOLOGY

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td><strong>Major in Biology (B.A.)</strong></td>
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<tr>
<td>BIO 124 &amp; BIO 124D</td>
<td>Integrative Biology: Genes, Cells, Change and Integrative Biology: Genes, Cells, Change Lab</td>
<td>4</td>
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<tr>
<td>BIO 128 &amp; BIO 128D</td>
<td>Integrative Biology: Metabolism, Energy, Biodiversity and Integrative Biology: Metabolism, Energy, Biodiversity Lab</td>
<td>4</td>
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<tr>
<td>BIO 218</td>
<td>Biology in a Changing World</td>
<td>3</td>
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<tr>
<td>BIO 399</td>
<td>Introduction to Research</td>
<td>1</td>
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<tr>
<td>BIO 495</td>
<td>Biology Seminar</td>
<td>2</td>
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<tr>
<td>Choose an applied experience:</td>
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<tr>
<td>BIO 481</td>
<td>Internship in Biology</td>
<td>2-3</td>
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<tr>
<td>BIO 496 &amp; BIO 497</td>
<td>Biology Research and Advanced Biology</td>
<td>4</td>
</tr>
<tr>
<td>BIO 499</td>
<td>Biology Symposium</td>
<td>1</td>
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<tr>
<td><strong>Choose one course from each of the following three areas, at least one of which must be a designated research course</strong></td>
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<td><strong>Environmental area courses:</strong></td>
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<tr>
<td>BIO 316 &amp; BIO 317</td>
<td>Wildlife Ecology and Management and Wildlife Ecology and Management Lab</td>
<td>4</td>
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<tr>
<td>BIO 318KZ</td>
<td>Ecology in the Tropics: Natural History and Future Prospects</td>
<td>1</td>
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<tr>
<td>BIO 324 &amp; BIO 325</td>
<td>Human Ecology and Human Ecology Lab</td>
<td>4</td>
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<tr>
<td>BIO 328 &amp; BIO 329</td>
<td>Invertebrate Biology and Invertebrate Biology Lab</td>
<td>4</td>
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<tr>
<td>BIO 330 &amp; BIO 331</td>
<td>Ecology and Ecology Lab ^1</td>
<td>4</td>
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<tr>
<td>BIO 342 &amp; BIO 343</td>
<td>Aquatic Biology and Aquatic Biology Lab</td>
<td>4</td>
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<tr>
<td>BIO 346 &amp; BIO 347</td>
<td>Animal Behavior and Animal Behavior Lab</td>
<td>4</td>
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<tr>
<td>&amp; BIO 372 &amp; BIO 373</td>
<td>Plant Taxonomy and Ecology and Plant Taxonomy and Ecology Lab</td>
<td>4</td>
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<tr>
<td>&amp; BIO 380 &amp; BIO 383</td>
<td>Environmental Plant Biology and Environmental Plant Biology Lab ^1</td>
<td>4</td>
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<tr>
<td>&amp; BIO 386 &amp; BIO 387</td>
<td>Developmental Biology and Developmental Biology Lab ^1</td>
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<tr>
<td><strong>Courses from Au Sable Institute of Environmental Studies</strong></td>
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<tr>
<td>BIO 214 &amp; BIO 215</td>
<td>Human Anatomy and Human Anatomy Lab</td>
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<tr>
<td>BIO 216 &amp; BIO 217</td>
<td>Human Physiology and Human Physiology Lab</td>
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<tr>
<td>BIO 238 &amp; BIO 239 &amp; BIO 240</td>
<td>Human Anatomy and Physiology and Human Anatomy Lab and Physiology Lab</td>
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<tr>
<td>BIO 326 &amp; BIO 327</td>
<td>Vertebrate Histology and Vertebrate Histology Lab</td>
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<tr>
<td>BIO 338 &amp; BIO 339</td>
<td>Endocrinology and Endocrinology Lab</td>
<td>4</td>
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<tr>
<td>BIO 358 &amp; BIO 359</td>
<td>Neurobiology and Neurobiology Lab</td>
<td>4</td>
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<tr>
<td>BIO 368 &amp; BIO 369 &amp; BIO 370</td>
<td>Structure and Development and Structure and Development of Vertebrates Lab</td>
<td>4</td>
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<tr>
<td>BIO 376 &amp; BIO 377</td>
<td>Animal Physiology and Animal Physiology Lab</td>
<td>4</td>
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| **Cell and molecular area courses:**                                                                                          |
| BIO 234 & BIO 235 | Microbiology and Microbiology Lab                                      | 4       |
| BIO 332 & BIO 333 | Genetics and Genetics Lab                                             | 4       |
| BIO 354 & BIO 355 | Cell Biology and Cell Biology Lab                                     | 4       |
| BIO 362 & BIO 363 & BIO 364 | Developmental Biology and Developmental Biology Lab and Immunology Lab ^1 | 4       |
| BIO 384 & BIO 387 | Immunology and Immunology Lab ^1                                       | 4       |
BIO 396 • Molecular Biology and Molecular Biology Lab 1
BIO 388 • Biochemistry I and Biochemistry I Lab
BIO 400 • Ultrastructure and Ultrastructure Lab
CHE 304 Essentials of Biochemistry and Essentials of Biochemistry Lab

Electives from 200 level or above biology courses 16
Two chemistry courses, excluding CHE 107/CHE 107D and CHE 200, or CHE 208/CHE 208D, plus one additional biology course numbered 200 or higher

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<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Major</td>
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<td>53-54</td>
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<tr>
<td>General Education</td>
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<td>49-50</td>
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<tr>
<td>Electives</td>
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<tr>
<td>Total Credits</td>
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<td>122</td>
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1 This is a designated research course.
Courses whose number is followed by a letter fulfill a General Education requirement.

BIO 100 • Principles of Biology 3 Credits.
Basic principles of modern biology. Topics include the scientific method, biology of the cell, genetic principles, anatomy and physiology of humans, plant biology, and environmental biology.
Corequisites: Registration in BIO 100D is required.
Offered: Occasionally.

BIO 100D • Principles of Biology Lab 1 Credit.
Laboratory experience accompanying BIO 100.
Corequisites: Registration in BIO 100 is required.
Offered: Occasionally.

BIO 104 • Human Biology 3 Credits.
Study of the biological aspects of the human species. Includes basic molecules of life, human cell biology, tissue types, anatomy and physiology of the 10 systems, human embryology and development, human genetics, nutrition, disease, and health.
Corequisites: Registration in BIO 104D is required.
Offered: Fall, Spring.

BIO 104D • Human Biology Lab 1 Credit.
Laboratory experience accompanying BIO 104.
Corequisites: Registration in BIO 104 is required.
Offered: Fall, Spring.

BIO 105 • Medical Terminology 2 Credits.
Study of medical terms. Students study material independently and take proctored examination to demonstrate knowledge of medical language.
Prerequisites: Permission of instructor. Offered: Fall, Spring.

BIO 114D • Introduction to Biodiversity, Ecology, and Adaptation 4 Credits.
An introduction to the diversity, interrelationships, and origins of living organisms. Focuses on three themes: an overview of kinds and diversity of organisms found in six kingdoms, the interaction of organisms with each other and their environment, and the change of organisms through time.
Offered: Occasionally.

BIO 120 • Introduction to Molecular and Cellular Biology 3 Credits.
An introduction to cellular and subcellular aspects of living organisms. Includes a study of basic chemistry, biological molecules, cells, enzymes, metabolism, classical genetics, and molecular genetics.
Corequisites: Registration in BIO 120D is required.
Offered: Fall, Spring. Special Notes: This course is intended for Nursing and other science related majors.

BIO 120D • Introduction to Molecular and Cellular Biology Lab 1 Credit.
Laboratory experience accompanying BIO 120.
Corequisites: Registration in BIO 120 is required.
Offered: Fall.

BIO 122 • Introduction to Organismic Biology 3 Credits.
An introduction to how living things work. Focuses on two main themes: the correlation between structure and function, and the capacity of organisms to adjust their internal environment in response to short-term and long-term fluctuations in the external environment.
Corequisites: Registration in BIO 122D is required.
Offered: Fall, Spring.

BIO 122D • Introduction to Organismic Biology Lab 1 Credit.
Laboratory experience accompanying BIO 122.
Corequisites: Registration in BIO 122 is required.
Offered: Fall, Spring.
BIO 124 • Integrative Biology: Genes, Cells, Change 3 Credits.
In a complex world, understanding challenges like infectious disease or environmental change requires a fundamental knowledge of biology. Using relevant examples, students will explore molecules, DNA, biotechnology, evolution, populations, ecosystems, disease, and human systems (e.g. digestive, immune) to gain a perspective on global health and personal responsibility to life.
Prerequisites: Declared major in Biology, Environmental Science, Environmental Studies, Biochemistry/Molecular Biology, Neuroscience, or Secondary Education Life Science OR a declared minor in Biology. Corequisites: BIO 124D. Offered: Fall, Spring.

BIO 124D • Integrative Biology: Genes, Cells, Change Lab 1 Credit.
Laboratory experience accompanying BIO 124. Corequisites: BIO 124. Offered: Fall, Spring.

BIO 126 • Integrative Biology and Global Health 3 Credits.
Cancer. Climate change. Infectious disease. These are some of the challenges before biologists; challenges that require knowledge and skills that are not confined to one sub-discipline to solve. Through real-world, case-based problems encompassing cells to ecosystems, this course unpacks what it means to be a biologist today. Concepts include genetics, evolution, population, community and ecosystem ecology and global change.
Corequisites: Registration in BIO 127 is required. Offered: Fall.

BIO 127 • Integrative Biology and Global Health Lab 1 Credit.
Laboratory experience accompanying BIO 126. Corequisites: Registration in BIO 126 is required. Offered: Fall.

BIO 128 • Integrative Biology: Metabolism, Energy, Biodiversity 3 Credits.
Living organisms face challenges requiring them to either adapt, move, acclimate or perish. Through real-world examples, students will gain a fundamental understanding of homeostasis, enzymes, metabolism, energy flow, movement, human systems (e.g., circulatory, nervous, excretory), photosynthesis, cellular respiration, extinction, biodiversity, transformation of matter and acclimation.
Prerequisites: Declared major in Biology, Environmental Science, Environmental Studies, Biochemistry/Molecular Biology, Neuroscience, or Secondary Education: Life Science OR Declared minor in Biology. Corequisites: Concurrent registration in BIO 128D is required. Offered: Fall, Spring.

BIO 128D • Integrative Biology: Metabolism, Energy, Biodiversity Lab 1 Credit.
Laboratory experience accompanying BIO 128. Corequisites: BIO 128. Offered: Fall, Spring.

BIO 130 • Introduction to Neuroscience 3 Credits.
An introduction to the biological basis of behavior. Focuses on two main themes: the cellular, molecular, and genetic processes that form the foundation of nervous system function and the systems-level organization of the nervous system that forms the foundation of human and animal behavior.
Corequisites: Registration in BIO 130D is required. Offered: Spring. Special Notes: Carries cross-credit in Psychology and Neuroscience.

BIO 130D • Introduction to Neuroscience Lab 1 Credit.
Laboratory experience accompanying BIO 130. Corequisites: Registration in BIO 130 is required. Offered: Spring. Special Notes: Carries cross credit with Neuroscience and Psychology.

BIO 132 • The Science of Birds 3 Credits.
An overview of the Minnesota avifauna and bird biology. Bird identification is discussed and practiced in the field. Selected topics from bird biology (migration, flight, reproduction, behavior, food, and conservation) are presented through lectures, numerous slide shows, and videos. These topics provide an introduction to the prevailing themes in modern biology.
Corequisites: Registration in BIO 132D is required. Offered: Occasionally Spring.
BIO 132D • The Science of Birds Lab 1 Credit.
Laboratory experience accompanying BIO 132.
Corequisites: Registration in BIO 132 is required.
Offered: Occasionally Spring.

BIO 214 • Human Anatomy 3 Credits.
Detailed study of the anatomy and histology of the human body in relation to its functional systems. Laboratory includes human cadaver dissections.
Prerequisites: One of the following: BIO 104/104D, BIO 120/120D, BIO 122/122D, BIO 124/124D, BIO 128/128D. Corequisites: Registration in BIO 215 is required. Special Notes: Not open to students who have taken BIO 238/239 except by department consent. Offered: Fall.

BIO 215 • Human Anatomy Lab 1 Credit.
Laboratory experience accompanying BIO 214.
Corequisites: Registration in BIO 214 is required.
Offered: Fall.

BIO 216 • Human Physiology 3 Credits.
Integration of basic principles of cell biology and mechanisms of physiology to the functions of the major organ systems of the human body; centered around the theme of homeostasis.
Prerequisites: BIO 214/215; One of the following: BIO 104/104D, BIO 120/120D, BIO 218. Corequisites: Registration in BIO 217 is required. Special Notes: Not open to students who have taken BIO 238/239 except by department consent and a course in chemistry is a recommended prerequisite. Offered: Spring.

BIO 217 • Human Physiology Lab 1 Credit.
Laboratory experience accompanying BIO 216.
Corequisites: Registration in BIO 216 is required.
Offered: Spring.

BIO 218 • Biology in a Changing World 3 Credits.
Through the exploration of interactions between genes and their environments, students articulate integrative topics (e.g., evolution, transformation of matter, and energy, information flow, systems and structure/function), identify career options and desired skill sets, make a growth plan and articulate an intellectual autobiography, including faith integration.
Prerequisites: BIO 124/124D; BIO 128/128D. Offered: Fall, Spring.

BIO 234 • Microbiology 3 Credits.
Microorganisms and viruses with respect to their structure, physiology, genetics, identification, control, host-microbe relationships, and exploitation by humans. Topics include pathogenic organisms, the infectious diseases they cause, and the events and products of vertebrate immune responses.
Prerequisites: One of the following: BIO 218 (may be taken concurrently), BIO 120/120D; One course in chemistry (A second course in chemistry is recommended). Corequisites: Registration in BIO 235 is required. Offered: Spring.

BIO 235 • Microbiology Lab 1 Credit.
Laboratory experience accompanying BIO 234.
Corequisites: Registration in BIO 234 is required.
Offered: Spring.

BIO 238 • Human Anatomy and Physiology 3 Credits.
Anatomy and physiology of the human body, with a major emphasis on the principle of homeostasis.
Prerequisites: One of the following: BIO 104/104D, BIO 120/120D, BIO 218, (may be taken concurrently). Corequisites: Registration in BIO 239 is required. Special Notes: A course in chemistry is a recommended prerequisite. Not open to students who have taken BIO 214/215, BIO 216/217. Offered: Spring.

BIO 239 • Human Anatomy and Physiology Lab 1 Credit.
Laboratory experience accompanying BIO 238.
Corequisites: Registration in BIO 238 is required.
Offered: Spring.

BIO 244 • Pathophysiology and Pharmacology 3 Credits.
An integrated exploration of disease processes and the drugs used to treat them. The functional and structural changes that accompany a particular injury, disease, or syndrome are correlated with the study of drugs and their actions on the body.
Prerequisites: BIO 214/215; BIO 216/217 (may be taken concurrently); BIO 218, (may be taken concurrently); two semesters of Chemistry.
Corequisites: Registration in BIO 245 is required. Offered: Spring.

BIO 245 • Pathophysiology and Pharmacology Lab 1 Credit.
Laboratory experience accompanying BIO 244.
Corequisites: Registration in BIO 244 is required.
Offered: Spring.
BIO 248 • Clinical Pathophysiology and Pharmacology 3 Credits.
An integrated exploration of disease processes and the drugs used to treat them. The functional and structural changes that accompany a particular injury, disease, or syndrome are correlated with the study of drugs and their actions on the body.
Prerequisites: Acceptance into the Nursing program or consent of instructor. Corequisites: Registration in BIO 249 is required. Offered: Spring. Special Notes: Not open to students who have taken BIO 244/245.

BIO 249 • Clinical Pathophysiology and Pharmacology Lab 1 Credit.
Laboratory experience accompanying BIO 248. Corequisites: Registration in BIO 248 is required. Offered: Spring.

BIO 316 • Wildlife Ecology and Management 3 Credits.
Analysis of terrestrial vertebrate populations, communities, and habitats. Exploration of how these analyses are applied to the manipulation, exploitation, protection, and restoration of animal populations and communities.
Prerequisites: BIO 218 (may be taken concurrently) or two of BIO 122/122D, BIO 128/128D, ENS 104/104D; Junior or senior standing. Corequisites: Concurrent registration in BIO 317 is required. Special Notes: Carries cross-credit in environmental science. Offered: Spring, even # years.

BIO 317 • Wildlife Ecology and Management Lab 1 Credit.
Laboratory experience accompanying BIO 316. Includes some outdoor and off-campus investigations. Corequisites: Registration in BIO 316 is required. Offered: Spring, even # years.

BIO 318KZ • Ecology in the Tropics: Natural History and Future Prospects 4 Credits.
Travel in Kenya or Ecuador surveying the land, climate, plants, animals, homes, transportation, and industries, noting especially the impact of human presence. Ecuador includes the Amazon rainforest, Andean cloud forests, volcanic mountains, highlands, towns, cities, and the Galapagos Islands. Kenya includes Nairobi, African savanna, the Rift valley, and Masai Mara. Prerequisites: Laboratory Science (D) course; Mathematics (M) course. Offered: Interim. Special Notes: Carries cross-credit in environmental science and general studies.

BIO 324 • Human Ecology 3 Credits.
Interrelationships between humans and the natural environment. Overpopulation, resource use, and pollution studied from biological, social, and economic standpoints, and skill development in the critical examination of the impacts of humans and our technology on the natural world. Prerequisites: One year of Chemistry; BIO 218 (may be taken concurrently) or both BIO 122/122D and ENS 104/104D; Junior or senior standing. Corequisites: Registration in BIO 325 is required. Offered: Occasionally.

BIO 325 • Human Ecology Lab 1 Credit.
Laboratory experience accompanying BIO 324. Corequisites: Registration in BIO 324 is required. Offered: Occasionally.

BIO 326 • Vertebrate Histology 3 Credits.
Microscopic structure of cells, tissues, and organs in vertebrate animals, with special emphasis on the way structural units are integrated. At all times efforts are made to correlate structure with specific physiological functions. Prerequisites: BIO 218. Corequisites: Registration in BIO 327 is required. Offered: Spring, odd # years.

BIO 327 • Vertebrate Histology Lab 1 Credit.
Laboratory experience accompanying BIO 326. Corequisites: Registration in BIO 326 is required. Offered: Spring, odd # years.

BIO 328 • Invertebrate Biology 3 Credits.
A survey of invertebrate groups from protozoa to prochordates with emphasis on organizational, functional, and ecological significance. Special attention is given to the morphology, life histories, and physiology of invertebrates within the context of survival in specialized environments. Prerequisites: BIO 218 (may be taken concurrently) or two of the following: BIO 122/122D, BIO 128/128D, ENS 104/104D. Corequisites: Registration in BIO 329 is required. Offered: Spring, odd # years.

BIO 329 • Invertebrate Biology Lab 1 Credit.
Laboratory experience accompanying BIO 328. Corequisites: Registration in BIO 328 is required. Offered: Spring, odd # years.
BIO 330 • Ecology 3 Credits.
Structure and function of wild nature. Topics include interrelationships of organisms with their environments, factors that regulate such interrelationships, and various roles that humans play in modifying patterns and processes of nature at organism, community, and ecosystem levels.
Prerequisites: BIO 218 (may be taken concurrently) or two of the following: BIO 122/122D, BIO 126/127, BIO 128/128D, ENS 104/104D. Corequisites: Registration in BIO 331 is required. Special Notes: This is a designated research course. Offered: Fall, odd # years.

BIO 331 • Ecology Lab 1 Credit.
Laboratory experience accompanying BIO 330. Corequisites: Registration in BIO 330 is required. Offered: Fall, odd # years. Special Notes: This is a designated research course.

BIO 332 • Genetics 3 Credits.
Principles that control inheritance, with examples chosen from plant and animal research, population genetics, cytogenetics, molecular genetics, and current work on human genetics.
Prerequisites: BIO 218 (may be taken concurrently) or BIO 120/120D; Two courses in chemistry. Corequisites: Registration in BIO 333 is required. Offered: Fall.

BIO 333 • Genetics Lab 1 Credit.
Laboratory experience accompanying BIO 332. Corequisites: Registration in BIO 332 is required. Offered: Fall.

BIO 336 • Entomology and Parasitology 3 Credits.
A comparative study of the major invertebrate groups from anatomical, physiological, and ecological perspectives with attention to insects and parasitic invertebrates.
Prerequisites: BIO 218 (may be taken concurrently) or two of the following: BIO 122/122D, BIO 126/127, BIO 128/128D, ENS 104/104D; Junior or senior standing. Corequisites: Registration in BIO 337 is required. Offered: Occasionally.

BIO 337 • Entomology and Parasitology Lab 1 Credit.
Laboratory experience accompanying BIO 336. Corequisites: Registration in BIO 336 is required. Offered: Occasionally.

BIO 338 • Endocrinology 3 Credits.
Processes by which hormones exert control over many aspects of reproduction, development, growth, metabolism, and behavior. Topics include the chemical nature of hormones, receptors and signaling pathways, morphology and histology of endocrine organs, regulation of hormone synthesis and secretion, and mechanism of action in target tissues.
Prerequisites: BIO 218 (may be taken concurrently) or BIO/NSC/PSY 130/130D, BIO 120/120D; BIO 122/122D. Corequisites: Registration in BIO 339 is required. Offered: Fall, even # years. Special Notes: A course in physiology is a recommended prerequisite.

BIO 339 • Endocrinology Lab 1 Credit.
Laboratory experience accompanying BIO 338. Work is largely experimental, using bioassay procedures. Corequisites: Registration in BIO 338 is required. Offered: Fall, even # years.

BIO 342 • Aquatic Biology 3 Credits.
Biological and physical aspects of natural, freshwater ecosystems, including fish and other aquatic animals, aquatic plants, algae, and their interrelationships with each other and the unique aqueous environment in which they live.
Prerequisites: BIO 218 (may be taken concurrently) or two of the following: BIO 122/122D, BIO 128/128D, ENS 104/104D. Corequisites: Registration in BIO 343 is required. Offered: Fall, even # years.

BIO 343 • Aquatic Biology Lab 1 Credit.
Laboratory experience accompanying BIO 342. Includes some outdoor and off-campus investigations. Corequisites: Registration in BIO 342 is required. Offered: Fall, even # years.

BIO 346 • Animal Behavior 3 Credits.
Behavior from primitive invertebrates to advanced mammals, highlighting trends in behavior systems. Natural setting studies in the ethology tradition, comparative psychology studies, and biosociological principles with their implications for human social systems.
Prerequisites: PSY 100 or BIO 218 (may be taken concurrently); Junior or senior standing. Corequisites: Registration in BIO 347 is required. Special Notes: Carries cross-credit in psychology. Offered: Fall, even # years.

BIO 347 • Animal Behavior Lab 1 Credit.
Laboratory experience accompanying BIO 346. Corequisites: Registration in BIO 346 is required. Offered: Fall, even # years.
BIO 354 • Cell Biology 3 Credits.
The molecular organization and function of cells and their organelles. Understanding how cell biology information is obtained experimentally.
Prerequisites: Two courses in Chemistry (CHE 224 recommended); BIO 218 (may be taken concurrently) or BIO 332/333 or both PSY 100 and BIO/PSY/NSC 130/130D. Corequisites: Registration in BIO 355 is required. Special Notes: This is a designated research course. Offered: Spring.

BIO 355 • Cell Biology Lab 1 Credit.
Laboratory experience accompanying BIO 354. Corequisites: Registration in BIO 354 is required. Offered: Spring. Special Notes: This is a designated research course.

BIO 358 • Neurobiology 3 Credits.
Nervous system of animals and humans. Includes comparative anatomy and physiology of humans with other vertebrates and invertebrates, as well as interactions of sensory, motor, and integrative mechanisms of nervous system control.
Prerequisites: BIO 218 (may be taken concurrently) or PSY 100 and BIO/NSC/PSY 130/130D; Junior or senior standing. Corequisites: Registration in BIO 359 is required. Offered: Fall, even # years.

BIO 359 • Neurobiology Lab 1 Credit.
Laboratory experience accompanying BIO 358. Corequisites: Registration in BIO 358 is required. Offered: Fall, even # years.

BIO 362 • Developmental Biology 3 Credits.
The basic question of developmental biology is “How does a single fertilized egg give rise to all the different cell, tissue, and organ types of the adult organism?” The developmental processes that give rise to these different cell, organ, and tissue types along with the mechanisms underlying those processes are studied at the cellular, genetic, molecular, and biochemical levels.
Prerequisites: BIO 120/120D or BIO 124/124D; BIO 218 (may be taken concurrently) or 8 credits of BIO courses not including BIO 124/124D and BIO 128/128D; Two courses in chemistry. Corequisites: Registration in BIO 363 is required. Special Notes: This is a designated research course. Offered: Spring, even # years.

BIO 363 • Developmental Biology Lab 1 Credit.
Laboratory experience accompanying BIO 362. Includes surgical manipulation of living organisms to elucidate developmental principles. Corequisites: Registration in BIO 362 is required. Offered: Spring, even # years. Special Notes: This is a designated research course.

BIO 368 • Structure and Development of Vertebrates 3 Credits.
An integrated and systematic approach to descriptive embryology and comparative anatomy of vertebrate species.
Prerequisites: BIO 218 (may be taken concurrently). Corequisites: Registration in BIO 369 is required. Offered: Fall, odd # years.

BIO 369 • Structure and Development of Vertebrates Lab 1 Credit.
Laboratory experience accompanying BIO 368. Observational studies of live embryos, microscopic examination of representative vertebrate embryos, and dissection of representative vertebrate types. Corequisites: Registration in BIO 368 is required. Offered: Fall, odd # years.

BIO 372 • Plant Taxonomy and Ecology 3 Credits.
Identification and distribution of flowering plants, including field work, keying, and laboratory preservation. Biogeography and factors important in plant distribution.
Prerequisites: BIO 218 (may be taken concurrently) or two of the following: BIO 122/122D, BIO 126/127, BIO 128/128D, ENS 104/104D. Corequisites: Registration in BIO 373 is required. Offered: Fall, odd # years.

BIO 373 • Plant Taxonomy and Ecology Lab 1 Credit.
Laboratory experience accompanying BIO 372. Corequisites: Registration in BIO 372 is required. Offered: Fall, odd # years.

BIO 376 • Animal Physiology 3 Credits.
Comparative physiology of animal nerves, muscles, hormones, circulation, respiration, excretion, digestion, and the way those systems function intact with processes of feeding, energetics, osmoregulation, metabolism, locomotion, biomechanics, and temperature regulation necessary for an organism’s survival.
Prerequisites: Two courses in Chemistry; BIO 218 (may be taken concurrently) or both PSY 100 and BIO/NSC/PSY 130/130D. Corequisites: Registration in BIO 377 is required. Offered: Spring, even # years.
BIO 377 • Animal Physiology Lab 1 Credit.
Laboratory experience accompanying BIO 376. 
Corequisites: Registration in BIO 376 is required. 
Offered: Spring, even # years.

BIO 380 • Environmental Plant Biology 3 Credits.
Exploration of the significant roles plants play in the environment - driving and responding to carbon, water availability, nutrient levels and light. The influence of abiotic factors on photosynthetic pathways, productivity and the movement of matter and energy will reveal how plants respond to rapid environmental changes. Course includes experiences working with data and statistics.
Prerequisites: BIO 218 (may be taken concurrently) or two of the following: BIO 12/12D, BIO 126/127, BIO 128/128D, ENS 104/104D; one semester of Chemistry. Corequisites: Registration in BIO 383 is required. Special Notes: This is a designated research course. Offered: Spring, odd # years.

BIO 383 • Environmental Plant Biology Lab 1 Credit.
Laboratory experience accompanying BIO 380. Includes some outdoor and off-campus investigations.
Corequisites: Registration in BIO 380 is required. 
Offered: Spring, odd # years. Special Notes: This is a designated research course.

BIO 384 • Immunology 3 Credits.
Study of the molecular and cellular mechanisms that allow organisms to recognize, control, and eliminate “nonself” entities such as bacterial pathogens, foreign tissue grafts, and even transformed (cancerous) cells.
Prerequisites: Two semesters of Chemistry and either BIO 218 (may be taken concurrently) or BIO 120/120D and BIO 122/122D. (One of the following: BIO 234/235, BIO 332/333, BIO 354/355 is strongly recommended). Corequisites: Registration in BIO 387 is required. Special Notes: This is a designated research course. Offered: Fall, odd # years.

BIO 387 • Immunology Lab 1 Credit.
Laboratory experience accompanying BIO 384. 
Corequisites: Registration in BIO 384 is required. 
Offered: Fall, odd # years. Special Notes: This is a designated research course.

BIO 388 • Biochemistry I 3 Credits.
Physical and chemical properties of living systems with an emphasis on macromolecular interaction, structure, and function. Structure, classification, purification, and function of nucleic acids, proteins, carbohydrates, and lipids, including membrane transport and enzymology.
Prerequisites: BIO 120/120D or BIO 124/124D; CHE 226/227 (BIO 128/128D recommended). 
Corequisites: Registration in BIO 389 is required. 
Special Notes: Not open to students who have taken CHE 304/305, Carries cross-credit in chemistry. 
Offered: Fall.

BIO 389 • Biochemistry I Lab 1 Credit.
Laboratory experience accompanying BIO 388. Techniques include spectroscopy, chromatography, centrifugation, electrophoresis, and enzyme kinetics.
Corequisites: Registration in BIO 388 is required. 
Offered: Fall.

BIO 396 • Molecular Biology 3 Credits.
Modern advanced molecular genetic research. Topics covered include regulation of gene expression during development, molecular biology of cancer, animal virology, eukaryotic gene organization, and methods in gene manipulation.
Prerequisites: BIO 332/333; one additional biology course; CHE 224/225; CHE 226/227. Corequisites: Registration in BIO 397 is required Special Notes: This is a designated research course. Offered: Spring.

BIO 397 • Molecular Biology Lab 1 Credit.
Laboratory experience accompanying BIO 396. Consists of research projects utilizing recombinant DNA/genetic engineering techniques.
Corequisites: Registration in BIO 396 is required. 
Offered: Spring. Special Notes: This is a designated research course.

BIO 399 • Introduction to Research 1 Credit.
An introduction to research methodology in the biological sciences, with experience in the use of biological literature and an examination of how to distinguish and evaluate different types of scientific writing and presentations. Experience in the development of a research proposal.
Prerequisites: BIO 218; major in biology or related field; Junior standing. Special Notes: Carries cross-credit in environmental studies. Offered: Fall, Spring.
**BIO 400 • Ultrastructure** 3 Credits.
Electron microscopy as a tool in the sciences with emphasis on its use in biological investigation. Students prepare a portfolio of micrographs on a variety of material. Demonstrations, discussions, seminars, field trips, and individual practice.
Prerequisites: BIO 124/124D; Junior or senior standing. Corequisites: Registration in BIO 401 is required. Offered: Occasionally.

**BIO 401 • Ultrastructure Lab** 1 Credit.
Laboratory experience accompanying BIO 400. Corequisites: Registration in BIO 400 is required. Offered: Occasionally.

**BIO 409 • Advanced Human Gross Anatomy** 4 Credits.
For the undergraduate pre-health professions student. A regional approach to the study of anatomy through the supervised and directed student dissection of human cadavers. Identification of detailed structures and understanding their significance to the body.
Prerequisites: BIO 214/215 or consent of instructor. Offered: Interim.

**BIO 481 • Internship in Biology** 1-4 Credits.
A learning/practicing experience in which the student applies biological understanding and skills in an off-campus professional setting.
Prerequisites: Major or minor in Biology; Junior or senior standing. Offered: Fall, Spring.

**BIO 493 • Literature Review in Biology** 1 Credit.
Thorough review of the primary and secondary literature pertaining to a particular question, problem, or phenomenon in the biological sciences. Culminates in written report that is presented orally in BIO 499.
Prerequisites: BIO 399; Senior standing; consent of instructor. Offered: Fall, Spring.

**BIO 495 • Biology Seminar** 1-2 Credits.
Readings and discussions of topics that relate biology to one’s Christian faith.
Prerequisites: BIO 399; Senior standing. Offered: Fall.

**BIO 496 • Biology Research** 1 Credit.
Students collect original data through independent laboratory research or field research under the supervision of a faculty member.
Prerequisites: BIO 399; Completion or co-completion of a tagged research course; consent of instructor. Special Notes: May be repeated once for credit. Offered: Fall, Spring.

**BIO 497 • Advanced Biology Research** 1 Credit.
Working under the supervision of a faculty mentor, students analyze the results of their original research completed in BIO 496 and write up their findings in a formal scientific paper. Results will be presented in class and possibly outside venues.
Prerequisites: BIO 496; consent of instructor. Offered: Fall, Spring.

**BIO 499 • Biology Symposium** 1 Credit.
The presentation of scientific research and literature. Culminates in departmental symposium in which students present their original research or literature review.
Prerequisites: BIO 493 or BIO 496. Special Notes: Carries cross-credit in environmental studies. Offered: Fall, Spring.