

Biology

Department Faculty

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Department Goals

All truly Christian education must have as its ultimate purpose the enhancement and further unfolding of each student's ability to accomplish his or her "chief end" of "glorifying God and enjoying Him forever." Our college purpose statement describes this as striving "to discern and unfold the implications of His preeminence in all things." Our department seeks to discern and unfold the implications of Christ's preeminence in biology. Toward this end we offer a curriculum that is consciously designed to enable and encourage fellow believers in the tasks of discerning, unfolding, glorifying and enjoying in the biological sciences.

In accordance with the general aims listed in the college's purpose statement, our departmental aims are: 1) to dramatically expand our students' knowledge of the biological aspects of creation to enable them to be broader, more versatile and more conscientious worshippers; 2) to help students become able, informed, vigilant and humble yet unashamed stewards of that which God has chosen to reveal about the biological aspects of his creation and also of the investigative processes through which much of this revelation comes; 3) to encourage students to become motivated servants who understand that the acquisition of skills and knowledge in biology carries with it the responsibility for practical application in redemptive activity.

Acceptance into the Biology Major

Because of the rigorous nature of the major, a minimum combined SAT score of 1100 (sum of the critical reading and math section scores), or composite ACT score of 24 is normally required for those declaring a biology major. Students with lower test scores should consult the Biology Department chair before registering for biology courses required in the major. The biology major calls for early counseling of students in order that they may be properly informed concerning requirements and necessary course sequences

Biology Major Options

The department offers four different concentrations for completing a major in biology:

1) a general option that includes a wide range of courses across the biological disciplines;

2) a biomedical concentration which emphasizes cellular and molecular biology and is the recommended biology major concentration for pre-medical students and students interested in biomedical research;

3) an environmental biology concentration; and

4) a health professions concentration recommended for those students considering graduate/professional training in nursing, physicians assistant, physical therapy, occupational therapy, and a variety other health related fields.

Students with questions concerning the best option for their future plans should consult the department chair.

Students interested in certification for teaching biology in secondary school (high school) should consult with the chair of the Education Department (See Requirements for a Major in Natural Science with Georgia Secondary School Broad Fields Sciences Certification)

Requirements for Major in Biology - General

The core and distribution requirements for a major in biology are those listed for baccalaureate degrees on page 24 with the exception that CHE 121. General Chemistry is fulfilling the natural science lab requirement, and is already required for the major.

Core requirements	54
Electives	3-7

Major and Supporting Course Requirements*

BIO 111-112. General Biology I, II	8
BIO 242. Cellular and Molecular Biology	4
BIO 260. Ecology 'W'	4
BIO 291. Biological Perspectives.....	3
BIO 311. Practicum in Biology	0-2
BIO 490. Biology Seminar 'S'	1
BIO 492-493. Senior Integration Paper I, II	2,1
Biology electives	
Group 2 electives—two courses (see list below)	7-8
Group 3 electives—two courses (see list below)	7-8
CHE 121-122. General Chemistry I, II.....	8
CHE 323-324. Organic Chemistry I, II	8
Mathematics through MAT 142. Precalculus. If a math placement level of 4 or higher is received, then one additional math course is required	

* These requirements may include enough units in chemistry for a chemistry minor. If an additional minor is desired, the total number of units taken may exceed the 126 needed for graduation.

(e.g. Calculus I, Elementary Statistical Methods).....	4
PHY 131-132. General College Physics I, II	<u>8</u>
Total hours for the major and supporting courses	<u>65-69</u>
Degree Total.....	126

Requirements for Major in Biology- Biomedical Concentration

This option offers a concentration in cellular and molecular biology and is recommended for those interested in biotechnology, biomedical research and professional school in medicine (veterinary as well as human), dentistry, podiatry and optometry. A minimum combined SAT score of 1200 (sum of the critical reading and math section scores), or composite ACT score of 27 at the time of acceptance into Covenant College is strongly recommended for those choosing the biomedical concentration.

The core and distribution requirements for a major in biology are those listed for baccalaureate degrees on page 24 with the exception that CHE 121. General Chemistry is fulfilling the natural science lab requirement, and is already required for the major.

Core requirements	54
Electives.....	3-7

Major and Supporting Course Requirements*

BIO 111-112. General Biology I, II	8
BIO 242. Cellular and Molecular Biology	4
BIO 260. Ecology ‘W’	4
BIO 291. Biological Perspectives	3
BIO 311. Practicum in Biology	0-2
BIO 490. Biology Seminar ‘S’	1
BIO 492-493. Senior Integration Paper I, II.....	2,1
Biology electives	
Group 2 electives—4 courses (see list below)	14-16
CHE 121-122. General Chemistry I, II	8
CHE 323-324. Organic Chemistry I, II	8
Mathematics through MAT 142 Precalculus. If a math placement level of 4 or higher is received, then one additional math course is required (e.g. Calculus I, Elementary Statistical Methods).....	4
PHY 131-132. General College Physics I, II	<u>8</u>
Total hours for the major and supporting courses	<u>65-69</u>
Degree Total.....	126

* These requirements may include enough units in chemistry for a chemistry minor. If an additional minor is desired, the total number of units taken may exceed the 126 needed for graduation.

Requirements for Major in Biology- Environmental Concentration

This option offers a concentration in environment/ecology-related topics and is recommended for those interested in environmental issues, conservation biology and wildlife biology.

Covenant is affiliated with AuSable Institute of Environmental Studies. By completing both the Covenant and AuSable programs, a student may earn an environmental certificate from the institute. Covenant will give credit for most AuSable Institute courses. Fellowships and scholarships are available. See Professor Wenger for further information.

The core and distribution requirements for a major in biology are those listed for baccalaureate degrees on page 24 with the exception that CHE 121. General Chemistry is fulfilling the natural science lab requirement, and is already required for the major.

Core requirements	54
Electives	3-5

Major and Supporting Course Requirements*

BIO 111-112. General Biology	8
BIO 260. Ecology ‘W’	4
BIO 291. Biological Perspectives.....	3
BIO311. Practicum in Biology	0-2
BIO 490. Biology Seminar ‘S’	1
BIO 492-493. Senior Integration Paper	2,1
Biology electives	
Group 1 elective—1 course (see list below)	3-4
Group 2 and 3 electives—two courses (see list below)	7-8
CHE 121-122. General Chemistry I, II.....	8
Either CHE 323-324. Organic Chemistry I, II or PHY 131-132. General College Physics I, II.....	8
MAT 142. Precalculus Mathematics	4
STA 251. Elementary Statistical Methods.....	4
Summer courses at AuSable Institute (3 courses)	<u>12</u>
Total hours for the major and supporting courses.....	<u>67-69</u>
Degree Total.....	126

* These requirements may include enough units in chemistry for a chemistry minor. If an additional minor is desired, the total number of units taken may exceed the 126 needed for graduation.

Requirements for Major in Biology- Health Professions Concentration

This concentration provides a solid foundation in biology and the flexibility to meet pre-requisites for graduate and professional programs for a variety of health professions. Students who intend to pursue graduate and/or professional training in physical therapy, nursing, physicians assistant programs, occupational therapy and other similar programs will be well served in this concentration. (Please note that the biomedical concentration is recommended for pre-medical students) Students need to be aware of any specific requirements of particular graduate/professional programs that are not included in the health professions concentration so that they can work with their advisor to make arrangements for any additional courses as needed.

The core and distribution requirements for a major in biology are those listed for baccalaureate degrees on page 24 with the exception that CHE 103. Introductory Chemistry or CHE 121. General Chemistry is fulfilling the natural science lab requirement, and is already required for the major, and PSY100 General Psychology will be taken for the social science distribution requirement.

Core requirements	50
Electives	7-11

Major and Supporting Course Requirements

BIO 111-112. General Biology I, II	8
BIO 242. Cellular and Molecular Biology	4
BIO 291. Biological Perspectives	3
BIO 311. Practicum in Biology	0-2
BIO 490. Biology Seminar ‘S’	1
BIO 492-493. Senior Integration Paper I, II.....	2,1
Biology electives	
Groups 1 and 2 electives—4 courses (see list below - one course must be designated a ‘W’ course).....	14-16
CHE 103-104. Introductory Chemistry I, II or	
CHE 121-122. General Chemistry I, II.....	8
MAT 142. Precalculus Mathematics	4
PSY100. General Psychology (to be taken to fulfill the core social science distribution requirement	4
PSY 303. Developmental Psychology.....	4
PHY 131-132. General College Physics I, II	8
STA 251. Elementary Statistical Methods	4
Total hours for the major and supporting courses	<u>65-69</u>
Degree Total.....	126

Biology Elective Course Groupings

Group 1: BIO 220 (W), 221, 219, 242, 260 (W)

Group 2: BIO 320, 321, 323, 340, 345, 346, 391; CHE 423 Biochemistry, PE 431 Kinesiology, PE433 Physiology of Exercise

Group 3 : BIO 324, 326, 327, 331, 335, 361.

Requirements for Minor in Biology

BIO 111-112. General Biology I, II	8
Biology electives	<u>12</u>
Total hours for the minor	20

Biology Courses

111. General Biology I

The course focuses on basic principles of biology at the molecular and cellular level: it includes an introduction to biochemistry, a survey of cell structures and functions, the study of energy transformations in cells, inheritance, cell division, molecular genetics, immunology and development. Designed for science majors and pre-nursing, pre-medical and pre-dental students. Three hours lecture. Three hours laboratory. Laboratory fee: \$30. Prerequisite: a minimum combined SAT score of 1100 (sum of the critical reading and math section scores), or composite ACT score of 24, or permission of instructor. Four hours. LAB

112. General Biology II

The course focuses basic principles of biology at the organ system, organism and community levels including a taxonomic survey of the major biological kingdoms. Three hours lecture. Designed for science majors and pre-nursing, pre-medical and pre-dental students. Three hours laboratory. Laboratory fee: \$30. Prerequisite: a minimum combined SAT score of 1100 (sum of the critical reading and math section scores), or composite ACT score of 24, or permission of instructor. Four hours. LAB

219. Nutrition

The course includes a study of the various types of nutrients, how they are digested, absorbed, and metabolized and how they function. Guidelines are given for amounts of the various nutrients needed to maintain good health and proper weight. Students are provided some experience in analyzing their own diets. Laws regulating ingredients are examined. Three hours.

220. Human Anatomy and Physiology I

The structure and function of the human body from the systems perspective. The course focuses on the circulatory, respiratory, digestive, urinary and reproductive systems. The cat is used for dissection purposes. Three hours lecture. Three hours laboratory. Laboratory fee: \$30. Prerequisite: BIO 111 or 112. Four hours. ‘W’

221. Human Anatomy and Physiology II

The structure and function of the human body from the systems perspective. The course focuses on the integumentary, skeletal, muscular, nervous and endocrine systems. The cat is used for dissection purposes. Three hours lecture. Three hours laboratory. Laboratory fee: \$30. Prerequisite: BIO 111 or 112. Four hours

242. Cellular and Molecular Biology

A detailed study of the nature and utilization of nucleic acid-based information systems in living cells. The course focuses on DNA (structure, replication, repair, gene regulation), RNA (structure, synthesis, processing and function) and proteins (structure, synthesis, function). Techniques for studying and engineering nucleic acids and proteins will also be covered. Prerequisites: BIO 111, 112. Three hours lecture; three hours laboratory. Laboratory fee: \$30. Four hours.

260. Ecology

Relations of organisms to the physical and biological conditions under which they live. Three hours lecture. Three hours laboratory. Prerequisites: BIO 111, 112. Laboratory fee: \$30. Four hours. 'W'

263. Natural History of the Appalachian Highlands

This is a study of the unique interface of northern and southern flora and fauna in the southeastern highlands region. The course will include an overview of the geology of the area and discussions of the interactions among native and European peoples. Issues of conservation will also be addressed. Three hours.

291. Biological Perspectives

The course is designed to familiarize students with the historical, philosophical and theological context of modern science in general and modern biology in particular. Examples are drawn from both the physical and biological sciences to illustrate the complex and inevitable interplay between philosophical and theological convictions and the practice of science. Prerequisites: BIO 111, 112. Three hours.

299. Special Topics

Opportunities for study in various topics of interest within the field of biology. These may be short-term courses offered during the semester or during the summer term. Topics will be decided by the Biology faculty as need and interest arise. Prerequisites: as appropriate. Credit to be determined.

311. Practicum in Biology

Introduction to work in a biologically-related area (medical, nutritional, environmental, business, physical therapy,

occupational therapy, etc). Prerequisites: BIO 111, 112, plus possible other appropriate courses depending on the area chosen. Not open to freshmen. Thirty hours work time per credit hour. Repeatable. One to three hours.

320. Comparative Anatomy

Classification and comparison of typical chordate animals with emphasis on the vertebrates. Prerequisites: BIO 111, 112. Two hours lecture. Six hours laboratory. Laboratory fee: \$30. Four hours.

321. Comparative Animal Physiology

A comparative study of functions of animal organ systems. Prerequisites: BIO 111, 112. Three hours.

323. Developmental Biology

Experimental and descriptive aspects of animal development, with emphasis on vertebrates. Prerequisites: BIO 111, 112. Three hours lecture. Three hours laboratory. Laboratory fee: \$30. Four hours.

324. Biology of Invertebrates

The study of invertebrate animals with emphasis on structure, function and taxonomy. Prerequisites: BIO 111, 112. Three hours lecture. Three hours laboratory. Laboratory fee: \$30. Four hours.

326. Insect Biology and Ecology

A study of insect taxonomy, ecology, anatomy and physiology, and economic importance. Prerequisites: BIO 111, 112. Laboratory fee: \$30. May also be taken at AuSable Institute. Four hours.

327. Ornithology

The biology, behavior, ecology, and identification of birds. Laboratory work includes field work as well as dissecting a pigeon. Prerequisites: BIO 111, 112. Laboratory fee: \$30. May also be taken at AuSable Institute. Four hours.

331. Herpetology

Herpetology is the study of the taxonomy, anatomy, natural history, and physiology of reptiles and amphibians. Any laboratory work will be done within the lecture periods. Prerequisites: BIO 111, 112. Three hours.

335. Field Botany

The course studies the taxonomy and ecology of vascular plants as components of natural communities. Field identification of plant species will be stressed and will include laboratory dissection and identification. Prerequisites: BIO 111, 112; or permission of instructor. Laboratory fee: \$30. May also be taken at AuSable Institute. Four hours.

340. Microbiology

The course studies microbial life histories, morphology, physiology, identification, culture techniques, environmental

microbiology, control, and the etiology and pathology of infectious disease. Prerequisite: BIO 242. Three hours lecture. Three hours laboratory. Laboratory fee: \$30. Four hours.

345. Immunology

A study of human defenses against exogenous infectious agents and endogenous neoplasia. The course includes an overview of the nonspecific defenses but focuses on specific defenses. Prerequisites: BIO 242. Three hours.

346. Cancer Biology

An examination of the molecular and cellular events that lead to the unregulated proliferation of cells in the human body. Significant attention is given to tumor immunology, mechanisms of metastasis and anti-cancer therapies. Some material concerning cancer epidemiology, host-tumor interactions and cancer prevention is also included. Prerequisite: BIO 242. Three hours.

361. Land Resources

Systems level perspective on land forms. Includes analysis and interpretation of data, both on-site and remote-sensing data. Includes readings on land use and planning. Prerequisite: one year of college science. Laboratory fee: \$20. Mainly offered at AuSable Institute. Four hours.

390. Special Topics in Biology

This course explores topics of current interest in the department not covered in other courses. Topics might include plant physiology, human genetics, history of biology, animal histology and microtechnique, and methods of biological research. Some offerings of this course may fulfill the 'S' requirement. Prerequisites: BIO 111, 112. Repeatable. One to four hours.

392. Directed Individual Study

Individualized study to pursue or review certain topics in biology. Prerequisite: permission of instructor. Repeatable. One to two hours. Course fee: up to \$30.

413. Genetics

Principles of heredity including classical, molecular, cellular, behavioral, and population genetics. Prerequisites: BIO 111, 112. Three hours lecture. Three hours laboratory. Laboratory fee: \$30. Four hours.

490. Biology Seminar

Oral presentation of scientific work is an essential element of all the scientific disciplines. This course provides instruction and practice in this important component of participation in the biological scientific community. Prerequisites: Biology major and junior-level standing. One hour. 'S'

492.-Senior Integration Paper in Biology I

The course is designed to help senior biology majors develop and execute to a "good draft stage" a scholarly project which deals with a topic of interest suitable for a biology major, in which they have a personal stake and which allows them in some aspect or other to explicitly exhibit the analytical skills of a Christian heart and mind in a "worldview-ish" mode. Prerequisites: Biology major and senior-level standing, or permission of the instructor. Two hours. 'S'

493. Senior Integration Paper in Biology II

Further refinement development of SIP I course products. Students will begin the course by reading and discussing fellow students' papers and offering suggestions for improvements. Each student will then meet with the instructor to plan and develop a contract for further work on the paper. Prerequisite: BIO 492. One hour.

The following courses are taught only at AuSable Institute (see their catalog for course descriptions of courses currently offered at www.ausable.org):

- 260. Field Natural History (Natural History in Spring)
- 262. Field Biology of the Pacific Northwest
(Natural History of Pacific Northwest)
- 315. Tropical Agriculture and Missions
(Continued on next page)
- 316. Ecological Agriculture
- 325. Marine Invertebrates
- 328. Birds and Mammals of South India
- 329. Marine Mammals
- 330. Mammals of East Africa
- 332. Fish Biology and Ecology
- 336. Wood Plants
- 371. Aquatic Biology
- 372. Limnology
- 381. Global Development and Ecological Sustainability
- 382. Development and Ecological Sustainability in Africa
- 467. Ecology of India Tropics
- 471. Conservation Biology
- 477. Plant Ecology
- 478. Alpine Ecology
- 479. Tropical Mountain Ecology of India
- 482. Restoration Ecology
- 485. Marine Stewardship