Biology

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.

For General Education
To help students develop an understanding of living organisms that will enable them:

- to perceive the order and design therein and to revere more highly the God who created life;
- to appreciate life and become better stewards of nature;
- to make intelligent decisions on contemporary issues such as creation and evolution, genetic manipulation, in vitro fertilization techniques, and fetal research.

For the Major Field
- to provide more thorough development of the goals for general education;
- to familiarize students with the modern concepts of biology;
- to help students learn a context and be able to incorporate new information into it;
- to prepare students for satisfying areas of service including secondary school teaching, various environmental options, and additional training in medical studies or graduate school.

Requirements for Major in Biology
The core and distribution requirements of a major in biology are those listed for baccalaureate degrees on page 22 with the following exceptions:

A minimum combined SAT score of 1100 on the critical reading and math sections or ACT of 24 is required for biology majors; and Laboratory Science (4 hours) is not required. The biology major calls for early and extensive counseling of students in order that they may be properly informed of the requirements and aims of the program. A student entering this program will ordinarily have to make his or her decision earlier in his or her college career than is necessary for some other programs. All biology majors are required to take either the subject GRE, MCAT, DAT, VCAT, or equivalent as a graduation requirement.

Core requirements .............................................................. 57
Elective (if major is 69 or greater, elective is zero).............. 3

Biology Major and Supporting Course Requirements*

General Professional Option
BIO 111-112. General Biology I, II ................................. 8
BIO 242. Cellular and Molecular Biology I ...................... 4
BIO 360. Ecology............................................................. 4
BIO 392. Directed Individual Study – variable credit ....... 1-3
BIO 490. Biology Seminar – two semesters ‘S’ ............. 1,1
BIO 491. Biological Perspectives......................................... 2
Biology electives, upper-division .................................. 14-16
BIO 492, 493. Senior Integration Paper I, II ................. 2,1
CHE 121-122. General Chemistry I, II ......................... 2,1
CHE 323-324. Organic Chemistry I, II ......................... 8
Mathematics through 142. Pre-Calculus Mathematics. If a math placement level of 4 or higher is received, then one additional math course is required (e.g. Calculus I, Elementary Statistical Method) .............. 4
PHY 131-132. General College Physics I, II ................... 8
Major requirements subtotal..................................... 66 or 70
Total............................................................................ 126-129

Bio-Medical Option
A minimum combined SAT score of 1200 on the critical reading and math sections or ACT of 27 is strongly recommended for this option. This option is the same as the General Professional Option except for:

4. Biology electives—choose four upper-division courses (consult your advisor).

Environmental Biology Option
Covenant is affiliated with AuSable Institute of Environmental Studies. By completing both their and our programs, a student may earn an environmental certificate from the institute. Covenant will give credit for most

* 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.
AuSable Institute courses. Fellowships and scholarships are available. See Professor Wenger for further information.

BIO 111-112. General Biology .............................................8
BIO 360. Ecology.........................................................4
BIO 490. Biology Seminar – two semesters ‘S’...............1,1
BIO 492, 493. Senior Integration Paper .................2,1
Biology electives – choose 4 upper division courses .... 10-12
(As approved by advisor)
CHE 121-122. General Chemistry I, II .........................8
MAT 142. Pre-Calculus Mathematics .........................4
PHY 131-132. General College Physics I, II or CHE 323-324, Organic Chemistry ..................8
STA 251. Elementary Statistical Methods ..................4
Summer(s) at AuSable Institute
(3 courses) .......................................................................12
Total................................................................. 67-69

Secondary School Option
See page 112 for requirements for major in Natural Science with Georgia Secondary School Broad Fields Science Certification program (grades 7-12).

Requirements for Minor in Biology
BIO 111-112. General Biology I, II .........................8
Biology electives .........................................................12
Total.................................................................20

Biology Courses

111-112. General Biology I, II
Basic principles of biology at molecular, cellular, organ system, organismic and community levels. Three hours lecture. Three hours laboratory. Laboratory fee: $20 per semester. Designed for science majors and pre-nursing, pre-medical and pre-dental students. Prerequisite: one year of high school biology. Four units each.

219 (319). 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. Additional research paper will be required for upper-division credit. Prerequisites: high school chemistry and biology. Three units.

220-221. Human Anatomy and Physiology I, II
A study of the structure and functions of the human body. The students will study the body from the systems perspective. The cat is used for dissection purposes. Three hours lecture. Three hours laboratory. Laboratory fee: $25 per semester. Four units each. ‘W’ for BIO221.

240. Microbiology
The course covers the six major groups of microbes: bacteria, viruses, archaea, fungi, algae and protozoa with particular focus on bacteria and viruses. Medical microbiology and immunology are emphasized with significant coverage of selected aspects of microbial physiology and genetics. Weekly labs will emphasize selected techniques for microbial manipulation and identification. Laboratory fee: $25. Four units.

242. Cellular and Molecular Biology I
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 or equivalent. Three hours lecture; three hours laboratory. Laboratory fee: $30. Four units.

243. Cellular and Molecular Biology II
A study of the structure, organizational features and operational mechanisms of single cells. The course includes extensive coverage of cell membranes, intracellular compartments and trafficking, energy conversion structures, cell signaling, cell motility and the cytoskeleton. Cell contexts are also considered in terms of the extracellular matrix, cell junctions and cell maintenance in multicellular organisms. Prerequisite: BIO 242 or equivalent. Three hours lecture; three hours laboratory. Laboratory fee: $30. Four units. ‘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. No prerequisite. Three units.

311. Practicum in Biology
Introduction to work in a biologically-related area (medical, nutritional, environmental, business). Prerequisite: BIO 111-112, CHE 121-122, 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 units.
312. Practicum in Physical Therapy
Introduction to work in the field of physical therapy or occupational therapy. The practicum can be done under a certified therapist in a hospital, clinic or private office. Prerequisite: BIO 220. Not open to freshmen. Thirty hours work time per credit hour. Repeatable. One to three units.

315 (215). Macroevolution and Microevolution
An examination of the theory of evolution including historical perspective, currently accepted mechanism, critical examination of the evidence and exploration of possible creationist alternatives. Students electing 315 will write one paper. Three Units.

320. Comparative Anatomy
Classification and comparison of typical chordate animals with emphasis on the vertebrates. Prerequisite: BIO 111-112 or equivalent. Two hours lecture. Six hours laboratory. Laboratory fee: $35. Four units.

321. Comparative Animal Physiology
A comparative study of functions of animal organ systems. Prerequisite: BIO 111-112 or equivalent. Three hours lecture. Three hours laboratory. Laboratory fee: $25. Four units.

323. Developmental Biology
Experimental and descriptive aspects of animal development, with emphasis on vertebrates. Prerequisite: BIO 111-112 or equivalent. Three hours lecture. Three hours laboratory. Laboratory fee: $25. Four units.

324. Biology of Invertebrates
The study of invertebrate animals with emphasis on structure, function and taxonomy. Prerequisite: BIO 111-112 or equivalent. Three hours lecture. Three hours laboratory. Laboratory fee: $25. Four units.

326. Insect Biology and Ecology
A study of insect taxonomy, ecology, anatomy and physiology, and economic importance. Prerequisite: BIO 111-112. Laboratory fee: $25. May also be taken at AuSable Institute. Four units.

327. Ornithology
The biology, behavior, ecology, and identification of birds. Laboratory work includes field work as well as dissecting a pigeon. Prerequisite: BIO 111-112. Laboratory fee: $25. May also be taken at AuSable Institute. Four units.

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. Prerequisite: BIO 111-112. Three units.

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. Prerequisite: BIO 111-112 or permission of instructor. Laboratory fee: $25. May also be taken at AuSable Institute. Four units.

340. Microbiology
Life histories, morphology, physiology, identification, culture techniques, environmental microbiology, control, pathology and immunity. Prerequisite: BIO 111-112 or equivalent. Three hours lecture. Three hours laboratory. Laboratory fee: $25. Four units.

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. Prerequisite: BIO 242-243. Three units.

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 242-243 or equivalent. Three units.

360. Ecology
Relations of organisms to the physical and biological conditions under which they live. Three hours lecture. Three hours laboratory. Prerequisite: BIO 111-112 or equivalent. Laboratory fee: $25. Four units. ‘W’

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 units.

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. Prerequisite: BIO 111-112 or equivalent. Repeatable. One to four units.

392. Directed Individual Study
Individualized study to pursue or review certain topics in biology. Prerequisite: permission of instructor. Repeatable. One to two units. Course fee: up to $30.

413. Genetics
Principles of heredity including classical, molecular, cellular, behavioral, and population genetics. Prerequisite: BIO 111-112 or equivalent. Three hours lecture. Three hours laboratory. Laboratory fee: $25. Four units.

490. Biology Seminar
To be taken once as a junior and once as a senior. The course consists of oral presentations, using powerpoint, of current research from the scientific literature. Repeatable. One unit. ‘S’

491. 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. Prerequisite: BIO 111, 112 and junior-level standing. Two units.

492, 493. Senior Integration Paper in Biology I, II
Two units in fall semester. One unit in spring semester to be taken in sequence.

The following courses are taught only at AuSable Institute (see their catalog for course descriptions):

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
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