

Albert A. Hopeman, Jr. School of Science and Engineering

The Albert A. Hopeman, Jr. School of Science and Engineering is comprised of the Departments of Biology; Chemistry; Engineering; Mathematics and Computer Science; and Physics. *Dr. Stacy Birmingham, Dean; Dr. Timothy A. Mohr, Assistant Dean.*



Albert A. Hopeman, Jr.
1911-1998

DEPARTMENT OF BIOLOGY

Dr. Sodergren, Chairman, Dr. Brenner, Dr. Dudt, Dr. Jenkins, Dr. Ray, Dr. Shaw, Dr. Weber. Part-Time: Mrs. Yeager.

The mission of the Department of Biology is to provide a quality education from a distinctly Christian perspective that will prepare men and women for the 21st century. This perspective has the practical effect of attracting outstanding students and faculty, thus perpetuating a learning climate centered on truth and excellence. The curriculum seeks to develop academic competency and professional awareness, to encourage meaningful integration between the biological sciences and other dimensions of life, and to promote life-long learning skills in problem-solving, research, and communication. Writing Intensive (WI), Speaking Intensive (SI), and Information Literacy (IL) skills are developed by special assignments in Biology 101, 234, and 486 or 488.

Departmental policy limits students to one major within the Department of Biology. Students are expected to contact their advisors for a detailed schedule of courses recommended to meet requirements for a major.

Course Requirements for Bachelor of Science Degree in Biology

Biology Core (21 hours):

Biology 101-102, 231, 234, 301, and 488.

Clusters (8 hours):

Choose a minimum of one course from each of the following clusters:

- Health/Medicine: Biology 302, 311, 312, and 407.
- Diversity/Ecology: Biology 305, 320, and 409.

Biology Electives (8 hours):

Eight additional hours of biology from 300-400 level courses.

No more than four credit hours of independent, internship, or special study (Biology 372-376, 390-393, 460, 473-476, 480, 497, and 499) may be applied to the additional eight hours.

Major-related requirements (12 hours):

Chemistry 101-102; Mathematics 161.

Students planning to do graduate work in biology are encouraged to take physics, calculus, statistics, organic chemistry, and biochemistry. Logic courses are helpful on standardized qualifying exams and one or more psychology courses are recommended for students aiming to enter a health profession. Business, communication, and computer skills are always helpful.

Course Requirements for Bachelor of Science Degree in Molecular Biology

Biology Core (9 hours):

Biology 101, 234, and 488.

Health/Medicine cluster (12 hours):

A minimum of three courses from Biology 302, 311, 312, or 407.

Biology Electives (8 hours):

Choose from any courses from Biology course offerings, with the exception that no more than four credit hours of independent, internship, or special study (Biology 372-376, 390-393, 460, 473-476, 480, 497, and 499) may be applied to the additional eight hours.

Chemistry Core (24 hours):

Chemistry 101-102, 241-242, and 351-352.

Major-related requirements (12 hours):

Mathematics 162; Physics 121-122.

Students planning to enter a health profession are highly recommended to take one or more psychology courses and a statistics course.

Course Requirements for Biology Major leading to (7-12) certification in Biology/General Science

Major field requirements (37 hours):

Same as Biology Major requirements, with the exception of Biology 486 instead of Biology 488.

Major-related requirements (25 hours): Chemistry 101, 102, Computer 204, Geology 201, Mathematics 161, Physics 206, Science 201 and/or Physics 121 (both are recommended, but Science 201 may *not* follow Physics 121).

Education requirements (33 hours): Education 201, 202, 305, 309, 361, 371, 431, 488, and Psychology 102.

Course Requirements for Biology Major leading to certification in Biology/General Science and Environmental Education (K-12)

Biology Core (30 hours):

Biology 101-102, 231, 234, 301, 320, 407, 484, and 486.

Environmental Cluster (8 hours):

A minimum of two courses from Biology 305, 402, 409, or 421.

Major-related requirements (41 hours):

Chemistry 101-102, Computer 204, Geology 201, Mathematics 161, Physics 206, Political Science 301, Science 204, and Sociology 103.

Either Economics 101 or 204.

Either Psychology 203 or Business 201.

Either Science 201 or Physics 121 (both are recommended but Science 201 may not follow Physics 121).

Education requirements (38 hours): Education 201, 202, 208, 305, 309, 325, 361, 371, 431, 488, and Psychology 102.

Course Requirements for a minor in Biology (20 hours)

Biology Core (8 hours):

Select one of the following combinations:

Biology 101 and 234 or

Biology 102 and 231.

Biology Electives (12 hours):

Select 12 hours from 300-400-level courses, excluding Biology 372-376, 390-393, 460, 473-476, 480, 484, 486, 488, 497, and 499.

BIOLOGY (BIOL)

101. GENERAL BIOLOGY I. An introduction to fundamental biological concepts including biomolecules, cells, energetics, metabolisms, classical/molecular genetics, and vertebrate systems. This course, along with Biology 234 and 486 or 488, fulfills the Writing Intensive (WI) and Information Literacy (IL) requirements for majors in the Department of Biology. Three lectures and one lab per week.

Fall semester only, four hours.

102. GENERAL BIOLOGY II. A study of biological concepts with an emphasis on diversity of life including classification, survey of organisms, animal behavior, population genetics, natural history, and ecology. Three lectures and one lab per week.

Spring semester only, four hours.

231. GENERAL ECOLOGY. A study of responses of living systems to a changing environment in relation to selected ecosystems with emphasis on the interrelations of individual, population, community, and habitat. Three lectures and one lab per week. Prerequisite: Biology 102 or permission.

Fall semester only, four hours.

234. CELLULAR AND MOLECULAR BIOLOGY. A focus on the organization and physiology of living cells using a problem-solving approach to learning with particular emphasis on web-based resources in biotechnology, genomics, genetic diseases, and immunology. The laboratory provides core experience with model cellular systems and basic tools of biomolecular research. This course, along with Biology 101 and 486 or 488, fulfills the Speaking Intensive (SI) and Information Literacy (IL) requirements for majors in the Department of Biology. Three lectures and one lab per week. Prerequisite: Biology 101 or equivalent.

Spring semester only, four hours.

301. GENETICS. A study of classical and molecular aspects of genetics with emphasis given to biochemical mechanisms of inheritance, genetic change, human disease, and development. Topics progress from Mendelism to modern DNA science and include history, cytogenetics, gene actions, and controls. Three lectures and one lab per week. Prerequisite: Biology 101.

Spring semester only, four hours.

302. DEVELOPMENTAL BIOLOGY. A study of organism development during all temporal phases of its life cycle. Embryological development is compared across several model systems. Topics include fertilization, cleavage, gastrulation, neurulation, and organogenesis. Particular attention is given to the common molecular aspects of differentiation and morphogenesis and to the techniques used to investigate these problems. Selected topics in post-embryologic development are also covered. Three lectures and one lab per week. Prerequisite: Biology 234. *Fall semester only, four hours.*

305. PLANT TAXONOMY. A study of plants in relation to their habitats, including aspects of plant geography and taxonomy in the lecture portion and methods of plant identification, collection, and preservation with emphasis on local flora in the lab portion. Three lectures and one lab per week. Prerequisite: Biology 102 or permission.

Fall semester only, four hours.

311. HUMAN ANATOMY AND PHYSIOLOGY I. A holistic study of the human body integrating anatomy, histology, and physiology. The course explores structure/function principles and has special importance as preparation for health-related careers. Topics are organized according to body system and include skin, skeletal, articular, muscular, circulatory, and immune systems. Three lectures and one lab per week. Prerequisite: Biology 234.

Fall semester only, four hours.

312. HUMAN ANATOMY AND PHYSIOLOGY II. A holistic study of the human body integrating anatomy, histology, and physiology. The course is a continuation of Human Anatomy and Physiology I and has special importance as preparation for health-related careers. Topics include nervous, endocrine, respiratory, digestive, and urinary systems. Three lectures and one lab per week. Prerequisite: Biology 234.

Spring semester only, four hours.

320. CONSERVATION AND WILDLIFE BIOLOGY. A comparative study of representative vertebrates with emphasis on population dynamics, biodiversity, morphological adaptation, wildlife conservation, and resource management. The laboratory involves field identifications, aging, and morphological adaptations of representative vertebrates. Three lectures and one lab per week. Prerequisite: Biology 102 or permission.

Spring semester only, four hours.

372. INVESTIGATIVE PROBLEMS IN BIOLOGY - WWW. Students who have displayed aptitude in biology investigate assigned research problems using web resources and report weekly to the class. A research proposal written according to professional guidelines is required. Prerequisite: consent of the department.

Semester course, one hour.

373. INVESTIGATIVE PROBLEMS IN BIOLOGY I. Junior students with special aptitude in biology investigate assigned research problems under the supervision of a faculty mentor. Prerequisite: Consent of the department. *Fall semester only, one hour.*

374. INVESTIGATIVE PROBLEMS IN BIOLOGY II. Junior students with special aptitude in biology investigate assigned research problems under the supervision of a faculty mentor. Prerequisite: Consent of the department. *Spring semester only, one hour.*

375. INVESTIGATIVE PROBLEMS IN BIOLOGY I - DNA. Junior students with special aptitude in molecular genetics investigate assigned problems in DNA research. Prerequisite: Consent of the instructor. *Fall semester only, one hour.*

376. INVESTIGATIVE PROBLEMS IN BIOLOGY II - DNA. Junior students with special aptitude in molecular genetics investigate assigned problems in DNA research. Prerequisite: Consent of the instructor. *Spring semester only, one hour.*

390. STUDIES IN BIOLOGY. A course permitting students with special interests and needs to examine topics not included in regular course offerings or in greater depth than possible in regular courses. Prerequisite: Consent of the department. *Semester course, one, two, three or four hours.*

391. STDS: CLINICAL PHYSIOLOGY. A course taken on campus and required as orientation for off-campus Biology 392. Formal registration and credit assignment will occur only after department approval. An additional fee is charged. *Semester course, two hours.*

392. STDS: MEDICAL MISSIONS. Involves clinical experience supervised by a faculty member and assisted by medical staff at a medically underserved domestic or foreign location. Prerequisite: Biology 391 and permission of instructor. *Summer or intersession course, three hours.*

393. STDS: MEDICAL TERMINOLOGY. A course exploring the language of medicine. Prerequisite: Consent of instructor. *January Intersession course only, two hours.*

402. BEHAVIORAL BIOLOGY. A comparative study of the behavior patterns exhibited by vertebrate and invertebrate organisms with field and lab experiments on the physiological and environmental factors affecting individual and group behavior. Emphasis is on the role of behavior in the regulation and evolution of animal populations and on the biological factors affecting learning. Three lectures and one lab per week. Prerequisite: Biology 101 or 102. *Spring semester only, four hours.*

407. MICROBIOLOGY. An introduction to microorganisms, primarily bacteria, encompassing considerations of taxonomy, structure, physiology, ecology, genetics, immunology, and disease. The course has importance for a variety of careers including areas of healthcare, environment, education, biotechnology, and research. Two lectures and two labs per week. Prerequisites: Biology 101 and Chemistry 101 or permission. *Fall semester only, four hours.*

409. ENTOMOLOGY. A study of the class Insecta, including insect diversity, life histories, morphology, physiology, behavior, ecology, and impact on human society.

Laboratories include taxonomic and anatomical exercises featuring field excursions that foster appreciation and add specimens to required student collections. Course traditions include a black-light party and a bug-feast. Three lectures and one lab per week. Prerequisite: Biology 102 or equivalent. *Fall semester only, four hours.*

412. BIOPHYSICS. Biological processes are the complex interactions of many macromolecules. In order to understand these processes, quantitative descriptions of the interactions of biological macromolecules are imperative. Biophysical chemistry adopts the thermodynamic approach to describe the interactions of biological macromolecules. Related topics include intramolecular reactions such as protein folding and intermolecular reactions such as binding and enzymatic catalysis. Additional topics include the theoretical basis behind important bio-techniques such as spectroscopy and crystallography. This course will investigate classic examples from the biophysical literature and will rely significantly on computer technology as a learning tool. Prerequisite: permission of instructor. *Spring semester only, three hours.*

421. AQUATIC AND FISHERY BIOLOGY. A study of freshwater and marine ecosystems, including the impact of pollution on aquatic environments, water chemistry, taxonomy of aquatic organisms, fisheries, and the management of aquatic systems. Three lectures and one lab per week. Prerequisite: Biology 231. *Fall semester only, four hours.*

429. PATHOPHYSIOLOGY. Human anatomy and physiology is the study of the structure and function of cells, tissues, organs, and organ systems. This discussion-oriented course emphasizes fundamental physiological principles and pathophysiology. This is a continuation of Human Anatomy and Physiology II and is designed to meet the needs of students seeking preparation for health-related careers and science education. Three lectures per week. Prerequisites: Biology 311 and 312. *Fall semester only, three hours.*

430. CARDIOPULMONARY PHYSIOLOGY. An in-depth study of the cardiovascular and respiratory systems of the human body with concentration on the cellular and systematic aspects of metabolism and homeostasis. Principles from chemistry, physics, and mathematics are applied to enable understanding of anatomical frameworks and mechanisms of action in the context of clinical settings. Prerequisites: Biology 311 or 312; Chemistry 241; and Physics 121. *Spring semester only, three hours.*

460. INDEPENDENT STUDY. An opportunity for individual study of specialized topics in the biological sciences. Prerequisite: Permission of the department. *Semester course, one, two, three, or four hours.*

473. INVESTIGATIVE PROBLEMS IN BIOLOGY III. Senior students with special aptitude in biology investigate assigned problems under the supervision of a faculty mentor. Not to be taken concurrently with Biology 499. Prerequisite: Consent of the department. *Fall semester only, one or two hours.*

474. INVESTIGATIVE PROBLEMS IN BIOLOGY IV. Senior students with special aptitude in biology investigate assigned problems under the supervision of a faculty

mentor. Not to be taken concurrently with Biology 499. Prerequisite: Consent of the department. *Spring semester only, one or two hours.*

475. INVESTIGATIVE PROBLEMS IN BIOLOGY III—DNA. Senior students with special aptitude in molecular genetics investigate assigned problems in DNA research. Not to be taken concurrently with Biology 497. Prerequisite: Consent of the instructor. *Fall semester only, one or two hours.*

476. INVESTIGATIVE PROBLEMS IN BIOLOGY IV—DNA. Senior students with special aptitude in molecular genetics investigate assigned problems in DNA research. Not to be taken concurrently with Biology 497. Prerequisite: Consent of the instructor. *Spring semester only, one or two hours.*

480. INTERNSHIP IN BIOLOGY. Selected students may participate in individual field experiences in research, medical, or other approved settings under the supervision of professional staff. Grade is dependent upon written evaluation by the cooperating institution and the student's submission of written report to the Department of Biology. Prerequisites: Minimum 8 hours of biology and permission of the department. *Summer or semester course, one, two, three, four, five or six hours.*

484. SEMINAR IN ENVIRONMENTAL EDUCATION. This seminar will provide reinforcement of the concepts and methods of environmental education; the development, organization, coordination of the environmental learning sequence for K-12; exploration of training in curricula in environmental education; and discussions of issues leading to increased understanding of the interrelatedness of areas of prior study such as environmental science, economics, sociology, political institutions processes, and technology in relation to environmental management. *Spring semester only, one hour.*

486. SEMINAR FOR BIOLOGY TEACHERS. Limited to junior or senior majors in the department accepted into teacher certification programs. Involves instruction, Project WET training, research using library/web resources, student presentation, and experience in preparing and conducting effective learning experiences in biology. This course, along with Biology 101 and 234, fulfills the Writing Intensive (WI), Information Literacy (IL), and Speaking Intensive (SI) requirements for majors in the Department of Biology. *Spring semester only, one hour.*

488. SEMINAR IN BIOLOGY. Required of all majors in the Department of Biology except for those in teacher certification programs. Involves in-depth research using library/web resources and oral presentation of an approved topic selected by the student. This course, along with Biology 101 and 234, fulfills the Writing Intensive (WI), Information Literacy (IL), and Speaking Intensive (SI) requirements for majors in the Department of Biology, and the SI requirement for the Biochemistry major. *Semester course, one hour.*

497. HONORS IN BIOLOGICAL RESEARCH-DNA. Seniors who have shown special aptitude in molecular genetics may undertake supervised DNA research. Public

presentation of findings is encouraged. Not to be taken concurrently with Biology 475 or 476. Prerequisite: Consent of instructor.

Fall-Spring sequence, one or two hours each semester.

499. HONORS IN BIOLOGICAL RESEARCH. Seniors who have shown special aptitude in biology may undertake supervised biological research. Public presentation of findings is encouraged. Not to be taken concurrently with Biology 473 or 474. Prerequisite: Consent of the department.

Fall-Spring sequence, one or two hours each semester.

GEOLOGY (GEOL)

201. GEOLOGY. A study of the dynamic systems operating within and on the earth with special emphasis on the development of materials, landforms, and geological structures with constant discussion of application of geologic principles to the solution of practical problems.

Spring semester only, three hours.