Course Offerings in the Sciences

The Science curriculum is designed to offer students a choice between two Individualized Majors that provide pathways to certain post-graduate professional and academic opportunities: the Health Science major and the Environmental Sciences major. The course offerings and descriptions in those two majors are listed below.

HEALTH SCIENCE MAJOR

100-Level Courses

Statistical Discovery for Everyone

This course introduces the framework and concepts for learning with data. Emphasis is on statistical discovery in everyday life and on drawing valid conclusions from data. Topics include the following: good and bad data; data ethics; how to conduct a valid survey; how to describe a population distributions; when to believe a poll; how to design an experimental study; how to avoid ambiguous results caused by "lurking" variables; understanding the issue of causation and chance in everyday life and scientific studies; and the use and misuse of statistics in explaining what is statistical significance.

Calculus

This course focuses on limits, derivatives and their applications, and integration. It also introduced parametric equations and infinite series and sequences. (Pre-calculus is available for those who need more preparation for the Calculus course.)

Biology I

This course is the basic introduction to the study of living systems illustrated by examples drawn from cell biology, biochemistry, genetics, microbiology, neurobiology, and developmental biology.. It focuses on the nature of cellular and molecular biology. There is a lab requirement.

Biology II

This course is the second introductory course in the area of biology. Its focus is an introduction to organismal and population biology. The course covers the study of organisms, emphasizing morphology, physiology, behavior, ecology, and evolution of whole organisms and populations. There is a lab requirement for the course.

Chemistry I

Chemistry provides the basis for understanding the other sciences since chemistry forms the bridge between physics and biology. This course provides a general base from which to build and expand our knowledge and appreciation of chemistry. We will begin to understand the nature of matter,

chemical reactions, covalent and ionic bonding, chemical calculations, gases, chemical equilibrium, and acid-base theory. There is a lab requirement.

Chemistry II

This course covers precipitation equilibria, introductory thermodynamics principles, electrochemistry, kinetics, buffers, and nuclear chemistry. The course places more emphasis on algebraic and logarithmic manipulations than Chemistry I. There is a lab involved.

Physics I

This course covers Newtonian mechanics (kinematics, dynamics, Newton's Laws, gravitation, energy and momentum and their application to understanding waves and the kinetic theory of gases) and basic concepts of heat, temperature, and thermodynamics. There is a lab requirement in the course.

200-Level Courses

Biology: Genetics

This course covers the basic concepts behind our understanding of genes from both the classical genetic and modern molecular viewpoints. Mendelism and chromosomal theory will be reviewed, as well as the complex molecular mechanisms of gene expression and its control. Evolutionary genetics and populations genetics will also be included, as well as an introduction to the powerful technology of genetic engineering. Lab experiments will be involved in the course.

Cell Biology

This course covers the structure and function of components of cells, the interrelated mechanisms of cell function, and how this knowledge was discovered. Topics include small molecules and energy, macro-molecules and information, protein function, membrane sorting, protein sorting, vesicular traffic, cell signaling, cytoskeleton, and cancer. Lab exercises are an important part of the course.

Microbiology

This course will examine the diverse world of microorganisms, from pathogens to extremophiles. The many roles played by microorganisms in a variety of environments will be emphasized, especially how they produce food products, manufacture organic materials, recycle nutrients, break down pollutants, and cause diseases. There is a lab component to this course.

Physics II

This course covers material on electricity, magnetism, and optics (Maxwell's Equations, electric potential, DC circuits, interference, and diffraction). A lab component of this course reinforces material learned in class.

Organic Chemistry I

In this course we will learn to control the covalent bond and produce chemicals with desired properties for pharmaceuticals and other materials. We will form the foundation of our organic chemistry knowledge by looking at the past as well as the present states of organic chemistry. We will begin to understand molecular orbital theory, symmetry, chirality, and how to control the constitution and conformation of organic molecules. There is a lab component to this course.

300-Level Courses

Organic Chemistry II

In this course we will emphasize the reactions of organic compounds. We will use the knowledge of molecular orbital theory from Organic Chemistry I to understand the mechanisms of these reactions in addition to applying these reactions to the synthesis of organic molecules for uses in pharmaceuticals and biochemical processes. There is a lab component to this course.

Animal Physiology

This course will cover general and comparative animal physiology including energy metabolism, respiration, circulatory controls, osmotic regulation and mechanisms, and muscle and nerve function in vertebrates and invertebrates. It will stress homeostatic and environmental aspects of animal function. There is a lab component to the course.

Comparative Vertebrate Anatomy

This course is a system by system examination of vertebrate morphology with an appreciation for the variation offered by the diversity of vertebrate forms. While morphology or physical form in the focus, each anatomical system is presented within a context of function and evolution. Laboratory exercises will involve dissection, and there will be one laboratory period or field trip per week.

Biochemistry

This course is an introduction to the molecular basis of life including general concepts of biological acids and bases, bioenergetics, enzyme kinetics, the class of biochemicals (amino acids, proteins, carbohydrates, lipids, nucleic acids), intermediary metabolism and biochemical function (replication, protein synthesis, active transport, respiration, and photosynthesis).

Intermediate Science Colloquy

400-Level Courses
Senior Research and Senior Project
Advanced Science Colloquy

For a description of the Senior Project and Colloquy, see the beginning of the academic program section of the Catalogue.

ENVIRONMENTAL SCIENCES MAJOR

100-Level Courses

Statistical Discovery for Everyone (see the description under the Health Science major above).

Introduction to Environmental Science

This course is a basic overview of the environmental impacts caused by humans on the natural systems of the Earth: the atmosphere, geosphere, hydrosphere, and biosphere. We will examine the scientific concepts that underlie the complex interactions occurring among these systems and how our actions endanger Earth's ecosystems. We will learn what is necessary to sustain our environmental resources so they continue to provide benefit for human beings and other living things on our planet.

Chemistry I (see the description under the Health Science major above).

Chemistry II (see the description under the Health Science major above).

Biology I (see the description under the Health Science major above).

Biology II (see the description under the Health Science major above).

Plant Biology

This course investigates the wide variety of plant forms and the molecular mechanisms that generate them. It provides a conceptual framework for understanding plant development that includes an evolutionary perspective. Ecological principles will be used to examine plant population and community processes. Special attention will be given to plant/animal interactions such as pollination, dispersal, and herbivory. Lab will use local habitats to gain hands-on experience in field observations and data collection and analysis.

200-Level Courses

Genetics (see description under Health Science major above).

Ethnobotany (Plants and People)

The science of plant biology and the many uses of plants by humans are an important aspect of our lives in the 21st century. This course will examine certain biological concepts as they relate to contemporary, historical, technological, and social issues of our global ecosystem. Such concepts include the impact of dwindling forest resources, the increased pressure that human population expansion is putting on natural habitats and ecosystems, and how plants provide people with the basic essentials of life: food, shelter, heat, oxygen, water purification, and other life support systems.

Organic Chemistry I (see description under Health Science major above).

Environmental Chemistry

The overall goal of this course is to gain an understanding of the fundamental chemical processes that are central to a range of important environmental problems and to utilize this knowledge in making critical evaluations of these problems. The course uses case studies of pollution in the biosphere and considers the potential effects on soil, plant, animal, and human health. Specific goals include an understanding of the chemistry of the stratospheric ozone layer and its depletion, the chemistry of tropospheric processes like smog and acid precipitation, and an understanding of the nature, reactivity, and environmental fates of toxic organic chemicals.

Field Botany

This course is designed to develop skills and knowledge necessary to identify and understand the ecological structure of the woody plants of the eastern deciduous forest community. We will learn the terminology, form, habitat, and plant structure of the woody plants throughout the course, as well as the ecological significance of the original plant communities typical of this bioregion. Field trips will enhance the material learned in the classroom.

Ecology

This course will cover the basic principles of ecology, with a natural history and evolutionary perspective. The activities of organisms and their relationships to one another are the foundation upon which populations, communities, and ecosystems are built. We will examine factors that influence exchanges between organisms and their physical environment; how organisms transform energy and process materials as they metabolize, grow, and reproduce; the characteristics of populations and how they interact within communities; the dynamics of ecosystems.
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300-Level Courses

Organic Chemistry II (see description under Health Science major above).

Hydrology

This course introduces the global hydrological cycle and the influence of climate, geology, and human activity. It includes the principles of precipitation, evaporation, and evapotranspiration; surface and groundwater flow; water quality and pollution; and water resource management and regulation. The course also introduces some of the key concepts and issues in oceanography. Finally, the course links the hydrogeology aspect of it to the science of living things: water quality analysis, indicator vertebrate and invertebrate species, water resource law, and land use patterns.

Soil Science

This course explores the nature, properties, and use of soil to capture its value and to understand better its critical role as a foundation of life. It is an introduction to soil organisms, and includes interactions between organisms, their processes, and metabolism with a major focus on microorganisms. This course also introduces students to basic concepts of soil science and the soil's contribution to the functions of natural and anthropogenic ecosystems. It provides an overview of soil's morphological, physical, chemical, and biological properties, and how these interact to form a soil with unique characteristics and ecosystem function. Students will discuss soils of the world from the perspective of soil taxonomy, the processes that form these soils, and land use properties specific to each soil order. Current issues regarding the proper use and management of soils are investigated.

Restoration Ecology

This course includes a survey of the biological, ecological, environmental, and social factors that affect the loss of habitat and reduce the number of species in the world. This human impact will be considered in connection with the loss of biodiversity from a particular region. The course beings with a focus on North America and moves to Antioch College's nature preserve Glen Helen. We will examine methods currently in use for preserving and restoring ecological diversity.

Ecological Agriculture

This course focuses upon the science of ecological agriculture and the importance of understanding and comparing the current methodologies of agriculture with appropriate alternatives. This course will also focus on understanding the ecological concepts that are of universal application in all bioregions where agriculture is practice. A special emphasis will be placed on alternatives to unsustainable systems that rely too heavily on chemicals and irrigation, such as the development of systems which mimic native ecosystems.

Biochemistry (see the description under the Health Science major above).

400-Level Courses

Senior Research and Senior Project
Advanced Colloquy
(descriptions available at the beginning of the academic program section of the Catalogue)