Natural Sciences

The natural sciences sequences provide a way for students in the humanities and social sciences to satisfy the general education requirements through integrated sequences in the physical and biological sciences. These requirements can be fulfilled separately, of course. The sequence Evolution of the Natural World follows a distinct theme through four quarters. Environmental Sciences, the second (six quarter) sequence offered, satisfies the general education requirements in the mathematical sciences as well as the physical and biological sciences.

The natural sciences sequences are open only to first- and second-year students and to first-year transfer students, with preference given to first-year students. The courses must be taken in sequence.

Courses

10100-10200-10300-10400. Evolution of the Natural World. *PQ: MATH 10600, or placement into 13100 or higher. This sequence satisfies the general education requirements in the physical and biological sciences for humanities and social sciences students. Open only to first- and second-year students and to first-year transfer students, with preference given to first-year students. Must be taken in sequence.* This is an integrated four-quarter sequence that emphasizes the evolution of the physical universe and life on Earth, and explores the interrelationships between the two.

10100. Evolution of the Solar System and the Earth. This course examines the physical and chemical origins of planetary systems, the role of meteorite studies in this context, and a comparison of the Earth with neighboring planets. It then turns to chemical and physical processes that lead to internal differentiation of the Earth. Further topics include the thermal balance at the Earth's surface (glaciation and the greenhouse effect), and the role of liquid water in controlling crustal geology and evolution. *F. Richter. Winter. L.*

10200. Evolution of the Universe. *PQ: NTSC 10100.* This course is designed to encourage a sense of awe, appreciation, and understanding of the topics investigated in modern astrophysics, such as the origin of the universe, the formation and evolution of the sun and the Earth, the nature of space and time, and the search for other planets and life in the universe. Students also have a chance to experience the predicting, testing, and investigative nature of science. *J. Carlstrom. L: E. Kibblewhite. Spring.*

10300. Biological Evolution. *PQ: NTSC 10200.* This course is an introduction to evolutionary processes and patterns in present-day organisms and in the fossil record and how they are shaped by biological and physical forces. Topics emphasize evolutionary principles. They include DNA and the genetic code, the genetics of populations, the origins of species, and evolution above the species level. We also discuss major events in the history of life, such as the origin of complex cells, the invasion of land, and mass extinction. *Autumn. L.*

10400. Environmental Ecology. (=BIOS 13107, ENST 10400) *PQ: NTSC 10300.* This course emphasizes basic scientific understanding of ecological and evolutionary principles that relate most closely to the ways humans interact with their environments. Topics include population growth, adaptation, and ecosystem structure and function. We also discuss the regulation and consequences of biodiversity. *Discussion required. M. Leibold. Winter.*

12100-12200-12300-12400-12500-12600. Environmental Sciences. *PQ: MATH 10600 or placement into 13100 or higher. This sequence satisfies the general education requirements in the physical, biological, and mathematical sciences for humanities and social sciences students. Open only to first- and second-year students and to first-year transfer students, with preference given to first-year students. Must be taken in sequence.* This six-quarter sequence integrates several basic science disciplines relevant to our understanding of human impact on the natural environment.

12100. Atmospheric Chemistry and Air Quality. (=ENST 12100, PHSC 13500) *PQ: MATH 10600 or placement into 13100 or higher.* This course considers: (1) the chemical, physical, and radiative processes that determine the composition of the atmosphere, and (2) the effects that increasing global industrialization and agriculturization are having upon the atmosphere. Particular attention is given to stratospheric ozone depletion, the chemistry of the global troposphere, the quality of urban air throughout the world, and the formation of acid precipitation. The extent to which locally-released pollutants affect the atmosphere on a global scale is addressed. *J. Frederick. Autumn. L.*

12200. Cells in their Environment. (=BIOS 10300, ENST 12200) *PQ: ENST 12100 or NTSC 12100, or consent of instructor. This course is an alternative to BIOS 10100 for students enrolled in the Environmental Sciences sequence.* We consider the molecular basis of life. Our focus is on the evolved structure, function, and organization of cells, as well as their constituents. We also take up how cells store and express information, obtain and use energy, and interact with their natural environment. *T. Steck. Winter. L.*

12300. Global Warming: Understanding the Forecast. (=ENST 12300, GEOS 13400, PHSC 13400) *PQ: NTSC 12200.* This course presents the science behind the forecast of global warming to enable the student to evaluate the likelihood and potential severity of anthropogenic climate change in the coming centuries. It includes an overview of the physics of the greenhouse effect, including comparisons with Venus and Mars; an overview of the carbon cycle in its role as a global thermostat; predictions and reliability of climate model forecasts of the greenhouse world; and an examination of the records of recent and past climates, such as the glacial world and Eocene and Oligocene warm periods. *D. Archer, R. Pierrehumbert. Spring. L.*

12400. Organisms and Ecosystems in the Environment. (=BIOS 13108, ENST 12400) *PQ: NTSC 12200 or consent of instructor. This is the second biological sciences course in the Environmental Sciences sequence.* This course examines the interactions between organisms and their environments. Topics include reproduction, nutrition, disease,

population, conservation, and interactions between species. Organismal biology and ecology are related to environmental problems (e.g., overpopulation, biodiversity loss, pollution) from a scientific perspective. *A. Hunter. Autumn.*

12500. Quantitative Methods in Environmental Science. (=ENST 12500, STAT 12500) *PQ: NTSC 12400 or consent of instructor.* This course studies mathematical, statistical, and computational approaches to scientific issues raised previously in this sequence. Three principal tools are: differential equations as a way to model a changing world, probability theory as a way to quantify uncertainty, and the application of computer simulations to understanding environmental processes. *M. Stein. Winter.*

12600. Environmental Science and Society. (=ENST 12600) *PQ: NTSC 12500 or consent of instructor.* In this course, we apply the knowledge and the methods of science to an exploration of how humans use their natural environment. We explore the meaning of scientific knowledge and how it is applied to problems in human affairs (e.g., the role of scientific evidence in public policy and popular debates). Of particular interest is the nature and application of energy. We also explore the parallel between science and art. *G. Eshel. Spring.*