

Genesis Rewritten: A History of Natural History and the Life Sciences Spring, 2019

Instructor

Robert Kiely oldstuff@imsa.edu

Office: A 120

Office Hours: B Days 12 – 2 PM; C Days 1 -3 PM; I Days 1-3 PM

Prerequisites: Grade Level: Senior

Course Description:

The issues of the life sciences are at once the most elusive and the most familiar of the mysteries of nature; they may be as mundane as the eating of a meal or as fantastic as the manipulation of a bacteria's genome. This course will trace the attempts to understand and explain the living world over the two thousand years from ancient Greece to twentieth century America, with an emphasis on the period from 1700 -- 2014. We will examine varied religious, philosophical, and scientific traditions and their attempts to account for the origins, structure, function, and interrelationships of living things. We will study issues of scientific methodology and matter theory, trace the chemical understanding of life itself, explore the human drive to order the living world, and consider the relationship between systems of political order and systems of natural order. The course will place special emphasis on the immense influence of Darwinian ideas of random variation and natural selection on the way we view the living world (and ourselves). Finally, we will consider the changing attitudes of humanity towards nature, wilderness and the environment, from the ancient notion of nature as dark and chaotic to the growth of modern notions of ecology.

Teaching and Learning Methodology:

The course emphasizes the analysis of primary sources in religion, philosophy, and science. Such primary readings form the core of class sessions and written assignments. Classroom discussion revolves around the background, content, and intellectual implications of a variety of texts and images from Renaissance Europe to the 20th century. When possible, students consider actual phenomena as well. The course pays special attention to the connections between intellectual systems, the features of different methodologies for explaining the natural world, the relationship between science and religion, the notion of design in nature, and the role of randomness in modern thought.

Student Expectations:

Students are asked, above all, to keep up with their reading and to add their analyses, opinions, and questions to class discussion. Students with specialized knowledge are encouraged to share their expertise – this is especially true with respect to specific biological expertise. Students are also expected to complete all written assignments, and to attend all classes (4 to 5 papers over the course of the semester).

Assessment Practices:

Student writing plays the major role in assessment; the course thus serves as an exercise in essay writing as well as a history of ideas seminar. All papers involve the analysis of texts; elegant argument and organization are critical. Students must support their assertions with properly cited references to primary sources. Short in-class essays focus on primary reading in a more immediate way. Finally, student discussion also plays a role in assessment; significant contribution to discussion can enhance a student's grade.

Assessments:

- 1 Short paper: 10%
- 3 Medium length papers: 60%
- In-Class Essays and Class Discussion: 10%
- Environment Group Project: 20%

Secondary Readings

Lloyd, *Science, Folklore, and Ideology*
Gould, *Time's Arrow, Time's Cycle*
Coleman, *Biology in the 19th Century* (Chapter 5)
Gould, *Wonderful Life* (selections)
Gould, selected essays
Fortey, *Life* (selections)
Hull, *Cambridge Guide to the Philosophy of Biology* (selections)
plus selected articles

Primary Readings

Genesis, Chap 1-7
Selections from Medieval Bestiaries
Hermetic Corpus (selections)
Paracelsus, *Credo*

Descartes, *Passions of the Soul*
Newton, *Principia* (selections)
Opticks (selections)
Boyle, *The Skeptical Chemist*, (selections)
On the Usefulness of Natural Philosophy
Linnaeus, *On the Classification of Plants*
Diderot, *Conversation with D'Alembert*
Buffon, *Natural History* (selections)
Whewell, *Bridgewater Treatises*
Lyell, *Principles of Geology* (selections)
Darwin, *Origin of Species* (abridged)
Bagehot, *Physics and Politics*
Morgan, *Sex Limited Inheritance in Drosophila*
Hershey/Chase, *Independent Functions of Viral Proteins and Nucleotides*

Plus, a variety of online sources and TED lectures

Schedule of Topics and Readings:

Life and Matter from Antiquity to the Renaissance

Readings:

Lloyd, *Science, Folklore and Ideology*
White, *The Bestiary*
Hermetic Corpus
Paracelsus, *Credo*

Topics for Discussion:

Greek notions of life, matter, and soul: *bios, zoe, psyche*
Life as imposed (Plato), inherent (Aristotle), emergent (Epicurus and Lucretius)
Aristotelian views of form, soul, hierarchy, generation
Epicurean Atomism, and related views of life and matter
Judeo-Christian Scripture: Creation as artifice or divine command
Medieval Bestiary: Nature as Scripture
Medieval Scholasticism and Christianized Aristotelian views of life, order, soul
Renaissance Humanism and Skepticism
Neoplatonic notions of divine intermediates and active matter
Alchemy and Paracelsian chemistry as a representative view of nature
Skepticism and eclecticism as early modern intellectual trends

Method, Mechanics, Life, and Design: the 17th Century

Readings:

Newton, *Principia* (selections)
On the Principle of Vegetation (unpublished; selections)
Boyle, *The Skeptical Chymist*
On the Usefulness of Natural Philosophy

Topics for Discussion:

17th century skepticism and eclecticism
Cartesian skepticism, epistemology, and the mechanical philosophy
Cartesian mechanistic views of life
Responses to Descartes: Gassendi, Pascal, Hobbes
English empiricism, experimentalism, and natural theology: Bacon, Boyle, Newton
Newton as Renaissance *magus*, Newton as author of modern scientific methodology
Empiricism, natural law, and the death of the “body politic”

First 5 page paper: Boyle and Diderot (5 pages)

Life and the Enlightenment

Readings:

Buffon, *Natural History* (selections)
Linnaeus (selections)
Diderot, *Conversation with D’Alembert*
Hankins, *Science in the Enlightenment* (chapter 4)

Topics for Discussion:

Buffon’s *Natural History*: empiricism and order
Buffon and views of time
Enlightenment views of epistemology and natural law
Views of religion: deism, atheism, natural theology and teleology
Linnaeus, Ray, and Taxonomy
Fossils and the Chain of Being in the Enlightenment
Mechanist and vitalist views of physiology
18th century views of Vital Principles and subtle Fluids
Diderot, atheism, and active matter

IV. Natural History and Deep Time

Readings:

Gould, *Time's Arrow, Time's Cycle*
Whewell, *Bridgewater Treatises* (selections)
Lyell, *Principles of Geology* (selections)

Topics for Discussion:

Notions of earth history or “deep time”—linear and cyclical
Smith and stratigraphy
Construction of geological periods
Uniformitarian and catastrophist views of geology (Hutton, Cuvier, Lyell)
French views of life and classification: Buffon, Cuvier, Lamarck
Natural theology, teleology, and Darwin’s intellectual background

Second 5 page paper: Darwin, Time, and Method

V. Darwin and Evolution

Readings:

Darwin, *Origin of Species* (abridged)
Coleman, *Biology in the 19th Century* (chapter 4)
Bagehot, *Physics and Politics*

Topics for Discussion:

Darwin’s theory: responses to scientific problems
Darwin’s Theory: implications for religion, culture
Scientific responses to Darwin
Religious responses to Darwin
Darwinian Taxonomy
Darwin and Philosophy—Randomness, teleology, and hierarchy
Social Darwinism, racism, and pseudoscience

Third 5 page paper: Darwin, Science, and Culture

VI. Morphology, Metabolism, and Heredity in the 19th century

Readings:

Coleman, *Biology in the 19th century* (chapter 2,6)

Topics for Discussion:

Tissue doctrine and Bichat

Cell Theory in the early 19th century
Chemical views of Life: Combustion and Respiration
Pasteur, Koch, and the origins of Microbiology
Enzymes and Catalysis
Classical Genetics

VII. Brief History of Genetics and Molecular Biology in the 20th century

This unit consists of a student-centered research project that focuses on the work of a prominent molecular biologist or biochemist from the period between 1920 and 1970. The unit requires students to construct an annotated powerpoint explaining the importance of the work of their chosen figure.

VIII. Life, Randomness and Contingency (3 classes)

Readings:

Wilford, *The Riddle of the Dinosaur* (selections)
Gould, *Wonderful Life* (selections)
Fortey, *Life* (selections)
Dawkins, *The Blind Watchmaker*

Topics for Discussion:

Vestiges of hierarchy: Dinosaur paleontology in the 19th and 20th centuries
Asteroid collision and the rebirth of catastrophe
Mass extinction and its relationship to Darwinism
Evolution and contingency
Cladistics, taxonomy, and notions of order
Rejections of teleology: Dawkins vs. Aristotle

IX. Views of the Environment in the 21st Century

Independent Research project (3-4 weeks)