

U29 Biology 415
 From Darwin to DNA: A History of the Life Sciences in the 20th Century
 Fall, 2008
 Mondays, 6:30-9:00 (Life Sciences Seminar Room 202)

Syllabus and Class Schedule

The purpose of this course is to explore the broad development of the life sciences during the twentieth century. The topic is obviously vast, so that in order to explore any topics in some depth the coverage will be somewhat selective. The core areas to be considered are: heredity (genetics), embryology, evolution, general physiology and neurophysiology, biochemistry, ecology, molecular biology (including molecular genetics). In each of these areas, where relevant, the relationship between biology and economic, social and political issues (social Darwinism, eugenics, high-energy radiation and mutation, ecological disruption, genetic engineering, stem cell research, and the implications of human behavioral/psychiatric genetics for current social and medical policy). We will also examine the development of biology in its institutional and national contexts. Class will involve a combination of lecture and discussion, while readings will be based on both primary and secondary sources.

The major theme of the course will be the transition of biology from a largely theoretical, descriptive and speculative science in the late 19th century to an experimental, quantitative and predictive science in the early 20th century. The areas in which this transformation first manifested itself were embryology and heredity, but similar motivations emerged in evolutionary biology and ecology by the 1920s and early 1930s. A secondary theme will trace the influence of changing economic and social policies in the industrialized nations as they came to see the life sciences, like the physical sciences in the 19th century, as profitable for capital exploitation (agriculture, medicine, pharmacology and, at present, genomics and pharmacogenomics). Emphasis will be placed on understanding the technical ideas of biology in each of these areas while also exploring the interaction among the various branches of biology and with the physical sciences (chemistry and physics). While no specific courses are prerequisite for this course, if you have not had at least the Biology Department's introductory sequence (Biology 2960, 2970 and/or 3050) you will have to be willing to learn some of the hard-core science as it developed throughout the century.

Readings

Most of the readings will be on electronic reserve (ERes) for the course. To access the reserve list you will need to go to any computer and type in the reserve **url**:

http://eres.wustl.edu>http://eres.wustl.edu
 find the class by dept and # or by professor's name
 click on the class (Bio 3182)
 enter password: 20cent

The main text for the course will be:

Allen, G.E. *From Little Science to Big Science: The Development of the Life Sciences in the Twentieth Century* [Formerly, *Life Science in the Twentieth Century* (Cambridge University Press, 1978)]. You will find on ERes revised drafts of the chapters of this book. Two copies of the original book are on reserve in the Biology Library. The revised chapters of this book are contained in a folder in Eres, "Life Sciences in the Twentieth Century-Revision Chapters."

Primary and secondary sources will consist mostly of published articles or selections from longer monographs, and will also be found in ERes. **Please Note:** ERes lists works alphabetically by title rather than author (it does not include prefatory articles like "A", "An" or "The"), so you will have to know the exact title of the book, article or chapter.

Books in the Washington University Bookstore (Malinckrodt Center, lower level)

There are three books on order for this course, all of which will be used later in the semester. All are in paperback.

MORANGE, Michel. 1998. *A History of Molecular Biology* (Cambridge, MA: Harvard University Press)

PAUL, Diane. 1995. *Controlling Human Heredity, 1865-Present*. (Atlantic Highlands, NJ: Humanities Press).

PROVINE, William B. 2001. *The Origins of Theoretical Population Genetics* (Chicago: University of Chicago Press; new printing of the original 1969 book, with a new "Afterword.")

Course Requirements

Attendance: Attendance is not required but is *strongly suggested*, as the give-and-take of classroom discussion provides a deeper and more well-rounded understanding of almost any subject. In addition, some of the issues and perspectives presented in the course will be drawn primarily from lecture-discussion and are not always as well represented in the readings.

In-Class Presentations: Every student will be required to make one in-class presentation during the semester based on one of the assigned readings, drawn mostly from the primary source literature. The presentation, about 15 minutes in length, should aim at explaining the nature of the paper, something about its author, and then provide several questions for discussion by the class as a whole.

Written Work: There will be no formal exams, but each student will write a mid-term paper, and carry out a final project.

(1) *Journal of Reading Notes:* You are asked to keep a journal of your notes on the readings (primary and secondary) that will be collected twice during the semester. This is partly a way of making sure people keep up with the reading and also to provide feedback on methods of note-taking. You will be given one week's notice on turning in the journal.

(1) *The mid-term writing project* will involve writing a book review of a recent work on the history of twentieth century life sciences. These will be chosen from a list provided by the instructor. Length should be approximately 5-7 pages.

(2) *The Final Project* will be a power-point presentation (a brief version of which is to be presented in class) based on analysis of a particular experiment or field study in the history of twentieth century biology. The presentation will include information about the background of the experimenter(s), the genesis of the idea for the experiment, the institutional context in which it was carried out, how the experiment/field study was organized and carried out, the nature of the data collected and the way it was interpreted by both the experimenters and their contemporaries. The full power-point presentation should be designed for a 45-minute class but the abbreviated version given in class should only be 15 minutes. With students' permission, the power point presentations will be made available on-line through the course web page.

Grade Determination:

Journal: 20%

Power-Point Presentation: 35%

Mid-term book review: 25%

In-Class Presentation: 20%

A general course outline follows on the next few pages. If past experience is any guide, we will not keep rigidly to this schedule. I want class time to be as unconstrained and flexible as possible. At each class session assignments will be distributed for the following class period(s), with assigned readings listed and questions to guide you in reading the material. All assignment sheets, as well as lecture presentations (Power-point) will be posted on the course web page.

Web page

There is a web page for the course where all assignments and class handouts will be listed. Power point presentations will be up and available for printing out before each class period (hopefully, the night before!). The web page will *not* contain the electronic reserve readings. The **url** for the web page is:

<http://www.nslc.wustl.edu/courses/Bio415/bio415.html>

The password is: **eugen**

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E-mail is probably the easiest way to reach me, but I can make appointments to meet with you when we can arrange it.

U29 Biology 415

Life Science in the Twentieth Century

General Course Schedule, Fall, 2008

- Sept 8 Introduction and Scope of the Course; Overview: The Uses of History of Science
Historical and Philosophical Background: Schools of Thought in Modern Science:
Idealism, Materialism (Mechanistic, holistic and dialectical materialism),
Paradigm Shifts, Social Construction of Science.
Readings: Allen, *Little Science to Big Science*, "Introduction"; Allen, "Notes and
Definitions Regarding the Philosophy of Science . . ."
- Sept 15 Economic, Political and Social History of Twentieth Century Biology; The
Darwinian Background: Evolutionary Biology 1859-1900. Darwin's Six Theories
and Morphology. Haeckel and Weismann: Ontogeny, Phylogeny and the
Continuity of the Germ Plasm.
Readings: Allen, *Little Science to Big Science*, Chapters 1-2;
- Sept 22 "On the Deathbed of Darwinism": Alternatives to Darwinian Theory, 1890-1920;
Social Darwinism; The Revolt from Descriptive Biology I: Roux, Driesch and
Entwicklungsmechanik; the Founding of Marine Research Stations (Naples, Woods
Hole, etc)
Readings: Allen, *From Little Science to Big Science*, Chapter 3; William Graham
Sumner, "What Social Classes Owe to Each Other"
- Sept 29 The Revolt from Descriptive Biology II: Heredity (Pre-Mendelian Theories of
Heredity; Rediscovery of Mendel in 1900); Development of the Mendelian-
Chromosome Theory: Mendelism and Cytology (*Drosophila* and Corn Take
Center Stage).
Readings: Allen, *From Little Science to Big Science*, Chapter 5; Morgan, T.H., "Sex-
limited Inheritance in *Drosophila*," *Science* (1910) and Morgan, "Random
Segregation *versus* Coupling in Mendelian Inheritance".
- Oct 6 Societal Aspects of Genetics: Capitalism Discovers Agriculture: Genetics &
Hybrid Corn for Profit, 1910-1950; The Control of Human Evolution: Eugenics in
Europe and the United States.
Readings: Allen, *From Little Science to Big Science*, Chapter 6: "Expansion and
Articulation of the Mendelian-Chromosome Theory"; Paul, *Controlling Human
Heredity, 1865-Present* (all).
- Oct 13 Mechanistic Materialism and Its Metamorphosis: General Physiology and the
Mechanistic Conception of Life (Jacques Loeb and Ivan Pavlov); The
Development of Biochemistry.
Readings: Allen, *From Little Science to Big Science*, Chapters 8-9
- Oct 20 Mechanistic Materialism and Its Metamorphosis. Sherrington, Cannon and
Henderson: Integration and Self-Regulation in Biological Systems; The Holistic
Biology Movement, 1910-1935; Social Homeostasis and "New Deal"
Progressivism.
Readings: Allen, *From Little Science to Big Science*, Chapter 11-12; Cannon,
"Relations of Biological and Social Homeostasis".
- Oct 27 The Evolutionary Synthesis I: From Hardy-Weinberg to Fisher, Wright &
Haldane; The Evolutionary Synthesis II: Dobzhansky, Simpson and Mayr

- Readings:** Allen, *From Little Science to Big Science*, Chapter 13, "Integrative Approaches to Evolution"
- Nov 3 Evolution and Evangelical Religion: The U.S. Controversy from the Scopes Trial to Scientific Creationism and "Intelligent Design". Readings to be assigned later.
- Nov 10 The Origin and Development of Molecular Biology, 1930-1952, Part 1.
Readings: Allen, *From Little Science to Big Science*, Chapter 14, Sections 14.1 – 14.6; Morange, *A History of Molecular Biology*, Chapter 1-10.
- Nov 17 The Origin and Development of Molecular Biology, 1953-1980, Part 2.
Readings: Allen, *From Little Science to Big Science*, Chapter 14, Sections 14.7-8; Morange, *A History of Molecular Biology*, Chapter 11-20.
- Nov 24 Biology, Biotechnology and Big Science: From Gene splicing to the Human Genome Project (1980-2000) (Some topics of choice for discussion: Cloning, Gene Therapy, Behavior Genetics, *etc.*)
Readings: To be assigned later.
- Dec 1 Power Point Project Reports
- Dec 8 Power Point Project Reports
- Dec 15 Power Point Projects (Final Version) due at Life Sciences 202D