

HI 481H : HISTORY OF THE LIFE SCIENCES

SPRING 2019

Tu/Th 10:15-11:30, #135 Withers Hall

Dr. William Kimler

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OFFICE HOURS: Tuesday 3:00 - 5:00

Wednesday 1:30 - 4:00

and by appointment by email

Syllabus & Readings & Updates at go.ncsu.edu/hi481

Course Prerequisite:

Jefferson Scholar [or by permission from Dr. Kimler, with Junior standing and Honors GPA].

General Education Program fulfillment:

This course is on the list for “Interdisciplinary Perspectives” courses. The course will help you to distinguish between the distinct approaches of history and science, identify and apply the connections between them, and explore and synthesize the views of the two disciplines as we examine modern ideas about living processes.

The course treats the growth of biology as a story about developing a set of core ideas or organizing concepts about the nature of life. Starting in the 1600s, investigators learned how to experiment on living functions. Over the next two centuries they developed a view that life is explained by structure (organs, tissues, cells) and function (chemistry). As new tools and methods provided control and precision, a biology of physiology, development, and heredity went from promise to the flourishing of molecular biology. On an overlapping track, naturalists developed the sciences of the ecological interactions, deep history, and evolution of life. Ideas never exist in a social vacuum, and so the course will draw attention to the connections between the life sciences and other aspects of culture, including religious beliefs, professional behavior and practices, and social goals.

In trying to explain the development of biological science, the historian asks some basic questions:

1. What do we know about the biological phenomenon? This includes what we think we’re seeing, how we describe it, how it connects to other things we know, and some explanation of its causes or operations.
2. How do we know all that? This means understanding the scientist’s method of working and explaining, and also how other scientists have been persuaded of this answer.
3. Who figured it out? The story of scientific ideas is an account of creativity and insight, which also means it’s an explanation of the cultural and intellectual conditions that allowed or fostered the work. It is also by turns peculiar, obvious, ironic, tragic, funny, unexpected, twisted, or noble. Seldom is it boring.

Biology today is one of most rapidly developing sciences, and its implications for modern life promise to be profound. As educated citizens, you ought to become aware of the history of the ideas that form the modern, biological view of life. This course is intended to provide you with the chance to develop an understanding of biological and biomedical ideas and practices as they developed, and provide material for your own reflections on this view of life.

Lectures organize the major themes and provide a narrative about the scientists as background and guidance. You’ll read extracts from the original works of biologists. Together, lectures and

discussions of the readings will provide the foundation for a historical view of biology.

Readings are online <<https://sites.google.com/ncsu.edu/hi-481/home/readings-list>> and also come from the required texts:

- William Harvey, *On the Motion of the Heart and Blood in Animals* (R. Willis translation), Buffalo, NY: Prometheus Books, 1993.
On Reserve in D. H. Hill Library Textbook Collection (Ask Us Center): QP101 .H3613 1993
Also available from the Internet Archive <https://archive.org/details/b22651135>
- Steven Johnson, *The Ghost Map: The Story of London's Most Terrifying Epidemic--and How It Changed Science, Cities, and the Modern World*, New York: Riverhead Books, 2007.
Also available from the Internet Archive <https://archive.org/details/pdfy-d2FfzgXId4Qz9mR4>
- Charles Darwin, *On the Origin of Species* (A Facsimile of the First Edition), Cambridge, MA: Harvard University Press, 2001.
The same 1859 text is also available from The Complete Work of Charles Darwin Online: <http://darwin-online.org.uk/content/frameset?viewtype=side&itemID=F373&pageseq=1>
- Charles Darwin, *The Autobiography of Charles Darwin: 1809-1882*, New York: W. W. Norton, 1993.
The same 1958 restored text is also available from The Complete Work of Charles Darwin Online: <http://darwin-online.org.uk/content/frameset?itemID=F1497&viewtype=text&pageseq=1>
- Claude Bernard, *An Introduction to the Study of Experimental Medicine*, Dover, 1957.
Also available from the Internet Archive <https://archive.org/details/in.ernet.dli.2015.463298>
- Jim Endersby, *A Guinea Pig's History of Biology* Cambridge, MA: Harvard University Press, 2007.
On Reserve in D. H. Hill Library Textbook Collection (Ask Us Center): QH431 .E615 2009
- James Watson, *The Double Helix* (Norton Critical Edition), W. W. Norton, 1981.
You will need this Critical Edition for its extra materials.

Attendance at class sessions is essential and required.

- Your responsibility to the class is to attend and to be familiar with the readings, able to discuss their content, and ready to explore ideas in class.
- In addition, you are responsible for material covered in class, independent of the readings. Much class material will be my synthesis of the scholarship, and you'll be expected to be able to draw on class discussions in your own written work.
- You are responsible for keeping up with changes made in class for our topics or readings, and posted online at go.ncsu.edu/hi481.

Grades will be based on

50% : Reading Responses, due by 9 a.m. on the day of the class session indicated in the schedule of reading assignments. Responses should be at least a page in length. Pick a major feature of the author's argument, presentation, or ideas to summarize in your own words, as a prompt for class discussion. See more advice in Moodle.

As these comments coordinate with the class sessions, no late papers are accepted. You will write **25 of these**. I will drop the 5 lowest scores.

50% : Research Paper of at least 2500 words [10 standard pages] in length, plus literature cited. In general, the paper will be an investigation of the development or impact of a particular idea, individual, technique, or institution in the history of biology, with preference given to a topic connected to your CALS major. But you may also investigate a different area of biology.

The Research Paper score is allocated as

5%: Proposal. I will discuss with you possibilities for papers, and **must approve** your choice of a topic. The Proposal identifies the topic of your research, the question you will ask, and the potential relevant sources. **Due February 14.**

5%: Introduction, Outline, & Draft Bibliography. I will be happy to discuss literature searching and materials you find as you research and write. Submit a draft Introduction that introduces the topic, establishes the historical question, and indicates the thesis (explanation of the answer to your question). Include a draft Outline of the contents and development of the argument, and list the major sources to be used. **Due March 19.**

10% : Submission of **Research Paper Draft** and **Comments** on classmate's draft. A **Draft version** of the Research Paper is due **by April 9**. By draft, I expect a well-formed research question, a close-to-complete search for sources, detailed coverage of your sources, and an attempt at your final analysis and conclusion. On any topic, I expect you to incorporate the course's insights about the developments of biological science. If there are parts of the paper not finished because you are waiting on a source or are still trying to figure something out, just indicate so in the draft with an outline of what you might fill in for that section. The purpose of a draft, after all, is to find the holes to be filled by more sources or analysis. It also allows a reader to see what's missing.

Comments:

Each of you will review one classmate's Draft and write Comments. We will do this as a workshop in class on Tuesday, **April 9**. See advice in Moodle.

I expect you to consider comments from your classmates and from me in your revisions of the Draft for final submission.

30%: The finished version of the **Research Paper, due by 11 a.m., Thursday, May 2.**

Scholarly forms of citation in historical writing are not trivial, and every publisher has its own requirements. I require citation in footnotes, with a Literature Cited section at the end. **I do not**

accept in-text citations (parenthetical MLA or “scientific” format). Citation format must follow *The Chicago Manual of Style*, available on-line <<http://www.chicagomanualofstyle.org/home.html>> and in Cindy Levine’s [Library Course Tools for History](#).

Grading scale:

A+	97-100	B+	87-89.9	C+	77-79.9	D+	67-69.9	F	<60
A	93-96.9	B	83-86.9	C	73-76.9	D	63-66.9		
A-	90-92.9	B-	80-82.9	C-	70-72.9	D-	60-62.9		

Absences and Missed Assignments:

- Reading Responses are due on the assigned date. You should discuss any problems in meeting the schedule with me before the due date.
- You should contact me as soon as possible, but not more than one week after the return to class, about absence because of illness or emergency.
- Make-up work for planned excused absences must be arranged with Dr. Kimler before due dates. Consult the University's Attendance Regulation for the definition of excused absence at <<http://policies.ncsu.edu/regulation/reg-02-20-03>>
- You are allowed **two** unexcused absences. Each additional unexcused absence will reduce your final grade by 3 points.

Academic Integrity:

I have come to expect the highest integrity from NC State students. I assume that you are familiar with NC State policy on Academic Integrity, found in the Code of Student Conduct, at <<http://policies.ncsu.edu/policy/pol-11-35-01>>. You are required to uphold the Honor Pledge (“I have neither given nor received unauthorized aid on this test or assignment.”), and your adherence to academic honesty is certified by your name on the test or assignment.

It is your responsibility to know what constitutes plagiarism and avoid it. If you have any questions about what is appropriate scholarly use of sources and citation, see the History Department's tips on avoiding plagiarism at <https://history.ncsu.edu/undergrad/plagiarism.php>. Or talk to me.

Disability Accommodations:

Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, you must register with the Disability Resource Office at 304 Holmes Hall, Campus Box 7509, 919-515-7653. For more information on NC State's policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulation at <<http://policies.ncsu.edu/regulation/reg-02-20-01>>

University Policies:

Students are responsible for reviewing the NC State University Policies, Regulations, and Rules which pertains to their course rights and responsibilities:

- Equal Opportunity and Non-Discrimination Policy Statement <https://policies.ncsu.edu/policy/pol-04-25-05> with additional references at <https://oied.ncsu.edu/equity/policies/>
- Code of Student Conduct <https://policies.ncsu.edu/policy/pol-11-35-01>
- Grades and Grade Point Average <https://policies.ncsu.edu/regulation/reg-02-50-03>
- Credit-Only Courses <https://policies.ncsu.edu/regulation/reg-02-20-15>
- Audits <https://policies.ncsu.edu/regulation/reg-02-20-04>

- JAN 8 The Modern Biological View of Life**
Scientific ideas about living processes, and the nature of modern study of biology.
READ: Endersby, Preface and Ch. 1
- JAN 10 Envisioning Living Structures and Function**
The early medical tradition. The role of illustration in medical texts. Vesalius and the Padua anatomists.
REVIEW: Illustrations slide sets
READ & RESPOND: Vesalius, extracts from *De humani corporis fabrica*
- JAN 15 Experimental Investigation**
Harvey's methods of research.
READ & RESPOND: Harvey, *On the Motion of the Heart and Blood* – thru Ch. 4
- JAN 17 Demonstration and Experimentation**
Harvey's arguments for the circulation of the blood.
READ & RESPOND: Harvey, *On the Motion of the Heart and Blood* – thru Ch. 14
- JAN 22 Experiment and Its Limits**
Descartes and reductionist methodology. The nature of digestion.
READ & RESPOND: Redi, *Experiments on the Generation of Insects*
 Foster, *Lectures on the History of Physiology* (early mechanists)
- JAN 24 The Material View of Life: New Organic Chemistry**
Magendie's chemical view. Analytical organic chemistry and drug synthesis. Liebig and agricultural and medical chemistry.
READ & RESPOND: Liebig, *Animal Chemistry* (Preface & I, thru p. 9)
 Foster, "The Condition of Physiological Science before Bernard Began His Labours"
- JAN 29 Disease and Public Health**
Disease theories, contagion, sanitation.
READ & RESPOND: Chadwick, *On the Sanitary Condition of the Labouring Population* (pp. 369-73)
 Johnson, *The Ghost Map* (thru p. 187)
- JAN 31 Contagion and epidemiology**
READ & RESPOND: Snow, *On the Mode of Communication of Cholera*
- FEB 5 Cells, the Chemical View of Life, and Germ Theory**
The cell doctrine. Pasteur and the physiological unity of living processes. Bacteriology, lab biology, and medicine.
READ & RESPOND: Pasteur, "Memoir on the Organized Corpuscles"
- FEB 7 Biology as an Experimental Science**
READ & RESPOND: Bernard, *Introduction to the Study of Experimental Medicine*, PART ONE

- FEB 12 Methods for the Experimental Study of Physiology**
 READ & RESPOND: Bernard, PART TWO extracts (assigned in class)
- FEB 14 The Ecological Web and the History of Life**
 Economy of Nature and natural theology. Deep time. Ideas of progress and naturalistic explanation.
 READ & RESPOND: Lyell, extract from *Principles of Geology*
 Buckland, extract from *Geology and Mineralogy*
- FEB 19 Problems of Natural History**
 Darwin's field investigations. The context of innovation.
 READ & RESPOND: Darwin, *Autobiography*
- FEB 21 Creating a Theory of Evolution**
 Theoretical inquiries: heredity and adaptation. The evolutionary tree. The theory of Natural Selection. The argument of *The Origin of Species*.
 READ & RESPOND: Darwin, *Origin of Species* extracts – Introduction thru Ch. 6
- FEB 26 The Evolutionary View of Life**
 The argument of *The Origin of Species*.
 READ & RESPOND: Darwin, *Origin of Species* extracts, Ch. 8 thru 14
- FEB 28 Unifying Biology**
 Reaction to *The Origin*. Acceptance and accommodation. New directions of research.
 READ & RESPOND: assigned review of *The Origin of Species*
- MAR 12 Investigations of Heredity**
 Plant and animal breeders. Darwinian theory and genetic mechanisms.
 READ & RESPOND: Goodale, *The Principles of Breeding*
 Endersby, Ch. 3
- MAR 14 Mendel's Innovation**
 Mendel's methods and reception. Factorial and blending theories of heredity in 19th century.
 READ & RESPOND: Mendel, "Experiments in Plant Hybridization"
 Endersby, Ch. 4
- MAR 19 The "New Experimental Biology"**
 The experimentalist revolt against morphology. Intellectual and institutional contexts of the new biological disciplines.
- MAR 21 The Invention of "Genetics"**
 The creation of Mendelism. The Morgan school of classical Mendelian genetics. Lingering vitalism.
 READ & RESPOND: Morgan, "What Are 'Factors' in Mendelian Explanations?"
 Morgan, extract from *The Physical Basis of Heredity*
 Haldane, extract from *Mechanism, Life, and Personality*

MAR 26 Directions in Genetic Research: Tracking Heredity

The “Fly Room.” The “Modern Synthesis” with Darwinism.

READ & RESPOND: Endersby, Ch. 6
 Endersby, Ch. 7

MAR 28 Directions in Genetic Research: The Nature of the “Gene”

Enzymes, vitamins, and genetic metabolic disease. Protein structure and function. Nuclein and heredity. Functional models (one gene-one enzyme).

READ AND RESPOND: Schultz, “The Evidence of the Nucleoprotein Nature of the Gene”

APR 2 Directions in Genetic Research: Experimental Paradigms

Delbrück, Phage Genetics, and the movement of “romantic” physicists.

READ & RESPOND: Endersby, Ch. 8

APR 4 Directions in Genetic Research: Molecules of Heredity

Structural methods and the molecule of heredity. Schrödinger’s “aperiodic crystal”.

READ & RESPOND: Schrödinger, *What Is Life?*

APR 9 Draft Paper & Comments

APR 11 The Discovery of the Structure of DNA

The narrative, and the character of James Watson.

READ & RESPOND: Watson, *The Double Helix*

APR 16, 18 Narratives of Discovery

Pauling, Watson, Crick and model-building. The role of Franklin.

READ & RESPOND: individually assigned selections of alternative accounts

APR 23, 25

Model organisms, applied biology, and discovery.

READ & RESPOND: Endersby, Ch. 9

MAY 2 Final Version of Research Paper due by 11:00 a.m.

Syllabus Version: 8 January 2019