

SYLLABUS **HI 581** **Spring 2020**

Dr. William Kimler

CLASS: Tu/Th 10:15-11:30 in Withers 110

3 credit hours

OFFICE HOURS: Tuesday, 3:00 - 4:30; Wednesday, 1:30 - 4:00; and by appointment (you may email a request)

OFFICE: # 351 Withers Hall Dr. Kimler's [homepage](#)

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Catalog Description: Historical context of the individuals, ideas, scientific practices, and social goals that created the core concepts of the modern biological sciences, from Renaissance medicine to molecular biology, with a focus on interconnections of the scientific knowledge and perspective of the life sciences with other aspects of culture, including other sciences, views about nature and life, religious belief, medical practice, and agriculture. Topics include the development of biological experiments; theories of ecology and evolution; the chemical understanding of health, food, and drugs; and the modern molecular revolution. Credit will not be given for both HI 481 and HI 581.

About this Course:

HI 581 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.

Class sessions 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. In practice, you should expect to be able to

- 1) recognize and evaluate cultural influences on the practices and beliefs of biological science;
- 2) recognize and apply historical methods and evidence to interpret major issues in the development of biology and medicine;
- 3) analyze the theoretical and/or technical constraints on scientific practice by exploring past scientific ideas about life; and
- 4) explain how scientists' methods, practices, or concepts are particular to a time and place.

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 the 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.

On Reserve in the D. H. Hill Library Textbook Collection (Ask Us Center) RC133 .G6 J64 2006

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*, Harvard University Press, 2009.
On Reserve in the 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.

Weekly Readings (Primary Sources):

THE LIST is at <https://sites.google.com/ncsu.edu/hi-481/home/readings-list>

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.

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 for each source. 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 [Advice for Analytical Reading Responses](#).

As these comments coordinate with the class sessions, no late papers are accepted. I will drop the 3 lowest scores (but you must submit a response on the days when I assign individual readings).

50% : Research Paper of at least 4000 words [16 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 thesis.

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%: Draft Introduction, Outline, & Annotated Bibliography. You must meet with me 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. Include a draft Outline of the contents and development of the argument. Provide an annotated list of your sources to date, indicating the nature of the source and how it is applicable as evidence or historiography. Due **March 17**.

10% : Submission of Research Paper Draft and Comments on classmate’s draft.

A Draft version of the Research Paper is due by April 7. 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.

Each of you will review one classmate’s Draft and write Comments. We will do this as a workshop in class on Tuesday, April 7. See [Advice for Providing Comments](#).

30%: Research Paper. I expect you to consider comments from your classmates and from me in your revisions of the Draft for final submission. The finished version is due by **11 a.m., Tuesday, April 28.**

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. Citation format must follow the "notes and bibliography" system of *The Chicago Manual of Style*, available on-line <https://www.chicagomanualofstyle.org/tools_citationguide/citation-guide-1.html>. I do not accept in-text citations (parenthetical "author-date" format).

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 Holmes Hall, Suite 304, 2751 Cates Avenue, 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>

SEQUENCE OF TOPICS

JAN 7 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 9 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 the [Preface](#), on [function](#), on [tools](#) from *De humani corporis fabrica*

JAN 14 Experimental Investigation

Harvey's methods of research.

read & respond: Harvey, [*On the Motion of the Heart and Blood*](#) – thru Ch. 4

JAN 16 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 21 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 23 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 28 Disease and Public Health

Disease theories, contagion, sanitation.

read & respond: Chadwick, ["Recapitulation of Conclusions" in *Report on the Sanitary Condition of the Labouring Population of Great Britain*](#) (pp. 369-73)

Johnson, *The Ghost Map* (thru p. 187)

JAN 30 Contagion and epidemiology

read & respond: Snow, [*On the Mode of Communication of Cholera*](#)

FEB 4 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 6 DISCUSS **Term Paper ideas**

FEB 11 Methods for the Experimental Study of Physiology: Bernard on Experiment

read & respond: Bernard, [*Introduction to the Study of Experimental Medicine*](#), Part One

FEB 13 Proposal Writing: No class. **Proposal due Feb 14**

FEB 18 The Ecological Web and the History of Life

Economy of Nature and natural theology. Deep time. Ideas of progress and naturalistic explanation. Darwin's field investigations. The context of discovery.

read & respond: Lyell, [Ch. 5 \("Review of the causes which have retarded the progress of Geology"\)](#)

Buckland, [Ch. 2 \("Consistency of Geological Discoveries with Sacred History"\)](#)

FEB 20 Creating a Theory of Evolution

Theoretical inquiries: heredity and adaptation. The evolutionary tree. The theory of Natural Selection. Building the argument of *The Origin of Species*.

read & respond: Darwin, [Autobiography](#)

FEB 25 The Evolutionary View of Life

The argument of *The Origin of Species*.

read & respond: Darwin, [On the Origin of Species extracts](#) – Introduction thru Ch. 6

FEB 27 Unifying Biology

Reaction to *The Origin*. Acceptance and accommodation. New directions of research.

read & respond: assigned review of *The Origin of Species*

MAR 3 Investigations of Heredity

Plant and animal breeders. Darwinian theory and genetic mechanisms.

read & respond: Goodale, [The Principles of Breeding](#) - read the first few pages of each chapter to see the definition and issues, then skim each for a sense of the kind of evidences used

Endersby, Ch. 3

MAR 5 Mendel's Innovation

Mendel's methods and reception. Factorial and blending theories of heredity in 19th century

read & respond: Mendel, ["Experiments on Plant Hybrids"](#)

Endersby, Ch. 4

MAR 17 The "New Experimental Biology"

The experimentalist revolt against morphology. Intellectual and institutional contexts of the new biological disciplines.

Introduction, Outline, & Draft Bibliography due

MAR 19 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](#) - read "Editor's

Announcement" (p. 5) and the "Introduction," pp. 15-19

Haldane, extract from [Mechanism, Life, and Personality](#) - read from bottom of p. 52 - 65

MAR 24 Directions in Genetic Research: Tracking Heredity
The “Fly Room.” The “Modern Synthesis” with Darwinism.
read & respond: Endersby, Ch. 6
Endersby, Ch. 7

MAR 26 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).

MAR 31 Directions in Genetic Research: Experimental Paradigms
Delbrück, Phage Genetics, and the movement of “romantic” physicists.
read & respond: Endersby, Ch. 8

APR 2 Directions in Genetic Research: Molecules of Heredity
Structural methods and the molecule of heredity. Schrödinger’s “aperiodic crystal”.
read & respond: Schrödinger, *What Is Life?* - read the [Table of Contents & ch. 1](#), [ch.2](#) and [ch. 7](#)

APR 7 Paper Draft Workshop: **Research Paper Draft due**

APR 9 The Discovery of the Structure of DNA
The narrative, and the character of James Watson.
read & respond: Watson, *The Double Helix*
Try to read the account in one or a few sittings -- read it as a story, not a textbook. Focus in this Response on your overall impression of Watson and the nature of this collaborative discovery.

APR 14 & 16 Narratives of Discovery
Pauling, Watson, Crick and model-building. The role of Franklin.
read & respond: individually assigned reviews of Watson's account of the discovery

APR 21 & 23 Model organisms, applied biology, and discovery.
read & respond: individually assigned alternative accounts of the discovery

April 28: Final Paper Due 11 a.m.