

History of Science 333: History of Modern Biology
Spring 1999

Prof. Lynn K. Nyhart

Office: 7127 Social Science Bldg.

Office Hours: Thurs. 1:30-3:15 and by appt.

262-3970

lknyhart@facstaff.wisc.edu

Format: Lecture/discussion

Meets: TR 9:30-10:45 in Social Science Bldg. 6232. In addition, graduate students will meet for further discussion, especially of historiographic issues, on Thursdays 12-1 in the History of Science Conference Room, Soc. Sci. 7130. Interested undergraduates are welcome to attend.

This year's course will focus on the history of biology since the mid-nineteenth century. The central stories will concern the history of genetics from its agricultural origins in the nineteenth century to the recent history of recombinant DNA and the history of evolution from Darwin's time through the 'new synthesis' in the mid-twentieth century up to the sociobiological 'synthesis' of the 1970s; some attention will also be paid to the rise of ecology. Through these stories, we will grapple with biologists' ideas about reductionism, holism, and levels of biological organization; analyze different modes of scientific practice (lab work, fieldwork, theorizing); and consider the institutional and broader social politics of biology as it has developed over the last century or so. Finally, we will also consider how these various themes are reflected in the ways that the history of biology has been written, by critically examining and comparing scientists' and historians' accounts.

Readings

Many readings for this course are provided in a reader. Two copies of this reader will be available in the History of Science Conference Room, 7130 Social Science. One is to remain in the room at all times for people to read there (a key may be obtained in the departmental office, or a prof. or grad student in the dept. can open it for you); the other copy may be removed briefly for photocopying. (There will be a sign-out sheet.) I recommend that you take the entire reader down to the Social Science Copy Center (6120 Soc. Sci., open 8 a.m. - 4:15 p.m.; get a debit card for the fast-feed photocopier) and copy it so you have it available all at once. (Unit One readings should run you a little under \$13.)

The following books are available for purchase at the University Book Store and have been placed on reserve in College Library:

Ernst Mayr, *One Long Argument* (first assignment due 1/21)

Peter J. Bowler, *The Non-Darwinian Revolution*

John and Mary Gribbin, *Mendel in 90 Minutes*

Robert E. Kohler, *Lords of the Fly*

James D. Watson, *The Double Helix*

Edward O. Wilson, *Naturalist*

General Requirements: Because this course revolves in good part around discussions based on

the reading, its success depends on its participants' having read the material carefully and being willing to talk about it. We will read both "primary" sources (writings by participants at the time) and "secondary" sources (writings by historians and scientists reflecting on what happened), with an emphasis on the latter. But note that one of the issues of the course surrounds exactly the blurriness of the line between primary and secondary sources!

Undergraduate Requirements:

Class participation (see below): 1/3

Two take-home essay exams (4-5 pages, **due Thurs. Feb. 25 and Thurs. April 8**): 1/6 each

Final paper (7-9 pages, **due Thursday, May 13**): 1/3

Class participation: Your class participation grade derives from three sources: in-class discussion, reading responses and occasional in-class assignments, and participation in the two writing workshops. The weight of each part of these is not fixed, to allow, for example, shy students who are not aggressive discussants to demonstrate their thoughtful analysis of the readings in written form. I will pay close attention to attendance, since you cannot participate even passively in the course if you aren't there.

Reading responses: For each class you will receive a focus question or set of questions for you to think about as you read. These will be typically delivered to you by email no later than Sunday night of each week, covering both the Tuesday and Thursday class. (I will make every effort to send these out earlier.) You are required to turn in **one reading response every week** over the course of the semester (except for the first week). Each reading response should be no more than one page long (I prefer word-processed, typed, or emailed, but handwritten is okay, so long as it is legible and in pen) and may be formulated in response to questions I pose or represent your own reactions to the readings and analysis of them. The idea is to get you to practice thinking through the material BEFORE you get to class. Therefore, you need to have the response ready to hand in at the beginning of the class that covers the readings you discuss. I will not accept reading responses handed in later than the class covering the relevant readings; if you email a response to me, it must be sent before 9 a.m. the day of the class. Any additional reading responses can be counted as extra credit for your class participation grade.

Writing Workshops: The class before the first and second take-home essays are due will be devoted to workshopping a draft of your paper with a small group of students. The purpose of these workshops is for you to help one another clarify and tighten your arguments, and also to expose you to other perspectives on the questions. In answering essay questions, there is no one right answer; your essays will be judged on their logic, use of evidence, and organization, all of which together add up to making a persuasive case for the position you take. More details on the writing workshops will be forthcoming closer to the first one.

For the final paper, students may choose between an essay based on a broad question provided by me or a research paper, the topic chosen in consultation with me. There will be no formal writing workshop for the final paper, but students are encouraged to share drafts, with me and/or with each other. If there is sufficient sentiment for it, I will set up a writing workshop time after the last class.

Honors Requirements: write both the final essay and a research paper.

Graduate Requirements: Writing: 20+ pages of scholarly prose (5 book reviews, a bibliographic or historiographical essay to prepare for prelims, a research paper, a dissertation proposal) as determined by your individual needs. Class participation is also factored into your grade (note that it is more important to say intelligent things than to talk a lot).

Topics and Assignments (readings marked with a * are in the photocopied reader):

1/19: Introduction: "Cultures" of Biology: Conflict, Cooperation, Growth, and Change over Time

Unit I: Darwinism and Mendelism; The Field and the Lab, 1859-1929

1/21: Darwin and the Darwinian Revolution

- *Charles Darwin, *On the Origin of Species* (London: John Murray, 1959), Table of Contents (look through carefully), pp. 80-96, 459-490
- Ernst Mayr, *One Long Argument*, pp. 1-47 (esp. 35-47)

1/26: Biological Theory and Practice after Darwin

- Bowler, *The Non-Darwinian Revolution*, pp. 1-19, 47-90
- Ernst Mayr, *One Long Argument*, pp. 90-107

1/28: "Man's" Place in Nature, and Biology's Place in Late Nineteenth-century Culture

Bowler, *Non-Darwinian Rev.*, 131-173

*Darwin, *The Descent of Man*, 2 ed. (New York: Hurst, 1874), pp. 80-81, 109-112, 194-197, 208-215, 579-589

- *Nancy Leys Stepan, "Race and Gender: The Role of Analogy in Science," *Isis*, 1986, 77: 261-277.

2/2: Mendel in context: agriculture, commerce, and religion in central Europe

John and Mary Gribbin, Mendel in 90 Minutes (all)

- *Robert Olby, "Mendel No Mendelian" *History of Science* 17 (1979): 53-72, reprinted in Olby, *Origins of Mendelism*, 2nd ed. (Univ. Chicago Pr., 1985), pp. 234-258

Note: for an interesting and informative way to explore more about Mendel and his paper (see next assignment), check out <http://MendelWeb>

2/4: Was Mendel a "Mendelian"? What was he after?

- *Gregor Mendel, "Experiments on Plant Hybrids," pp. 1-48 in Curt Stern and Eva Sherwood, eds., *The Origin of Genetics: A Mendel Sourcebook* (San Francisco: W.H. Freeman, 1966)

2/9: The "Rediscovery" of Mendel's Laws, the "Mendelian Revolution," and the Experimentalist-Naturalist Dichotomy

Bowler, *Non-Darwinian Revolution*, 113-125

- *David Magnus. "Theory, Practice, and Epistemology in the Development of Species

- Concepts," *Stud. Hist. Phil. Sci.* 27 (1996): 521-533 (Note: this is parts I-IV of the article; the rest is to be read later.)
- *Hugo de Vries, "Evolution and Mutation," pp. 1-26 in idem, *Plant Breeding* (Chicago: Open Court, 1907)
- *T. H. Morgan, "The Theory of the Gene," *American Naturalist* 51 (1917): 513-544
- 2/11: Deepening the Picture: Experimentalists' and Naturalists' Practices and Locations
- *Bert Theunissen, "Knowledge is Power: Hugo de Vries on Science, Heredity, and Social Progress," *Brit. J. Hist. Sci.* 27 (1994): 291-311
- *Sharon Kingsland, "The Battling Botanist: Daniel Trembly MacDougal, Mutation Theory, and the Rise of Experimental Evolutionary Biology in America, 1900-1912," *Isis*, 82 (1991): 479-509
- *Lynn K. Nyhart, "Natural History and the 'New' Biology," pp. 426-443, 490-491 in *Cultures of Natural History*, ed. N. Jardine, J.A. Secord and E.C. Spary (Cambridge University Press, 1996)
- 2/16: "Classical" Genetics and the Culture of the (Morgan) Lab
(Undergrads: receive Unit I Take-home essay questions)
Robert E. Kohler, *Lords of the Fly*, pp. 1-52, 91-132
- 2/18: Translations and Transplantations: Genetics Between Europe and America
- *Jonathan Harwood, "The Reception of Morgan's Chromosome Theory in Germany: Inter-War Debate over Cytoplasmic Inheritance," *Medizinhistorisches Journal* 19 (1984): 3-32 (Translations of German passages follow in the reader.)
Kohler, *Lords*, 87-90, 133-170 (skim)
- 2/23: Workshop on Unit I Essays
- 2/25: Eugenics and its Legacies
- UNIT I Take-home Exams due IN CLASS**
- Unit II: New Metaphors and New Cultures: Realigning Biology, ca. 1935-1966**
- 3/2: Population Thinking, Fly Genetics, Population Genetics
- Bowler, *Non-Darwinian Rev.*, pp. 107-113, 125-130
- *Mark B. Adams, "Sergei Chetverikov, the Kol'tsov Institute, and the Evolutionary Synthesis," pp. 242-278 in Ernst Mayr and William Provine, *The Evolutionary Synthesis: Perspectives on the Unification of Biology* (reprint edition, Harvard U. Press, 1998)
- Kohler, *Lords*, pp. 250-293
- 3/4: The Evolutionary Synthesis: What did it synthesize? What, and who, got left out?
- Mayr, *One Long Argument*, pp. 132-140; review pp. 32-47
- *David J. Depew and Bruce J. Weber, pp. 299-303 in *Darwinism Evolving: Systems Dynamics and the Genealogy of Natural Selection* (MIT Press, 1995)
- *Magnus. "Theory, Practice, and Epistemology," pp. 533-545 (Parts V-IX) (filed earlier in reader)

- *Mayr, Ch. 5, "The Systematic Categories and the New Species Concept," pp. 102-122 in idem, *Systematics and the Origin of Species* (Columbia Univ. Pr., 1942).
- *J. Chris Pires, "Power of the Unified Narrative: Placing Botany in the Evolutionary Synthesis," Paper delivered at conference on the "Casualties of History: Losers, the Lost, and the Problem of Defeat," held at Princeton University, Oct. 4-5 1997.

SPRING BREAK

- 3/16: Human evolution and genetics before and after Hiroshima
 - *Garland Allen, "J. Huxley and the Eugenical View of Human Evolution," pp. 193-222 in C. Kenneth Waters and Albert Van Helden, eds., *Julian Huxley: Biologist and Statesman of Science* (Houston: Rice U. Press)
 - *Diane Paul, "'Our Load of Mutations' Revisited," *J. Hist. Biol.* 20(3), Fall 1987, 321-335
 - *John Beatty, "Stalemate in the Classical/Balance Controversy," *ibid.*, 289-319
- 3/18: The Unity and Diversity of Mankind: Human Evolutionary Studies in the Cold War
 - *Dobzhansky, Chapter 9: "Polymorphism, Class, and Caste" pp. 230-265 in idem, *Mankind Evolving: The Evolution of the Human Species* (NY: Bantam Books, 1962)
 - *Donna Haraway, Chapter 8: "Remodeling the Human Way of Life: Sherwood Washburn and the New Physical Anthropology" (selection), pp. 197-217 in idem, *Primate Visions: Gender, Race, and Nature in the World of Modern Science* (NY: Routledge, 1989)
- 3/23: Physics, Phage, and Molecular Biology in postwar England and America
 - James D. Watson, *The Double Helix* (Chapters 1 - 15)
 - *Evelyn Fox Keller, "Physics and the Emergence of Molecular Biology: A History of Cognitive and Political Synergy," *J. Hist. Biol.*, 23 (1990): 389-410
- 3/25: Watson's Double Helix: the reconstruction of the past and the construction of history
 - Watson, *The Double Helix* (Ch. 16 - end)
 - *John Ziman, "The Quest of the Golden Helix," pp. 15-21 in Ziman, *Puzzles, Problems, and Enigmas* (NY: Cambridge U. Pr. 1981)
 - *Erwin Chargaff, "A Quick Climb Up Mount Olympus," *Science*, vol. 159, 29 March 1968: 1448-1449
 - *Reviews by Sinsheimer, Lear, Waddington, and letters by Perutz, Wilkins, and Watson, 191-198, 204-212, in James D. Watson, *The Double Helix*, ed. Gunther Stent. (Norton Critical Edition, 1980)
- 3/30: Information as an Organizing Concept in the Postwar Period: The Genetic Code, 1952-1966
 - *F. H. C. Crick, "The Genetic Code—Yesterday, Today, and Tomorrow," pp. 3-9 in *The Genetic Code. Cold Spring Harbor Symposia on Quantitative Biology* vol. 31 (Cold Spring Harbor, NY, 1966)
 - *Crick, *What Mad Pursuit: A Personal View of Scientific Discovery* (Basic Books, 1988), pp. 108-136
 - *Keller, *The Body of a New Machine: Situating the Organism Between Telegraphs and Computers.* *Perspectives on Science* 2 (1994): 302-323

4/1: Naturalists in a Molecular World

E. O. Wilson, *Naturalist*, pp. 138-235, **esp. pp. 218-235**

*T. Dobzhansky, "Are Naturalists Old-Fashioned?" *American Naturalist* 100 (1966), 541-550

4/6: Workshop on Unit II Essays

4/8: Film: The Race to the Double Helix

Unit II Take-home Essays Due in Class

Unit III: Systems, Hierarchies, and the Ethos of Intervention: Biology as an Engineering Science

4/13: Ecology as Cold War Science: Radiation and Systems Biology

*Joel Hagen, *The Entangled Bank*, pp. 100-145

*Peter J. Taylor, "Technocratic Optimism, H. T. Odum, and the Partial Transformation of Ecological Metaphor after World War II," *J. Hist. Biol.* 21 (1988): 213-244

4/15: Evolutionary Ecology

*Sharon E. Kingsland, Chapter 8, "The Eclipse of History," pp. 176-205 in idem, *Modeling Nature: Episodes in the History of Population Ecology* (Chicago: Univ. of Chicago Press, 1985)

Wilson, *Naturalist*, pp. 238-281

4/20: Wilson and the "New **Synthesis**" of Sociobiology

Wilson, *Naturalist*, pp. 282-329

*Wilson, *Sociobiology: The New Synthesis* (Cambridge: Belknap/Harvard, 1975), Chapter 1, "The Morality of the Gene" (pp. 3-6); Ch. 14: "Roles and Castes" (selections: pp. 298-313, 554-555).

4/22: The Sociobiology Debate(s)

*Stephen Jay Gould, "Biological Potential vs. Biological Determinism" from *Natural History Magazine* (May 1986), reprinted as pp. 343-351 in Arthur L. Caplan, ed., *The Sociobiology Debate: Readings on the Ethical and Scientific Issues Concerning Sociobiology* (NY: Harper and Row, 1978)

*Richard Lewontin, Steven Rose, and Leon J. Kamin, Chapter 9, "Sociobiology: The Total Synthesis" pp. 233-264 in idem, *Not in Our Genes: Biology, Ideology, and Human Nature* (NY: Pantheon, 1984)

*Anne Fausto-Sterling, "Putting Woman in Her (Evolutionary) Place," pp. 156-204 in idem, *Myths of Gender: Biological Theories about Women and Men* (NY: Basic Books, 1985) (skim pp. 167-175)

Wilson, *Naturalist*, pp. 330-353

4/27: Recombinant DNA (1): The Debate, ca. 1975

*Science for the People, "Biological, Social and Political Issues in Genetic Engineering," pp. 99-126 in David A. Jackson and Stephen P. Stich, eds., *The Recombinant DNA Debate* (Engelwood Cliffs, N.J.: Prentice-Hall, 1979)

*Joshua Lederberg, "DNA Splicing: Will Fear Rob Us of Its Benefits?" (1975) reprinted in *ibid.*, pp. 173-180.

*Susan Wright, "Recombinant DNA Technology and its Social Transformation, 1972-1982," *Osiris*, 2nd ser., 1986, 2: 303-325 (=Parts I-III)

4/29: Recombinant DNA (2): The (Re)Entry of Industry

*Susan Wright, "Recombinant DNA Technology and its Social Transformation, 1972-1982," *Osiris*, 2nd ser., 1986, 2: 325-60 (Part IV-end)

*Paul Rabinow, Chapter One, "Toward Biotechnology," pp. 19-45 in *idem*, *Making PCR: A Story of Biotechnology* (Chicago: University of Chicago Press, 1996)

5/4: Biotechnology and the Cyborgian Future

*Donna J. Haraway, "FemaleMan©_Meets_OncoMouse™. Mice Into Wormholes: A Technoscience Fugue in Two Parts" pp. 49-118 (skim pp.69-78) in *idem*, *Modest_Witness@_Second_Millennium. FemaleMan©_Meets_OncoMouse™. Feminism and Technoscience.* (NY: Routledge, 1997).

5/6: The Diversity of Life(?) And the Diversity of Biology Wilson, *Naturalist*, 354-364

Final Essay Due Thursday, May 13, at 12:25 pm. IN MY MAILBOX. NO EXTENSIONS!

GRADING POLICIES:

Extensions are only granted if requested before the due date, and only in case of illness or other serious emergency. All extensions will have a definite new due date established. Papers received after the new due date will be subject to late paper penalties.

Late paper policy: any piece of writing that you hand in late without an extension will have the following penalties assessed: a quarter of a grade for every working day late. For example, if the paper on its merits deserves a B, after one day it would receive a B/BC, after two days a BC, after three a BC/C, after four a C. NOTE: LATE TAKE-HOME FINAL EXAMS WILL NOT BE ACCEPTED.

Plagiarism: plagiarism is grounds for automatic failure on the assignment plagiarized (take-home exam or paper). If you use 3 or more words in a row from another source, it must be placed in quotation marks and footnoted. Otherwise, it is plagiarism.

Paper rewrites: Anyone who wants to rewrite a research paper for a higher grade may do so. (Take-home essays are not eligible.) Rewrites must be substantial, not confined to copyediting (grammar, spelling, etc.); you should therefore consult with me if you plan to rewrite. The original paper with my comments on it must be handed in with the rewrite. I will accept rewrites up to the time the final exam is due, but no later than that.

If you have questions about a grade, come speak to me. If the problem is not solved, speak with the Chair, Prof. David Lindberg. He will attempt to resolve the issue informally and inform you of

the Appeals Procedures if no resolution is reached informally.

Grading Scale for Essay Exams:

- A: For outstanding essays only. Thesis and argument are clear, thought-provoking, and based on correctly understood facts; material used to support the argument synthesizes ideas from different parts of the course (readings, lectures, discussions from different weeks); relationships drawn between facts and ideas are sophisticated, subtle, and/or original. Writing is grammatically correct and succinct. The argument flows well from point to point, without any puffery or wasted words.
- AB: For very good essays that for some reason fall short of the criteria listed above. For example, the argument may be murky in one place; information may be presented that doesn't directly or clearly contribute to the argument; writing style may be awkward here and there, or flawed by one or two consistent (if minor) grammatical errors.
- B: Your basic okay grade. The essay may pursue a straightforward but not especially deep or sophisticated argument; it is okay as far as it goes, but doesn't penetrate the material very far. It may have a flash of brilliance that is unfulfilled, counterbalanced by minor grammatical problems, a weakness in argumentation, and/or a significant misunderstanding of events or chronology.
- BC: The essay shows some of the basics of the ideal essay, but is weakened by a lack of serious think-work or writing problems. It may make superficial connections without offering sufficient evidence to make the connections plausible or persuasive, or it may have what is in principle a good argument supported by incorrect facts or chronology. Alternatively, it may provide a fairly solid argument with minor flaws, from which the reader is repeatedly distracted by awkward or ungrammatical prose.
- C: A grade signifying some serious problem in essay-writing. It may deliver facts without a recognizable thesis or argument; it may wander away from the point; or it may be a thoughtful attempt so weakened by writing problems (grammar, punctuation, word choice) that it is difficult for the reader to understand a crucial point you are trying to make.
- D: A marginal grade. There may be enough in here to show you have attended a few lectures and/or done some of the reading, but the essay indicates no effort at synthesis or thinking on your own, or else shows a serious misunderstanding of the nature of the material and/or the assignment. Also used for essays that are just barely coherent.
- F: For unacceptable essays. An essay may be judged unacceptable if it contains plagiarism (see below); if it consists primarily in content inappropriate to the question or the material for this course; if it shows a complete misunderstanding of the course content; or if the writing fails to meet standard college-level requirements of basic communication in English.

History of Science 333

Revised Syllabus

Spring 1999

(readings marked with a * are in this reader)

2/23: Population Thinking, Fly Genetics, Population Genetics

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5/6: The Diversity of Life(?) And the Diversity of Biology

Wilson, *Naturalist*, 354-364

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History of Science 538: Science in the Twentieth Century--Historical Themes & Issues

3 Credits; H(Humanities); I(Intermediate)

2 hrs lec (11:00 MW, 5106 Social Science), 1 hr disc (11:00 F, 6304 Soc Sci)

Prerequisites: Hist of sci grad or undergrad majors only. Jr st or cons inst. Not open to stdts who have had Hist Sci 203

Instructor: Mr. Siegel

Major themes in the physical and biological sciences in the twentieth century, with attention to:

- * conceptual development in science
- * interaction of science and society
- * philosophical issues in science
- * personalities in science

Lectures

Lectures will meet with History of Science 203, and will furnish additional material for the Friday discussion meetings (see 203 course description for lecture topics).

Discussion Meetings

Friday discussion meetings will deal with common reading material and work in progress on term paper projects.

Course Requirements

Students are asked to bring to each weekly discussion meeting a response paper (approximately 2 pages double-spaced), responding to the common reading material for the week (and integrating supplementary material from lecture and other reading as appropriate); these will be utilized in the discussions in various ways and will be turned in. Alternatively, the paper can on occasion respond primarily to some other appropriate reading material, oriented either toward the weekly topic or toward the term paper.

A serious term paper (15 pages for undergrads, 20-25 for grads) will be due in lieu of a final exam at 12:25 p.m., Wednesday, May 17. The topic should be established in consultation with me, and it would be wise to consult with peers as well as with me throughout.

Brief presentations (10 minutes each) of the term paper topics will be made in the final two discussion sessions; various formats are possible.

The final grade will be based on the response papers, class discussion, the term paper, and the presentation. Attendance is required at all class sessions.

