

Hist. Sci. 350: The Molecular Revolution in Biology: What is Life and Why it Matters, 17th Century to the Present

Dr. Erik L. Peterson / epeterson6@wisc.edu

Spring Semester 2012

Tuesdays (mostly discussion), 3:30p to 5:25p and Thursdays (mostly lecture), 3:30-4:20p

Theme of the course

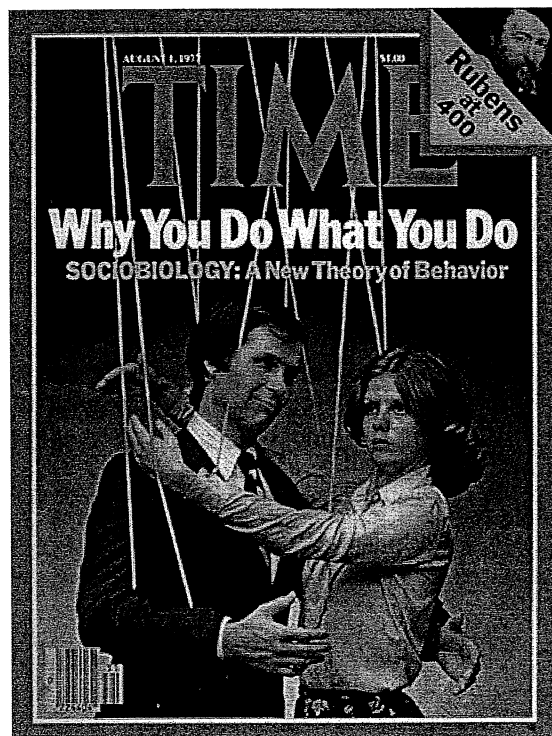
In 1977, *Time* magazine ran a cover story on a new scientific concept known as sociobiology:

It made some people upset. The sociobiology discussed in this article harnessed two new ideas: (a) that human behavior, like all other aspects of animal existence, is programmed by collections of DNA molecules known as genes; (b) those genes were inherently "selfish."

Wasn't biology about classifying animals and plants and giving an evolutionary story about their relationship? How did it get to be about the structure, characteristics, and behavior of invisible molecules? And what are the implications of this sort of thinking? This course will attempt to address these sorts of questions.

The course is structured around three questions that roughly coincide with historical debates:

1. What is Life? (17th to late-19th century)
2. What is the basic unit of life? (1880s-1970s)
3. Does it matter if we are "just molecules"? (1960s-present)



Books required for purchase in the order you'll need them (I prefer you use A Room of One's Own on State and W. Johnson)

1. Lily Kay, *The Molecular Vision of Life*
2. Robert Kohler, *Lords of the Fly*
3. Michel Morange, *The History of Molecular Biology*
4. Lenny Moss, *What Genes Can't Do*

In addition, there is a **course reader** for purchase at the Social Sciences copy shop.

Assessment

- Weekly discussion questions, participation (15%)
- Quiz 1 (10%); Quiz 2 (15%); Quiz 3 (15%)
- Final paper & presentation (all parts = 45%: initial essay - 5%; draft 1 - 10%; presentation - 10%; final paper - 20%)

Possible topics for final paper include: reductionism vs. anti-reductionism; Sociobiology; *The Selfish Gene*; the Human Genome Project; Eugenics and 'New'genics.

CP stands for 'found in course packet'

<...> stands for e-resources either emailed or on Learn@UW

Hist. Sci. 353: The Molecular Revolution in Biology: What is Life and Why it Matters, 17th Century to the Present

Dr. Erik L. Peterson / epeterson6@wisc.edu

Spring Semester 2012

Tuesdays (mostly discussion), 3:30p to 5:25p and Thursdays (mostly lecture), 3:30-4:20p

Important notes:

1. I do not accept late work. My reasoning behind not accepting late work is not to be mean. It really isn't. It's because the actual purpose of assignments like these is to keep students current with work in order to keep discussions rolling. Extrinsic motivators (like grades for you and salaries for me) are sometimes the only ways to keep us motivated enough to do work. Doing the this type work after the fact--and I am limiting it only to the kinds of work I'm assigning in this class, not homework in general--doesn't serve the purpose of inspiring communication or deeper understanding of the issues: it's merely about the grade. Work completed now, far after the due dates, would not demonstrate that the student was following along and able to participate in the discussions, which is the whole point. So do your work steadily and every day to prevent getting in the situation where you need an excuse for an extension.
2. My classes are intentionally flexible so that I can judge where students are and then adjust accordingly. Thus the schedule below is permanently tentative. I reserve the right to make changes. I will do my best to communicate those to you well in advance.

COURSE SCHEDULE

(Weekday/Date L=lecture, D=discussion — Topic)

Week 1

Tu/ Jan 24 D — Intro

WHAT IS LIFE?

Th/Jan 26 L — German Vitalism

Read: CP-> Descartes, *Treatise of Man* (sections); Hunter, "On the vital principle"; Blumenbach, "On the *Nisus formativus*."

Week 2

Tu/Jan 31 D — Lavoisier and Kant

Read: CP-> Lavoisier, "Experiments on Respiration" and "Memoir on Heat"; Kant, *Critique of Judgment* (selections).

*Write: "What are we and does it matter?" Initial Essay. Post to Google Docs by class.

Th/Feb 02 L — Cell Theory

Read: CP-> Schwann, *Microscopical Investigations* (selections)

CP stands for 'found in course packet'

<...> stands for e-resources either emailed or on Learn@UW

Hist. Sci. 353: The Molecular Revolution in Biology: What is Life and Why it Matters, 17th Century to the Present

Dr. Erik L. Peterson / epeterson6@wisc.edu

Spring Semester 2012

Tuesdays (mostly discussion), 3:30p to 5:25p and Thursdays (mostly lecture), 3:30-4:20p

Week 3

Tu/Feb 07 D — Helmholtz and Ludwig; the biophysical reaction

Read: CP-> Helmholtz, "On the Essence of Fermentation and Putrefaction"; and "Interaction of Natural Forces"; Ludwig, "Introduction," *Lehrbuch der Physiologie* (1858).

Also, Coleman, *Biology in the 19th Century*, ch. 6.

Th/Feb 09 L — *Entwicklungsmechanik*

Read: Nyhart, *Biology Takes Form*, ch. 9.

*Quiz 1 live on Learn @ UW.

Week 4

Tu/Feb 14 D — Roux, Driesch, and Loeb

Read: CP-> Roux paper; Driesch paper; Driesch, *Science and Philosophy of the Organism*; Loeb, "the Mechanistic Conception of Life".

*Quiz 1 due by class time on Learn @ UW.

*Th/Feb 16 L — Begin final papers

No reading, but should have an idea of what you'll want to write on.

WHAT IS THE BASIC UNIT THAT MAKES UP LIFE?

Week 5

Tu/Feb 21 D — Mendel, Morgan, and the Fly Room. **We may have a laboratory this day instead of normal class meeting.**

Read: CP-> TH Morgan, "Sex-Linked Inheritance in *Drosophila*" (1910); * "Chromosomes and Heredity" (1910); * "The Localization of the Hereditary Material in the Germ Cells" (1915); Alfred Sturtevant, "The Linear Arrangement of Factors in *Drosophila*" (1913). and Kohler, *Lords of the Fly*, "Preface" and ch. 1.

Th/Feb 23 L — Chromosomes and development

Read: Kohler, *Lords of the Fly*, ch. 2

Week 6

Tu/Feb 28 D — Muller and Dobzhansky: the origins of theoretical population genetics

Read: HJ Muller, "Variation Due to Change in the Individual Gene" (1922); <Dobzhansky, *Genetics and the Origin of Species* (selections)>

And, Kohler, *Lords of the Fly*, ch. 3-5.

Th/Mar 1 L — Localizing the gene

Read: Kohler, *Lords of the Fly*, ch. 6.

CP stands for 'found in course packet'

<...> stands for e-resources either emailed or on Learn@UW

Hist. Sci. 353: The Molecular Revolution in Biology: What is Life and Why it Matters, 17th Century to the Present

Dr. Erik L. Peterson / epeterson6@wisc.edu

Spring Semester 2012

Tuesdays (mostly discussion), 3:30p to 5:25p and Thursdays (mostly lecture), 3:30-4:20p

Week 7

Tu/Mar 6 D — Why “Molecular” Biology?

Read: Kay, *Molecular Vision*, ch. 1-3; Morange, *History of MB*, Intro - ch. 2.

Th/Mar 8 L — X-Rays mark the spot

Read: Morange, *History of MB*, ch. 9.

Week 8

Tu/Mar 13 D — Biophysicists and the *Dreimännerwerk* (3 Man Paper)

Read: <Max Delbrück, “A Physicist Looks at Biology” (1949), *Phage and the Origins of Molecular Biology*, pp. 9-22; Schrödinger, *What is Life?* (1944); Bohr, “Light and Life.”>

Th/Mar 15 L — Making institutions “molecular”: What’s in a name?

Read: Kay, *Molecular Vision*, chs. 5-6.

Week 9

*Tu/Mar 20 D — The Code of Life 1: “Life Story” (1987). **We may move this to a night movie showing, TBD.**

Read: <Jim Watson, “Growing up in the Phage Group,” *Phage and the Origins of Molecular Biology*, pp. 239-45.>

And: Morange, *History of MB*, ch. 4-6.

Th/Mar 22 L — The Code of Life 2

*No readings, but Quiz 2 goes live.

Week 10

Tu/Mar 27 D — Why DNA?

Read: CP-> Hershey and Chase, “Independent Functions of Viral Protein”; Watson and Crick, “The Structure of DNA” and “Genetical Implications of the Structure of DNA”.

And: Morange, *History of MB*, ch. 11-12.

Th/Mar 29 L — Beyond DNA

Read: CP-> Gamow, “Relation of DNA to Protein”

****QUIZ 2 DUE on Learn @UW BEFORE you leave for break.****

SPRING BREAK

CP stands for ‘found in course packet’

<...> stands for e-resources either emailed or on Learn@UW

Hist. Sci. 353: The Molecular Revolution in Biology: What is Life and Why it Matters, 17th Century to the Present

Dr. Erik L. Peterson / epeterson6@wisc.edu

Spring Semester 2012

Tuesdays (mostly discussion), 3:30p to 5:25p and Thursdays (mostly lecture), 3:30-4:20p

Week 11

Tu/Apr 10 D — Regulatory genetics of Jacob and Monod

Read: CP-> Jacob and Monod, "Genetic Regulatory Mechanisms in the Synthesis of Proteins"; <Kay, *Who Wrote the Book of Life?*, ch. 5-6>

And: Morange, *History of MB*, ch. 13-15.

Th/Apr 12 L — Homeobox

No readings.

*Write: Draft 1 of paper due on Google Docs by FRIDAY, APR. 13th.

Week 12

Tu/Apr 17 D — Evo-devo and modern genomics

Read: <Barnes and Dupré, *Genomes and What to Make of Them*, ch. 5>

*Write: BRING PAPER COPY of Draft 1 to class.

Wednesday, April. 18 or Thursday, April 19: Set up a meeting with Dr. P to go over papers in more detail (optional, but recommended).

Th/Apr 19 L — Why does it matter if we're just molecules?

No readings.

WHY DOES IT MATTER IF WE'RE JUST MOLECULES?

Week 13

Tu/Apr 24 D — Sociobiology, *The Selfish Gene*, Bio-engineering (presentation day)

Non-presenters read: <E. O. Wilson, *Sociobiology* (selections); Dawkins, *The Selfish Gene* (selections)>; CP-> Jonas, "Biological engineering: a preview"

Th/Apr 26 L — Reductionism as a philosophy of biology [Class may have to be cancelled]

Week 14

Tu/May 1 D — The Human Genome Project and GMOs (presentation day)

Non-presenters read: CP-> Beatty, "Origins of the US Human Genome Project"; Morange, *History of MB*, ch. 20. Selection on GMOs (up for discussion)

Th/May 3 L — What Genes Can't Do: Anti-reductionism wins? (debate day) [grene, "biology and the problem of levels of reality"]

Read: Lenny Moss, *What Genes Can't Do*, ch. 5-6

*Quiz 3 live on Learn @ UW.

CP stands for 'found in course packet'

<...> stands for e-resources either emailed or on Learn@UW

Hist. Sci. 353: The Molecular Revolution in Biology: What is Life and Why it Matters, 17th Century to the Present

Dr. Erik L. Peterson / epeterson6@wisc.edu

Spring Semester 2012

Tuesdays (mostly discussion), 3:30p to 5:25p and Thursdays (mostly lecture), 3:30-4:20p

Week 15

Tu/May 8 D — Eugenics and “Newgenics” (presentation day)

Non-presenters read: Kay, “Life as Technology”; CP-> Kitcher, “Utopian Eugenics” and reply by Diane Paul.

Th/May 10 L — Conclusions

*No reading, but Quiz 3 due by class time on Learn @ UW.

FINAL ESSAYS DUE by 5pm on Google Docs BEFORE leaving for break