Phil 147
Philosophy of Biology
Fall 2011, Tues., Thurs., 12:30-1:50 pm

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1. Course Description

The various sciences each have a subject matter—biology, in particular, studies the processes involved in living organisms. Philosophy of biology likewise has a subject matter—biology itself. As a part of philosophy of science, a major part of the goal in philosophy of biology is to understand the ways in which biologists produce knowledge. This inquiry addresses such questions as: What kinds of explanations do biologists provide? How do the explanations of biology relate to those of physics and chemistry? A distinctive feature of biology is that the phenomena it studies have evolved. How can we know about the history of living systems and the processes that shape evolution? Our investigation of biology will look both at its history and its contemporary practice. The reason for turning to its history is that many of the fundamental ideas that guide contemporary biology were developed over the last 200 years and can be identified more crisply during the historical development of modern biology. Thus, we will consider the development of cell theory, physiological chemistry, evolution, and genetics in the 19th century. Many of the same theoretical and conceptual issues that biologists confronted in the 20th century continue to be the focus in contemporary biology, especially those concerned with the mechanisms responsible for biological phenomena and their evolution. To ground our discussion of the contemporary period we will focus on research on one biological phenomenon--circadian rhythms. Students are invited and encouraged to draw upon their own knowledge of biology and its history in class discussions.

Given the nature of the class, substantial material will be presented in lectures that goes beyond what is included in the readings. Also, philosophy is an activity, and learning activities requires active engagement. Accordingly, class attendance and discussion is critical. Although we will have discussions on other occasions as well, several classes are designated as discussion classes and the topics for discussion in these classes will be determined by students.

2. Course Requirements

Class attendance is **mandatory**. Missing classes more than very occasionally will result in a reduction in your grade. To get the most out of the class, it is absolutely essential that you come to class having read the assigned material and being prepared to discuss it. This does not mean that you are expected to understand everything in the assigned reading prior to class. Part of the function of classes will be to clarify and interpret the assigned readings. To ensure that this happens and to foster subsequent discussions in class, you will be required to turn in a very short (one paragraph) comment or question on *readings assigned during each week of the quarter*. You can write about anything you found interesting, puzzling, strange, clearly wrong, provocative, etc. These will be graded as acceptable or unacceptable. To ensure that your submission is acceptable, your comment or question must demonstrate that you have read and thought about the assigned material. (Your paragraph may focus on one specific part of the reading--do not try to discuss everything.) These must be submitted as email (as plain text, ***not as attachments***) to phil147@mechanism.ucsd.edu by 6AM on days marked with an asterisk in the schedule of classes below. You must turn in eight acceptable weekly assignments to receive a passing grade for the course. (If I do not respond with a note that your submission is unacceptable, you can assume that it acceptable.)

Your base grade in the course will be based on two examinations and one 3-5 page paper. The mid-term and final examination will each count for 30% of your grade and the paper will count for 40% of the grade. The paper, due by NOON on Wednesday, November 23, must be on one of the topics that will be assigned in class. If possible,

the paper should be submitted in Word by email attachment (please be sure to check for viruses before submitting your file!) to papers@mechanism.ucsd.edu. Above average or below average participation in class discussions can result in a raising or lowering of your final grade from what is determined by the above percentages on these other assignments.

3. Texts

All of the reading assignments can be found by following links on the web site. See the schedule of classes and readings below.

4. Email List

There is an email distribution lists for this course. It is required that you subscribe to this list. Do it IMMEDIATELY. You can always unsubscribe later if you drop the course. The purpose of the list is to allow me to distribute information regarding due dates for assignments, changes of schedule, etc. Some of this information is crucial, and some of it may be distributed early on. To subscribe, you simply need to send an email message with *Subscribe* in the header to the following address: philbio-subscribe@mechanism.ucsd.edu. After you send the subscribe request, you will receive a reply from philbio-subscribe@mechamism.ucsd.edu that will ask you to confirm your request. Follow the directions in this message to confirm you subscription. If you later want to remove yourself from this list, send email with the header *Unsubscribe* to philbio-unsubscribe@mechanism.ucsd.edu. At the end of the course I will unsubscribe everyone on the list so you do not have to do this.

Only I have authorization to send mail to this list. There should be no spam. If you receive mail from this list that is not from me, be assured that I will as well and will take measures to block further abuse. (The welcome message you receive suggests that you can send email to the list. Sorry, but you cannot. If there is interest in setting up a voluntary discussion list for the class to which anyone can submit, I am happy to do so, but participation will not make it required.)

5. Schedule of Classes and Readings

Note: This schedule of reading assignments is tentative and subject to revision. When powerpoints from lectures are available, there will be a link from the lecture title to the pdf file. Dates with asterisks are dates on which comments/question paragraphs on the reading are due. These comments/questions must be sent to phil147@mechanism.ucsd.edu by 6 AM on the dates indicated.

September 22: Early Mechanist Ideas about Living Things: Harvey, Descartes, and Boyle

Recommended: William Harvey: *On The Motion Of The Heart And Blood In Animals*.

September 27: The Cell Theory

History of Biology: Cell Theory and Cell Structure: http://www.biologyreference.com/Gr-Hi/History-of-Biology-Cell-Theory-and-Cell-Structure.html

Theodor Schwann (1838), *Microscopical Researches into the Accordance in the Structure and Growth of Animals and Plants*, Author's Preface and pp. 1-9, 161-215.

Useful links: Richard Robinson, Cell theory: http://fig.cox.miami.edu/~cmallery/150/unity/cell.text.htm

***September 29: The Chemistry of Life**

Justig Liebig (1838), *Animal Chemistry, or organic chemistry in its application to phyiology and pathology*, Preface and pp. 1-23.

Louis Pasteur (1860), "Infusorian Animalcules Living Without Free Oxygen and Determining Fermentation," pp. 303-307.

Buchner, Eduard (1897). "Alcoholic Fermentation Without Yeast Cells," translation by Herbert C. Friedmann of ""Alkoholische Gährung ohne Hefezellen"," originally published in *Ber. Dt. Chem. Ges.* **30,** 117-124.

Useful links: John Pebble, History of Biology: Biochemistry http://www.biologyreference.com/Gr-Hi/History-of-Biology-Biochemistry.html

October 4 : Vitalism and *Organized* Mechanisms

Xavier Bichat, *Physiological Researches on Life and Death*. (Translated by F. Gold. Boston: Richardson and Lord, 1827, pp. 9-24.)

William Bechtel and Robert C. Richardson, Vitalism, *Routledge Encyclopedia of Philosophy*.

Claude Bernard, *Introduction à l'étude de la médecine expérimentale*. (Paris: J.B. Baillière et Fils, 1865, pp. 85-92, 101-4, 107-112, 265-301).

***October 6: Discussion**

October 11: Background to Darwin

Phillip Sloan (2008), Evolution, *Stanford Encylopedia of Philosophy*, Part 1.

Charles Darwin (1859), *On the origin of species* (introduction and chapters 1-3).

Useful links: Vassiliki Betty Smocovitis, History of Evolutionary Thought, http://www.biologyreference.com/Gr-Hi/History-of-Evolutionary-Thought.html; 17th-19th Century Discoveries that Led to the Acceptance of Biological Evolution, http://anthro.palomar.edu/evolve/default.htm

***October 13: Darwin's Account of Evolution by Natural Selection**

Charles Darwin (1859), *On the origin of species* (chapters 4, 6, 9, 14).

Phillip Sloan (2008), Evolution, *Stanford Encyclopedia of Philosophy,* Part 2.

James Lennox (2010), Darwinism, *Stanford Encyclopedia of Philosophy*, Parts 1 and 2.

Useful link: About Darwin http://www.aboutdarwin.com/index.html

October 18: 19th Century Reactions to Darwin

Samuel Wilberforce (1860). On Darwin's Origin of Species. *Essays Contributed to the Quarterly Review,* 2 Vols., (London, 1874), I.92-95.

Huxley, Thomas H. Time and Life: Mr. Darwin's "Origin of Species" *Macmillan's Magazine* (1859).

Phillip Sloan, Evolution, *Stanford Encyclopedia of Philosophy,* Part 3.1.

***October 20: Discussion**

October 25: Midterm Exam

***October 27: Mendel: Darwin's Savior or Opponent?**

Gregor Mendel (1865), Experiments in Plant Hybridization, *Verhandlungen des Naturforschenden Vereines in Brüun, 4*, 3-47.

Hans-Jörg Rheinberger and Staffan Müller-Wille (2009), Gene, *Stanford Encyclopedia of Philosophy*, Parts 1 and 2.

Useful Links: An Introduction to Mendelian Genetics http://anthro.palomar.edu/mendel/default.htm; Lynn Nyhart, History of Biology: Inheritance, http://www.biologyreference.com/Gr-Hi/History-of-Biology-Inheritance.html

November 1: The Evolutionary Synthesis

Semir Okasha (2006), Population Genetics, *Stanford Encyclopedia of Philosophy*.

Phillip Sloan (2008), Evolution, *Stanford Encyclopedia of Philosophy*, Part 3.2.

Useful links: Synthetic Theory of Evolution: An Introduction to Modern Evolutionary Concepts and Theories http://anthro.palomar.edu/synthetic/default.htm; Paul Cabe, Population Genetics, http://www.biologyreference.com/Ph-Po/Population-Genetics.html

***November 3: Ontology of Evolution: Species and Higher Taxa**

Marc Ereshefsky (2010), Species, *Stanford Encyclopedia of Philosophy*.

Elisabeth Lloyd (2005), Units and Levels of Selection, *Stanford Encyclopedia of Philosophy*.

Useful link: Ann E. Kessen and Robert M. Zink, Species, http://www.biologyreference.com/Se-T/Species.html; Defining a Species, http://evolution.berkeley.edu/evosite/evo101/VADefiningSpecies.shtml; Species Problem (Wikipedia), http://en.wikipedia.org/wiki/Species_problem; Unit of Selection (Wikipedia), http://en.wikipedia.org/wiki/Unit_of_selection; Barry Sinervo, Levels of Selection, http://bio.research.ucsc.edu/~barrylab/classes/animal_behavior/LEVELS.HTM

November 5: Teleology and Function

Larry Wright (1973), Functions, *The Philosophical Review*, 82, pp. 139-168; especially the section entitled "An alternative view."

Cummins, Robert (1975), Functional analysis, *The Journal of Philosophy*, 72, 761-745; especially part III.

Colin Allen (2003), Teleological Notions in Biology, *Stanford Encyclopedia of Philosophy*.

***November 8: Discussion**

November 10: Mechanism and Delineating Circadian Phenomena

Machamer, P., Darden, L., Craver, C. F. (2000). Thinking about mechanisms. *Philosophy of Science*, 67, 1-25.

Koukkari, W. L., & Sothern, R. B. (2006). The study of biological rhythms. In W. Koukkari & R. N. Southern (Eds.), *Introducing biological rhythms* (pp. 1-18). New York: Springer Netherlands.

Aschoff, J. (1965). Circadian rhythms in man. *Science*, 148, 1427-1432.

For addition background, see: Kuhlman, S. J., Mackey, S. R., & Duffy, J. F. (2007). Biological rhythms workshop I: Introduction to chronobiology. *Cold Spring Harbor Symposia on Quantitative Biology*, 72, 1-6.

Useful links: Steve Kay on UCSD TV: The Diversity of Development: Clockwork Genes: Biological Rhythms in Health and Agriculture; Circadiana: Clock tutorial #2: Basic concepts and terms

***November 15: Mechanism and Reduction: Decomposing Circadian Clocks**

Panda, S., Hogenesch, J. B., & Kay, S. A. (2002). Circadian rhythms from flies to human. *Nature*, 417, 329-335.

Bechtel, W. (2009). Generalization and discovery by assuming conserved mechanisms: Cross species research on circadian oscillators. *Philosophy of Science*, 76, 762-773.

Useful link: Circadian rhythm in *Wikapedia*; Circadian rhythms from Kimball's Biology Pages

November 17: Mechanism and Levels of Organization: Recomposing and Situating Circandian Clocks

Freeman, G. M., Webb, A. B., An, S., & Herzog, E. D. (2008). For whom the bells toll: Networked circadian clocks. *Sleep and Biological Rhythms*, 6, 67-75.

Bechtel, W. and Abrahamsen, A. (2009). Decomposing, Recomposing, and Situating Circadian Mechanisms: Three Tasks in Developing Mechanistic Explanations. In Leitgeb, H. and Hieke, A. (Eds.), *Reduction and Elimination in Philosophy of Mind and Philosophy of Neuroscience* (pp. 173-186). Frankfurt: Ontos Verlag.

Useful link: Circadiana: ClockTutorial #5: Circadian Organization

***November 22: Complicated and Complex Mechanisms: Computational Modeling of Circadian Rhythms**

Smolen, P. D., & Byrne, J. H. (2009). Circadian rhythm models. In L. R. Squire (Ed.), *Encyclopedia of Neuroscience* (pp. 957-963). Oxford: Academic Press.

Leise, T., & Siegelmann, H. (2006). Dynamics of a multistage circadian system. Journal of Biological Rhythms, 21, 314-323.

d'Eysmond, T., & Naef, F. (2010). Systems biology and modeling of circadian rhythms. In U. Albrecht (Ed.), The Circadian Clock (Vol. 12, pp. 283-293): Springer New York.

Bechtel, W. and Abrahsmen, A. (2010). Complex biological mechanisms: Cyclic, oscillatory, and autonomous. In C. A. Hooker (Ed.), *Philosophy of complex systems. Handbook of the philosophy of science*, Volume 10. New York: Elsevier

November 23: 3-5 Page paper due by NOON. Email to papers@mechanism.ucsd.edu

November 24: No class: Thanksgiving

November 29: Evolution of Mechanisms: Descent and Selection of Circadian Clocks

Roenneberg, T., & Merrow, M. (2002). "What watch?... such much!"* Complexity and evolution of circadian clocks. Cell and Tissue Research, 309, 3-9.

Paranjpe, D., & Sharma, V. (2005). Evolution of temporal order in living organisms. *Journal of Circadian Rhythms*, 3, 7.

Useful links: Circadiana: Clock tutorial #3: Clock evolution; Circadiana: III. Where Clock & Origin

Useful link: Circadiana Clock tutorial #3: Clock evolution; Circadiana: III. Whence Clocks? Origin, Evolution, and Adaptive Function of Biological Clocks

***December 1: Discussion**

December 9 : Final Exam: 11:30-2:30