Phil 247
Philosophy of Biology
Fall 2010, Wednesday, 5:00-7:50

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1. Course Description

Since the 1970s philosophical interest in the biological sciences has exploded. This course will provide an introduction to the major issues in biology addressed by philosophers (and by biologists interested in the conceptual and foundational issues concerning their field).

The focus is necessarily selective. For example, this course will not historical development of biology prior to the mid-20th century. There will be more coverage of that material in Phil 147, the undergraduate philosophy of biology, and you are welcome to sample the readings on the webpage for that course.

2. Course Requirements

Students are expected to do the assigned reading and to attend all the class sessions. By 9 am prior to each class session each student should submit a one-paragraph comment or question to the course email list: gradpbio@mechanism.ucsd.edu. These may either seek clarification about or raise objections to *major* points in the reading. The contributions should reflect an effort to understand the assigned material and provide the context for the issue raised. There are also be three papers assigned during the quarter (due dates are October 22, November 12, and December 6--these dates do not correspond to class days). These papers should be in the range of 1,200 to 1,800 words and will be based largely on the material we are covering in class (i.e., they are not research papers). Topics will be provided about ten days before papers are due. Papers should be submitted electronically in Word to papers@mechanism.ucsd.edu

3. Texts

All of the reading assignments can be found on the web. Readings which are copy-projected are only available on a password controlled portion of the course website. The userid and password for this portion of the website are both *biology*. See the schedule of classes and readings below.

The literature in philosophy of biology is massive. Even the range of central, important papers exceeds what we can cover in this course. The list below includes many readings (marked with an asterisk) that we will not cover in class but which you may find useful, especially if you choose paper topics to which they are relevant.

4. Email List

There is an email list for this seminar: gradpbio@mechanism.ucsd.edu. 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 twofold--to enable me to communicate information about upcoming seminar sessions and to allow members of the seminar to raise questions or engage in discussion outside of the seminar. Initially the list will be unmoderated, which will enable all (but only) subscribers to send email to the list. (You will need to send email from the address you use to register for the list.) If this is abused, we will need to move to a moderated list.

To subscribe, you simply need to send an email message to the following address: gradpbio-subscribe@mechanism.ucsd.edu. After you send the subscribe request, you will receive a reply from gradpbio-subscribe@mechanism.ucsd.edu that will ask you to confirm your request. Follow the directions in this message to confirm your subscription. If you later want to remove yourself from this list, send email to gradpbio-unsubscribe@mechanism.ucsd.edu.

4. Schedule of Classes

The assigned readings are those with NO # or *. Readings marked with a # are recommended--in some cases they provide a global overview of an issue, in other cases they provide an introduction to the pertinent biology. Readings marked with an * are additional sources that those seriously interested in an issue might consult.

September 22 : Setting the Stage: The Evolutionary Synthesis

Plutynski, A., & Ewens, W. J. (2006). Population genetics. In S. Sarkar & J. Pfeifer (Eds.), *Philosophy of Science: An encyclopedia* (pp. 578-585). New York: Routledge.

Semir Okasha (2006), Population Genetics, *Stanford encyclopedia of philosophy*

#Wikipedia: Modern Evolutionary Synthesis

#Sober, Elliott (2006). Natural selection. In S. Sarkar & J. Pfeifer (Eds.), *Philosophy of Science: An encyclopedia* (pp. 497-502). New York: Routledge.

*Beatty, J. (1984). Chance and natural selection. *Philosophy of Science, 51*, 183-211.

*Millstein, R. L. (2002). Are Random Drift and Natural Selection Conceptually Distinct? *Biology and Philosophy, 17*, 33-53.

September 29 : Processes of Evolution: Adaptationism and its Critics

Gould, S. J., & Lewontin, R. C. (1979). The spandrels of San Marco and the Panglossian paradigm: A critique of the adaptationist programme. *Proceedings of the Royal Society of London, Series B, 205*, 581-598.

Lewens, T. (2009). Seven types of adaptationism. *Biology and Philosophy*, 24 (2), 161-182.

Orzack, S. H., & Sober, E. (1994). Optimality models and the test of adaptationism. *The*

American Naturalist, 143, 361-380.

Brandon, R., & Rausher, M. D. (1996). Testing Adaptationism: A Comment on Orzack and Sober. *The American Naturalist, 148*, 189-201.

Orzack, S. H., & Sober, E. (1996). How to formulate and test adaptationism. *The American Naturalist, 148*, 202-210.

#Forber, Patrick (2009). Introduction: A primer on adaptationism. *Biology and Philosophy*, 24, 155-159.

#Okasha, S. (2006). Adaptation and adaptationism. S. Sarkar & J. Pfeifer (Eds.), *Philosophy of Science: An encyclopedia* (pp. 3-7). New York: Routledge.

*Maynard Smith, J. (1978). Optimization theory in evolution. *Annual Review of Ecology and Systematics, 9*, 31-56.

*Beatty, J. (1997). Why do biologists argue like they do? *Philosophy of Science, 64*, S432-S443.

*Beatty, J., & Desjardins, E. (2009). Natural selection and history. *Biology and Philosophy*, 24 (2), 231-246.

*Godfrey-Smith, P. (1999). Adaptationism and the power of selection. *Biology and Philosophy, 14*, 181-194.

October 6: No class--replaced by class on September 22

October 13: Taxonomy and Ontology: Species and Higher Taxa

Hull, D. L. (1978). A matter of individuality. *Philosophy of Science, 45*, 335-360.

Mayr, E. (1996). What is a Species and What Is Not? *Philosophy of Science, 63*, 262-277.

Mishler, B. D., & Brandon, R. N. (1987). Individuality, pluralism, and the phylogenetic species concept. *Biology and Philosophy, 2*, 397-414.

Devitt, M. (2008). Resurrecting Biological Essentialism. *Philosophy of Science*, 75 (3), 344-382.

O'Malley, M. A. (2010). Ernst Mayr, the tree of life, and philosophy of biology. Biology and Philosophy, 25, 529-552.

#Ereshefsky, Marc (2010). Species. *Stanford encyclopedia of philosophy*.

*Ghiselin, M. T. (1974). A radical solution to the species problem. *Systematic Zoology, 23*, 536-544.

*Hull, D. L. (1976). Are species really individuals? *Systematic Zoology, 25*, 174-191.

*Kitcher, P. (1984). Species. *Philosophy of Science, 51*, 308-333.

*Mayr, E. (1987). The ontological status of species: Scientific progress and philosophical terminology. *Biology and Philosophy, 2*, 145-166.

*Sokal, R. R., & Crovello, T. J. (1970). The biological species concept: A critical evaluation. *The American Naturalist, 104*, 127-153.

October 20: Reductionism and Evolution: Units and Levels of Selection

Wimsatt, W. C. (1980). Reductionistic research strategies and their biases in the units of selection controversies. In T. Nickles (Ed.), *Scientific discovery: Case studies* (pp. 213-259). Dordrecht: Reidel.

Wilson, D. S., & Wilson, E. O. (2007). Rethinking the theoretical foundations of sociobiology. *Quarterly Review of Biology*, 82, 327-348.

Wilson, R. A. (2006). Levels of selection. In M. Matthen & C. Stephens (Eds.), *Handbook of the Philosophy of Science. Volume 2: Philosophy of Biology* (pp. 155-176). New York: Elsevier.

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

*Hull, D. L. (1980). Individuality and selection. *Annual Review of Ecology and Systematics, 11*, 311-332.

*Wilson, D. S. (1989). Levels of selection: An alternative to individualism in the human sciences. *Social Networks, 11*, 257-272.

October 27: Reduction and Biological Explanation

Schaffner, K.F. (1967), Approaches to reduction, *Philosophy of Science* 34:137–147.

Craver, C.F. (2005), Beyond reduction: mechanisms, multifield integration and the unity of neuroscience. *Studies in History and Philosophy of Biological and Biomedical Sciences* 36:373–395.

Bechtel, W. and Hamilton, A. (2007). Reductionism, integration, and the unity of the sciences. T. Kuipers (ed.), *Philosophy of Science: Focal Issues,* pp. 377-430 (Volume 1 of the Handbook of the Philosophy of Science). New York: Elsevier.

#Brigandt, I. and Love, A. (2008). Reduction in biology. *Stanford Encyclopedia of Philosophy*

*Kauffman, S.A. (1971), Articulation of parts explanations in biology and the rational search for them, *Boston Studies in the Philosophy of Science* 8:257–272.

*Wimsatt, W. C. (1976), Reductive explanation: a functional account, in R.S. Cohen and A.

Michalos (eds.), *Proceedings of the 1974 meeting of the Philosophy of Science Association*, Dordrecht: D. Reidel, 671–710.

*Craver, C. F. and Bechtel, W. (2007). Top-down causation without top-down causes. *Biology and Philosophy*, *22*, 547-563.

*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.

November 3: Reductionism and Genetics: Molecular Genetics

Hull, D. (1979). Reduction in genetics*Philosophy of Science*, 46: 316-320.

Kitcher, Philip (1984), 1953 and all that: A tale of two sciences, *Philosophical Review* 93:335-373.

Waters, C. K. (1994). Genes made molecular. *Philosophy of Science, 61*, 163-185.

Rosenberg, A. (1997). Reductionism redux: Computing the embryo. *Biology and Philosophy, 12*, 445-470.

#Lindley Darden and James Tabery (2005), Molecular Biology, *Stanford Encyclopedia of Philosophy*

*James D. Watson and Francis H. C. Crick (1953), Molecular structure of Nucleic Acids *Nature*, 171, 737-738.

*Griffiths, P. E., & Neumann-Held, E. M. (1999). The many faces of the gene. *BioScience, 49*, 656-662.

*Waters, C. K. (1990). Why the anti-reductionist consensus won't survive: The case of classical Mendelian genetics. In *PSA 1990* (Vol. 1, pp. 129-139). East Lansing, MI: Philosophy of Science Association.

*Moss, L. (2003). One? two? (Too), many genes. *The Quarterly Review of Biology, 78*, 57-67.

*Knight, R. (2007). Reports of the death of the gene are greatly exaggerated. *Biology and Philosophy, 22*, 293-306.

*Maynard Smith, J. (2000). The concept of information in biology. *Philosophy of Science, 67*, 177-194.

*Downes, S. M. (2006). Biological information. S. Sarkar & J. Pfeifer (Eds.), *Philosophy of Science: An encyclopedia* (pp. 64-68). New York: Routledge.

November 10: What about Development? Evolutionary-Developmental Biology

Griffiths, P. E., & Gray, R. (1994). Developmental systems and evolutionary explanation. *Journal of Philosophy, 91*, 277-304.

Sterelny, K., Smith, K. C., & Dickison, M. (1996). The extended replicator. *Biology and Philosophy, 11*, 377-403.

Griffiths, P. E., & Gray, R. (1997). Replicator II -- Judgement day. *Biology and Philosophy, 12*, 471-492.

Schaffner, K. F. (1998). Genes, behavior, and developmental emergentism: One Process, Indivisible? *Philosophy of Science*, 65, 209-252.

Griffiths, P. E., & Knight, R. (1998). What is the developmental challenge? *Philosophy of Science, 65*, 253-258.

#Wikipedia, Evolutionary developmental biology

*Amundson, R. (1994). Two concepts of constraint: Adaptationism and the challenge from developmental biology. *Philosophy of Science, 61*, 556-578.

*Griffiths, P. E. (1996). Darwinism, process structuralism, and natural kinds. *Philosophy of Science, 63, Supplement*, S1-S9.

*Jason Scott Robert, Brian K. Hall, and Wendy M. Olson, (2001), Bridging the gap between developmental systems theory and evolutionary developmental biology. *Bioessays*. 10, 954-62.

*Gibert, S. F. (2003). The morphogenesis of evolutionary developmental biology. *International Journal of Developmental Biology*, 47, 467-477.

*Wimsatt, W. C. (1999). Generativity, entrenchment, evolution, and innateness: Philosophy, evolutionary biology, and conceptual foundations of science. In V. G. Hardcastle (Ed.), *Where biology meets psychology: Philosophical essays* (pp. 139-179). Cambridge, MA: MIT Press.

*Gould, S. J., & Eldredge, N. (1977). Puncutated equilibria: the tempo and mode of evolution reconsidered. *Paleobiology, 3*, 115-151.

November 17: Genetics and Systems Biology: Post-Genomic Molecular Genetics

Griffiths, P. E., & Stotz, K. C. (2007). Gene. In D. Hull & M. Ruse (Eds.), *Cambridge companion to the philosophy of biology*. Cambridge, England: Cambridge University Press.

Noble, D. (2007). Claude Bernard, the first systems biologist, and the future of physiology. *Experimental Physiology*, 93 (1), 16-26.

Jablonka, E. and Lamb, M. (2002). The changing concept of epigenetics. *Annals of the New York Academy of Sciences*, 981 (1), 82-96.

*Jablonka, E. and Lamb, M. (2007). Précis of Evolution in Four Dimensions. Behavioral and Brain Sciences, 30 (04), 353-365.

*Stotz, K. C. (in press). 2001 and all that: a tale of a third science. *Biology and Philosophy*.

*Sarkar, S. (2006). Molecular biology. In S. Sarkar & J. Pfeifer (Eds.), *Philosophy of science: an encyclopedia* (pp. 480-490). New York: Routledge

November 24 (I expect there will be a desire to reschedule this class--to November 22 or 23?) : Complexity: Self-organization and Emergence

Boogerd, F. C., Bruggeman, F. J., Richardson, R. C., Stephan, A., & Westerhoff, H. V. (2005). Emergence and its place in nature: A case study of biochemical networks. *Synthese, 145*, 131-164.

Edelmann, J. B., & Denton, M. J. (2007). The uniqueness of biological self-organization: Challenging the Darwinian paradigm. *Biology and Philosophy, 22*, 579-601.

Kauffman, S. A., & Clayton, P. (2005). On emergence, agency, and organization. *Biology and Philosophy, 21*, 501-521.

*Wikipedia, Self-organization, Emergence

*Kauffman, S. A., Logan, R. K., Este, R., Goebel, R., Hobill, D., & Shmulevich, I. (2008). Propogating organization: An enquiry. *Biology and Philosophy*, 23, 27-45.

December 1: What is Life? Minimal Living Systems

Collier, J. D. and Hooker, C. A. (1999). Complexly organized dynamical systems. *Open Systems and Information Dynamics*, 6, 241-302.

Ruiz-Mirazo, K. and Moreno, A. (2004). Basic autonomy as a step in the synthesis of life. *Artificial Life*, 10: 235-259.

Ruiz-Mirazo, K, Umerez, J., and Moreno, A. (2007). Enabling conditions for 'open-ended evolution'. *Biology and Philosophy*, 23, 67-85.

#Bruce Weber (2008), Life. *Stanford encyclopedia of philosophy.*

#Wikipedia: Life; Entropy and Life

*Bechtel, W. and Abrahamsen, A. (2011). 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

*Moreno, A. and Ruiz-Mirazo, K. (2009). The problem of the emergence of functional diversity in prebiotic evolution. Biology and Philosophy, 24, 585-605

December 6: Final papers due