PHIL 415 / 510 – Philosophy of Biology

Winter Term 2014

Tue, Thu 2:00–3:20 pm, Assiniboia Hall 1-26

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A. Course overview and aims

To some extent, philosophy of biology pursues questions from general philosophy of science in the context of biology (e.g., what is a scientific theory, how are theories confirmed, what is a scientific explanation, is there a logic of discovery). But typically, philosophy of biology addresses a variety of conceptual questions that arise from within biology and are peculiar to that domain (e.g., what is the unit of selection, what is the nature of species, can biology be reduced to molecular biology). Philosophy of biology as a discipline is currently thriving within philosophy of science (and philosophy in general), largely because the biological and biomedical sciences it studies have attained a major importance for science and society.

The aim of this class is to cover most major topics in contemporary philosophy of biology. Some pertain to evolutionary biology, which has been the philosophical focus in the recent past (e.g., the nature of species, different species concepts, the units of selection debate, adaptationism and evolutionary psychology, teleology and functional explanation). Other issues are about molecular and developmental biology, which has gained prominence in recent philosophical discussions (e.g., reductionism and interdisciplinary research, gene concepts, the idea of genetic information). We shall also take a look at evolutionary developmental biology ('evo-devo')—a recent and one of the most interesting fields in current biology.

To this end, we will read and discuss influential original articles written by philosophers or biologists during the last three decades (grouped around several core topics, see Section G).

B. Prerequisites

The class is organized such that background knowledge in biology or philosophy of science is not required, though interests in either field are desirable. Formal prerequisite: to take the class as an undergraduate (PHIL 415), you must have previously completed two philosophy classes (including one class at the 200-level or higher) or obtain my permission.

C. Required texts

The required readings consist in journal articles and book chapters, and are listed below in Section H. Most of the readings can be accessed online via our course website.

Optional reading: Paul E. Griffiths and Kim Sterelny, *Sex and Death: An Introduction to Philosophy of Biology*. University of Chicago Press, 1999.

D. Course requirements

- Term paper(s) 70%
- Oral presentation 20%
- Participation 10%

Term paper(s) (70%): You must write **either one long term paper**, worth 70% of credit, **or two short term papers**, each of which is worth 35% of credit. An electronic version of the long term paper is due on Saturday, April 19 at 2 pm. If you choose the second option, an electronic version of the first short paper is due on February 25 at 2 pm, and the second one is due on April 19 at 2 pm.

Approximate length of a long paper: 4000–5000 words if you are an undergraduate student (signed up for PHIL 415); 5000–7000 words if you are a graduate student (PHIL 510).

Approximate length of each short paper: 2000–2500 words if you are an undergraduate student; 2500–3500 words if you are a graduate student.

I am happy to provide comments on term paper drafts. In the case of the long paper and the 2nd short paper, I guarantee comments if you send me an electronic draft by April 12.

Oral presentation (20%): Every student has to give one oral presentation. Your task as a presenter is to briefly summarize this meeting's readings (highlighting points that you find particularly relevant) but primarily to start the discussion by having prepared some questions (e.g. about problematic issues in the readings). Alternatively, you may present on other material that is relevant to our topic. In either case, I ask you to (a) prepare a short handout and email me a draft in advance so that I can provide comments, and to (b) make copies of the final version for the whole class, so that everyone has a summary of your presentation. You may give your presentation using PowerPoint (and use a printout of the slides as a handout).

Participation (10%): Attendance and active participation is important for this class. It is the responsibility of each student to come to class prepared to actively engage in discussion. Each of you will probably have picked up different points from the readings or have questions or objections, so please share them! You can also obtain participation credit by starting topics and replying to posts at the discussion forum on our website.

E. Academic integrity and plagiarism

The University of Alberta is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards and to uphold the policies of the university in this respect. Students are urged to familiarize themselves with the Code of Student Behaviour (http://tinyurl.com/CodeofStudentBehaviour) and avoid any behaviour which could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the university. For a summary please see http://www.governance.ualberta.ca/en/StudentAppeals/DontCheatsheet.aspx

The Code of Student Behaviour defines plagiarism as follows:

> No Student shall submit the words, ideas, images or data of another person as the Student's own in any academic writing, essay, thesis, project, assignment, presentation or poster in a course or program of study.

The library has a general website on plagiarism: http://www.library.ualberta.ca/guides/plagiarism. See in particular the section on "Avoiding Plagiarism" (sidebar on the left, among "Resources for Students").

F. Course website

The course has a website at https://eclass.srv.ualberta.ca . Our assigned readings and additional literature can be accessed from this site, and I use it to post presentation handouts. The site also contains a discussion board.

G. Schedule of classes

Jan 7	**Introduction.**
Jan 9	**Gene concepts 1.** Waters "Genes made molecular." [optional: *Sex and Death*, sections 6.2–6.5]
Jan 14	**Gene concepts 2.** Griffiths and Stotz "Gene." Moss *What Genes Can't Do*, pp. 44–50.
Jan 16	**Reduction 1.** Schaffner "Reductionism in biology." Hull *Philosophy of Biological Science*, pp. 30–44. [optional: *Sex and Death*, section 6.1]
Jan 21	**Reduction 2.** Fodor "Special sciences." [optional: *Sex and Death*, chapter 7]
Jan 23	**Integration 1.** Darden "Relations among fields."
Jan 28	**Integration 2.** Bechtel "The downs and ups of mechanistic research."
Jan 30	**Genetic information 1.** Maynard Smith "The concept of information in biology."
Feb 4	**Genetic information 2.** Robert *Embryology, Epigenesis, and Evolution*, pp. 34–55.
Feb 6	**Development.** Robert *Embryology, Epigenesis, and Evolution*, pp. 1–22. Laubichler and Wagner "How molecular is molecular developmental biology?", pp. 53–55, 57–66.
Feb 11	**Function 1.** Wouters "The function debate in philosophy," Sect. 1–2.4, 3.1–3.5, 3.7.
Feb 13	**Function 2.** Griffiths "Function, homology, and character individuation," Sect. 1–6.

Reading week

Feb 25	**Species 1.** Hull "A matter of individuality," pp. 335–341, 344–355. Griffiths "Squaring the circle," pp. 209–212, 215–223. **1st short term paper due at 2pm**
Feb 27	**Species 2.** Kitcher "Species", pp. 308–309, 315–331. [optional: *Sex and Death*, sections 9.1–9.2]

Mar 4	**Species 3.** Ereshefsky "Eliminative pluralism." Brigandt "Species pluralism does not imply species eliminativism," pp. 312–315.
Mar 6	**Levels of selection 1.** Dawkins *The Selfish Gene*, pp. 1–11, 15–39. [optional: *Sex and Death*, chapter 3]
Mar 11	**Levels of selection 2.** Okasha "Why won't the group selection controversy go away?" [optional: *Sex and Death*, section 9.4]
Mar 13	**Levels of selection 3.** Brandon "The levels of selection: a hierarchy of interactors." [optional: *Sex and Death*, chapter 4]
Mar 18	**Adaptationism 1.** Gould and Lewontin "The spandrels of San Marco and the Panglossian paradigm." [optional: *Sex and Death*, chapter 10]
Mar 20	**Adaptationism 2.** Buller "Evolutionary psychology: a critique." Griffiths "What is innateness?" [optional: *Sex and Death*, chapter 13]
Mar 25	**Evo-devo 1.** Amundson "Two concepts of constraint."
Mar 27	**Evo-devo 2.** Hendrikse et al. "Evolvability as the proper focus of evolutionary developmental biology." Gerhart and Kirschner "The theory of facilitated variation."
Apr 1	**Evo-devo 3.** Robert "How developmental is evolutionary developmental biology?" [optional: *Sex and Death*, chapter 5]
Apr 3	**Evo-devo 4.** Wagner "What is the promise of developmental evolution? Part I." Love "Interdisciplinary lessons for the teaching of biology from the practice of evo-devo," pp. 255–270.
Apr 8	**Wrapping up.**

Apr 19 Long term paper / 2nd short term paper due at 2 pm.

In this schedule, *Sex and Death* refers to the optional textbook listed in section C; bibliographic details on the other readings can be found in Section H.
I recommend reading the optional material if you give a presentation or write a term paper on the respective topic, or if you wish to have broader overview of the issue and relevant background.

H. Bibliography of required readings

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

Brandon, R. N. (1988). The levels of selection: a hierarchy of interactors. In H. Plotkin (Ed.) *The Role of Behavior in Evolution*, pp. 51–71. Cambridge, MA: MIT Press.

Brigandt, I. (2003). Species pluralism does not imply species eliminativism. *Philosophy of Science* 70, 1305–1316.

Bechtel, W. (2010). The downs and ups of mechanistic research: circadian rhythm research as an exemplar. *Erkenntnis* 73, 313–328.

Buller, D. J. (2006). Evolutionary psychology: a critique. In E. Sober (Ed.), *Conceptual Issues in Evolutionary Psychology*, 3rd edition, pp. 197–214. Cambridge, MA: MIT Press.

Darden, L. (2005) "Relations among fields: Mendelian, cytological and molecular mechanisms." *Studies in History and Philosophy of Biological and Biomedical Sciences* 36: 349–371.

Dawkins, R. (2006). *The Selfish Gene*, 3rd edition. Oxford: Oxford University Press.

Ereshefsky, M. (1992). Eliminative pluralism. *Philosophy of Science* 59, 671–690.

Fodor, J. A. (1974). Special sciences (or: the disunity of science as a working hypothesis). *Synthese* 28, 97–115.

Gould, S. J. and R. Lewontin (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, Biological Sciences)* 205, 581–598.

Griffiths, P. E. (1999). Squaring the circle: natural kinds with historical essences. In R. A. Wilson (Ed.), *Species: New Interdisciplinary Essays*, pp. 208–228. Cambridge, MA: MIT Press.

Griffiths, P. E. (2002). What is innateness? *The Monist* 85, 70–85.

Griffiths, P. E. (2005). Function, homology, and character individuation. *Philosophy of Science* 73, 1–25.

Griffiths, P. E. and K. Stotz (2007). Gene. In D. L. Hull and M. Ruse (Eds.) *The Cambridge Companion to the Philosophy of Biology*, pp. 85–102.

Hendrikse, J. L., T. E. Parssons, and B. Hallgrímsson (2007). Evolvability as the proper focus of evolutionary developmental biology. *Evolution & Development* 9, 393–401.

Hull, D. L. (1974). *Philosophy of Biological Science*. Englewood Cliffs: Prentice-Hall.

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

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

Gerhart, J. C., and W. M. Kirschner. (2007). The theory of facilitated variation. *Proceedings of the National Academy of Sciences USA* 104, 8582–8589.

Laubichler, M. and G. P. Wagner (2001). How molecular is molecular developmental biology? A reply to Alex Rosenberg's Reductionism redux: computing the embryo. *Biology and Philosophy* 16, 53–68.

Love, A. C. (2013). Interdisciplinary lessons for the teaching of biology from the practice of evo-devo. *Science & Education* 22, 255–278.

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

Moss, L. (2003). *What Genes Can't Do*. Cambridge, MA: MIT Press.

Okasha, S. (2001). Why won't the group selection controversy go away? *British Journal for the Philosophy of Science* 52, 25–50.

Robert, J. S. (2002). How developmental is evolutionary developmental biology? *Biology and Philosophy* 17, 591–611.

Robert, J. S. (2004). *Embryology, Epigenesis, and Evolution: Taking Development Seriously*. Cambridge: Cambridge University Press.

Schaffner, K. F. (1976). Reductionism in biology: prospects and problems. In R. S. Cohen and A. Michalos (Eds.), *Proceedings of the 1974 Biennial Meeting of the Philosophy of Science Association*, pp. 613–632. Dordrecht: Reidel.

Wagner, G. P. (2000). What is the promise of developmental evolution? Part I: Why is developmental biology necessary to explain evolutionary innovations? *Journal of Experimental Zoology (Molecular and Developmental Evolution)* 288, 95–98.

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

Wouters, A. G. (2005). The functions debate in philosophy. *Acta Biotheoretica* 53, 123–151.

I. Further relevant literature

While additional journal articles can be accessed via our course website (e.g., for the purpose of term papers), here are further relevant books.

Textbooks:

Griffiths, P. E. and K. Sterelny (1999) *Sex and Death: An Introduction to Philosophy of Biology*. University of Chicago Press. [Recent textbook in philosophy of biology. Highly recommended.]

Garvey, B. (2007) *Philosophy of Biology*. Acumen Press. [The most recent introductory textbook.]

Sober, E. (2000) *Philosophy of Biology*. 2nd ed. Westview Press. [Good textbook, but deals exclusively with evolutionary biology and hardly differs from its first, 1993 edition.]

Companions:

Hull, D. and M. Ruse (Eds.) (2007) *The Cambridge Companion to the Philosophy of Biology*. Cambridge University Press. [Very good collection of recent essays surveying some main issues in philosophy of biology.] As an ebook at http://cco.cambridge.org.login.ezproxy.library.ualberta.ca/uid=1628/book?id=ccol9780521851282_CCOL9780521851282

Ayala, F. and R. Arp (Eds) (2010) *Contemporary Debates in Philosophy of Biology*. Wiley-Blackwell. [On several topics, there is each one essay arguing for and one essay arguing against a thesis.]

Ruse, M. (Ed) (2008) *The Oxford Handbook of Philosophy of Biology*. Oxford University Press. [Collection of recent essays surveying some main issues.]

Sarkar, S. and A. Plutynski (Eds) (2008) *A Companion to the Philosophy of Biology*. Blackwell. [Collection of recent essays surveying some main issues.] As an ebook at http://www.blackwellreference.com.login.ezproxy.library.ualberta.ca/subscriber/book?id=g9781405125727_9781405125727

Matthen, M. and C. Stephens (Eds) (2007) *Philosophy of Biology*. Elsevier. [Collection of recent essays surveying some main issues in philosophy of biology.] As an ebook at http://login.ezproxy.library.ualberta.ca/login?url=http://www.sciencedirect.com/science/book/9780444515438

Anthologies:

Hull, D. and M. Ruse (Eds.) (1998) *The Philosophy of Biology*. Oxford University Press. [Collection of many classical, original articles by biologists and philosophers of biology.] As an ebook at http://www.netlibrary.com.login.ezproxy.library.ualberta.ca/summary.asp?ID=12424

Sober, E. (Ed.) (2006) *Conceptual Issues in Evolutionary Biology*. 3rd ed. MIT Press. [Another collection of classical, original articles by biologists and philosophers of biology.]

Other books:

Craver, C. F. (2007) *Explaining the Brain: Mechanisms and the Mosaic Unity of Neuroscience*. Oxford University Press. [Prominent account of mechanistic explanation, used to argue that integration is a better model than reduction, in the context of neuroscience] As an ebook at http://www.oxfordscholarship.com.login.ezproxy.library.ualberta.ca/view/10.1093/acprof:oso/9780199299317.001.0001/acprof-9780199299317

Weber, M. (2005) *The Philosophy of Experimental Biology*. Cambridge University Press. [Good and recent book on the philosophy of molecular biology.] As an ebook at http://site.ebrary.com.login.ezproxy.library.ualberta.ca/lib/albertaac/Doc?id=10131669

Robert, J. (2004) *Embryology, Epigenesis and Evolution: Taking Development Seriously*. Cambridge University Press. [Recent book on the philosophy of developmental biology.] As an ebook at http://site.ebrary.com.login.ezproxy.library.ualberta.ca/lib/albertaac/Doc?id=10124681

Beurton, P., R. Falk, and H.-J. Rheinberger (Eds.) (2000) *The Concept of the Gene in Development and Evolution: Historical and Epistemological Perspectives.* Cambridge University Press. [A collection of recent essays by biologists and historians and philosophers of biology on the gene concept.]

Keller, E. F. (2000) *The Century of the Gene.* Harvard University Press. [Popular discussion of the gene concept in contemporary molecular biology. Good account of the complexity of genetic processes and why the term 'gene' has partially ceded to many other genetic terms.]

Sober, E. (1984) *The Nature of Selection: Evolutionary Theory in Philosophical Focus*. MIT Press. [Classical philosophical discussion of the units of selection.]

Dawkins, R. (1989) *The Selfish Gene.* Oxford University Press. 2nd ed [Prominent and popular defence of gene selectionism.]

Dawkins, R. (1999) *The Extended Phenotype: The Long Reach of the Gene*. 2nd ed. Oxford University Press. [A development of many of the ideas in *The Selfish Gene*, written primarily for biologists but still quite accessible.]

Roughgarden, J. (2009) *The Genial Gene: Deconstructing Darwinian Selfishness*. University of California Press. [An evolutionary biologist proposes social selection theory in opposition to sexual selection and the selfish gene theory.]

Sober, E. and D. S. Wilson (1998) *Unto Others: The Evolution and Psychology of Unselfish Behavior*. Harvard University Press. [Much debated discussion of altruism and defence of group selection.]

Oyama, S., P. E. Griffiths, and R. Gray (Eds.) (2001) *Cycles of Contingency: Developmental Systems and Evolution.* MIT Press. [Essays on developmental systems theory, an approach developed by psychobiologists that views the developmental system rather than the gene as the unit of evolution.]

Kitcher, P. (1985) *Vaulting Ambition: Sociobiology and the Quest for Human Nature.* [Classical critique of human sociobiology by a philosopher.]

Buller, D. J. (2005) *Adapting Minds: Evolutionary Psychology and the Persistent Quest for Human Nature*. MIT Press. [A critique of evolutionary psychology.]

Richardson, R. C. (2007) *Evolutionary Psychology as Maladapted Psychology*. MIT Press. [Another philosophical critique of evolutionary psychology.] As an ebook at http://cognet.mit.edu.login.ezproxy.library.ualberta.ca/library/books/view?isbn=0262182602

Kirschner, M. W. and J. C. Gerhart (2005) *The Plausibility of Life: Resolving Darwin's Dilemma*. Yale University Press. [Good popular introduction to evolutionary developmental biology.]

Amundson, R. (2005) *The Changing Role of the Embryo in Evolutionary Thought: Roots of Evo-Devo.* Cambridge University Press. [Discusses how the neo-Darwinian framework and its interpretation of history originated, comparing it with modern evo-devo.]