Phil*2000: Philosophy of Biology

Winter 2017

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Location: MCKN 227

Time: Wednesday 7:00 – 9:20 pm

Office/hrs: MACK 358/ Wednesday: 5:00-6:00 or by app.

Course website: www.biophilosophy.ca/Teching/Philosophy2000

Course Description

Over the past few decades the disciplines of biology and philosophy have become increasingly intertwined. Many influential biologists have written philosophical books on evolutionary theory, ecology, molecular biology, conservation, etc. Philosophers have likewise made important theoretical contributions in these and other areas. It is now possible to identify a distinctive subdiscipline –the philosophy of biology –with its own journals, academic societies, and textbooks. This course will provide an introduction to some of the core issues in this exciting new field. In particular, we will explore the following three topics.

(1) Gene Centrism

In the mid1960s a new perspective started to emerge within the field of evolutionary biology. Thanks to the work of W.D. Hamilton, G.C. Williams, E.O Wilson, and others, biologists started thinking about genes as the focal units of evolution. This involved a shift away from a view of natural selection acting at the level of the organisms, group, or even species. Suddenly, traits that had been difficult to explain under the conventional Darwinian framework (e.g. eusociality in insects, cooperation in humans) were recast in a new light. Rather than having evolved for the good of the group, such traits were now regarded as the expression of an underlying "selfish" gene. Richard Dawkins 1976 book by this title soon became the authoritative statement of a new scientific paradigm.

Forty years later, we are now in a position to reflect on the merits and drawbacks of selfish gene theory. One important criticism claims that the arguments against group-level selection were in fact not so strong- that selection can and does act above the level of the gene. Another criticism claims that gene-centrism ignores the important role of the organism and its development in generating phenotypes. Yet another line of criticism argues that the gene centric framework assigned too prominent a role to natural selection, as opposed to other processes like genetic drift or developmental constraint. In fact, many of the recent theoretical developments in our understanding of evolution have been inspired by the perceived limitations of selfish gene theory. Hence, a central objective of this course will be to examine this theory, focusing on the arguments offered both for and against it.

(2) Trust, Methodology, and Scientific Conduct

A second topic in the philosophy of biology concerns the existence (or lack) of a scientific "method." Philosophers have long abandoned the idea that science proceeds by a mechanical process of hypothesis generation and testing. It is not so much that this view is mistaken, but rather that it only scratches the surface of how science manages to generate knowledge. The more accurate picture includes, among other things, an account of the social practices that scientists engage in (like peer review, competition for funding, selective citation, and so on). Some of our attention in this course will be dedicated to the ways in which certain social institutions promote trust in science (both among researchers and in their interactions with the public) and how that trust can be easily eroded.

(3) Generality in Ecology

A third general topic concerns the way in which practicing ecologists interpret their own findings. As with the fields of medicine and economics, the findings of ecology are often used to inform public policy. Ecological systems, however, are difficult to investigate experimentally. This is because ecosystems are large, because they have many interacting components, because they lack discrete boundaries, and because ecological processes unfold over extended periods of time. Such factors have led some ecologists to conclude that there are no general principles or "laws" that might allow us to predict and explain ecosystem behaviour. If so, what does this mean about the prospects for ecology to inform public policy? Can ecology be legitimately regarded as a science without generalizations that are backed by controlled experiments?

General Learning Objectives

- Sharpen students' skills in **critical thinking** and **argument analysis**.
- Help students improve the **clarity and precision** of their **written and oral communication.**
- Expose students to topics that will inform their choice of **4th year research projects**.
- Provide a venue for students to **ask "big picture" questions** about their discipline.

Readings

- Richard Dawkins (1976/ 2016), *The Selfish Gene*. Oxford University Press.
- Kristin Shrader-Frechette (2016), *Tainted: How Philosophy of Science can Expose Bad Science*. Oxford University Press.
- Additional articles made available on the course website. (www.biophilosophy.ca)

Assessment

Participation: 10%- Students are expected to attend class and to participate in discussions.

Reflection Questions: 50% – Each week there will be a set of reflection questions (approximately 1 page each) addressing some aspect of the required reading. These questions are to be submitted using Dropbox on each **Tuesday, the day before class.** The purpose of these assignments is to help guide students through the reading, to provide an opportunity for students to formulate their ideas, and to serve as a basis for in-class discussion. Each reflection assignment is worth 5% of the final grade. Students' lowest two grades will be discounted.

Midterm Paper**:** 15% - A short paper (approximately 3 pages) will be due at the beginning of class on March 01. In addition to a list of topics, students will receive explicit guidelines on how to write this paper. The aim of this assignment is to provide students with an opportunity to develop their skills in thinking and writing about theoretical topics.

Final paper: 25% - A slightly longer paper (approximately 4-5 pages) will be due at during the exam period. Students will presented with a list of potential topics, but are also encouraged to write about an individually selected topic. Those who select the latter option must receive prior approval from the instructor. In addition to providing students with further opportunity to hone their philosophical thinking and writing, this assignment will encourage students to gain expertise on a particular topic of interest to them.

Course Outline

Jan 11: Introduction: Evolutionary theory before gene centrism.

Learning objective: Students will examine their understanding core concepts in this course, including evolution, natural selection, trait, gene, and organism. We will also consider how social behaviour was explained by evolutionary biologists prior to the emergence of gene-centric thinking.

Jan 18: Selfish Gene Theory I: Objections to group selection.

Learning objective: students will be able to reconstruct and evaluate Dawkins' objections to group selection, in particular his objection to the idea that altruism evolves by group selection.

- Required reading: Dawkins (1976), *The Selfish Gene.* Ch. 1 "Why are people?" (p. 1-14).

Jan 25: Selfish Gene Theory II: The informational gene.

Learning objective: students will be able to distinguish Dawkins' definition of "gene" from the ways that genes are defined in developmental biology and genomics. We will also consider some popular objections to Dawkins' proposal.

- Required reading: Dawkins (1976), *The Selfish Gene.* Ch. 2 "The replicators" and Ch. 3 "Immortal coils" (p. 15-58).
- Background reading: Wheeler, M. (2007), "Traits, genes and coding." In Matthen and Stephens (eds) *Philosophy of Biology* (p. 369-399).

Feb 01: Selfish Gene Theory III: The kin selection controversy.

Learning objective: students will be able to explain how apparently altruistic behaviour is thought to evolve by kin selection, and consider recent arguments suggesting that the role of kin selection in evolution has been overstated.

- Required reading: Dawkins (1976), *The Selfish Gene.* Ch. 6" Genemanship" (p. 114-140)
- Background reading: Birch, J. and Okasha, S. (2015), "Kin selection and its critics" Bioscience 65(1): 22-32.

Feb 08: Key issues in the levels-of-selection debate.

Learning objective: By this stage in the course, students will recognize that there is an ongoing debate over whether selection acts only on genes or, alternatively, whether it occurs at multiple levels. This week our aim will be to summarize the key disagreements between these two positions.

- Required Reading: Wilson, R. (2007), "Levels of selection." In Matthen and Stephens (eds) *Philosophy of Biology* (p. 111-128).
- Background Reading: Sober, E. and Wilson, D.S. excerpt from *Unto Others: the Biology and Psychology of Unselfish Behaviour*.

Feb 15: Biological individuality.

*Learning objective***:** Selfish Gene Theorists define biological individuals as entities that pass through a single "genetic bottleneck" and they argue that selection acting on genes tends to produce these sorts of biological assemblages. The aim this week will be to become clear on their arguments in defense of this view, and to consider some putative counter examples.

- Required Reading: Dawkins (1976), *The Selfish Gene.*Ch. 13: "The long reach of the gene."
- Background Reading: TBA

March 01: Adaptationism.

Learning objective: Students will be able to identify the alternative explanations for the evolution of a complex trait besides natural selection, and they will be able to identify ways in which those hypotheses can be tested in practice.

- Required reading: Gould, SJ & Lewontin, D. (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*: vol. 205: 581-598. .
- Background reading: Lewens T. (2009) "Seven types of adaptationsim." *Biology & Philosophy* 24:161.

March 03: **Midterm paper due**

March 08: The scientific method – Some popular misconceptions.

Learning objective: Students will come to understand why most philosophers reject Popperian hypothesi- testing as an adequate description of the scientific method. In its place, we will consider the social institutions that promote the acquisition of scientific knowledge.

- Required reading: Woodward, J. and Goodstein, D. (1996), "Conduct, misconduct and the structure of science." *American Scientist* 84(5): 468-478.
- Background Reading: Whyte, K.P. and Crease, R.P. "Trust, expertise, and the philosophy of science." *Synthese* 177: 411-425.

March 15: Practical challenges for hypothesis testing.

Learning objective: Using Shrader-Frechette's example of radioactive release at Yucca mountain, we will consider whether scientists' adherence to a deductive model of hypothesis testing gave rise to this disaster. We will also consider how this case exemplifies the questionable role for scientific laws in the deduction of hypotheses.

- Required reading: Shrader-Frechette (2014) *Tainted*, Ch. 2: "Discovering Dump Dangers." (pp. 17-28) and Ch. 9: "Releasing Radioactivity" (111-127).

Mach 22: The comparative approach to hypothesis testing.

Learning objective: Using Shrader-Frechette's example of Florida Panther conservation, we will consider whether the comparative model is an adequate approach for justifying scientific hypotheses.

- Required reading: Excerpt from Lauden, L. (1977) Progress and its Problems; and Shrader-Frechette (2014) *Tainted*, Ch. 10: "Protecting Florida Panthers"." *Tainted* (pp. 128-143).
- Background reading: Bird, A. (2007) "What is scientific progress?" Nous 41:64-89.

March 29: Ecological laws I (the case against).

Learning objective: Students will consider the reasons why some ecologists think that this discipline lacks and genuine laws, and whether ecology is a science of case studies.

- Required readings: Simberloff, D. (2004) "Community ecology, is it time to move on?" *The American Naturalist* 163: 787-799; and Shrader-Frechette (2014) Tainted, Ch. 11. "Cracking case studies." (p. 144-156).
- Background reading: Cooper, G. (1998) Generalizations in edology: a philosophical taxonomy. *Biology & Philosophy* 13:555-586.

April 05: Ecological Laws II (the case for).

Learning objective: Students will consider whether the debate over the existence of ecological laws can be better understood as a question about the 'reslience' of ecological generalizations.

- Linquist et al (2016) Yes! There are resilient generalizations ("laws") in ecology. *Quarterly Review of Biology* 91: 1-13.
- Background reading: Colyvan and Ginzburg (2003) "Laws of nature and laws of ecology." Oikos 101:649; & Lockwood, D. (2008), "When logic fails ecology." *Quart. Review of Biol.y* 83: 57-64.

April 15 (approximately): **Final paper due**