

Phil*2000 - Philosophy of Biology

Winter 2018

Instructor: Dr. Stefan Linquist

Location: [MCKN 115](#)

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Time: Tuesday 7:00 – 9:50 pm

Office: MCKN 358 (located in the office wing, not the classroom wing of MacKinnon).

Hours: Tuesday: 5:00-6:00 or by appointment

Course Description

Over the span of an undergraduate degree a typical biology student encounters various philosophical questions which are only touched upon (if discussed at all) in their lectures and textbooks. Students often get the impression that these issues are uncontroversial or settled, only to encounter them later as pivotal questions in their professional lives or in graduate school. This course on the philosophy of biology provides students with an opportunity to stop and explore some of those issues in more detail. At the same time, this exercise of questioning and examining controversial ideas will sharpen student's skills in reasoning and communication. Many of the questions we will explore do not have clear cut answers. This is because they are still not resolved even at the highest levels of biological theorizing. However, in philosophy you can expect to attain a deeper understanding of an issue --comprehending how and why it arises -- even if this sometimes generates new questions.

The first topic is whether evolution and natural selection should be understood as a process that occurs exclusively at the level of the gene, as opposed to higher-levels such as whole organisms, groups, or species. The "selfish gene" perspective became popular in the 1980s because it appeared to resolve the nagging puzzle of altruism: how could selection favour any behaviour that tends to increase the fitness of another organism? Over the years, a number of problems with selfish gene theory have emerged and it is now challenged by multi-level selectionist. We will review the arguments originally presented in favour of selfish gene theory by its most famous advocate (Richard Dawkins) and consider how others have responded. We will also consider some general philosophical issues that arise along the way, such as the implications of selfish gene theory for our understanding of humans as independent decision makers.

The second topic concerns a disagreement over the right way to think about the genome. Much of the hype surrounding the Human Genome Project in the late 1990s emphasized the idea that the genome is a program for controlling the expression of traits. The idea was that by "decoding" this program, we can cure most diseases and understand human nature. This picture has not played out as expected, and we will consider various explanations for why this is so. Some researchers argue that we only need to understand the epigenetic factors that regulate gene expression. More radical proposals claim that the very idea of a genetic program is a misguided metaphor and we need to move past it.

A third topic is concerns the putative reasons for conserving biodiversity and whether they withstand scientific and philosophical scrutiny. Most of us are familiar with the idea that biodiversity promotes ecosystem services, that it leads to the discovery of new medicines, or more generally that it is just good to keep it around as a precautionary measure. It turns out that these familiar arguments encounter some serious objections. By considering these objections and attempting to generate responses to them, we will consider whether it is possible to bolster the scientific and philosophical justifications for biodiversity conservation.

Learning Outcomes

- Written responses to reflection questions are designed to sharpen students' skills in **critical thinking** and **argument analysis**.
- Participation in group discussion improves students' **clarity of oral communication**.
- The final paper provides an opportunity to explore ideas relevant for their **4th year research projects**.
- Overall, the topics in this course provide a venue **asking "big picture" questions** about biology.

Readings

R. Dawkins (1976/ 2016), *The Selfish Gene*. Oxford University Press.

J. Newman, G. Varner & S. Linquist (2017), *Defending Biodiversity*. Cambridge Press.

Additional readings will be made available on Courselink. The Course Outline (below) identifies the required readings for each week. Please make sure to read these articles and chapters at least once prior to the date on which they are assigned. All readings listed on the syllabus are required.

Assessment

Participation: 10%- This is a seminar-based course. Students are expected to attend class and participate in discussions. Please bring your textbooks or other reading materials to class, we will regularly be consulting those texts as a part of our discussion.

Reflection Questions: 60% – Roughly every second week students will submit answers to a set of reflection questions addressing some aspect of the required reading. These questions are to be submitted using Dropbox on each **Monday, the day before the class in which they will be discussed**. The purpose of these assignments is to help guide students through the reading, to provide an opportunity to formulate their ideas, and to serve as a basis for in-class discussion.

Final paper: 30% - A final paper will be due at the end of semester. Students will presented with a list of potential topics, but are also encouraged to write about an individually selected topic. Those who select their own topic must receive prior approval from the instructor.

Please see [this link](#) for additional information about student rights and responsibilities, as outlined by UofG College of Arts.

Course Outline

Week 1 (01/09): Introduction to course themes

Learning objective: Students will review the syllabus and understand course objectives. You will be provided some historical and theoretical context for the first topic: selfish gene theory.

Week 2 (01/16): Selfish Gene Theory I: immortal replicators as the units of selection.

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

- Required reading: *The Selfish Gene*. Ch. 1 "Why are people?"
- First reflection due on Monday, January 15.

Week 3 (01/23): 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."

Week 4 (01/30): Selfish Gene Theory III: Hamilton's rule and kin selection.

Learning objective: students will be able to explain how apparently altruistic behaviour is thought to evolve by kin selection, and consider some of the predictions of this theory and what it might take to falsify them.

- Required reading: *The Selfish Gene*. Ch. 4 "The gene machine" & Ch. 6 "Genemanship"
- Second Reflection due on Monday, January 29th.

Week 5 (02/06): The fall and rise of multi-level selection theory.

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: Excerpt from Sober and Wilson (1998), *Unto Others* (p. 15-101).

Week 6 (02/13): Adaptationism and scientific conduct.

Learning objective: An ongoing debate in biology concerns the extent to which it qualifies as good scientific practice to assume that most traits are adaptations (i.e. that they have been shaped by natural selection.) Students will be able to identify alternative explanations for the evolution of complex traits, and they will be able to identify ways in which those hypotheses can be tested in practice.

- 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. .
- Third reflection questions due on Monday, Feb 12.

Week 7 (02/27): A multi-level perspective on the genome.

Learning objective: The debates over multi-level selection and adaptationism had an effect in the 1980s on the ways that molecular biologists started to think about genomes. Students will be able to identify these themes in these canonical papers on “selfish DNA” and be able to reconstruct the arguments presented in favour of this approach.

- Orgel, L.A and Crick, F. (1980), "Selfish DNA: the ultimate parasite." *Nature*, 284: 604-607.
- Doolittle, W. F. & Sapienza, C. (1980), "Selfish genes, the phenotype paradigm and genome evolution." *Nature*, 284: 601-603.

Week 8 (03/06): The human genome project: genome as program, genome as panacea.

Learning objective: During the lead up to the Human Genome Project a number of exaggerated promises were made about how such a huge expenditure of funds would revolutionize medicine and our understanding of humanity. Here we review some of the critical voices that emerged at the time. Students should be able to explain what proponents of the HGP meant by a “theoretical” understanding of the genome and why it was not realized. They should also be able to develop a thoughtful position on whether the idea of a genomic program is merely a metaphor.

- Tauber and Sarkar (1992) “The Human Genome Project: Has Blind reductionism gone too far?” *Perspectives in Biology and Medicine*, 35:220-235.
- Nijhout, H.F. (1990) “Metaphors and the roles of genes in development. *Bioessays*,
- Fourth reflection due on Monday March 5

Week 9 (03/13): The ENCODE debacle: a case study for the importance of conceptual clarity.

Learning objective: ENCODE is the contemporary equivalent of the Human Genome Project, and once again we are seeing biased interpretations and exaggerated promises of what the genome is and how understanding it will improve human life. Students should be able to identify the objections to ENCODE’s claim that 80% of the human genome is functional. They should also be able to explain how this claim involved an equivocation on different philosophical senses of the term “function.”

- Doolittle, W.F. (2012) “Is Junk DNA bunk? A reply to ENCODE.” *PNAS*, 110: 5294-5300.
- Elliott et al. (2014), “Conceptual and empirical challenges of assigning functions to transposable elements.” *American Naturalist*, 184: 14-24.

Week 10 (03/20): Should biodiversity be conserved to promote ecosystem services?

Learning objective: A popular argument for conserving biodiversity appeals to the idea of an ecosystem service. Students should be able to take a critical look at the science behind this claim and consider whether there is sufficient evidence to link biodiversity with services like stability. You should also develop an informed opinion on whether ecosystem services might be sometimes better promoted with a reduction in biodiversity.

- Newman et al. (2017) *Defending Biodiversity*, Chapter 1 “Biodiversity and the Environmentalist Agenda” and Ch 2 “Ecosystem functioning and stability.” (pp. 192)
- Fifth reflection due, Monday, March 19

Week 11 (03/27): Does the precautionary principle justify biodiversity conservation?

Learning objective: Students should come to recognize how the precautionary principle is employed as an allegedly value free decision procedure in policy making, and why many economists and decision theorists dismiss it as misleading or useless.

- Required reading: Newman et al. (2017) *Defending Biodiversity*, Ch. 3 The Precautionary Principle. (pp. 97-131)

Week 12 (04/06): Should biodiversity be conserved for medicinal or recreational benefits?

Learning objective: Students should be able to articulate the economic argument for why it is not in the interest of private companies to invest in bioprospecting. They should also develop an informed opinion on whether nature recreation provides an adequate justification for conserving the parts of biodiversity that are not covered by other defenses.

- Newman et al. (2017) *Defending Biodiversity*, Ch. 4 “Agricultural and pharmaceutical benefits,” and Ch 5. “Nature based tourism and transformative value.” (pp. 132-192).
- Sixth reflection due, Monday April 5th.

April 12 (approximately): **Final paper due**