Bibliographic Details

A Dictionary of Cultural and Critical Theory: Second Edition

Edited by: Michael Payne and Jessica Rae Barbera
eISBN: 9781405168908
Print publication date: 2010

biology, philosophy of

LEONORE FLEMING

Subject	Literature
DOI:	10.1111/b.9781405168908.2010.x

The branch of philosophy that is devoted to the study of biology. As a subset of PHILOSOPHY OF SCIENCE, philosophy of biology restricts its focus mainly to biology, although other sciences such as physics and chemistry are also important.

Essentially, biology is the study of life, and it is often to biology that we turn when we have questions not just about life in general, but about human nature. Although biology is mainly comprised of facts, “biology's exciting conclusions do not follow from the facts alone” (Sterelny and Griffiths, 1999, p. 5). Claims in biology often leave the realm of data analysis and enter the realm of self-reflection and speculation, and for this reason, one might argue, philosophy has a clear place in biology.

For simplicity's sake, one might say there are three general types of questions in philosophy of biology. The first contains questions in philosophy of science that have been narrowed to the subject of biology. For example, general epistemological questions about explanation in science or the status of laws in science are narrowed to questions about explanation in biology and the status of laws in biology. The second type of question contains problems in biology that biology has been unable to answer. An example here would be any question in theoretical biology, such as whether organisms have become more complex over time. A third type of question takes traditionally philosophical questions and applies biology to them in an attempt to make some philosophical progress. For example, one might look towards biology to understand the development of morality based on our social instincts.

With respect to philosophy, the first set of questions can be construed as mainly philosophy of science and the third set as purely philosophical. However, the second set of questions is solely philosophy of biology. Most of the questions I pose in this article are of this second kind.

Biology is a vast area of research that includes many disciplines and subfields that are constantly expanding and diverging. Philosophy of biology recognizes this and attempts to deal with all of biology, from genetics to paleontology to biotechnology. The biological and philosophical questions raised among each discipline are of course quite diverse, but a few of the most relevant and philosophically interesting can serve as an introduction to this diverse field.

Genetics Genetics studies inheritance, or rather the heredity unit, the gene. Although one might argue that philosophy of biology started with the publication of David Hull's *Philosophy of Biological Science* (1974), it wasn't until Richard Dawkins's book *The Selfish Gene* was published in 1976 that questions in philosophy of biology became prominent. Dawkins's basic argument is that in evolutionary theory one should not focus on natural selection acting on organisms (as Darwin did in *The Origin of Species)*, but rather one should concentrate on genes. To appreciate Dawkins's point, we must first understand Darwin's perspective on natural selection at the organismic level.

Darwin gave three conditions for evolution by natural selection: variation, heredity, and differential reproduction. The first is self-explanatory, the second concerns some kind of replication or way for information to pass from one generation to the next, and the third says that entities reproduce at different rates. For Darwin, organisms met these three conditions; for example, ants vary, they have a hereditary mechanism (although Darwin did not know what it was), and some ants will reproduce better than other ants. For Dawkins however, it is the gene that best fits these conditions; genes vary, they *are* a hereditary mechanism, and some genes do better getting into the next generation than others. *The Selfish Gene* argues that genes are the replicators “striving” to get into the next generation, and they “use” organisms merely as their vehicles. So it is the “selfish” genes that are running the show, and we are merely their disposable transport. This of course raises many questions, the most basic being, what is a gene (e.g. Beurton et al., 2000) and do genes actually carry information? Although somewhat simplistic, these are questions that still plague philosophers and biologists today, and surprisingly there is much disagreement among the literature.

Some more questions created by Dawkins include: How much are we “hardwired” by our genes, and do we have “genes for” certain behavioral characteristics? Is the genetic level somehow unique and more important than other levels, such as the organismic or molecular level? And is the best explanation for biological phenomena found at the genetic level?

Dawkins's ideas were and are very controversial. One reason is because “the selfish gene” can also be read as “the altruistic human,” since a human who acts altruistically is only that way because of his or her selfish genes. As Dawkins argues, often the best way for genes to get to the next generation is if they help other copies of their genes found in relatives. This is known as kin selection. Another way to explain the altruistic “vehicle” is that an altruistic organism is more likely to find a mate, be helped out of dangerous situations, etc., which gives a gene a better possibility of surviving to the next generation. Many criticisms of Dawkins focus on his parsimony and level monism, because he only focuses on the genetic level; biology is a complex discipline that many argue cannot be reduced and simplified to one level of explanation like the story in *The Selfish Gene*.

Molecular Biology Molecular biology studies the interactions between molecules. Questions in philosophy of biology that concern molecular biology are often very similar to those concerning genetics. For instance, with respect to the genetic level, a good question is whether or not most biological explanation can occur at this level. With respect to molecular biology, one can ask if it is not really the genes but the molecules that give complete explanation. As an example, take the Mendelian concept of a gene: it is a functional unit used in population biology, evolutionary theory, etc., that allows biologists to track heredity among populations. For molecular biology, however, a gene is a string of nucleic acids that codes for proteins. For someone who wants to reduce biological explanation to the molecular level, there is the question of how we reconcile the Mendelian gene with the molecular gene – is it even possible? Alex Rosenberg (2006) argues that reducing all biology, such as Mendel's theory, to molecular biology is ideal, and that the only reason we really have genetics and especially higher-level biology, such as population biology, macroevolution, etc., is because of our epistemic limitations. If we could understand everything at the molecular level, Rosenberg argues that we could understand and predict all biological and scientific phenomena. Philosophical questions that arise from molecular biology quite often hinge on whether or not biology is reducible.

Evolutionary Biology Evolutionary biology is a broad discipline concerned with questions about the origin and descent of species and their modification over time, i.e. their evolution. NEO-DARWINISM refers, in its broad usage, to the current biological paradigm where evolutionary theory permeates all biological research. Evolutionary biology as an academic discipline began as a result of the modern synthesis around the 1930s and 1940s. It is one of the largest areas to attract philosophers of biology because it contains much theoretical biology found in subfields such as paleobiology, macroevolution, phylogenetics, etc. I will describe a few of the more interesting questions for philosophers of biology that arise in evolutionary biology.

1. What is a species? Just like asking what is a gene, asking what is a species seems like a very simple question, but the literature is full of disagreement. First of all one could be an essentialist and argue that a species has an essence that defines it. This idea can be traced back to platonic forms and Plato's idea that nature is "carved at its joints" (*Phaedrus* 265d–266a). However, because evolution is based on change, one might argue that species are never static enough to have true and stable essences. It is also a problem because defining when speciation has created a new species as opposed to slightly changing an already defined species is a problem. A second answer is that a "species is a series of ancestor descendent populations passing through time and space independent of other populations, each of which possesses its own evolutionary tendencies and historical fate" (**George Gaylord Simpson, 1951**). This is known as the evolutionary species concept, not to be confused with another answer to the question, the biological species concept, where species are defined as interbreeding concepts. This last idea is probably the most widely accepted, although it is still a question among the philosophy of biology literature whether or not a species has unchanging essential characteristics.
2. How deterministic is evolution? The topic of how much chance or determinism there is in evolution can be approached from a micro- or macro-evolutionary level. With respect to the latter, **Steven J. Gould famously asked (1989)**: if we reran the "tape of life" starting from the Cambrian Explosion, would we get the same outcome? The Cambrian Explosion occurred around 570–530 million years ago and marks an "explosion" of diversity among living things, with the appearance of the lineages of almost all living animals today. Interestingly enough, most of that diversity went extinct. Gould is asking: if we reran the tape of life and allowed the Cambrian Explosion to take place again, would the same organisms survive? Would humans still exist, would mammals, would vertebrates? This question ultimately hinges on how much determinism or chance there is in evolution. After the Cambrian Explosion, Gould argues that the organisms that survived did so mainly by chance and that if we reran the tape of life the "coin flip" might go in the other direction and humans would not have evolved. This means that human existence is accidental, a rather disconcerting and controversial idea.

With respect to micro-evolution, one might ask whether more change in a population occurs from genetic drift or natural selection. For example, when we look at butterfly spots that have changed from one generation to the next, this could be an adaptation, or simply the result of a random genetic mutation. Although there may be ways to try to test whether these butterfly spots are an adaptation, *in general* there is no empirical way as of yet to test how much change in a population is due to natural selection as opposed to drift. Hence there is no way to tell how much chance there is at the micro-evolutionary level. So there is still a theoretical debate as to the role of natural selection and chance (drift) in evolutionary change.

3. How important is adaptation? Along the same lines as arguing about the importance of natural selection, we can argue about the importance of adaptation. Traits are adaptive if they are selected for and increase the fitness of an organism in a certain environment; for example, plants may develop toxicity because they are in an environment where their leaves are being eaten by insects. As already discussed, besides adaptation, some traits might come about by random mutation, and other traits might come about as "by-products" or "spandrels." During one of the most heated debates in philosophy of biology, Steven J. Gould and Richard C. Lewontin (1979) argued against panadaptationism and the

"Panglossian Paradigm." Panadaptationism, or simply adaptationism, is the idea that every trait contributes to the fitness of an organism and hence is adaptive. The Panglossian Paradigm refers to Voltaire's Dr Pangloss, who said that everything happened for a reason, such as the bridge of our nose for holding spectacles, because we live in the best of all possible worlds. Gould and Lewontin claim that panadaptationists argue the same thing. For example, they argue that traits such as our ear lobes are adapted for holding earrings (or more realistically for sexual selection), when really ear lobes were not selected for at all, they are just by-products, or "spandrels," from the way our ears form. Another example would be the human chin. It is most likely that the chin was not necessarily selected for, but just a by-product of the constraints produced by human facial structure; thus the chin itself is a somewhat arbitrary trait. The problem, as Gould and Lewontin see it, is that evolutionary biologists often tend to try to explain all traits in all organisms as somehow adaptive, and end up telling "just-so stories" with no real scientific basis (Gould and Lewontin, 1979).

4. Is there progress in evolution? Another important topic in evolutionary biology pertains to evolutionary progress. If we compare bacteria to humans, for instance, can we say there has been some progress? This is a tricky question because in evolutionary terms an organism is successful if it survives and reproduces, and cyanobacteria have been around for about 3.5 billion years; humans on the other hand have only been around for about 200,000 years. However, one might argue that our intelligence seems to show that humans have progressed beyond cyanobacteria. But again, this is tricky, because progress is a subjective and value-laden term, and biology is based on facts. One would not want to fall prey to Hume's is-ought problem. It seems that whenever progress is discussed in evolution it ultimately leads to the conclusion that humans are the pinnacle of progress and whatever characteristics we have are the best and most progressive. To avoid this anthropocentrism, instead of progress one can discuss trends in evolution. There are trends in body size, tool-use, number of parts, and so on. This probably isn't satisfying for someone trying to prove the remarkableness of humans, but it is better science.

Human Biology Probably the most far reaching of the different areas, human biology discusses human nature by touching upon CULTURAL ANTHROPOLOGY, cultural evolution, biological anthropology, evolutionary psychology, neuroscience, and many other disciplines. I will discuss three of the questions most interesting in human biology for a philosopher of biology.

1. Is there an essential human nature? One way to approach this question is to look at the genetic code and the similarities in the genetic code among all humans. However, our DNA is 96–98 percent similar to chimpanzee DNA, so general similarity may not be the answer. If we knew more about specific genes then perhaps certain genes unique to humans could be part of an essential human nature (e.g. a gene for language), but science is far from understanding genes and their functions. Besides this empirical way to test for an essential human nature, there is the theoretical question of whether or not it can even exist. If *Homo sapiens* is a species like any other that changes and evolves over time, then a stable essence seems impossible. Yet there is still something intriguing about finding out what makes humans human. Another possibility is to look at what is unique to humans, such as language, abstract thought, symbolic behavior, and so on; however, recent experiments done with chimpanzees seem to show that all these behaviors are a difference in degree and not kind. Chimps can perform primitive sign language, they show some symbolic behavior, etc. So either we redefine the "traits" that are uniquely human, or we recognize that humans possess a great similarity with other animals.

2. Are some of our cultural behaviors "hardwired"? In many ways one could interpret this as a modern day nature versus nurture debate. However, this distinction is problematic because it presupposes mutual exclusivity. It is more useful to ask if our behaviors are hardwired, and if so, how rigidly. Even if a behavior is hardwired, this only means that one has a propensity to follow it, and without the right circumstances a hardwired behavior may not come to fruition. For instance, it has been shown that many humans are hardwired to be afraid of snakes (**Öhman and Mineka, 2001**) because snakes were potentially deadly threats to our ancestors. For our ancestors, a hardwired fear of snakes was important because a learned fear would often mean a snake bite and then death before reproduction, so those

humans with a fear "module," as Öhman and Mineka say, would have higher fitness. However, you could imagine a case where someone with a snake fear module grew up in a household of snakes, thus overcoming this fear. Or imagine someone without the snake fear having a traumatic experience with a snake, thus causing a learned fear. This is just one of the ways to approach the question of whether or not cultural behaviors are learned or hardwired.

3. What is culture and how does it evolve? It is hard to find a general definition of culture, because culture in many ways seems best defined by examples. Yet for anthropologists, physiologists, etc., it is important to have a general, practical, and working definition. I give three possible ways to approach understanding culture.

First of all, a philosopher of biology most likely wants to define culture in terms of Darwinian natural selection. However, this broaches questions like number 2 above about whether or not our behavior is hardwired by genes. This was the view of E.O. Wilson in *Sociobiology: The New Synthesis* and was one of the most despised theories among philosophers and biologists alike. Wilson argued that much of our culture and social behavior is evolutionarily based, meaning in our genes. Much of his book was uncontroversial, but near the end he suggested that human behaviors such as racism, rape, and homosexuality might be hardwired; he even suggested that some humans might have a predisposition to certain social classes. The problem was, and is, that humans aren't as easy to study as ants, Wilson's other specialty. Humans have a longer generational time, they have much more variety in environments, their actions are more plastic because of consciousness and rational decision, and therefore generalizations about human action are not easily justified. By making general statements about human behavior one can fall prey to genetic determinism – again, not an appealing conclusion. However, this does not mean that evolution is not helpful when looking at human culture: socio-biology has just taught us to be careful with our speculations, because human behaviors are not as easily understood as ant behaviors.

A second way to define culture is through Dawkins's use of "memes." Dawkins introduced the idea of memes at the end of *The Selfish Gene* and compared a meme in culture to a gene in an organism. Just like genes, memes replicate and carry information. A meme can be a catchy tune, a way of dressing, a certain phrase, a moral norm, a dance step, an action such as smoking, and so on. As Dawkins says, it is "a unit of cultural transmission, or a unit of imitation" (1976). However, memes are not controlled by genes but are just their own products that have their own "agenda" to reproduce. According to memetics a type of Darwinian selection does control culture, but it is independent from natural selection at the genetic level.

A third way to define culture is to take this theory of memetics and deepen it by introducing a relationship between genes and memes. This theory is called gene/culture dual evolutionary theory or dual inheritance theory. In this theory genes and cultural variants (what gene/culture dual evolutionists call memes) evolve simultaneously. For example, the gene for lactose tolerance was recently found to have coevolved with the spread of dairy farming, which started around 9,000 years ago in Europe (see Laland and Brown, 2002). When humans started dairy farming, this cultural trait created a selection pressure for an allele for lactose tolerance. This allele arose as a random mutation, but because of the cultural environment, became a fitness-enhancing trait. So the gene/culture dual evolutionary theorists disagree with the memeticists by arguing that culture is not completely independent from our genes and our biology. However, unlike the sociobiologists, they give examples like diary farming where the culture comes first, and then the genetics coevolve.

Although none of these approaches give a definite definition to culture, they do show how the term is used in contemporary research.

Conclusion The philosopher of biology Robert Brandon said that in the late 1970s he knew of only five other philosophers of biology (1996, pp. xii–xiii). Since that time the field has grown considerably. It is an exciting branch of philosophy with a rich and diverse set of issues whose reflections change as biological theories change. Not only does philosophy of biology theorize about the latest biological findings, it also examines problems that have plagued philosophy for centuries and renders them in a new light, with new possibilities of understanding and discovery.

Reading

Beurton, P.J., Falk, R. and Rheinberger, H. 2000: The Concept of the Gene in Development and Evolution: Historical and Epistemological Perspectives.

Brandon, R.N. 1996: Concepts and Methods in Evolutionary Biology.

Dawkins, R. 1976: The Selfish Gene.

Gould, S.J. 1989: Wonderful Life: The Burgess Shale and the Nature of History.

Gould, S.J. 2002: The Structure of Evolutionary Theory.

Gould, S.J. and Lewontin, R.C. 1979: “The spandrels of San Marco and the panglossian paradigm: a critique of the adaptationist programme.”.

Hull, D.L. 1974: Philosophy of Biological Science.

Laland, K.N. and Brown, G.R. 2002: Sense and Nonsense: Evolutionary Perspectives on Human Behaviour.

Öhman, A. and Mineka, S. 2001: “Fears, Phobias, and Preparedness: Toward an Evolved Module of Fear and Fear Learning.”.

Rosenberg, A. 2006: Darwinian Reductionism, or, How to Stop Worrying and Love Molecular Biology.

Rosenberg, A. and McShea, D.W. 2008: Philosophy of Biology: A Contemporary Introduction.

Simpson, G.G. 1951: “The Species Concept.”.

Sterelny, K. and Griffiths, P.E. 1999: Sex and Death: An Introduction to Philosophy of Biology.

Wilson, E.O. 1975: Sociobiology: The New Synthesis.

Cite this article

FLEMING, LEONORE. "biology, philosophy of." *A Dictionary of Cultural and Critical Theory: Second Edition*. Payne, Michael and Jessica Rae Barbera (eds). Blackwell Publishing, 2010. Blackwell Reference Online. 07 July 2012 <http://www.blackwellreference.com/subscriber/tocnode?id=g9781405168908_chunk_g97814051689084_ss1-17>