The Long Reach of Philosophy of Biology

Ruse: The Oxford Handbook of Philosophy of Biology. Oxford University Press, 2008

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Abstract

The Oxford Handbook of Philosophy of Biology covers a broad range of topics in this field. It is not just a textbook focusing on evolutionary theory but encompasses ethics, social science and behaviour too. This essay outlines the scope of the work, discusses some points on methodology in the philosophy of biology, and then moves on to a more detailed analysis of cultural evolution and the applicability of a philosophy of biology toolkit to the social sciences. It is noted that concepts like the species concept may generalize to other domains whilst failing to account for the nature of all species. Finally, the author notes the omission of any discussion of information in biology.

Keywords

Culture, development, ethics, evolution, information, philosophy of biology, social science, species

Introduction and Structure of the Book

The Oxford Handbook of Philosophy of Biology promises 'to give the reader an introduction… and… to move the subject forward dramatically'. In this essay I assess these claims. This is an ambitious and wide-ranging introduction to the philosophy of biology. This book is not quite a textbook, as the contributions often push the authors' favoured theories, but this volume is nevertheless a fine introduction to the controversies and gives a grounding in most, though not all, of the major issues in philosophy of biology. Ruse compiles a collection of views not just on the philosophy of evolutionary biology but on the other sub disciplines in philosophy of biology as well. We are treated to chapters covering topics as diverse as the intersection of ethics and biology, feminist philosophy of biology and rhetoric.

I begin this review by surveying the structure of the book, then comment upon some strengths of the collection. I then note how moving the subject 'forward dramatically' might even better be done. I conclude by arguing that works such as *The Oxford Handbook of Philosophy of Biology* show that philosophy of biology is well placed to mediate conceptual integration across a range of scientific and social scientific disciplines.

The book is arranged in twenty-five chapters with an introduction by Michael Ruse. Though not divided further into thematic sections there is an obvious progression from discussions of evolution to those of behaviour and social issues. After David Hull's

chapter on the history of the philosophy of biology, chapters two to nine deal with the philosophy of evolutionary biology, often with no-nonsense historical clarity. After treatments of Darwinian theory, population thinking, adaptationism, teleology, evolvability, species, contingency and macroevolution, chapters ten to thirteen are an odd mix, which include origin of life studies, the reductionism debate, evo-devo, and the philosophy of genomics. But then chapters fourteen through seventeen pick up the thread of mind and behaviour, including an excellent chapter by Matteo Mameli on sociobiology, evolutionary psychology and cultural evolution. I discuss this section in some detail below. Chapters eighteen to twenty-three delve into moral, social and ethical aspects of biology and philosophy. Genetic engineering, the natural and the normative in environment and ecology, agricultural biotechnology and race arise in this phase of the book. It is worth noting that the chapter on biology and religion consciously omits any discussion of the evolution of religious belief. This is disappointing because this is an area where philosophers of biology seem to be getting some traction (e.g. Barrett 2007, Bulbulia 2007). Rounding out this volume are two chapters, which though important don't naturally fit any of the broad themes I have already noted. The penultimate chapter by Carla Fehr is on feminist philosophy of biology and the last chapter is unique in this context, an assessment of the rhetoric employed by Stephen Jay Gould.

Methodology and Reductionism

Dealing with moral, social and ethical concerns makes *The Oxford Handbook of Philosophy of Biology* different from other similar texts. We begin to canvass the territory of ethics, both as informed by biology, by the evolution of moral norms, and biology as informed by ethics. This is no mere ethical debate about which biological technologies we ought to pursue, there is also analysis of how ethics ought to relate to biology. Lisa Gannett calls for a fundamental reassessment of the relationship between ethics and biology. She claims that if bioethicists limit themselves to debate downstream, after the science has been done, then some issues of considerable social and ethical relevance will be missed. For example, the employment of terms like 'genetic error', 'genetic lesion', or 'normal gene' are 'already directing preferred courses of action prior to any ethical assessment' (453). This may or may not be true. What is true is that such terms are normatively loaded. Scientists employing them are not pretending to do ethics, but their terms load an evaluative bias that may affect judgments within the debate. Terminology has an influence on how we interpret concepts.

It is not just in Gannett's chapter that this book focuses on methodology. Often the question, 'how ought we to answer questions in biology?' is probed. For example, there is a fact of the matter about whether adaptationism is correct, argues Steve Orzack. John Maynard Smith (1978) thought that adaptationism is correct *a priori*, Gould and Lewontin (1979) have argued that it is false *a priori*. Orzack argues that we can test these theses empirically. Orzack notes that there now exists sufficiently sophisticated computing technology to perform an ensemble test. We employ an array of investigators and sample in a principled manner from the phylogeny of life. Such an Adaptationism Project, like the human genome project, moves beyond 'the scientist as investigator' into the realm of science being done 'by small and large teams'. There is scope for

philosophers of biology to contribute to biological analysis by suggesting how science might usefully be done.
In a chapter on genomics Zachary Ernst argues that computing has fundamentally altered what we can know about genomics and that a strong case can be made that earlier epistemic limitations in this field have been rendered obsolete by technology. Existing philosophical accounts of scientific explanation are 'overly psychologistic' (325). For example, there is a many-to-many mapping relationship between genotypes and phenotypes. Often this is taken to suggest that the genotype-phenotype relation is intractable complex. However, the availability of cheap fast computers may render this complexity irrelevant.

Carla Fehr's feminist chapter also warrants comment. She makes two claims. First that attending to sex, gender and women can result in important alternative theories and approaches perhaps missed by traditional philosophers of biology. This is almost certainly correct as, for example, Sarah Hrdy's work has shown (e.g. Hrdy 1999). The second claim is that mechanism need not be associated with reductionism. Hence, relatively high-level concepts such as sex-specific behaviour need not reduce to genetics or hormonal states. I don't think that anyone seriously denies that environmental and social changes will contribute to development and this will include development of gender behaviour. We don't want to deny that gender exists as something ontologically real, even if it is a social construction, but it does seem that there is still an important case for causal reduction. We can explain what gender results from genetically and culturally. There will be important genetic contributions to gender, via hormonal states for example, and there will be important cultural determinants. But gender is likely to be able to be broken down to a list of social causes and genetic causes without reducing culture to biology. As is stands we are epistemically insecure about the details of this causal reduction, but this does not mean that the reduction doesn't go through. This interesting chapter ignites yet again the hydra-like reductionism/antireductionism debate, which rears its many heads in several sections of this book.

A Measured Approach to Human Behaviour and Culture

Overall this treatment of the philosophy of biology is impressive in its breadth. Again it is not just a book on the philosophy of evolutionary biology. This is to be expected in a work of 642 pages. The main additional strengths lie in the fusion of philosophy, biology and social issues. The fusion project is one to which philosophers of biology are well placed to contribute. I will now suggest how biology and the social sciences may be brought into alignment. I begin with Mameli's excellent chapter, which clarifies the debate over the determinants of human behaviour and cultural change. Sadly chapter seventeen is the only chapter mentioning these important topics.

Mameli claims that 'an accurate evolutionary account of human psychological traits needs to give proper consideration to the role in humans of factors such as cultural transmission, niche construction, environmental change, and developmental plasticity' (411). This is true and important. Mameli argues that neither Sociobiology nor Evolutionary Psychology is up to this task. It is not good enough to merely import the

traditional tools of the study of genetic coding to debates about the nature of human behaviour. A first incorrect assumption made by sociobiologists is that genetic adaptations are invariably developmentally robust. Mameli notes that this assumption is simply false. For example, the same psychological mechanisms can give different behaviour in different environments. As reading shows, evolutionary novelties can occur. Being able to read is highly adaptive now, and results from the construction of a cognitive niche around ourselves. But reading is not an adaptation; it has at most a few thousand years evolutionary history. The core point is a crucial one, 'a gene that was selected because, in a given developmental environment, it resulted in a given psychological mechanism may, when it operates in a different developmental context result in a different psychological mechanism' (421). And over evolutionary, and indeed historical time, human selective environments have changed, but so, too, have human developmental environments. The argument is this: if many human psychological mechanisms are evolutionary novelties due to the interaction of ancestral genes and new environments, then many of these mechanisms are not adaptations and the adaptive thinking of evolutionary psychology will fail to identify or explain them.

Having tackled the genetics of psychological devices, Mameli moves on to culture and evolution. He notes, 'even if there are some behavioural differences between populations that have (in part) a genetic origin, most of the variation at the population level and most of the homogeneity within populations may still need to be accounted for by appeal to processes of cultural transmission' (423). He argues that evolutionary psychologists overstate the case for evoked culture. There are many traits it is simply impossible for humans to develop without information transfer between individuals. And many traits require intense enculturation. But this doesn't rule out evolved biases that act upon cultural transmission, nor the fact that culture itself evolves by natural selection. Culture itself is, importantly, an information system that is subject to selection (I return to this when I discuss the omission of biological information as a topic in this volume).

Memetics has attempted to describe cultural evolutionary change, but has met much resistance; however, even if this resistance is justified, this does not mean culture is not an evolutionary process. Statistical distributions of traits in one generation are causally connected (via transmission channels) to statistical distributions of traits in other generations. Mutation, selection and transmission describe cultural change generation to generation. 'The existence of gene-like particles is a feature of some important biological transmission processes that occur on planet Earth, but such particles are not an essential feature of an evolutionary system' (426). This seems obvious when we look at culture.

As we learn more about cultural evolution then perhaps new and interesting features of evolutionary processes in general come to light. We may be able to feed some of this knowledge gleaned from the fusion of social science and evolutionary theory back into biological explanation. Cross-fertilization between biology and cultural science can occur, if we can get biologists and social scientists framing debates in the same language. An example goes back to Darwin. 'It is a well-known fact that two of Darwin's most important influences came from the social sciences, namely, Adam Smith's laissez-faire

economics and Thomas Robert Malthus's thinking on the growth of populations' (Lachapelle 2000, pg 331).

The final point raised by Mameli is that we need to understand the interactions between genetic and cultural evolution in order to understand the evolutionary history of human minds. This means understanding gene-culture coevolution as championed in particular by Boyd and Richerson (1985, 2005), but also the effect that downstream niche construction has on these processes. Human parents (and teachers!) shape the developmental environments of their offspring. This often causes the children to develop the same cognitive traits as their parents. What Mameli forgets to mention is that niche construction has its most dramatic effects where a subsequent generation acquires a different cognitive suite to the previous generation as a consequence of the environmental modifications the previous generation has made. We see rapid turning points and branching, particularly in recent cognitive evolution. For example, the rapid Twentieth Century rise in the IQ Raven's matrices, and similarities sub-tests may be a result of niche construction by previous Twentieth Century generations (see Flynn 2007, Blair et. al. 2005).

When it comes to human cognition there is a very strong case for the claim that development drives evolution. If we assume that human genomes have been relatively stable for the last ten or twenty thousand years, then changes in cultural technologies and cognitive developmental environments must be the explanation for all cognitive evolution from the minds of the Lascaux cave painters to the development of scientific cognition and quantum physics. In light of this certain puzzles of prehistory start to disappear.

Take Renfrew's Sapient Paradox as an example. Anatomically and genetically modern humans emerged in Africa over 100,000 years ago. However, significant modern cultural take-off seems to have occurred much later. Some characterize a behavioural transition in France around 40,000 years ago, which included improved stone tools, the first use of bone, ivory, and antler, a rise in the tempo of technological change, the appearance of beads and other personal adornments, naturalistic art, and changes in economic and social organization. It might be argued that this was a modest and localized affair, but even if so, there is no doubt that there was a spectacular burst of behavioural change around 10,000 years ago when the agricultural revolution began. These changes were very marked indeed (Renfrew, 2008). The paradox is this: If the arrival of Homo sapiens was such a significant evolutionary event, why did it take so long for the really impressive cognitive innovations to occur? It seems that by looking at the effect of niche construction and development on human cognitive phenotypes, we have our answer. Only once certain cultural technologies were in place did certain types of cognition become possible. Without number words, for example, exact arithmetic is not possible (Pica et al. 2004). The reason then that Neanderthals did not acquire symbolic cognitive abilities like Homo sapiens, may be less that they were cognitively inferior, but more that they lacked intense enculturation, at the right developmental stage, with symbolic media. Mameli's criticisms of sociobiology and evolutionary psychology and his advocacy of synthetic theories of cultural evolution have far reaching theoretical implications, for example the Sapient Paradox dissolves.

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In places this book lives up to its expressed goal of pushing the field forward. But more can be done. Two questions can be asked about the nature of the philosophy of biology itself. One is a question about the robustness of philosophical conclusions within biology itself, and the other is a question about the generality of these arguments outside of biology.

After one hundred and fifty years of thinking about biology, we are beginning to emerge with a conceptual and theoretical toolkit. In many cases this toolkit is being applied in domains beyond those in which it was developed. For example James Griesemer theorizes about the origins of life. He notes that in this domain all the usual biological assumptions dissolve. What constitutes biology is very contentious. However, many of the tools from the philosophy of biology toolkit are likely to apply here too. There are still developmental systems, there are still niches as defined by the interaction of a unit of selection with its environment, and there are still multiple hierarchical levels of description. We can extend the tools of philosophy of biology in this way outside of what is traditionally biology. What are the limits of this new toolkit?

I have already begun to talk about culture and mind. A well known, though controversial, application of the tools of philosophy of biology to this domain is meme theory (e.g. Dawkins 1976). There seems to be something important in this approach to social science, even if it is not the sole explanation of cultural change (Sterelny 2006, Gers 2008). But there are other possible avenues for exploration. I will mention only the concept of a species, and the notion of information in biology.

Richard Richards writes about the concept of a species and the species debate in a chapter on species and taxonomy. Darwin himself was skeptical as to the existence of species 150 years ago. There has as yet been no resolution of this issue. Richards in this volume argues that no single species concept will do the work we require. He advocates a species pluralism founded on pragmatism. Others push monist lines, such as Mayr (1982). On some views of species the philosophy of biology fails to even generalize to all of biology. This is because species concepts deduced from thinking about eukaryotes are notoriously difficult to apply to prokaryotes (see Ereshefsky, unpublished manuscript). What counts as interbreeding for a bacterium? And prokaryotes constitute most of the biomass on the planet. It may be that a fully worked out concept of prokaryote species might usefully be applied to explanations of artifact lineages. With these extended possibilities of use for the tools of philosophy of biology it is disappointing that Richards' chapter neglects significant discussion of the topic of prokaryote species. On other views the species concept is fluid and particular to the questions we happen to be asking. It is within this fluid and pragmatic view that the concept of a species may not be restricted to biology.

Furthermore, different disciplines can inform each other. Temkin and Eldridge's (2007) analysis of the phylogenetics of material culture shows that there are phylogenetic processes occurring in cultural evolution that we do not see in the standard biological

case. Of course, they note that they are talking about the standard eukaryote case, and prokaryote biology may more accurately reflect artifact lineages. It is possible that cultural science might inform biology. If we can put the findings of cultural scientists into biological terms it may help us understand the nature of biological processes given that these two domains may well be instantiations of a more abstract entity, that being evolving systems.

Another example of attempted cross-fertilization from biological evolutionary theory to the cultural case is Riede (2009). He picks up on the idea that we can model material cultural evolution as host-associate cospeciation. The underlying biological observation is that if a host speciates, then a parasite or associate of that host tends to speciate also. Cospeciation macro-analyses, rather than coevolutionary micro-analyses, may reveal congruence of lineage trees in pairings such as host/technology, mind/technology, technology/technology. Indeed, Riede demonstrates that this is the case for the association of 'species' of early modern knife technologies and early modern fork technologies. Riede points out that, 'many historical processes, whether in biology, at the interface between biology and culture, or between different facets of culture, are made up of multiple lineages of information transmission, and these lineages may be linked through historical association' (94). Riede argues that if patterns produced (in biological and cultural evolution for example) are similar, then we can study the phenomena using analogous toolkits even if the processes are not identical.

Although some attempt has clearly been made to ensure that this book is comprehensive, I must note one area that is neglected. The concept of information in biology is again missing from a compilation on the philosophy of biology. There is live debate in this area and the implications are important. If we focus on information in evolution, rather than on form, then we can begin to compare different domains in biology and inheritance in a common currency. There is a risk of fostering a naïve genetic determinism if we look at information as being only in genes. This is the essentialist fallacy (e.g. Sterelny and Godfrey-Smith 2007). There are two potential explanatory roles for genetic information concepts. First, genes are crucial for explaining the development of organisms. Second, genes are crucial for explaining inheritance of characteristics across generations. I suggest that there is a parallel debate to be had as to whether elements or variants of culture play these roles. If theoretical parity can be drawn between concepts of biological information and the role that culture plays in cognitive development, then social scientists may be more open to embracing theoretical biology. Social science has long argued the primacy of culture in explaining development, and cultural evolutionary theorists apply inheritance concepts to culture. An informational analysis might help to unite genetic and cultural elements.

Conclusions

The philosophy of biology is now well placed with an emerging tool kit. This consists not only of genetic evolutionary theory, but also conceptual tools pertaining to species, teleology, information and much more. We ought to see in the future more attempt to integrate fields such as ethics, feminist thought, and the study of rhetoric in ways that do

not merely respond to the philosophy of biology but drive it forward. As some have argued, there is a role for disciplines such as these in guiding how the philosophy of biology is conducted. Once the influence of social science touches the heart of philosophy of biology then the social sciences and humanities may be more willing to listen to philosophers of biology on the evolution of human culture and the nature of minds. There is wide scope for interdisciplinary cross-fertilization of theory in this exciting domain, and a work that truly pushed the philosophy of biology forward would tackle more of these challenging issues.

So who should read *The Oxford Handbook of Philosophy of Biology*? There is much in here for students and professionals in philosophy and biology alike, but also there is much here that ought to pique the interest of ethicists and social scientists too.

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