DOWNLOAD PDF PHILOSOPHY OF BIOLOGY (PHILOSOPHY AND SCIENCE)

Chapter 1 : Philosophy of Biology (Philosophy and Science) - PDF Free Download

Biology raises distinct questions of its own not only for philosophy of science, but for metaphysics, epistemology and ethics. This comprehensive new textbook for a rapidly growing field of study provides students new to the subject with an up-to-date presentation of the key philosophical issues.

Pre-modern[edit] The origins of philosophy of science trace back to Plato and Aristotle [28] who distinguished the forms of approximate and exact reasoning, set out the threefold scheme of abductive , deductive , and inductive inference, and also analyzed reasoning by analogy. The eleventh century Arab polymath Ibn al-Haytham known in Latin as Alhazen conducted his research in optics by way of controlled experimental testing and applied geometry , especially in his investigations into the images resulting from the reflection and refraction of light. Roger Bacon â€” , an English thinker and experimenter heavily influenced by al-Haytham, is recognized by many to be the father of modern scientific method. In this philosophy[,] propositions are deduced from the phenomena and rendered general by induction. The 19th century writings of John Stuart Mill are also considered important in the formation of current conceptions of the scientific method, as well as anticipating later accounts of scientific explanation. Logical positivism Instrumentalism became popular among physicists around the turn of the 20th century, after which logical positivism defined the field for several decades. Logical positivism accepts only testable statements as meaningful, rejects metaphysical interpretations, and embraces verificationism a set of theories of knowledge that combines logicism , empiricism , and linguistics to ground philosophy on a basis consistent with examples from the empirical sciences. Seeking to overhaul all of philosophy and convert it to a new scientific philosophy, [34] the Berlin Circle and the Vienna Circle propounded logical positivism in the late s. Thereby, only the verifiable was scientific and cognitively meaningful, whereas the unverifiable was unscientific, cognitively meaningless "pseudostatements"â€”metaphysical, emotive, or suchâ€”not worthy of further review by philosophers, who were newly tasked to organize knowledge rather than develop new knowledge. Logical positivism is commonly portrayed as taking the extreme position that scientific language should never refer to anything unobservableâ€—even the seemingly core notions of causality, mechanism, and principlesâ€—but that is an exaggeration. Talk of such unobservables could be allowed as metaphoricalâ€—direct observations viewed in the abstractâ€—or at worst metaphysical or emotional. Theoretical laws would be reduced to empirical laws, while theoretical terms would garner meaning from observational terms via correspondence rules. Mathematics in physics would reduce to symbolic logic via logicism, while rational reconstruction would convert ordinary language into standardized equivalents, all networked and united by a logical syntax. A scientific theory would be stated with its method of verification, whereby a logical calculus or empirical operation could verify its falsity or truth. In the late s, logical positivists fled Germany and Austria for Britain and America. The logical positivist movement became a major underpinning of analytic philosophy , [35] and dominated Anglosphere philosophy, including philosophy of science, while influencing sciences, into the s. Yet the movement failed to resolve its central problems, [36] [37] [38] and its doctrines were increasingly assaulted. Nevertheless, it brought about the establishment of philosophy of science as a distinct subdiscipline of philosophy, with Carl Hempel playing a key role. The Structure of Scientific Revolutions In the book The Structure of Scientific Revolutions , Thomas Kuhn argued that the process of observation and evaluation takes place within a paradigm, a logically consistent "portrait" of the world that is consistent with observations made from its framing. A paradigm also encompasses the set of questions and practices that define a scientific discipline. He characterized normal science as the process of observation and "puzzle solving" which takes place within a paradigm, whereas revolutionary science occurs when one paradigm overtakes another in a paradigm shift. More than one logically consistent construct can paint a usable likeness of the world, but there is no common ground from which to pit two against each other, theory against theory. Each paradigm has its own distinct questions, aims, and interpretations. Neither provides a standard by which the other can be judged, so there is no clear way to measure scientific progress across paradigms. For Kuhn, the choice of paradigm was sustained by rational processes, but not ultimately determined by them. The choice between paradigms involves setting two or more "portraits" against the world and deciding which likeness is most promising. For Kuhn, acceptance or rejection of a paradigm is a social process as much as a logical process. That is, the choice of a new paradigm is based on observations, even though those observations are made against the background of the old paradigm. These assumptionsâ€"a paradigmâ€"comprise a collection of beliefs, values and techniques that are held by a given scientific community, which legitimize their systems and set the limitations to their investigation. The scientific method is to be used to investigate all reality. Nevertheless its very existence is assumed. As infants we made this assumption unconsciously. People are happy to make this assumption that adds meaning to our sensations and feelings, than live with solipsism. For the most part, science is the discovering and explaining of the external world. The benefit of SRS is that the investigator is guaranteed to choose a sample that represents the population that ensures statistically valid conclusions. Coherentism Jeremiah Horrocks makes the first observation of the transit of Venus in , as imagined by the artist W. Lavender in In contrast to the view that science rests on foundational assumptions, coherentism asserts that statements are justified by being a part of a coherent system. Or, rather, individual statements cannot be validated on their own: As explained above, observation is a cognitive act. That is, it relies on a pre-existing understanding, a systematic set of beliefs. An observation of a transit of Venus requires a huge range of auxiliary beliefs, such as those that describe the optics of telescopes, the mechanics of the telescope mount, and an understanding of celestial mechanics. If the prediction fails and a transit is not observed, that is likely to occasion an adjustment in the system, a change in some auxiliary assumption, rather than a rejection of the theoretical system. Quine , it is impossible to test a theory in isolation. The investigations that followed led to the discovery of an eighth planet, Neptune. If a test fails, something is wrong. But there is a problem in figuring out what that something is: Instead, he favored a "survival of the fittest" view in which the most falsifiable scientific theories are to be preferred. He argued that "the only principle that does not inhibit progress is: Because of this, he said it was impossible to come up with an unambiguous way to distinguish science from religion , magic , or mythology. He saw the exclusive dominance of science as a means of directing society as authoritarian and ungrounded. Sociology of scientific knowledge According to Kuhn, science is an inherently communal activity which can only be done as part of a community. Others, especially Feyerabend and some post-modernist thinkers, have argued that there is insufficient difference between social practices in science and other disciplines to maintain this distinction. For them, social factors play an important and direct role in scientific method, but they do not serve to differentiate science from other disciplines. On this account, science is socially constructed, though this does not necessarily imply the more radical notion that reality itself is a social construct. However, some such as Quine do maintain that scientific reality is a social construct:

Chapter 2 : Philosophy v science: which can answer the big questions of life? | Science | The Guardian

Philosophy of biology's naturalism and the continuity of its concerns with science itself is shared with much other recent work in the philosophy of science, perhaps most notably in the philosophy of neuroscience (Bechtel, Mandik et al.).

Alexander Bird This new series in the philosophy of science offers fresh treatments of core topics in the theory and methodology of scientific knowledge and introductions to new areas of the discipline. The series also seeks to cover topics in current science that raise significant foundational issues both for scientific theory and for philosophy more generally. No reproduction without permission. Designed and typeset by Kate Williams, Swansea. Printed and bound by Biddles Ltd. Contents ix xi 1. A storm in a teacup? But what is innateness? The ordinary-language concept Canalization Generative entrenchment A deflationary approach Conclusion 89 89 94 96 99 7. Comprehensiveness, unity and simplicity Conclusion My thanks go to those institutions for inviting me to speak, and to all who participated in those events. I have benefited greatly from informal conversations with many of my colleagues at Trinity College Dublin and Lancaster University, and with other friends elsewhere. I have also taught courses in philosophy of biology at Trinity College Dublin and Lancaster University, which enabled me to test-drive much of the material in this book, and I thank my students for their lively participation and feedback. I thank Alan T. Lloyd for reading drafts of the final two chapters, and for giving me extremely useful commentary. A very special thank you goes to William Lyons, for years of encouragement and mentorship. The second group included objects made of wood, paper and leather, and the third included ones made of metal and stone. Even at that early age â€" we must have been about six at the time â€" there was no perceived problem in assigning the objects to their various categories. Seeing things as living or non-living seems to be a basic component of our experience. We somehow have a gut feeling that there is an absolute difference between living things and non-living things. The theory of evolution, however, rides roughshod over this gut feeling. For it leads to the conclusion that the processes going on in living things, and the processes by which they are created, are fundamentally the same as the processes going on in the non-living physical world. Philosophy of biology can be considered a part of philosophy of science. Very broadly, we might say that philosophy of science deals with questions that arise from science, but are not themselves scientific questions. But this statement needs to be qualified. First, philosophy of science is not the same as history of science or sociology of science, both current growth areas. Nor is it, much, concerned with the ethical questions that arise because of science. Medical ethics, for example, is a separate field. Philosophy, on this view, is just the more reflective, armchairspeculative end of a spectrum that has hands-on empirical work at its other end. Philosophers of biology have often xi philosophy of biology worked fruitfully with scientists, and many of the issues in philosophy of biology belong in a zone somewhere between philosophy and science. Indeed, there is no clear boundary between philosophy of biology and theoretical biology. Richard Dawkins considers his book The Extended Phenotype to be a work of philosophy. Philosophy of science is supposed to be about science in general. The hard sciences were assumed, sometimes tacitly, sometimes openly, to be models of all that a good science should be. In the case of philosophy of biology, many books and papers have retrospectively become part of the genre. Partly this is because philosophers have realized that these sciences are different from each other; they do not use all the same concepts, for a start. Even then, though, physics and chemistry seem to go together, with biology the odd one out. Physics and chemistry appear to possess clearly defined entities and strict, exceptionless laws. By contrast, many biological entities have very fuzzy boundaries. Where does a species begin and end, for example? The very idea of a strict, exceptionless law of biology seems misguided. For all that, though, biology is a clear, indisputable example of a science in good working order. It has a well-established core unifying theory â€" the theory of evolution â€" and it is precisely because of that theory that there is so much imprecision. There is conceptual work to be done to understand biology, for it has concepts that seem to belong especially to it. So part of the job of philosophy of biology is to help us to understand these concepts. What is it for something to be innate? What is it for something to have a function? What is a species? To approach such questions, however, we will first need an understanding of some of the subtle nuances of the theory of evolution, and its place in our overall view of the world. Next, I shall address some of the conceptual questions I have mentioned: All this conceptual strangeness is to be found, remember, in a science in perfectly good working order. This will be followed by a chapter on some of the consequences of biology for traditional ideas in philosophy of science Chapter The remainder of the book will deal with some of the claims that have been made about what the theory of evolution, and in particular the fact that human beings are products of evolution, implies for various fields of more general concern. There will be discussion of the implications of evolution for epistemology Chapter 11 , religion Chapter 12 , human nature Chapter 13 and, finally, ethics Chapter The deluge of popular books and magazine articles about evolution and what it tells us is testimony to this. And the passion with which some of these subjects are debated is evidence of much more than intellectual curiosity or love of truth. The battles over evolution versus religion, and over sociobiology and its offspring evolutionary psychology, are battles of hearts as well as minds, and are often fought as if the moral standing, not just the intellectual standing, of the combatants were at stake. As I shall try to show throughout this book, it is important to be clear about what the theory of evolution implies, and, just as important, what it does not imply. However, present-day evolutionists readily acknowledge that Darwin made the crucial breakthrough. In this chapter I want to show why that is. Popular and polemical Darwinian literature often contrasts the theory of evolution with religious accounts of the origin of life, that is, with the claim that God is needed to explain the origin of life e. However, it is not at all obvious that the only alternative to Darwinism, as an account of why living things are the way they are, is that God created them that way. More sophisticated defences of Darwinism e. As this literature presents it, essentialism is, roughly speaking, the view that natural kinds â€" including biological species â€" can be given strict definitions, and are fixed and unchanging. But in fact, as he was fully aware, he was not the first person to take this step. Among others, Jean-Baptiste Lamarck whom I shall discuss briefly here and Robert Chambers, in his anonymously published Vestiges of the Natural History of Creation , took it before him. But that means that Darwin was not the first person to propose a theory of evolution. Why, then, is he regarded as one of the greatest scientists of all time, when Lamarck, Chambers and the rest are not? Unlike earlier evolutionists, Darwin was able to show that the factors that produce evolution actually exist, and are sufficient to explain what he called 1 philosophy of biology on them to explain. For the purposes of demonstrating this, I shall very briefly present two earlier accounts of how life got to be the way it is. Ever since Aristotle, biologists had been aware of two salient facts about living things in general: Our eyes are very good at seeing, and our hearts are very good at pumping blood around our bodies. Moreover, both our eyes and our hearts help us to stay alive, that is, they serve the living organism as a whole. It is not surprising that facts such as these have led people to believe that there just has to be a God: One might alternatively think that organisms being that way is just a part of the way things are: Moreover, the categories seem to be nested: Again, not everyone was willing to accept either of these. Lucretius was a member of the Epicurean school of philosophers, which means that his views were in some ways similar to modern-day materialists. Like them, he seems to have wanted to explain how animals are apparently well designed without appealing to an intelligent, deliberate designer. What he proposed was that nature initially produced all kinds of creatures: Some of these simply died because they were ill equipped, while the better-equipped ones survived: And in the ages after monsters died, Perforce there perished many a stock, unable By propagation to forge a progeny. On the Nature of Things: V This might seem to go some way towards an explanation of how creatures come to be well equipped for life. The initial process that produces organisms does not have to be in any way geared to producing ones that are well designed. We should not be surprised that the ones that survived bear the appearance of good design. It is, however, unsatisfactory on at least one important count. It requires us to believe that, at some time in the past, nature just spontaneously produced large numbers of creatures of various different kinds, completely at random. But we do not see this happening anywhere in the world now. We have never seen nature produce an organism, even a badly designed one, out of non-living matter. Did it do so once, and has it now stopped? Perhaps, but we have absolutely no reason to believe that this ever actually happened. By contrast, as we shall see, the factors that Darwin uses to explain things are processes that we can see happening in the world. This, however, can be shown to be false by his assertion in On the Origin of Species: The real difference between Darwin and Lamarck on this score is the use to which each puts the principle of inheritance of acquired traits in his theory. For Lamarck, it is the primary factor that explains how organisms come to be well designed for living in their environments. This idea can be given some plausibility if one thinks about the thick skin human beings are born with on the soles of our feet. As we all know, skin gets thicker from continuous friction; guitarists often have thickened skin on parts of their fingers, and violinists on the part of their neck where they rest the violin. Creatures sometimes lose an eye, but their offspring are not born one-eyed as a result.

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Chapter 3 : Biology, philosophy of - Routledge Encyclopedia of Philosophy

The philosophy of biology is a subfield of philosophy of science, which deals with epistemological, metaphysical, and ethical issues in the biological and biomedical sciences. Although philosophers of science and philosophers generally have long been interested in biology (e.g., Aristotle, Descartes, and even Kant), philosophy of biology.

Philosophy The distinction between philosophy and science is very slim, but there are some differences nonetheless. Many people assume that science and philosophy are concepts contradictory to each other, but both subjects share a more positive relationship rather than an animosity. Science can be defined as a study and understanding of natural phenomena. It is concerned with empirical data, meaning data that can be observed, tested, and repeated. It is systematic in nature, and there is a specific course of action used called the scientific method. Science bases its explanation on the results of experiments, objective evidence, and observable facts. These branches can be classified under various headings: Also included in these classifications are exact science and descriptive science. Science started out as a part of philosophy. It was then called natural philosophy, but science deviated from philosophy in the 17th century and emerged as a separate study or domain. Science involves objective types of questions. As a study, it tries to find answers and prove them to be objective fact or truth. In its method, the experiment creates certain hypotheses that can be proven or validated as fact. In the same manner, hypotheses can also be wrong or falsified. By observing and undertaking an experiment, science produces knowledge through observation. It is broadly defined as an activity that uses reason to explore issues in many areas. Its application to many different fields makes it impossible for it to have a definite and concrete definition. Philosophy tries to study and understand the fundamental nature of two things: It also has many branches: Philosophy uses arguments of principles as the basis for its explanation. Philosophy entertains both subjective and objective types of questions. This means that aside from finding answers, it also resolves to generate questions. It raises questions and processes before finding out the answers. Philosophy is mostly involved with thinking and creating knowledge. Philosophy and science are two studies and domains. Philosophy came first and became the basis for science, formerly known as natural philosophy. Both studies have many branches or fields of study and make use reasoning, questioning, and analysis. The main difference is in the way they work and treat knowledge. Science is concerned with natural phenomena, while philosophy attempts to understand the nature of man, existence, and the relationship that exists between the two concepts. Another common element between the two studies is that they both try to explain situations and find answers. Philosophy does this by using logical argumentation, while science utilizes empirical data. Science is used for instances that require empirical validation, while philosophy is used for situations where measurements and observations cannot be applied. Science also takes answers and proves them as objectively right or wrong. Subjective and objective questions are involved in philosophy, while only some objective questions can be related in science. Aside from finding answers, philosophy also involves generating questions. Meanwhile, science is only concerned with the latter. Philosophy creates knowledge through thinking; science does the same by observing. Science is also a defined study, in contrast to philosophy, which can be applied to many extensive areas of discipline. If you like this article or our site. Please spread the word.

Chapter 4 : History and Philosophy of Science | University of Pittsburgh

History & Philosophy of Biology In addition to strengths in the philosophy of physics, early modern natural philosophy, and ancient science, the department has excellent resources for graduate study in the philosophy and history of biology.

Introduction According to several reconstructions of the history of philosophy of biology, the field emerged gradually in the s with a first generation of self-identified philosophers of biology, especially Morton Beckner, David Lee Hull, Marjorie Grene, Kenneth Schaffner, Michael Ruse, and William C. As an explanation for such branching of philosophy of science, some philosophers put forth the decline of logical positivism in the s and s. For others, logical positivism did not actually decline, and anyway it had never suppressed philosophy of biology Callebaut For Byron , proper philosophy of biology was already there in early philosophy of science, since the s, as shown by a bibliometrical analysis. The most quoted philosopher in this article is David Lee Hull He is a noncontroversially important figure in the founding generation of philosophers of biology. Griesemer, Philip Kitcher, Elisabeth A. Some of them were experienced philosophers who progressively shifted to biological issues. The first journal partially devoted to philosophy of biology â€” History and Philosophy of the Life Sciences â€" began to be published in , and in the mids the discipline was fully established. In the early s, a growing number of scholars, institutions, and journals specialized in philosophy of biology, and the discipline gained more and more room in scientific books, journals, and conferences see the resources at the end of the article. As we shall see, philosophy of biology provides accounts of biological knowledge, asking: Does biology differ from other sciences? And how do we understand the epistemological diversity across different branches of the biological sciences? Philosophy of biology can be seen as a possible aid for scientific advancement in the life sciences. Contributions of philosophers were widely appreciated by scientists, for example, in the areas of classification, taxonomy, and related activities, and in the abstract formulation of natural selection in the development of biology after Darwin. Scientists themselves may reflect philosophically on their own field of research, justifying and correcting their practices, or denouncing biases and transformations in their own community. Multiple and conflicting meanings may be uncovered and systematized to help the progress of science and to develop more general messages. Phenomena studied by biology make this science particularly sensible and interesting for philosophy. Humans are organisms, and quite a few fields of biology have potential or direct implications for our self-understanding. Philosophy overcame mere self-defensive attitudes, and its important role lied in epistemological analysis and in deep reflections on the limits and conditions of naturalization, which may be understood as the transition of a problem into the domain of empirical science. Neurobiology offers a particularly fertile ground for reflections about how human phenomena can be related to, or even explained by, biology. And how should a philosophical field like moral philosophy take biology into account? For more on the topic of the naturalization of morality, for example, see ethics. Philosophy of biology may study and support the interaction among different life sciences, as in the case of evolutionary developmental biology, where workers claim to be reuniting genetics and evolution with embryology, recomposing a historical divide in biology. How do different research traditions integrate or replace each other? This question illuminates classic issues such as progress and scientific change with new light. Philosophy of biology also monitors the natural hybridization of biology with extra-biological fields, such as cultural transmission, and enriches the debate among scientists where extreme positions often pop out: Are we facing, instead, a case of mutual inspiration? Which reciprocal prejudices are well-grounded? And how can they be overcome for fruitful scientific collaborations? Philosophy of biology also has a mandatory critical role towards biology. For example, it can unveil the progressionist, anthropomorphic, and anthropocentric biases that affect scientists as human beings who live immersed in a society and in a cultural environment. Critical attention must be particularly high when scientific classifications of humans for example, through measures such as IQ or ethnicity may lead to justify and increase social discrimination, segregation or oppression. Philosophy of biology may also develop ways of thinking up from biological research, providing an inspiring and readable encompassing view of the living world that will hardly be found in any standard, scientific publication. Furthermore, philosophy of biology is called upon to work on the interface between science and society, contributing to both the common misunderstandings and the best strategies for citizens to become conscious and informed, as they are called to decide what kind of research and intervention will be allowed or actively pursued by society. It is hard for philosophy of biology to keep pace with the fast development of biological knowledge. But the effort of following the moving frontier of knowledge allows philosophy of biology to study the fall of influential ideas, such as the universal Tree of Life, and the rise of new scientific practices, such as intensive computer modeling. Philosophy also has the unsettling opportunity to constantly rethink its own approach, avoiding drifting too far away from scientific practice so as to become detached. In this dynamic, philosophy of biology is also well integrated with history of science, so that it is often hard to distinguish between the two. An analysis of the relationship between molecular biology and Mendelian genetics, for example, is intertwined with the historical account of the birth and early development of molecular biology in the s. In turn, the philosophical framing of genetics and developmental biology as either ontology-based disciplines or research styles transforms radically the way in which the history of the two fields is told. Philosophy of biology belongs to philosophy, therefore, no fixed procedure or protocol constrains its research what is philosophy? Philosophy of biology consists in free and critical â€” although rigorous and informed â€” thought on biological knowledge as the latter develops through time. However, as a mature and recognized field with its own interconnected practicing community, philosophy of biology seems to feature some methodological principles: Philosophy of biology is supposed to be scientifically informed and up-to-date, capturing how recent research modifies established knowledge and creates new scientific practices. Philosophy and biology are not always clearly distinct. Scientific work can routinely require, for example, conceptual or epistemological On the other hand, philosophy can turn out to be effective in setting up scientific research projects. However, philosophy can be characterized by its leaning towards generalities about biology, namely general philosophical problems, general characterizations of fields and approaches within biology, or conceptualizations of biology as a whole or even of science as a whole. Philosophy of biology should try to be understandable and possibly useful to biologists. Its tools â€” conceptual analysis, epistemology , traditions of thinking and debates â€” should be put to use for improving scientific research. Biologists can do philosophy of biology. This happens, for example, when they become interested in general features of biology and try to contribute with principles derived from their work or when they think about the inferential patterns employed by themselves and their colleagues. Also, scientists can do philosophy and speak to philosophy when particular objects of philosophical study, such as human morality, get naturalized see below. Philosophy of biology cares for working across disciplinary contexts. For example, it studies novel contacts between previously separated fields, develops general views of the living world from some aspect of the life sciences, or reveals complex connections between science and the socio-cultural context in which it is carried out. It also takes advantage of its knowledge for monitoring and assisting how science is publicly communicated and interrogated. Philosophy of biology is increasingly seen as one piece with history of biology, since philosophical and historical theses are mutually necessary, and their results reverberate reciprocally. These six methodological principles are usually tacit, but sometimes they are made explicit by philosophers of biology, who may also disagree on some of them. The principles will be presented here by means of exemplar studies. Any set of examples is anyhow partial and biased, since philosophy of biology is a huge field full of fascinating topics, growing exponentially along with biology. For a more complete picture, the interested reader will have to navigate the resources listed at the end of the article, such as philosophy of biology journals or programs of conferences such as the biennial meetings of the International Society for the History, Philosophy, and Social Studies of Biology, the main reference society of the field. A number of textbooks in philosophy of biology are available, often in the form of anthologies. A list of all these resources is provided at the end for further reading. Given the vastness of the philosophy of biology literature, this article can only indicate some of the main topics and the richness of discussions. The examples in this article are mainly focused on evolutionary biology. Evolutionists such as Ernst Mayr and Stephen Jay Gould , two of the most influential authors, are extensively treated in this article though they are not universally representative. Philosophy of biology is already tackling an enormous range of topics in the most disparate fields, from biomedicine to community ecology, from neurobiology to microbiology and microbial ecology, and from chemistry and biochemistry to exobiology. To look for some specific area, the interested reader is, once again, encouraged to venture into the journals and online resources. General Issues in Philosophy of Biology Philosophers of science though not always under this fairly recent name have reflected for centuries on explanation , causation , correlation, chance, and many other general topics concerning science or knowledge in general. Important philosophers contributed to concepts like reduction vs. During the second half of the 20th century, philosophy of science adopted a pluralistic strategy, considering the diversity of scientific disciplines and methods and striving to understand their differences along with their common aspects. With this pluralization, the complex task remained of finding a satisfying description of science as an endeavor whichâ€"unitary or notâ€"is distinct from other forms of knowledge. The study of living beings offers a universe of occasions for philosophy of science to advance the reflection. For instance, explanations by natural selection and by drift see below, 2. Homology explanations, another typical feature of biology, explain the properties or the variability of a biological character by citing the ancestral character or organ, and the causal factors that historically modify the descendants of that ancestral organ. In trying to account for biological sciences, philosophy of biology may take concepts from philosophy of science, such as causal explanation or reduction, and find new putative cases of them in the life sciences or locate failures of reduction in biology. Other times, philosophy of biology may need to tailor new concepts to accommodate biology. In fact, some kinds of explanation seem peculiar to biology or to historical sciences. While chasing the peculiarities of biology, philosophy of biology also has some general research goals among its aims: Additionally, new general problems arise from the particular forms that explanation , causation , or reduction take in biology. Sometimes philosophy of biology seeks general characterizations of particular fields, practices, or ways of thinking within the life sciences Other times, the goal seems to be a general picture of biology, especially by contrast to other sciences, such as classical mechanics. Sometimes philosophy of biology suggests general views of science, descriptions and characterizations of science with all the complexity, differentiation, and plurality that it exhibits in the contemporary world. General Problems in Philosophy of Science, as Seen in Biology Natural selection is a major biological explanation for the features of organisms. Inherited traits, originated by cumulative retention of random variation, are there because of the positive contribution they have brought to their bearers in past generations, in terms of survival and reproduction. Yet, the explanatory structure of natural selection is very complex, and implies a reflection on concepts like causality and randomness. In a classic book, Sober pointed out that only a few of the traits that get selected are in fact explanatory, specifically those traits that are selected for. Other traits are free riders that are somehow correlated with traits that are selected for and thus are preserved in the population without actively contributing to fitness. Thus, there is selection of such free rider traits that are not causally relevant to survival and reproduction. Hearts are positively selected; heartthrob is also selected, but not selected for; efficiency in pumping blood is selected for; the existence of heartthrob is thus explained by natural selection, but heartthrob is not explanatory per se; it undergoes selection of, not selection for. The idea of free riders on selection was already considered by Darwin, but philosophers of biology spelled out its consequences for the explanatory structure of natural selection. Causal relationships are the core of some theories of explanation. Sober proposed rethinking the idea of causality in light of evolutionary biology, and this is an example of how classic philosophical categories can be modified in their application to biology: Randomness and chance are very important in biology. Natural selection is not random: Random does not necessarily mean lacking deterministic causes. Rather, random mutation points to the fact that the usefulness of a trait in the environment where it appears is not among the causes of its appearance. The source of variation is thus more properly contingent with respect to fitness. Genetic drift is the predictable change of the frequencies of traits that are not under selection. The absence of selection makes the dynamic depend only on the reproduction mechanism, and although the fate of individual traits is not predictable, the overall landscape of frequencies is.

Chapter 5 : Philosophy of Biology (Philosophy and Science) 1, Brian Garvey - calendrierdelascience.com

Philosophy of science is a sub-field of philosophy concerned with the foundations, methods, and implications of science. The central questions of this study concern what qualifies as science, the reliability of scientific theories, and the ultimate purpose of science.

See Article History Biology, philosophy of, philosophical speculation about the concepts, methods, and theories of the biological sciences. The sharp increase in understanding of biological processes that has occurred since the midth century has stimulated philosophical interest in biology to an extent unprecedented since the first formulation of evolutionary theory in the s. Most of the problems of contemporary philosophy of biology are traditional questions now being investigated afresh in the light of scientific advances, particularly in molecular genetics , and new standards of philosophical rigour. This article discusses the chief topics in the philosophy of biology as well as recent developments in ancillary and related fields. For detailed treatment of ethical issues relating to the biological sciences, the natural environment , and health care, see bioethics. For discussion of philosophical criticisms of evolutionary theory inspired by religion , see evolution. History Teleology from Aristotle to Kant The philosophy of biology, like all of Western philosophy , began with the ancient Greeks. From a historical perspective, his most important contributions were his observations that biological organisms can be arranged in a hierarchy based on their structural complexityâ€"an idea that later became the basis of the Great Chain of Being â€"and that organisms of different species nevertheless display certain systematic similarities, now understood to be indicative of a common evolutionary ancestry see homology. Although it is not clear whether Aristotle thought of final causality as pertaining only to the domain of the living, it is certainly true that he considered it essential for understanding or explaining the nature of biological organisms. One cannot fully understand why the human eye or heart has the structure it does without taking into account the function the organ performs. The notion of final causality was taken for granted by most philosophers from the Hellenistic age through the end of the Middle Ages. Indeed, philosophers and theologians in the medieval and early modern periods adopted it as the basis of an argument for the existence of Godâ€"the teleological argument , also known as the argument from design , which was developed in sophisticated ways in the 19th and 20th centuries see intelligent design. During the scientific revolution of the 17th century, however, final causes came to be regarded as unnecessary and useless in scientific explanation; the new mechanistic philosophy had no need for them. The English philosopher and scientist Francis Bacon â€" likened them to the Vestal Virgins â€"decorative but sterile. Despite these criticisms, the notion of final causality persisted in biology, leading many philosophers to think that, in this respect at least, the biological sciences would never be the same as the physical sciences. Others, like the British historian and philosopher of science William Whewell â€" , took it as demonstrating simply that different sciences are different and thus that a form of explanation that is appropriate in one field might not be appropriate in another. Vitalism and positivism In the late 19th century, the question of the supposed inherent differences between the biological and the physical sciences took on new importance. Ultimately, however, it fell out of favour, because it proved to have little direct scientific application. The difficulty was not that life force was not observable in the world at least indirectly but that it did not lead to new predictions or facilitate unified explanations of phenomena formerly thought to be unrelated, as all truly important scientific concepts do. Some philosophers tried to find a way of preserving the autonomy of the biological sciences without resort to special forces or entities. Others turned to early 20th-century advances in logic and mathematics in an attempt to transform biology into something parallel to, if not actually a part of, the physical sciences. The most enthusiastic proponent of this approach, the British biologist and logician Joseph Woodger â€" , attempted to formalize the principles of biologyâ€"to derive them by deduction from a limited number of basic axioms and primitive termsâ€"using the logical apparatus of the Principia Mathematica â€"13 by Whitehead and Bertrand Russell â€" In the first half of the 20th century Anglo-American philosophy analytic philosophy was dominated by a school of scientific empiricism known as logical positivism. Braithwaite â€”90 , and Karl Popper â€”94 â€”argued that genuine scientific theories, such as Newtonian astronomy, are hypothetico-deductive , with theoretical entities occupying the initial hypotheses and natural laws the ultimate deductions or theorems. For the most part these philosophers were not particularly interested in the biological sciences. Their general assumption was that, insofar as biology is like physics, it is good science, and insofar as it is not like physics, it ought to be. The best one can say of modern biology, in their view, is that it is immature; the worst one can say is that it is simply second-rate. Twentieth-century resurgence This uncharitable perspective was soon undermined, however, by at least three important developments. First, in the s the biological sciences became philosophically much more complex and interesting, as the stunning breakthroughs in molecular biology of the previous decadeâ€”particularly the discovery in of the nature of the DNA moleculeâ€”were starting to bear fruit. For example, one could now study variation between or within populations quantitatively, rather than simply by estimation or guesswork. At the same time, there were major new developments and discoveries in the theory of evolution , especially as it applied to the study of social behaviour. It was therefore no longer possible for philosophers to dismiss biology as an inferior science merely because it did not resemble physics. Model of a DNA molecule. Drawing on the work of the philosopher and historian of science Thomas Kuhn â€”96 , critics argued that the picture of scientific theories as structurally uniform and logically self-contained was ahistorical and unrealistic. Accordingly, as philosophers broadened their appreciation of scientific-theory construction in the real world, they became increasingly interested in biology as an example of a science that did not fit the old logical-positivist paradigm. Third, in the early s the history of science began to emerge as a distinct academic discipline. Its rapid growth attracted the attention of philosophers of science and helped to strengthen the new consensus among them that an appreciation of the history of science is necessary for a proper philosophical understanding of the nature of science and scientific theorizing. Significant new work by historians of science on the development of evolutionary theory was taken up by philosophers for use in the explication of the nature of science as it exists through time. In this newly receptive intellectual climate, research in the philosophy of biology proceeded rapidly, and the influence and prestige of the discipline grew apace. New professional organizations and journals were established, and the area soon became one of the most vital and thriving disciplines within philosophy. Although the philosophy of biology is still marked by a concentration on evolutionary theory as opposed to other subjects in the life sciences, this may simply reflect the fact that evolution is an especially interesting and fertile topic for philosophical analysis. Topics in the philosophy of biology Natural selection Without doubt, the chief event in the history of evolutionary theory was the publication in of On the Origin of Species , by Charles Darwin â€” Arguing for the truth of evolutionary theory may be conceived as involving three tasks: In On the Origin of Species, Darwin accomplished the first and the third of these tasks he seemed, in this and subsequent works, not to be much interested in the second. Library of Congress, Washington, D. The major early objection was that the term is inappropriate: One form of this objection comes from philosophers who dislike the use of any metaphor in scienceâ€”because, they allege, metaphorical description in some sense conceals what is objectively thereâ€—while another comes from philosophers who merely dislike the use of this particular metaphor. The second form of the objection is that the metaphor inclines one to see function and purpose where none in fact exist. The Darwinian response in this case is to acknowledge that there are indeed examples in nature of features that have no function or of features that are not optimally adapted to serve the function they apparently have. Nevertheless, it is not a necessary assumption of evolutionary theory that every feature of every organism is adapted to some purpose, much less optimally adapted. As an investigative strategy, however, the assumption of function and purpose is useful, because it can help one to discover adaptive features that are subtle or complex or for some other reason easy to overlook. As Kuhn insisted, the benefit of good intellectual paradigms is that they encourage one to keep working to solve puzzles even when no solution is in sight. The best strategy, therefore, is to assume the existence of function and purpose until one is finally forced to conclude that none exists. It is a bigger intellectual sin to give up looking too early than to continue looking too long. If the thesis of natural selection is equivalent to the claim that those that survive are the fittest, and if the fittest are identified as those that survive, then the thesis of natural selection is equivalent to the claim that those that survive are those that surviveâ€"true indeed, but hardly an observation worthy of science. Defenders of Darwin have issued two main responses to this charge. The first, which is more technically philosophical, is that, if one favours the semantic view of theories, then all theories are made of models that are in themselves a prioriâ€"that is, not as such claims about the real world but rather idealized pictures of it. To fault selection claims on these grounds is therefore unfair, because, in a sense, all scientific claims start in this way. It is only when one begins to apply models, seeing if they are true of reality, that empirical claims come into play. There is no reason why this should be less true of selection claims than of any other scientific claims. One could claim that camouflage is an important adaptation , but it is another matter actually to claim and then to show that dark animals against a dark background do better than animals of another colour. The second response to the tautology objection, which is more robustly scientific, is that no Darwinian has ever claimed that the fittest always survive; there are far too many random events in the world for such a claim to be true. However fit an organism may be, it can always be struck down by lightning or disease or any kind of accident. Or it may simply fail to find a mate, ensuring that whatever adaptive feature it possesses will not be passed on to its progeny. Indeed, work by the American population geneticist Sewall Wright â€" has shown that, in small populations, the less fit might be more successful than the more fit, even to the extent of replacing the more fit entirely, owing to random but relatively significant changes in the gene pool, a phenomenon known as genetic drift. What the thesis of natural selection , or survival of the fittest , really claims, according to Darwinians, is not that the fittest always survive but that, on average, the more fit or the fittest are more successful in survival and reproduction than the less fit or unfit. Another way of putting this is to say that the fit have a greater propensity toward successful survival and reproduction than the less fit. Undoubtedly part of the problem with the thesis of natural selection is that it seems to rely on an inductive generalization regarding the regularity of nature see induction. Natural selection can serve as a mechanism of evolutionary change , in other words, only on the assumption that a feature that has adaptive value to an individual in a given environmentâ€"and is consequently passed onâ€"also will have value to other individuals in similar environments. This assumption is apparently one of the reasons why philosophers who are skeptical of inductive reasoningâ€"as was Popper â€"tend not to feel truly comfortable with the thesis of natural selection. Setting aside the general problem of induction , however, one may ask whether the particular assumption on which the thesis of natural selection relies is rationally justified. Some philosophers and scientists, such as the evolutionary biologist Richard Dawkins , think not only that it is justified but that a much stronger claim also is warranted: Other philosophers and scientists, however, are doubtful that there can be any laws in biology, even assuming there are laws in other areas of science. Although they do not reject inductive inference per se, they believe that generalizations in biology must be hedged with so many qualifications that they cannot have the necessary force one thinks of as characteristic of genuine natural laws. For example, the initially plausible generalization that all mammals give birth to live young must be qualified to take into account the platypus. An intermediate position is taken by those who recognize the existence of laws in biology but deny that natural selection itself is such a law. If one were to look for such a force, all one would actually see are individual organisms living and reproducing and dying. At best, therefore, selection is a kind of shorthand for a host of other processes, which themselves may or may not be governed by natural laws. In response, defenders of selection charge that these critics are unduly reductionistic. In many other areas of science, they argue, it is permissible to talk of certain phenomena as if they were discrete entities, even though the terms involved are really nothing more than convenient ways of referring, at a certain level of generality, to complex patterns of objects or events. If one were to look for the pressure of a gas, for example, all one would actually see are individual molecules colliding with each other and with the walls of their container. But no one would conclude from this that there is no such thing as pressure. Likewise, the fact that there is nothing to see beyond individual organisms living and reproducing and dying does not show that there is no such thing as selection. Levels of selection Darwin held that natural selection operates at the level of the individual. Adaptive features are acquired by and passed on to individual organisms, not groups or species, and they benefit individual organisms directly and groups or species only incidentally. One type of case, however, did cause him worry: How could a feature for self-sacrifice be explained, if adaptive features are by definition beneficial to the individual rather than to the group? Eventually Darwin decided that the nest as a whole could be treated as a kind of superorganism, with the individual members as parts; hence the individual benefiting from adaptation is the nest rather than any particular insect. Wallace differed from Darwin on this question, arguing that selection sometimes operates at the level of groups and hence that there can be adaptive features that benefit the group at the expense of the individual. When two groups come into conflict, members of each group will develop features that help them to benefit other group members at their own expense i. When one group succeeds and the other fails, the features for altruism developed in that group are selected and passed on. For the most part Darwin resisted this kind of thinking, though he made a limited exception for one kind of human behaviour , allowing that morality , or ethics , could be the result of group selection rather than individual selection. But even in this case he was inclined to think that benefits at the level of individuals might actually be more important, since some kinds of altruistic behaviour such as grooming tend to be reciprocated. Several evolutionary theorists after Darwin took for granted that group selection is real and indeed quite important, especially in the evolution of social behaviour. Konrad Lorenz â€”89 , the founder of modern ethology , and his followers made this assumption the basis of their theorizing. Haldane â€” â€”resisted such arguments. In the s, the issue came to a fore, and for a while group selection was dismissed entirely. Some theorists, notably the American evolutionary biologist George C. Williams , argued that individual interests would always outweigh group interests, since genes associated with selfish behaviour would inevitably spread at the expense of genes associated with altruism.

Chapter 6 : Philosophy of Biology | Internet Encyclopedia of Philosophy

Philosophy of Biology. Philosophy of biology is the branch of philosophy of science that deals with biological calendrierdelascience.com can be practiced not only by philosophers, but also by scientists who reflect on their own work.

From natural philosophy to theories of method Philosophy and natural science The history of philosophy is intertwined with the history of the natural sciences. They were joined in these reflections by the most eminent natural scientists. Galileo â€" supplemented his arguments about the motions of earthly and heavenly bodies with claims about the roles of mathematics and experiment in discovering facts about nature. Similarly, the account given by Isaac Newton â€" of his system of the natural world is punctuated by a defense of his methods and an outline of a positive program for scientific inquiry. Antoine-Laurent Lavoisier â€"94 , James Clerk Maxwell â€"79 , Charles Darwin â€"82 , and Albert Einstein â€" all continued this tradition, offering their own insights into the character of the scientific enterprise. Some philosophers continue to work on problems that are continuous with the natural sciences, exploring, for example, the character of space and time or the fundamental features of life. They contribute to the philosophy of the special sciences, a field with a long tradition of distinguished work in the philosophy of physics and with more-recent contributions in the philosophy of biology and the philosophy of psychology and neuroscience see mind, philosophy of. This is the topic of the present article. Logical positivism and logical empiricism A series of developments in early 20th-century philosophy made the general philosophy of science central to philosophy in the English-speaking world. Inspired by the articulation of mathematical logic, or formal logic , in the work of the philosophers Gottlob Frege â€" and Bertrand Russell â€" and the mathematician David Hilbert â€" , a group of European philosophers known as the Vienna Circle attempted to diagnose the difference between the inconclusive debates that mark the history of philosophy and the firm accomplishments of the sciences they admired. In the light of logic, they thought, genuinely fruitful inquiries could be freed from the encumbrances of traditional philosophy. To carry through this bold program, a sharp criterion of meaningfulness was required. Unfortunately, as they tried to use the tools of mathematical logic to specify the criterion, the logical positivists as they came to be known encountered unexpected difficulties. Again and again, promising proposals were either so lax that they allowed the cloudiest pronouncements of traditional metaphysics to count as meaningful, or so restrictive that they excluded the most cherished hypotheses of the sciences see verifiability principle. Faced with these discouraging results, logical positivism evolved into a more moderate movement, logical empiricism. Many historians of philosophy treat this movement as a late version of logical positivism and accordingly do not refer to it by any distinct name. Logical empiricists took as central the task of understanding the distinctive virtues of the natural sciences. In effect, they proposed that the search for a theory of scientific method â€" undertaken by Aristotle, Bacon, Descartes, and othersâ€"could be carried out more thoroughly with the tools of mathematical logic. Not only did they see a theory of scientific method as central to philosophy, but they also viewed that theory as valuable for aspiring areas of inquiry in which an explicit understanding of method might resolve debates and clear away confusions. Their agenda was deeply influential in subsequent philosophy of science. Discovery, justification, and falsification Logics of discovery and justification An ideal theory of scientific method would consist of instructions that could lead an investigator from ignorance to knowledge. Descartes and Bacon sometimes wrote as if they could offer so ideal a theory, but after the midth century the orthodox view was that this is too much to ask for. There are, however, no such rules that will guide someone to formulate the right hypothesis, or even hypotheses that are plausible or fruitful. Although the idea that there cannot be a logic of scientific discovery often assumed the status of orthodoxy, it was not unquestioned. As will become clear below see Scientific change , one of the implications of the influential work of Thomas Kuhn â€"96 in the philosophy of science was that considerations of the likelihood of future discoveries of particular kinds are sometimes entangled with judgments of evidence , so discovery can be dismissed as an irrational process only if one is prepared to concede that the irrationality also infects the context of justification itself. Sometimes in response to Kuhn and sometimes for independent reasons, philosophers tried to analyze particular instances of complex scientific discoveries, showing how the scientists involved appear to have followed identifiable methods and strategies. The most ambitious response to the empiricist orthodoxy tried to do exactly what was abandoned as hopelessâ€"to wit, specify formal procedures for producing hypotheses in response to an available body of evidence. So, for example, the American philosopher Clark Glymour and his associates wrote computer programs to generate hypotheses in response to statistical evidence, hypotheses that often introduced new variables that did not themselves figure in the data. These programs were applied in various traditionally difficult areas of natural and social scientific research. Perhaps, then, logical empiricism was premature in writing off the context of discovery as beyond the range of philosophical analysis. In contrast, logical empiricists worked vigorously on the problem of understanding scientific justification. They recognized, of course, that a series of experimental reports on the expansion of metals under heat would not deductively imply the general conclusion that all metals expand when heatedâ€"for even if all the reports were correct, it would still be possible that the very next metal to be examined failed to expand under heat. Nonetheless, it seemed that a sufficiently large and sufficiently varied collection of reports would provide some support, even strong support, for the generalization. The philosophical task was to make precise this intuitive judgment about support. During the s, two prominent logical empiricists, Rudolf Carnap â€" and Carl Hempel â€"97 , made influential attempts to solve this problem. Carnap offered a valuable distinction between various versions of the question. The comparative problem attracted little attention, but Hempel attacked the qualitative problem while Carnap concentrated on the quantitative problem. Courtesy of the University of California, Los Angeles It would be natural to assume that the qualitative problem is the easier of the two, and even that it is quite straightforward. Many scientists and philosophers were attracted to the idea of hypothetico-deductivism, or the hypothetico-deductive method: An apparently innocuous point about support seems to be that, if E confirms H, then E confirms any statement that can be deduced from H. Suppose, then, that H deductively implies E, and E has been ascertained by observation or experiment. If H is now conjoined with any arbitrary statement, the resulting conjunction will also deductively imply E. Hypothetico-deductivism says that this conjunction is confirmed by the evidence. By the innocuous point, E confirms any deductive consequence of the conjunction. One such deductive consequence is the arbitrary statement. So one reaches the conclusion that E, which might be anything whatsoever, confirms any arbitrary statement. But if one tacks on to Newtonian theory any doctrine one pleasesâ€"perhaps the claim that global warming is the result of the activities of elves at the North Poleâ€"then the expanded theory will equally yield the old predictions. On the account of confirmation just offered, the predictions confirm the expanded theory and any statement that follows deductively from it, including the elfin warming theory. Carnap considered artificial systems whose expressive power falls dramatically short of the languages actually used in the practice of the sciences, and he hoped to define for any pair of statements in his restricted languages a function that would measure the degree to which the second supports the first. Despite the failure of the official project, however, he argued in detail for a connection between confirmation and probability, showing that, given certain apparently reasonable assumptions, the degree-of-confirmation function must satisfy the axioms of the probability calculus. Bayesian confirmation That conclusion was extended in the most prominent contemporary approach to issues of confirmation, so-called Bayesianism, named for the English clergyman and mathematician Thomas Bayes â€" The guiding thought of Bayesianism is that acquiring evidence modifies the probability rationally assigned to a hypothesis. For a simple version of the thought, a hackneyed example will suffice. As the evidence comes in, one forms a probability that is conditional on the information one now has, and in this case the evidence drives the probability upward. This need not have been the case: Bayes is renowned for a theorem that explains an important relationship between conditional probabilities. But how should scientists conclude that the probability of an interesting hypothesis takes on a particular value or that a certain evidential finding would be extremely improbable if the interesting hypothesis were false? The simple example about drawing from a deck of cards is potentially misleading in this respect, because in this case there seems to be available a straightforward means of calculating the probability that a specific card, such as the king of hearts, will be drawn. There is no obvious analogue with respect to scientific hypotheses. It would seem foolish, for example, to suppose that there is some list of potential scientific hypotheses, each of which is equally likely to hold true of the universe. Bayesians are divided in their responses to this difficulty. The only limits on rational choice of prior probabilities stem from the need to give each truth of logic and mathematics the probability 1 and to provide a value different from both 0 and 1 for every empirical statement. The former proviso reflects the view that the laws of logic and mathematics cannot be false; the latter embodies the idea that any statement whose truth or falsity is not determined by the laws of logic and mathematics might turn out to be true or false. On the face of it, subjective Bayesianism appears incapable of providing any serious reconstruction of scientific reasoning. One begins by assigning the Newtonian hypothesis a small but significant probability; the other attributes a probability that is truly minute. For the first scientist it approaches 1. The second, however, has begun with so minute a probability that, even with a large body of positive evidence for the Newtonian hypothesis, the final value assigned is still tiny. From the subjective Bayesian perspective, both have proceeded impeccably. Yet, at the end of the day, they diverge quite radically in their assessment of the hypothesis. No subjective Bayesian can tolerate this diagnosis , however. The Newtonian hypothesis is not a logical or mathematical truth or a logical or mathematical falsehood , and both scientists give it a probability different from 0 and 1. By subjective Bayesian standards, that is all rational inquirers are asked to do. The orthodox response to worries of this type is to offer mathematical theorems that demonstrate how individuals starting with different prior probabilities will eventually converge on a common value. Indeed, were the imaginary investigators to keep going long enough, their eventual assignments of probability would differ by an amount as tiny as one cared to make it. In the long run, scientists who lived by Bayesian standards would agree. Eliminativism and falsification Subjective Bayesianism is currently the most popular view of the confirmation of scientific hypotheses, partly because it seems to accord with important features of confirmation and partly because it is both systematic and precise. But the worry just outlined is not the only concern that critics press and defenders endeavour to meet. Among others is the objection that explicit assignments of probabilities seem to figure in scientific reasoning only when the focus is on statistical hypotheses. A more homely view of testing and the appraisal of hypotheses suggests that scientists proceed by the method of Sherlock Holmes: Unlike Bayesianism, this approach to scientific reasoning is explicitly concerned with the acceptance and rejection of hypotheses and thus seems far closer to the everyday practice of scientists than the revision of probabilities. But eliminativism, as this view is sometimes called, also faces serious challenges. The first main worry centres on the choice of alternatives. In the setting of the country-house murder, Sherlock Holmes or his counterpart has a clear list of suspects. In scientific inquiries, however, no such complete roster of potential hypotheses is available. For all anyone knows, the correct hypothesis might not figure among the rivals under consideration. How then can the eliminative procedure provide any confidence in the hypothesis left standing at the end? Eliminativists are forced to concede that this is a genuine difficulty and that there can be many situations in which it is appropriate to wonder whether the initial construction of possibilities was unimaginative. If they believe that inquirers are sometimes justified in accepting the hypothesis that survives an eliminative process, then they must formulate criteria for distinguishing such situations. By the early 21st century, no one had yet offered any such precise criteria. An apparent method of avoiding the difficulty just raised would be to emphasize the tentative character of scientific judgment. This tactic was pursued with considerable thoroughness by the Austrian-born British philosopher Karl Popper â€”92 , whose views about scientific reasoning probably had more influence on practicing scientists than those of any other philosopher. That criterion was linked to his reconstruction of scientific reasoning: Popper thus envisaged an eliminative process that begins with the rival hypotheses that a particular group of scientists happen to have thought of, and he responded to the worry that the successful survival of a series of tests might not be any indicator of truth by emphasizing that scientific acceptance is always tentative and provisional. Philosophers, however, were less convinced. For however much he emphasized the tentative character of acceptance, Popperâ€"like the scientists who read himâ€"plainly thought that surviving the eliminative process makes a hypothesis more worthy of being pursued or applied in a practical context. A second major worry about eliminativism charged that the notion of falsification is more complex than eliminativists including Popper allowed. As the philosopher-physicist Pierre Duhem â€" pointed out, experiments and observations typically test a bundle of different hypotheses. A particularly striking example of this situation comes from the early responses to the Copernican system. Astronomers of the late 16th century, virtually all of whom believed in the traditional view that the heavenly bodies revolved around the Earth, pointed out that if, as Copernicus claimed, the Earth is in motion, then the stars should be seen at different angles at different times of the year; but no differences were observed, and thus Copernicanism, they concluded, is false.

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Overview[edit] The philosophy of biology can be seen as following an empirical tradition, favoring naturalism. Many contemporary philosophers of biology have largely avoided traditional questions about the distinction between life and non-life. Instead, they have examined the practices, theories , and concepts of biologists with a view toward better understanding biology as a scientific discipline or group of scientific fields. Scientific ideas are philosophically analyzed and their consequences are explored. It is sometimes difficult to delineate philosophy of biology as separate from theoretical biology. A few of the questions philosophers of biology have attempted to answer, for example, include: Furthermore, progress in biology urges modern societies to rethink traditional values concerning all aspects of human life. The possibility of genetic modification of human stem cells , for example, has led to an ongoing controversy on how certain biological techniques could infringe upon ethical consensus see bioethics. Some of the questions addressed by these philosophers of biology include: Ontologies such as the Gene Ontology [2] are being used to annotate the results of biological experiments in a variety of model organisms in order to create logically tractable bodies of data available for reasoning and search. The Gene Ontology itself is a species-neutral graph-theoretical representation of biological types joined together by formally defined relations. Reductionism, holism, and vitalism[edit] One subject within philosophy of biology deals with the relationship between reductionism and holism, contending views with epistemological and methodological significance, but also with ethical and metaphysical connotations. Scientific reductionism is the view that higher-level biological processes reduce to physical and chemical processes. For example, the biological process of respiration is explained as a biochemical process involving oxygen and carbon dioxide. Holism is the view that emphasizes higher-level processes, also called emergent properties: For example, to explain why one species of finch survives a drought while others die out, the holistic method looks at the entire ecosystem. Reducing an ecosystem to its parts in this case would be less effective at explaining overall behavior in this case, the decrease in biodiversity. As individual organisms must be understood in the context of their ecosystems, holists argue, so must lower-level biological processes be understood in the broader context of the living organism in which they take part. Proponents of this view cite our growing understanding of the multidirectional and multilayered nature of gene modulation including epigenetic changes as an area where a reductionist view is inadequate for full explanatory power. Vitalism is the view, rejected by mainstream biologists since the 19th century, that there is a life-force called the "vis viva" that has thus far been unmeasurable scientifically that gives living organisms their "life. Examples of vitalist philosophy are found in many religions. Mainstream biologists reject vitalism on the grounds that it opposes the scientific method. The scientific method was designed as a methodology to build an extremely reliable understanding of the world, that is, a supportable, evidenced understanding. Following this epistemological view, mainstream scientists reject phenomena that have not been scientifically measured or verified, and thus reject vitalism. Some philosophers of biology have attempted to explain the rise and fall of reductionism, vitalism, and holism throughout the history of biology. For example, these philosophers claim that the ideas of Charles Darwin ended the last remainders of teleology in biology , though the matter continues to be debated. Debates in these areas of philosophy of biology turn on how one views reductionism. An autonomous philosophy of biology[edit] All processes in organisms obey physical laws, the difference from inanimate processes lying in their organisation and their being subject to control by coded information. This has led some biologists and philosophers for example, Ernst Mayr and David Hull to return to the strictly philosophical reflections of Charles Darwin to resolve some of the problems which confronted them when they tried to employ a philosophy of science derived from classical physics. This latter, positivist approach, exemplified by Joseph

Henry Woodger , emphasised a strict determinism as opposed to high probability and to the discovery of universally applicable laws, testable in the course of experiment. It was difficult for biology, beyond a basic microbiological level, to live up to these structures. Biologists with philosophic interests responded, emphasising the dual nature of the living organism. On the one hand there was the genetic programme represented in nucleic acids - the genotype. On the other there was its extended body or soma - the phenotype. In accommodating the more probabilistic and non-universal nature of biological generalisations, it was a help that standard philosophy of science was in the process of accommodating similar aspects of 20th century physics. This led to a distinction between proximate causes and explanations - "how" questions dealing with the phenotype; and ultimate causes - "why" questions, including evolutionary causes, focused on the genotype. This clarification was part of the great reconciliation, by Ernst Mayr , among others, in the s, between Darwinian evolution by natural selection and the genetic model of inheritance. A commitment to conceptual clarification has characterised many of these philosophers since. Trivially, this has reminded us of the scientific basis of all biology, while noting its diversity - from microbiology to ecology. A complete philosophy of biology would need to accommodate all these activities. Since , scientists have had no need for a notion of cosmic teleology - a programme or a law that can explain and predict evolution. But teleological explanations relating to purpose or function have remained stubbornly useful in biology - from the structural configuration of macromolecules to the study of co-operation in social systems. By clarifying and restricting the use of the term to describe and explain systems controlled strictly scientifically by genetic programmes, or other physical systems, teleological questions can be framed and investigated while remaining committed to the physical nature of all underlying organic processes. Just as biology has developed as an autonomous discipline in full conversation with the other sciences, there is a great deal of work now being carried on by biologists and philosophers to develop a dedicated philosophy of biological science which, while in full conversation with all other philosophic disciplines, attempts to give answers to the real questions raised by scientific investigations in biology. Other perspectives[edit] While the overwhelming majority of English-speaking scholars operating under the banner of "philosophy of biology" work within the Anglo-American tradition of analytical philosophy , there is a stream of philosophic work in continental philosophy which seeks to deal with issues deriving from biological science. The communication difficulties involved between these two traditions are well known, not helped by differences in language. On the other hand, one scholar who has attempted to give a more continental account of the philosophy of biology is Hans Jonas. Another account is given by the late Virginia Tech philosopher Marjorie Grene. Philosophy of biology was historically associated very closely with theoretical evolutionary biology, however more recently there have been more diverse movements within philosophy of biology including movements to examine for instance molecular biology. Such data-intensive scientific discovery is by some considered to be the fourth paradigm, after empiricism, theory and computer simulation. According to their explanation a lesson to be learned from the successes of cancer immunotherapy is that they emerged from decoding of basic biology. Janes [21] showed however the context-dependent nature of signaling driving cell decisions demonstrating the need for a more system based approach.

Chapter 8 : Philosophy of science - Wikipedia

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Share via Email Does philosophy or science have all the big answers? Julian Baggini No one who has understood even a fraction of what science has told us about the universe can fail to be in awe of both the cosmos and of science. When physics is compared with the humanities and social sciences, it is easy for the scientists to feel smug and the rest of us to feel somewhat envious. Philosophers in particular can suffer from lab-coat envy. If only our achievements were so clear and indisputable! How wonderful it would be to be free from the duty of constantly justifying the value of your discipline. Not content with having achieved so much, some scientists want to take over the domain of other disciplines. History has taught us that many philosophical issues can grow up, leave home and live elsewhere. Science was once natural philosophy and psychology sat alongside metaphysics. I cannot see how mere facts could ever settle the issue of what is morally right or wrong, for example. So tell me, how far do you think science can and should offer answers to the questions that are still considered the domain of philosophy? Lawrence Krauss Thanks for the kind words about science and your generous attitude. To first approximation, all the answerable ones end up moving into the domain of empirical knowledge, aka science. Getting to your question of morality, for example, science provides the basis for moral decisions, which are sensible only if they are based on reason, which is itself based on empirical evidence. Without some knowledge of the consequences of actions, which must be based on empirical evidence, then I think "reason" alone is impotent. Ultimately, I think our understanding of neurobiology and evolutionary biology and psychology will reduce our understanding of morality to some well-defined biological constructs. The chief philosophical questions that do grow up are those that leave home. This is particularly relevant in physics and cosmology. Vague philosophical debates about cause and effect, and something and nothing, for example â€” which I have had to deal with since my new book appeared â€” are very good examples of this. One can debate until one is blue in the face what the meaning of "non-existence" is, but while that may be an interesting philosophical question, it is really quite impotent, I would argue. I agree that many traditional questions of metaphysics are now best approached by scientists and you do a brilliant job of arguing that "why is there something rather than nothing? But we are missing something if we say, as you do, that the "chief philosophical questions that do grow up are those that leave home". My contention is that the chief philosophical questions are those that grow up without leaving home, important questions that remain unanswered when all the facts are in. Moral questions are the prime example. No factual discovery could ever settle a question of right or wrong. But that does not mean that moral questions are empty questions or pseudo-questions. We can think better about them and can even have more informed debates by learning new facts. What we conclude about animal ethics, for example, has changed as we have learned more about non-human cognition. I would reply that it is an ineliminable feature of human life that we are confronted with many issues that are not scientifically tractable, but we can grapple with them, understand them as best we can and we can do this with some rigour and seriousness of mind. It sounds to me as though you might not accept this and endorse the scientistic point of view. I do think philosophical discussions can inform decision-making in many important ways, by allowing reflections on facts, but that ultimately the only source of facts is via empirical exploration. And I agree with you that there are many features of human life for which decisions are required on issues that are not scientifically tractable. Human affairs and human beings are far too messy for reason alone, and even empirical evidence, to guide us at all stages. I have said I think Lewis Carroll was correct when suggesting, via Alice, the need to believe several impossible things before breakfast. We all do it every day in order to get out of bed â€” perhaps that we like our jobs, or our spouses, or ourselves for that matter. Where I might disagree is the extent to which this remains time-invariant. What is not scientifically tractable today may be so tomorrow. And I do think factual discoveries can resolve even moral questions. Take homosexuality, for example. Iron age scriptures might argue that homosexuality is "wrong", but scientific discoveries about the frequency of homosexual behaviour in a variety of species tell us that it is completely natural in a rather fixed fraction of populations and that it has no apparent negative evolutionary impacts. This surely tells us that it is biologically based, not harmful and not innately "wrong". In fact, I think you actually accede to this point about the impact of science when you argue that our research into non-human cognition has altered our view of ethics. I admit I am pleased to have read that you agree that "why is there something rather than nothing? But, in this regard, as I have argued that "why" questions are really "how" questions, would you also agree that all "why" questions have no meaning, as they presume "purpose" that may not exist? JB It would certainly be foolish to rule out in advance the possibility that what now appears to be a non-factual question might one day be answered by science. If not, then we might be too quick to turn over important philosophical issues to scientists prematurely. Your example of homosexuality is a case in point. I agree that the main reasons for thinking it is wrong are linked with outmoded ways of thought. But this mixes up ethical and scientific forms of justification. Homosexuality is morally acceptable, but not for scientific reasons. Right and wrong are not simply matters of evolutionary impacts and what is natural. There have been claims, for example, that rape is both natural and has evolutionary advantages. But the people who made those claims were also at great pains to stress this did not make them right â€” efforts that critics sadly ignored. Similar claims have been made for infidelity. What science tells us about the naturalness of certain sexual behaviours informs ethical reflection, but does not determine its conclusions. We need to be clear on this. LK Once again, there are only subtle disagreements. We have an intellect and can therefore override various other biological tendencies in the name of social harmony. However, I think that science can either modify or determine our moral convictions. The fact that infidelity, for example, is a fact of biology must, for any thinking person, modify any "absolute" condemnation of it. Moreover, that many moral convictions vary from society to society means that they are learned and, therefore, the province of psychology. Others are more universal and are, therefore, hard-wired â€” a matter of neurobiology. A retreat to moral judgment too often assumes some sort of illusionary belief in free will which I think is naive. I want to change the subject. I admit I am pleased that you agree that "why is there something rather than nothing" is a question best addressed by scientists. But I claim more generally that the only meaningful "why" questions are really "how" questions. Let me give an example to put things in context. Astronomer Johannes Kepler claimed in to answer an important "why" question: The answer, he believed, lay in the five Platonic solids whose faces can be composed of regular polygons â€” triangles, squares, etc â€” and which could be circumscribed by spheres whose size would increase as the number of faces increased. If these spheres then separated the orbits of the planets, he conjectured, perhaps their relative distances from the sun and their number could be understood as revealing, in a deep sense, the mind of God. Now, we understand the question is meaningless. We not only know there are not six planets, but moreover that our solar system is not unique, nor necessarily typical. The important question then becomes: Not only has "why" become "how" but "why" no longer has any useful meaning, given that it presumes purpose for which there is no evidence. Again, I agree with a lot here. I am unpersuaded, for example, by the argument that there is never any conflict between religion and science because the latter deals with "how" questions and the former "why" ones. The two cannot be so easily disentangled. But I would not go so far as to say that all "why" questions can only be properly understood as "how" ones. The clearest example here is of human action, for which adequate explanations can rarely do without "why" questions. We do things for reasons. Some very hard-nosed philosophers and scientists describe this as a convenient fiction, an illusion. They claim the real explanation for human action lies at the level of "how", specifically, how brains receive information, process it and then produce action. But if we want to know why someone made a sacrifice for a person close to them, a purely neurological answer would not be a complete one. The full truth would require saying that there was a "why" at work, too: Love is indeed at root the product of the firings of neurons and release of hormones. How the biochemical and psychological points of view fit together is clearly puzzling, and, as your aside on free will suggests, our naive assumptions about human freedom are almost certainly false. But we have no reason to think that one day science will make it unnecessary for us to ask "why" questions about human action to which things such as love will be the answer. Or is that romantic tosh? LK Well, I am certainly enjoying the conversation, which is apparently "why" I am doing it. However, I know that my enjoyment derives from hard-wired processes that make it enjoyable for humans to tangle linguistically and philosophically. I guess I would have to turn your question around and ask why if you will excuse the "why" question! For that not to be the case, there would have to be something beyond the purely "physical" that governs our consciousness. I guess I see nothing that suggests this is the case. Certainly, we already understand many aspects of sacrifice in terms of evolutionary biology. Sacrifice is, in many cases, good for survival of a group or kin. It makes evolutionary sense for some people, in this case to act altruistically, if propagation of genes is driving action in a basic sense. It is not a large leap of the imagination to expect that we will one day be able to break down those social actions, studied on a macro scale, to biological reactions at a micro scale. In a purely practical sense, this may be computationally too difficult to do in the near future, and maybe it will always be so, but everything I know about the universe makes me timid to use the word always. So, right now, I cannot imagine that I could computationally determine the motion of all the particles in the room in which I am breathing air, so that I have to take average quantities and do statistics in order to compute physical behaviour.

Chapter 9 : History & Philosophy of Biology | History and Philosophy of Science | University of Pittsburgh

Biology & Philosophy aims to publish the best original work in philosophy of biology, broadly understood to span conceptual, theoretical, and methodological issues in the biological sciences. It is aimed at a broad readership across the sciences and humanities, and welcomes submissions from authors.

Pre-history of Philosophy of Biology As is the case for most apparent novelties, closer inspection reveals a prehistory for the philosophy of biology. H Woodger and the philosopher Morton Beckner both published major works on the philosophical of biology Woodger ; Beckner , but these did not give rise to a subsequent philosophical literature. Some philosophers of science also made claims about biology based on general epistemological and metaphysical considerations. Perhaps the most famous example is J. Like engineering, biology cannot make any addition to the laws of nature. It can only reveal how the laws of physics and chemistry play out in the context of particular sorts of initial and boundary conditions. The encouragement of prominent biologists such as Mayr and F. J Ayala Ayala ; Mayr was one factor in the emergence of the new field. From then on the field developed rapidly. Three Types of Philosophy of Biology Three different kinds of philosophical enquiry fall under the general heading of philosophy of biology. First, general theses in the philosophy of science are addressed in the context of biology. Second, conceptual puzzles within biology itself are subjected to philosophical analysis. Third, appeals to biology are made in discussions of traditional philosophical questions. The first major debate in the philosophy of biology exemplified the first of these, the use of biological science to explore a general theme in philosophy of science. Schaffner applied the logical empiricist model of theory reduction to the relationship between classical, Mendelian genetics and the new molecular genetics Schaffner a; Schaffner b; Schaffner David Hull argued that the lesson of this attempt was that Mendelian genetics is irreducible to molecular genetics Hull ; Hull However, the apparent absurdity of the claim that the molecular revolution in biology was not a successful instance of scientific reduction also led the formulation of increasingly more adequate models of theory reduction Wimsatt ; Wimsatt ; Schaffner ; Waters ; Sarkar In another important early debate philosophers set out to solve a conceptual puzzle within biology itself. The concept of reproductive fitness is at the heart of evolutionary theory, but its status has always been problematic. Alexander Rosenberg and Mary B. Williams went on to argue that fitness is an irreducible primitive which derives its meaning from its place in an axiomatic formulation of evolutionary theory Rosenberg ; Sober a; Williams and Rosenberg Although fitness is defined in terms of reproductive success, it is not a tautology that the fittest organisms have the most offspring, any more than it is a tautology that dice produce even numbers more often than they produce sixes. The propensities of fit organisms to survive and of dice to fall equally often on each side both allow us to make fallible predictions about what will happen, predictions that become more reliable as the size of the sample increases. It remains unclear, however, whether it is possible to specify a probability distribution or set of distributions that can play all the roles actually played by fitness in population biology. The conceptual work done by philosophers of biology in many cases merges smoothly into theoretical biology. It also sometimes leads philosophers to criticise the chains of argument constructed by biologists, and thus to enter directly into ongoing biological debates. In the same way, the first kind of philosophy of biology I have describedâ€”the use of biological examples to work through general issues in the philosophy of scienceâ€”sometimes feeds back into biology itself through specific recommendations for improving biological methodology. It is a striking feature of the philosophy of biology literature that philosophers often publish in biology journals and that biologists often contribute to philosophy of biology journals. The philosophy of biology also has a potentially important role as a mediator between biology and society. Popular representations of biology derive broad lessons from large swathes of experimental findings. Philosophers of science have an obvious role in evaluating these interpretations of the significance of specific biological findings Stotz and Griffiths A third form of philosophy of biology occurs when philosophers appeal to biology to support positions on traditional philosophical topics, such as ethics or epistemology. The extensive literature on biological teleology is a case in point. Eventually, the philosophical debate produced an analysis of teleological language fundamentally similar to the view associated with modern synthesis biology Millikan ; Neander Philosophy of Evolutionary Biology Philosophy of biology can also be subdivided by the particular areas of biological theory with which it is concerned. But most of this work is concerned with conceptual puzzles that arise inside the theory itself, and the work often resembles theoretical biology as much as pure philosophy of science. Evolutionary theory in philosophical focus Sober b marks the point at which most philosophers became aware of the philosophy of biology. This sort of careful, methodological analysis of population genetics, the mathematical core of conventional evolutionary theory, continues to give rise to interesting results Pigliucci and Kaplan ; Okasha Ideas from the philosophy of science were used to argue for both transformations, and the philosopher David L. Hull was an active participant in scientific debates throughout these two revolutions Hull ; Hull ; Hull ; see also Sober The biologist Michael Ghiselin piqued the interest of philosophers when he suggested that systematics was fundamentally mistaken about the ontological status of biological species Ghiselin Species are not types of organisms in the way that chemical elements are types of matter. Instead, they are historical particulars like nations or galaxies. Individual organisms are not instances of species, as my wedding ring is an instance of gold. Instead, they are parts of species, as I am a part of my family. This has led some philosophers of biology to argue for a new conception of laws of nature Mitchell Philosophy of Molecular Biology I mentioned above that the reduction of Mendelian genetics to molecular genetics was one of the first topics to be discussed in the philosophy of biology. The reductionist position was revived in a series of important papers by Kenneth Waters Waters ; Waters and debate over the cognitive relationship between the two disciplines continues today, although the question is not now framed as a simple choice between reduction and irreducibility. Moreover, molecular biology does not have the kind of grand theory based around a set of laws or a set of mathematical models that is familiar from the physical sciences. Another important topic in the philosophy of molecular biology has been the definition of the gene Beurton, Falk and Rheinberger ; Griffiths and Stotz Philosophers have also written extensively on the concept of genetic information, the general tenor of the literature being that it is difficult to reconstruct this idea precisely in a way that does justice to the apparent weight placed on it by molecular biologists Sarkar ; Maynard Smith ; Griffiths ; Jablonka The debate over developmental constraints looked at developmental biology solely from the perspective of whether it could provide answers to evolutionary questions. Philosophy of Ecology and Conservation Biology Until recently this was a severely underdeveloped field in the philosophy of biology. This is surprising, because there is obvious potential for all three of the approaches to philosophy of biology discussed above. There is also a substantial body of philosophical work in environmental ethics, and it seems reasonable to suppose that answering the questions that arise there would require a critical examination of ecology and conservation biology. Strategies for Conservation â€”was an honorable exception to the philosophical neglect of ecology in earlier decades. In the past decade philosophers have started to remedy the neglect of ecology and a number of major books have appeared Cooper , Ginzburg and Colyvan , Sarkar , MacLaurin and Sterelny Methodology in Philosophy of Biology Most work in the philosophy of biology is self-consciously naturalistic, recognizing no profound discontinuity in either method or content between philosophy and science. Ideally, philosophy of biology differs from biology itself not in its knowledge base, but only in the questions it asks. The philosopher aims to engage with the content of biology at a professional level, although typically with greater knowledge of its history than biologists themselves, and less hands-on skills. It is common for philosophers of biology to have academic credentials in the fields that are the focus of their research, and to be closely involved with scientific collaborators. Even the distinction between the questions of biology and those of philosophy of biology is not absolutely clear. As noted above, philosophers of biology address three types of questions: When addressing the second sort of question, there is no clear distinction between philosophy of biology and theoretical biology. Certainly, the professional skills of the philosopher are as relevant to these internal conceptual puzzles as they are to the other two types of question. All three types of questions can be related to the specific findings of the biological sciences only by complex chains of argument. A contemporary introduction The changing rule of the embryo in evolutionary biology: Topics in Philosophy of Biology, â€" Philosophy and the Neurosciences: The biological way of thought. The Concept of the Gene in Development and Evolution. Concepts and Methods in Evolutionary Biology. Integrating Evolution and Development. The Science of the Struggle for Existence: On the foundations of ecology. The Disorder of Things: Metaphysical Foundations of the Disunity of Science. The Latest on the Best: Essays on Optimality and Evolution. How planets Move and Populations Grow. Oxford and New York: A Metaphor in Search of a Theory. Cambridge Companion to Philosophy of Biology, 85â€" Philosophy of Biological Science. Science as a Process: University of Chicago Press. The Philosophy of Biology. The Cambridge Companion to the Philosophy of Biology. New York, Cambridge University Press. The Structure and Confirmation of Evolutionary Theory. From Embryology to Evo-Devo. Language, Thought and Other Biological Categories. Evolution and the Levels of Selection. New York and Oxford: Making Sense of Evolution: The Conceptual Foundations of Evolutionary Theory. Embryology, Epigenesis and Evolution: Cambridge and New York: