REVIEWS AND BRIEF NOTICES

HISTORY, PHILOSOPHY & ETHICS

DARWIN'S FISHES: AN ENCYCLOPEDIA OF ICHTHYOLOGY, ECOLOGY, AND EVOLUTION.

By Daniel Pauly. Cambridge and New York: Cambridge University Press. $80.00. xxv + 340 p; ill.; index to the fishes. ISBN: 0–521–82777–9. 2004.

What a wonderful idea. Spend 20 years combing all Darwin's writings on anything the great man had to say about fish, assess his comments and interpretations against the source material cited by Darwin, evaluate his interpretations in the light of current knowledge (Whig history, but here it works), and turn the research into a chrestomathy (for a definition of which, see page 35)—an encyclopedic treatment from A (which tells readers how to use the book) to ZZZ. If you usually read a book with a bookmark in the endnotes to speed the checking of details, sources, or esoterica, then this volume is for you.

Extensive cross-referencing and quotations from Darwin's writings will lead readers from topic to related topic. And the diversity of subjects is expansive; Darwin had an enormous amount to say about fishes, as exemplified in three appendixes of the fishes he collected during the voyage of the *Beagle*. Readers will learn about fish that climb, flatfish, lumpfish, and salmon, about the zooplankton on which many fish feed, and about the fish experts with whom Darwin interacted (Günther, Jenyns, Agassiz, and Huxley) but, curiously, not about Forbes or Lankester, perhaps a reflection of the omission of larval and life-history stages—and of larvae in plankton—from the book. The inclusion of topics and taxa unknown to Darwin (Hox genes, *Acanthostega*, and *Ichthyostega*) seemed unusual at first, but provides a link between 19th and 21st century understanding of the 9000 fish species known in Darwin's time, and the 28,000 species known today. A small number of figures illustrate some of the fishes discussed. The annotated bibliography is extensive. A taxonomic index of the fishes cited concludes the book. The layout is attractive, the typographical errors few (e.g., on page 69, "ontogeny recapiculates phylogeny" is one I caught in checking for coverage of embryos), and the price is reasonable. Go fish.

BRIAN K HALL, *Biology, Dalhousie University, Halifax, Nova Scotia, Canada*

BAYES'S THEOREM. *Based on a symposium held on 10 March 2001. Proceedings of the British Academy, Volume 113.*

Edited by Richard Swinburne. Published by Oxford University Press, Oxford and New York, for The British Academy. $24.95. ix + 149 p; ill.; no index. ISBN: 0–19–726267–8. 2002.

Bayesian analysis is slowly becoming mainstream in several fields of science, and lately even in some areas of evolutionary biology (especially phylogenetic reconstruction, but also population genetics and evolutionary ecology). Yet, Bayes's theorem—first published posthumously in 1763—continues to generate controversy in both science and philosophy. This slim volume, edited by, of all things, a philosopher of Christian religion, is not quite as all-encompassing as the title would lead casual readers to believe. But it is well worth the time to read the essays collected by Swinburne, if nothing else because of their breadth and contrasting viewpoints.

To begin with, recall that Bayes's theorem says that the probability of a hypothesis given the evidence and our prior knowledge is equal to the

product of the probability of the evidence given the hypothesis and prior knowledge, multiplied by the probability of the hypothesis given prior knowledge, the whole thing divided by the probability of the evidence given the prior knowledge. In symbols (where h is the hypothesis being considered, e the evidence, and k the prior knowledge):

$$P(h|e\,\&\,k) = \frac{P(e|h\,\&\,k) * P(h|k)}{P(e|k)}$$

After Swinburne's own rather uninspiring introduction, philosopher of biology Elliott Sober mounts a sustained criticism of Bayesianism, the philosophical position that Bayes's theorem offers not just an insight into the consequences of conditional probabilities, but a general theory of scientific inquiry. Sober is certainly right that we should not equate Bayes's theorem with Bayesianism, and that the latter cannot be the whole story about how science works. Nonetheless, I find the general idea that scientists approach competing hypotheses with prior expectations, and that we change them (i.e., derive posteriors) on the basis of available evidence and how it relates to the various hypotheses being considered, an intuitively appealing summary of what goes on most of the time during the process of scientific discovery.

Colin Howson's essay on Bayesianism in statistics is a very useful analysis of the history of the field. I wonder how many biologists realize, for example, that Bayes's approach was actually the dominant paradigm in statistical analysis until Fisher introduced what is today known as "frequentism" (i.e., the framework within which probabilities are interpreted as frequencies of events). More interestingly, Howson explicitly discusses the relationship between Fisher's approach (still the most widely followed one in biostatistics) and Karl Popper's idea of falsificationism. Popper suggested that the distinguishing feature of good science is that it formulates hypotheses that can, in principle, be falsified by new empirical evidence. Fisher's famous emphasis on attempts to reject a "null hypothesis" in statistics parallels the philosopher's suggestion. Since Popper's falsificationism has long been abandoned by more sophisticated philosophers of science (because it turns out that it is actually very difficult to really falsify any sufficiently complex hypothesis), I wonder if biologists are simply late in the game when still clinging to both Fisher and Popper.

Philip Dawid's chapter on using the Bayesian approach in jury trials is both interesting and amusing. The author actually reports instances of juries in Britain that have been instructed in the theory of conditional probabilities in order to be better able to judge complex claims about DNA evidence and the like. Somehow, I simply cannot imagine that an American judge would go along with such a procedure, as beneficial as it may be to both justice and the jurors themselves.

John Earman's essay on David Hume, Bayes, and the proper evaluation of testimony in the case of miracles is perhaps the most bizarre of the whole volume, and I cannot resist seeing its inclusion in the book as a direct result of the editor being a Christian theologian. Although Earman concludes at the end of his essay that the long-established tradition of natural theology (i.e., deriving proof of the existence of God through an analysis of the natural world) is doomed to failure, he nevertheless engages in a caustic and often gratuitous attack on 18th-century philosopher David Hume's famous essay on miracles. In essence, Earman charges Hume with being either trivial (i.e., simply suggesting that one should always be cautious about accepting testimony of alleged miraculous events) or absurd (i.e., claiming that no amount of evidence could ever establish the reality of a miracle). Earman's ambiguity about what Hume actually says is strange, given that plenty of commentators (including Hume's detractors) have found the Scottish philosopher to be perfectly clear in what he meant. Indeed, if one pieces together quotes from Hume contained in Earman's chapter, one clearly sees that Hume did not err on either the side of triviality or that of absurdity. Rather, he suggested that testimonial evidence ought to be treated differently in the case of unusual natural occurrences (which are within the proper realm of scientific investigation) versus alleged supernatural events. Ironically, and contrary to Earman, Hume's position can be interpreted in Bayesian fashion as saying that the posterior probabilities of a natural or supernatural explanation for an occurrence are different even when the testimonial evidence is the same, because the *priors* we attach to natural and supernatural phenomena are different, given our antecedent experience (which favors natural explanations over supernatural ones)!

The final chapter in the book is by David Miller, and I regret its brevity, considering that it tackles a subtle but important concept in probability theory: the proper interpretation of probabilities of individual events as "propensities." Again, we go back to Popper, who, in an essay published in 1957, proposed that—contrary to the frequentist school of thought that sees probabilities as a measure of the frequency of occurrence of a population of events—it makes sense to talk about the probability of a single event, such as the decay of an atom in quantum mechanical theory. According to this view, the probability of an event should be thought

of as the "propensity" of that event actually occurring, a notion that makes sense only in a universe that is not entirely deterministic (otherwise any event would simply have a propensity of either zero or one). Miller's task is to square Popper's suggestion with the framework of Bayes's theorem, something he succeeds in doing—I think—in a mere five pages.

All things considered, this book is worth reading for anyone interested in the conceptual issues surrounding the application of Bayes's theorem to a wide range of problems in science and philosophy. Although certainly not intended as a guide for practicing biologists, there is much food for thought here that can be profitably digested.

MASSIMO PIGLIUCCI, *Ecology & Evolution, Stony Brook University, Stony Brook, New York*

SCIENCE AND OTHER CULTURES: ISSUES IN PHILOSOPHIES OF SCIENCE AND TECHNOLOGY.

Edited by Robert Figueroa and Sandra Harding. New York: Routledge. $96.95 (hardcover); $29.95 (paper). viii + 276 p; index. ISBN: 0–415–93991–7 (hc); 0–415–93992–5 (pb). 2003.

The essays in this volume "originated in a National Science Foundation grant to the American Philosophy Association (APA) to develop a series of research activities focused on the topic of diversity issues in the philosophy of science" (p vii). In light of this origin, one might expect the volume to be disjointed and uneven—the product of cutting-edge research that has yet to solidify into a coherent body of work. Such concerns are inapplicable here. Not only is the volume an important scholarly contribution to the philosophies of science and technology, but due to its diverse scope, rigorous treatment of the material, and judicious choice of authors, it makes for a fine textbook. This volume will be appropriate for any college course related to values and science or values and technology. Although the book has the potential to contribute meaningfully to the culture of science criticism, it avoids many of the reductive tendencies that can sometimes be found in alternative scholarship that aspires toward the same goal. While the authors display sensitivity to a variety of social and political concerns, neither the abstract enterprise of scientific inquiry nor its concrete institutions and practices are reduced to exclusively social and political activity.

The volume is organized around three themes. The first theme—Sciences in cultures, cultures in sciences—addresses "philosophic issues about the complex ways in which sciences fit into their larger cultures and, in turn, harbor cultural values, interests, desires, and fears in even their most abstract elements" (p 4). The next theme—Classifying people: science and technology at our service—is an examination of how "Western sciences have been called upon to produce a politics of classification that, intended or not, turns out to serve the interests primarily of dominant groups at great cost to already vulnerable groups" (p 6). The final theme—Technological change, tradition, and modernity—attends to matters concerning technological change in Japan in order to raise "questions about the relations between traditionalism and modernity that may well have implications for our understandings of scientific change" (p 7).

In Part 1, Robert Hood turns to a controversy concerning international HIV/AIDS research in developing countries in order to shed light on how medical researchers can proceed ethically under crisis conditions. Alison Wylie proposes a framework for standpoint analysis of scientific practice that addresses its historical challenges and can be concretized via discussion of Blanche, a fictional character who appears in a murder mystery written by Barbara Neely. Sandra Harding reviews the metaphilosophical implications of multicultural and postcolonial science studies, establishing points of convergence between them and the post-positivistic philosophy of science. James Maffie examines the relevant features of an epistemological framework that is incommensurate with modern Western science and Conquest-era Nahua inquiry. Hugh Lacey appeals to the notion of sociocultural nexus in order to take issue with the argument that the development and practical utilization of transgenic seeds serve human interests universally. Finally, Robert Crease adopts a hermeneutic approach to narration in order to make sense of the differences between local and nonlocal views concerning the treatment of those exposed to H-bomb tests on Bikini in the Marshall Islands shortly after World War II.

In Part 2, Anita Silvers and Michael Ashley Stein reflect on how to establish the proper legal framework for protecting against discrimination based on genetic information. Licia Carlson engages in the project of rethinking the concept of normalcy, the goals of normalization, and Alasdair MacIntyre's views on flourishing by bringing these considerations to bear on the topic of mental retardation. Sara Goering highlights the dangers that attend to the medical establishment's appeal to an objective model of health to justify cosmetic surgery. Sara Waller considers the epistemic significance of ethnicity and socioeconomic status in the context of establishing tests that measure cognition. Naomi Zack contends that it is illegitimate to appeal to geographical origins to establish racial distinctions. Margaret Cuonzo examines circular