Book Reviews

The Strategies of Real Science

Method and Appraisal in the Physical Sciences. The Critical Background to Modern Science, 1800–1905. COLIN HOWSON, Ed. Cambridge University Press, New York, 1976. viii, 344 pp. $24.50.

If we ask such questions as "How do scientific theories develop through time?" or "What leads to the replacement of one theory by another?" we find that much of the best-known historical scholarship provides no satisfactory answers. A different weakness haunts much writing within the philosophy of science. Philosophers have offered us many careful and detailed analyses of scientific inference, but there is virtually unanimous agreement that none of the classical philosophical models of science finds any actual exemplifications in science itself. Erstwhile philosophers of science thus often find themselves developing models not of science as it is or has been but of some utopian enterprise which science neither is nor can become.

The essays in this volume aspire to achieving what neither history of science nor philosophy of science usually does: an account of actual science which, by utilizing a blend of historical data and philosophical argument, exhibits both how science has developed and the conditions under which such development can be regarded as rational and progressive. Put simply, the authors seek to apply the methodology of scientific research programs (a philosophical tool originally developed by Imre Lakatos) to a series of classical cases of theoretical confrontation in the sciences. Among the episodes treated are phlogistic and oxygen chemistry, wave and corpuscular optics, atomism and thermodynamics, and early relativity theory. In each case, the author's concern is to give a historically accurate and philosophically relevant explanation of the confrontation between different "paradigms." Some contributions come closer to achieving this goal than others; to that extent the volume is of uneven quality. It is nonetheless a fitting memorial to Imre Lakatos, since virtually all the contributions represent attempts to apply his provocative philosophy of science to some of the classic controversies in the history of science. If the book has any persistent flaw it is the reluctance of most authors to utilize the historical cases they discuss as instruments for moving beyond Lakatos's methodology. There seem to be times when opportunities for cogent criticism are ignored and when the actual cases are too rigidly compartmentalized in order to accommodate them within the framework. But the great strength of this work is that it does manage, rather more successfully than Kuhn's classic *Structure of Scientific Revolutions*, to raise some deep philosophical questions about the manner in which modern science has taken the form it has. It raises them, moreover, within the context of a fine-grained analysis of some of the most exciting episodes in the history of science.

Doubtless the book will encounter much resistance. Historians of science will see it as a sinister subversion of true history, insofar as its authors seek to force the complexities of history into the confines of a rigid philosophical system. Traditional philosophers, on the other hand, will be dismayed by the presumption that the data of history can have any significance for debates about the nature of scientific rationality.

On the whole, the essays vitiate these traditional criticisms. Here is a refreshingly brash approach which says to the philosopher of science that the legitimative and argumentative strategies of real science are far richer and more subtle than most philosophical models have allowed. Equally, it says to the historian that hidden within the seeming minutiae of the past are a set of profound philosophical puzzles about the nature of rationality, puzzles that bring a vitality and relevance to the past that are sorely lacking in most historical scholarship.

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Progressionism

Fossils and Progress. Paleontology and the Idea of Progressive Evolution in the Nineteenth Century. PETER J. BOWLER. Science History Publications (Neale Watson), New York, 1976. viii, 192 pp., illus. $9.95.

Popular accounts of geology work by synecdoche in assigning entire periods to single groups. Thus, an age of fishes (though it contained orders of magnitude more brachiopods) yields to an age of reptiles, and finally to an age of mammals (with vastly more beetles). Popular accounts of science follow the same strategy—the 16th century is Copernicus's, the 17th Galileo's, and the 19th Darwin's.

Evolution becomes the great watershed for natural science in the 19th century, and we align its scientists by their stance toward Darwin's insight. Buckland, Cuvier, and Agassiz stand together as antievolutionists (and bad guys); Lyell redeemed himself with a belated conversion; Darwin is a hero, and Chambers is a prophet (for his anonymous defense of evolution in 1844).

This anachronistic typecasting by the issues most relevant to our concerns often distorts the course of debate in its own time. I would be dismissed incredulously by many colleagues if I pulled out a scorecard with Buckland and Lyell on one side and Chambers and Agassiz on the other. Yet this is the proper lineup for an issue that agitated 19th-century paleontology far more than evolution—the continuously vexatious question of progress in the history of life. Does life move from lower to higher during its history (as the absurdly selective account in terms of "ages" implies)? If it does, what is the mechanism of advance? Bowler's splendid little book on progressionism in 19th-century paleontology finally restores a group of fine scientists to their own primary concerns.

Bowler traces ideas of progress from unilinear schemes of successive, disconnected creations to the branching and diverging trees of later evolutionists (though Darwin himself cared little for doctrines of progress and preferred to view evolution as a tale of adaptation to changing local environments). Once evolution triumphed, Spencer's belief in progress as the universal direction of development replaced earlier creationist accounts of organic advance. Earlier rationales proceeded along two very different paths. Some geologists followed the Paleyan tradition of natural theology: animals are exquisitely designed to fulfill their roles on a harmonious earth. The cause of organic progress must be sought in a direction of environmental change; for life must always match its surround-