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EDITED BY ROBERT S. COHEN AND MARX W. WARTOFSKY

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Edited by

MARJORIE GRENE AND EVERETT MENDELSOHN

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PREFACE

The philosophy of biology should move to the center of the philosophy of science – a place it has not been accorded since the time of Mach. Physics was the paradigm of science, and its shadow falls across contemporary philosophy of biology as well, in a variety of contexts: reduction, organization and system, biochemical mechanism, and the models of law and explanation which derive from the Duhem-Popper-Hempel tradition.

This volume, we think, offers ample evidence of how good contemporary work in the philosophical understanding of biology has become. Marjorie Grene and Everett Mendelsohn aptly combine a deep philosophical appreciation of conceptual issues in biology with an historical understanding of the radical changes in the science of biology since the 19th century. In this book, they present essays which probe such historical and methodological questions as reducibility, levels of organization, function and teleology, and the range of issues emerging from evolutionary theory and the species problem. In conjunction with Professor Grene's collection of essays on the philosophy of biology, *The Understanding of Nature* (Boston Studies in the Philosophy of Science, Vol. XXIII) and the occasional essays on these topics which we have published in other volumes (listed below), this volume contributes to bringing biology to the center of philosophical attention.

Everett Mendelsohn, 'Explanation in Nineteenth Century Biology' (Boston Studies, Vol. II, 1965).

David Hawkins, 'Taxonomy and Information', (Boston Studies, Vol. III, 1967).

Norman Geschwind, 'The Work and Influence of Wernicke', (Boston Studies, Vol. IV, 1969).

Carl Wernicke, 'The Symptom Complex of Aphasia: A Psychological Study on an Anatomical Basis', (Boston Studies, Vol. IV, 1969).

Norman Geschwind, 'Anatomy and the Higher Functions of the Brain', (Boston Studies, Vol. IV, 1969).

Milic Capek, 'Ernst Mach's Biological Theory of Knowledge', (Boston Studies, Vol. V, 1969).

June Goodfield, 'Theories and Hypotheses in Biology: Theoretical Entities and

Functional Explanation', (Boston Studies, Vol. V, 1969); with comments by Ernst Mayer and Joseph Agassi.

Floyd Ratliff, 'On Mach's Contributions to the Analysis of Sensations', (Boston Studies, Vol. VI, 1970).

Milic Capek, Part I, 'Bergson's Biological Theory of Knowledge', (Boston Studies, Vol. VII, 1971).

Edward Manier, 'Functionalism and the Negative Feedback Model in Biology', (Boston Studies, Vol. VIII, 1971).

William C. Wimsatt, 'Some Problems with the Concept of "Feedback",' (Boston Studies, Vol. VIII, 1971).

Eugene P. Wigner, 'Physics and the Explanation of Life', (Boston Studies, Vol. XI, 1974).

J. Bronowski, 'New Concepts in the Evolution of Complexity: Stratified Stability and Unbounded Plans', (Boston Studies, Vol. XI, 1974).

Kenneth F. Schaffner, 'The Unity of Science and Theory Construction in Molecular Biology', (Boston Studies, Vol. XI, 1974).

Huseyin Yilmaz, 'Perception and Philosophy of Science (Boston Studies, Vol. XIII, 1974).

Ernst Mayr, 'Teleological and Teleonomic, a New Analysis', (Boston Studies, Vol. XIV, 1974).

Norman Geschwind, *Selected Papers on Language and the Brain* (Boston Studies, Vol. XVI).

Stuart Kauffman, 'Elsasser, Generalized Complementarity, and Finite Classes: A Critique of His Anti-Reductionism', (Boston Studies, Vol. XX, 1974).

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MARX W. WARTOFSKY

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FOREWORD

Philosophy of science in the past has focussed largely on examples from physics; even since 'logical reconstruction' has yielded ground to a more historically oriented position, talk of 'scientific revolutions' and so on has dealt chiefly with cases like the shift from Newton to Einstein rather than, say, from Darwin and Mendel to Watson and Crick. At the same time, however, there has been increasing interest on the part, not only of students, but of philosophers and historians, in conceptual problems at the foundations of the biological, as distinct from the 'exact' sciences. There are, indeed, some books, as well as anthologies, available in the field; but we felt that there was room at this stage for a carefully selected, yet representative, collection that would exemplify the major problems and some of the typical approaches to their resolution.

"Science", James Franck is supposed to have remarked, "is either something people do or it is nothing at all." Both editors agree with this pronouncement; we have tried to implement our acceptance of it by placing a trio of essays in the history of biology at the head of our collection. The fact that two of these papers happen to be by us does not mean, however, that we consider our work more important than that of our other contributors. Nor are we alleging that philosophical and historical problems are identical; what we *are* alleging is that conceptual problems at the foundations of any discipline originate, like any other human problem, *within* an historical, social-political-intellectual-personal, situation – a situation that not only establishes necessary conditions for their emergence as conceptual problems, but shapes them as the problems they have become of and for those scientists, or, at one remove, philosophers and/or historians, for whom, in the apposite situation, they have arisen. 'Logical reconstruction' *in vacuo*, therefore, necessarily ignores the substantive conceptual issues to which, in their development, the sciences recurrently give rise. This has been a hard lesson for philosophers of science to learn, but they are learning it; we have tried to

stress it, pedagogically, by putting history first on paper as it is in very truth.

Parts II to V deal with the issues usually raised in discussions of the philosophy of biology – each time, again, with a brief selection of papers standing for many more. The first question, of course, has been the question whether biology is anything at all, or only, in the last analysis, a part of physics. On this issue Michael Polanyi's paper has by now become a classic. True, his argument should be modified to take account of the fact that some of the four bases on the DNA chain do combine more readily than others, and so the improbability of the code is not as complete as it seemed to be when his paper first appeared. With that qualification, however, his fundamental thesis remains defensible. It should be emphasized, moreover, that there is no question here, as some critics have supposed, of an old-fashioned vitalism; no serious philosopher any longer espouses such a view, if any ever did. What is at issue is the hierarchically organized structure of living things, which permits their study by scientists on a number of levels. (On this, see *e.g.*, Pattee or Kauffman in Part III). Against this position, Professor Schaffner states the equally classic case for physicalism: for the view that science is physics and that's the end of it.

Supposing, however, that radical physicalism is untenable, and that there *are* problems unique to biology, it remains to pose them. First, there is the question of biological explanation, to which Part III of our anthology is devoted. There is a complex network of problems here, which we have tried to exemplify in three parts. First, the question of levels of organization, already raised in Polanyi's paper, is considered from the point of view of an embryologist by Grobstein, of a biophysicist by Pattee and of a philosopher by Wimsatt. Second, the question of teleological explanation, which used to be 'the' question about explanation in biology, is represented by two papers among many devoted to the subject. Beckner's, again, has become a classic in this field. Wright's is of interest as representing a serious consideration of teleology in the explanation of animal behavior, rather than in biological explanation as such. It thus opens the possibility, which the same author has developed elsewhere, of separating the problem of functional explanation ('What does the liver do?' and even 'How does it do it?') from teleological explanation in a narrower sense ('Why did the rabbit run into its bur-

row?'). Wright's paper is of interest also for its careful modification of Charles Taylor's formulation of teleological explanation in his important and influential work *The Explanation of Behaviour* (Routledge and Humanities Press, 1964). Kauffman's essay, presenting an original view of the uniqueness of biological explanation, seems to fall into a class by itself, and so we have placed it alone as III C.

In the field of evolutionary theory, or meta-theory, it has been difficult to select from an extensive literature. We might have introduced specific problems like those arising from the question of group selection; or, some may think, we should have included treatment of such grand topics as 'emergent evolution'. The former, however, though fascinating, would be too specialized for our purposes, and the latter, we agree, though it may engender lively metaphysical discussion, is no longer a live subject for debate in the philosophy of biology. By and large, evolutionary theory means the theory of natural selection. What supplementation it needs is ably suggested in Slobodkin's paper, and one of the debatable areas it still leaves open, the precise meaning and scope of 'adaptation,' is discussed by Munson. Lewontin's paper indicates the possible application of a mathematical technique, the theory of games, to evolutionary questions; this application seems to be bearing fruit, or at least to be stimulating further discussion at the present time. Ayala's contribution might perhaps have been included in Part II, or indeed III B, for it constitutes a programmatic pronouncement that evolutionary theory alone saves biology from reduction to physics, and that it does so because its explanatory power is teleological, while that of physics is not. This thesis can be, and has been, criticized, but, once more, the essay has already become a classic in the field; and, together with Slobodkin's, it presents contrary interpretations by evolutionists of the conceptual structure of their theory.

Our last section raises recent issues most hotly debated by contemporary biologists: problems of the foundations of taxonomy; and at the same time it introduces one of the most venerable problems of philosophy, the problem of universals. Are there real classes, and, if so, how are they to be characterized? Ernst Mayr speaks most authoritatively, and clearly, for the majority of taxonomists; the range of contemporary positions is summarized by Hull in his review paper, and Pratt contributes a recent discussion of the issues as a philosopher sees them. In

this field, too, of course, there is a great deal more we might have included; the reading list, which in turn includes books with extensive bibliographies, will, we hope, guide the student in further exploration.

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Everett I. Mendelsohn: 1968, 'Philosophical Biology versus Experimental Biology', *Actes*, Tome I, B, Discours et Conferences Colloques, XII[e] Congrès International d'Histoire des Sciences, Paris.
Stephen Jay Gould: 1971, 'D'Arcy Thompson and the Science of Form', *New Literary History* **II**, No. 2.
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Clifford Grobstein: 1969, 'Organizational Levels and Explanation', *J. History Biology* **2**, No. 1.
H. H. Pattee: 1971, 'Physical Theories of Biological Co-ordination', *Quart. Rev. Biophys.* **4**, 2 and 3.
William C. Wimsatt: 1974, 'Complexity and Organization', *Philosophy of Science Association*, 1972, *Boston Studies in the Philosophy of Science*, D. Reidel, Dordrecht.
Morton Beckner: 1969, 'Function and Teleology', *J. History Biology* **2**, No. 1.
Larry Wright: 1973, 'Functions', *Phil. Rev.* **82**, No. 2.
Stuart A. Kauffman: 1971, 'Articulation of Parts Explanation in Biology and the Rational Search for Them', *Boston Studies in the Philosophy of Science* **VIII**, pp. 257–272, D. Reidel, Dordrecht.
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