

## EMPIRICISM AND DARWIN'S SCIENCE

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*To my wife,  
Linda Rothman*

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## PREFACE

I would like to record my thanks to Paul Thompson for useful conversations over the years, and also to several generations of students who have helped me develop my ideas on biological theory and on Darwin.

My wife has, as usual, been more than helpful; in particular she typed a good portion of the manuscript while I was on leave a few years ago, more now than I like to remember.

My parents were both looking forward to holding a final copy of this book. I only regret that my mother did not live long enough to see its completion.

I must also thank the publishers and their staff. They have been remarkably patient about meeting deadlines — promises were repeatedly made and then, owing to family situations, had to be broken — and for this I am considerably in their debt.

I would further like to thank the following authors and publishers for permission to use their work:

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The works of Charles Darwin are in the public domain, but I have quoted extensively from his and A. Wallace's 'On the Tendency of

Species to Form Varieties', in Paul H. Barrett (ed.), *The Collected Papers of Charles Darwin*, Vol. 2, 3–19. The efforts of the editor and of the publisher, the University of Chicago Press, to keep these works in print should also be acknowledged.

## INTRODUCTION

Darwin's *Origin of Species* provided a unifying theory for biology in much the same way that Newton's *Principia* did for physics. Yet, as it lacks the mathematical structure of Newton's book, the logical structure of Darwin's theory is not nearly as evident as that of Newton's. And so we have had a considerable amount of discussion about that structure. Some have argued that it is hypothetico-deductive<sup>1</sup> while it has also been noted that much of Darwin's case depends upon arguments that have the structure of analogical inferences.<sup>2</sup> If this is so, then how do the two sorts of pattern hang together? Others have spoken of "inferences to the best explanation."<sup>3</sup> And there have been still further suggestions.<sup>4</sup>

Another area of disagreement concerns whether there are laws in the explanations that Darwin offers. Some are committed to there being laws in the strict sense in Darwin's theory<sup>5</sup>; others are not so sure.<sup>6</sup> And if there are laws, then it is also true, some hold, that the laws are "loose."<sup>7</sup> Some suggest, indeed, that Darwin's own theories fall short of the ideal of strict lawfulness, though the theories of modern biology, including population genetics, do contain lawlike principles.<sup>8</sup> Some cite the lack of an adequate theory of inheritance as the grounds for holding that the Darwinian theories fall short of the ideal of lawfulness<sup>9</sup>; others cite the fact that in the *Origin* Darwin often tells what are intended to be, not established truth, but rather only "imaginary stories."<sup>10</sup>

Then there is the question of evidence. Some claim that Darwin's theories are justified by the empirical consequences that are derived from them.<sup>11</sup> Others suggest that analogy (particularly the analogy with artificial selection) plays a role in providing evidential support for the core premises of the Darwinian explanations.<sup>12</sup> Others point out the role of "fruitfulness" in justifying Darwin's theory,<sup>13</sup> or, what is perhaps the same, the role of "consilience."<sup>14</sup>

The aim of the present essay is to attempt to lay out as clearly as possible exactly what is the logical structure of both Darwinian explanations and the evidence that is marshalled to justify these explanations. It will be argued that these structures are basically those of an empiricism

of the sort defended by John Stuart Mill or the logical positivists of the Vienna Circle. It will be found, however, that the structure is not crudely hypothetico-deductive, and that analogy does indeed play a role. But it will also be argued that all this is quite compatible with the empiricism of Mill and the logical positivists.

Some will object to the very idea that an empiricist account of explanation should be used to attempt to understand *any* scientific theory, and Darwin's in particular. After all, do we not all know that the empiricist or positivist account of explanation and theories is insensitive to the role of historical and social forces in determining the nature, and acceptability, of explanations and theories? We should adopt, rather, the views of such thinkers as Kuhn, who are not in this way insensitive to many of those things that are essential if we are to understand the development of any *real* theory, be it Darwin's or anyone else's.<sup>15</sup> One of the points that we shall argue in the first two chapters, however, is that this is a spurious dichotomy, that is, that the empiricist account of science is in fact compatible with the theses of Kuhn about the nature of scientific discovery. Or, at least, since a full defence of a thesis like this is beyond the scope of the present essay, it will be argued that the distinction between the two approaches is not as sharp as the critics of empiricism often claim. And our discussion of Darwin's theories will itself offer further support for this claim, since it will be an analysis which will be, one hopes, sensitive to the historical detail in a way that the critics of empiricism insist that any account of a real theory should be sensitive.

Part I, below, develops the essential features of an empiricist or positivist methodology. It also argues that such a methodology is compatible with many of the positions on theory structure and theory change that Kuhn has so carefully described. Crucial to the subsequent discussions will be the notion of abstractive generic laws which are at once pieces of imperfect or gappy knowledge relative to the explanation of individual facts or events but at the same time are of a form that permits them to unify bodies to laws into theories and to provide a guide for subsequent research. The existence of laws of this sort has often been ignored by critics of the positivist philosophy of science, and our noting them will enable us to reply to those critics. They will, moreover, provide us with the tools for understanding the role of analogy in Darwin's theory.

The account of theory change that is proposed is certainly not that

standardly associated with the notion of empiricism, though it is not incompatible with an empiricist account of theory structure. It is neither probabilistic with Carnap nor falsificationist with Popper. The model proposed is, rather, a more complex one deriving its thrust from Kuhn's historically informed insights. In particular, it draws a distinction between normal and revolutionary science, arguing for the rationality of both. Perhaps not surprisingly, this account of theory change turns upon certain features of the account of the logical structure of scientific theories that this essay develops.

Part II applies these principles to a general discussion of explanation and theory structure in biology and of the role of purposive and functional explanations. In particular, the discussion of so-called "narrative explanations" will enable us to reply to those critics who find that Darwin presents far too many "likely stories" rather than confirmed theories in the *Origin of Species*.

Finally, Part III deals with Darwin's theory of the origin of species. Crucial to our account will be the notion of imperfect knowledge and of abstractive generic laws. This notion will enable us to accommodate within a positivist philosophy of science the notion that the laws that Darwin is working with are "loose"; and will enable us to reply to charges, like that of Popper, that the theory is not scientific because it is unfalsifiable.

Darwin's theory of the origin of species is often held to be of a second-rate status so far as concerns scientific theories when compared to those of, say, physics. The purpose of the present essay is to argue that, if the account of theories that it presents is correct, then the theory is far from second-rate; to the contrary, I argue that if the empiricist account of theories that we adumbrate is correct, then it is indeed well-supported. In fact, I argue that the case for the theory was *already made*, and *strongly made*, in the slim paper that was the initial presentation of the theory by Darwin and Wallace to the Linnaean Society ('On the Tendency of Species to Form Varieties'). The *Origin* simply adds detail — though to such an extent that in the end only the irrational and the self-deceiving could reject Darwin's theory. What I attempt to do is argue the more difficult case that the theory of the short essay is already a strongly supported theory, one worthy of acceptance for purposes of explanation and prediction, and for guiding further research; and that the evidence marshalled in the short paper already strongly supports the theory of the evolutionary origin of species by natural selection. It is often said, by philosophers of science perhaps

only somewhat less frequently than creationists, that Darwin's theory is either tautological or lacks evidential support. If my argument is correct, then even on good empiricist grounds the theory is well-supported.

Of course, it does not follow that the theory *is* well-supported. The latter is so only if the empiricist account of theories and of theory change that I present is correct. On the other hand, as so many have recently emphasized, no philosophy of science is adequate unless it is historically realistic. The thrust of the present essay is thus to help in establishing the *bona fides* of empiricism, by demonstrating that, so far as Darwin's theory is concerned, empiricism provides an adequate account.

Furthermore, this essay also argues that the account of theories and theory change that we propose is essentially that which Darwin himself accepted. It is thus another part of our argument that the theory of evolution by natural selection that Darwin developed satisfied his own standards of theory evaluation.

The present essay is not intended to be yet another contribution to what Ruse has called the "Darwin industry."<sup>16</sup> At least, it is intended to be more than that. It aims not only to explicate Darwin but also to use Darwin to develop an argument in the philosophy of science. The latter is an argument to defend an account of science which is at once empiricist and positivist and also incorporates an account of research that builds on the insights of Kuhn concerning what he referred to as "normal science." It is argued that so-called "paradigms" can be construed as what I have elsewhere called abstractive generic theories.<sup>17</sup> Darwin's theory of the origin of species has just this logical form. This logical form can account, it is argued, for the practice of research in "normal science," and in particular for what Kuhn has described as the "function of dogma in scientific research."<sup>18</sup> But besides this role of abstractive generic theories in the context of discovery they also play an important and neglected role in the context of justification. Using Darwin's theory as an example we shall attempt to locate this role that theories (= paradigms) play in transmitting evidential support. And this latter discussion will also reveal that Darwin's theory is in fact empirically well-supported.

The aim of this essay, then, is, first, to use philosophy of science to illuminate the logical structure of Darwin's theory, and thereby to defend that theory; and, second, to use Darwin's theory to illuminate some issues in the philosophy of science.