

Preface

The year 2009 was a memorable one for evolutionary biology as the year in which the whole world celebrated the 200th anniversary of Darwin's birth and the 150th anniversary of the publication of *The Origin of Species*. But 2009 was also the anniversary of another biological achievement that, although less noted, may have been equally monumental: namely, the publication of Lamarck's *Philosophie zoologique*. In a coincidence of history, the year of Darwin's birth was also the year in which the first comprehensive and systematic theory of biological evolution appeared.

This volume has its origin in a workshop held in Jerusalem, in June 2009, to celebrate the 200th anniversary of the publication of Lamarck's magnum opus. The aim of this workshop was twofold: first, to redress a critical lapse in historical memory (to our knowledge, ours was the only full-scale international meeting devoted to commemorating the publication of *Philosophie zoologique*), and second, to bring into sharper focus new developments in biology that make Lamarck's ideas relevant not only to modern empirical and theoretical research, but also to problems in the philosophy of biology and to the writing of the history and sociology of evolutionary theory.

We wish to make clear at the outset that it is not our intention to contribute to a debate about Lamarckism versus Darwinism. Such a dichotomy is both theoretically unjustifiable and historically misleading. The theories that Lamarck and Darwin originally formulated were radically transformed as biological research advanced since the early nineteenth century. Lamarckism in particular has been evolving or, to use Lamarckian terminology, *transforming*. There is little similarity between Lamarck's descriptions of the subtle fluids that lead to the transformations of organisms during the vast epochs of time and modern ideas and research on "Lamarckian" evolution, which are based on the inheritance of epigenetic variations and the evolution of self-organizing structures, and make use of sophisticated molecular and computational tools. There is, however, a certain logic, or stance, which differentiates the Lamarckian and Darwinian approaches. Selection is central to Darwinian

thought, whereas the generation of developmental variations is central to Lamarckian thought. In the early twentieth century Delage and Goldsmith were already explaining what the Lamarckian stance is by contrasting it with neo-Darwinism, formulated as a challenge to the logic and relevance of Lamarckism:

Neo-Darwinism, which has found its most complete expression in Weismann's writings, constitutes a well-harmonised system of conceptions relative to the structure of living matter, ontogenesis, heredity, evolution of species, etc. Lamarckism on the other hand is not so much a system as a point of view, an attitude towards the main biological questions.

Whatever theory emphasises the influence of the environment and the direct adaptation of individuals to their environment, whatever theory given to actual factors the precedence over predetermination can be designated as Lamarckian. (Delage and Goldsmith [1909]; trans. Tridon 1912:244-245)

The two approaches, the one which stresses developmental variation, and the other which stresses selection, are complementary rather than mutually exclusive. Yet their different emphases have important implications for the kinds of questions biologists ask and for the type of research they conduct. We refer to the former stance as the "Lamarckian problematics," and we believe the time is ripe for an examination of the crystallization of this problematics in the modern era. This, in fact, is what the present volume is about. The volume is based on the papers presented and the discussions that took place in our workshop, and it describes work from a wide range of disciplines. Because of this we have included a glossary of some of the specialist terms that may be unfamiliar to those not directly involved in the various research areas.

The book begins with an introductory essay by Gabriel Motzkin, who considers how an engagement with Lamarckian problematics forces us to consider multiple levels of organization and analysis. As Motzkin argues, interactions between principles of causality that can be distinguished not only by the level at which they operate, but also by their different modes of operation, open up new approaches and new questions. Pietro Corsi then gives sketches of Lamarck's life and of his main ideas that dispel some common myths about the man and his thought, and provide a far more realistic, sophisticated, and interesting view of Lamarck's life and way of thinking.

Part I of the book deals with the historical transformations of Lamarckism from the 1820s until the 1940s. It illustrates how scientific, cultural, and national contexts and styles formed and shaped modes of understanding, thus producing different images of Lamarck and Lamarckism. At some periods in the nineteenth century, Lamarckism seemed compatible with Darwinism. In the late nineteenth century, however, neo-Darwinism emerged as an exclusively selectionist, anti-Lamarckist view of evolution. The historical section also includes a consideration of the impact of Lamarckian ideas on social thought.

The Modern Synthesis of evolution is the subject of part II. The fusion of ideas from various branches of biology that took place in the 1930s and 1940s and gave Mendelian genetics a central place in evolutionary thinking forms a bridge between the historical and biological parts of this volume. The workshop participants agreed that, in spite of the different ways biology developed in Great Britain and the United States, by the 1960s there was a clear eclipse of Lamarckism in both countries. With the establishment of the Modern Synthesis in the 1960s and its persistence until the early 1990s, the exclusion of "soft inheritance"—the term adopted to embrace all alternatives to Weismannism, including "the inheritance of acquired characters"—seemed final and irreversible. Many biologists regarded Lamarckism in much the same way they regarded the phlogiston theory in chemistry. It was seen as being of historical interest only, though perhaps having some heuristic value in the teaching of Darwinism. However, as the lectures and discussion that are reported in this part of the book show, there are still many unanswered questions about how and why the development-oriented approach to evolution was replaced by the Modern Synthesis view, and how evolutionary thinking became increasingly dominated by genes and by selection.

The essays in part III present theoretical and experimental work that focuses (directly or indirectly) on Lamarckian problematics. *Plasticity*—the capacity of organisms to change in response to varying conditions—is the theme of several contributions. It is a large topic, but, just as Lamarck anticipated, an understanding of plasticity is now recognized as being fundamental to an understanding of evolution. Another theme that is explored by some of the contributors is that of *soft inheritance*. Experimental work now shows that, contrary to the dogmatic assertions of many mid-twentieth-century biologists that it could not occur, even a form of "inheritance of acquired characters" does occur and might even be said to be ubiquitous. In particular, new variations induced by stress are sometimes inherited. The molecular mechanisms that underlie such inheritance—the epigenetic inheritance systems—are now partially understood, and are outlined in appendix B. As some of the contributors suggest, the existence of various types of soft inheritance affects how we have to see adaptive evolution and speciation. It also has implications for human health.

Part III ends with two essays on biological *individuality*, a theme that is related both to the nature of hereditary continuity and to the inheritance of acquired variations. It is now recognized that the acquisition of new genes and genomes from non-parents, including individuals belonging to other species, has been of major importance in microbial evolution. It is also clear that symbiotic interactions among organisms have led to the construction and evolution of new types of developmental systems, and new types of more or less cohesive superorganisms or consortiums—that is, to new types of biological individuals. These realizations create problems for

conventional theories that assume linear descent with modification and treelike evolutionary lineages; they also provoke questions about the speed of evolutionary change and the nature of species.

Part IV of this volume is about the importance of the Lamarckian problematics—that is, of a developmental approach to evolution—in the philosophy of biology. Following the biologists, most earlier philosophers of biology also stayed away from Lamarckism. Nevertheless, since the 1990s, philosophers of biology have spearheaded the formulation of new ideas about the relationship among heredity, development, and evolution; in short, they have begun to formulate, as James Griesemer succinctly puts it, a philosophy *for* biology. One finds in this literature an empirically oriented approach to philosophical questions, as well as suggestions for new theoretical and research heuristics—heuristics that may even be of help to biologists in formulating relevant biological questions.

The volume ends (part V) with a series of short contributions and a summary of the discussion in the final session of the workshop. They illuminate some biological, philosophical, sociological, and historical issues raised by the Lamarckian problematics that open up future perspectives—issues that either had not been discussed previously or that had only been hinted at, but that we felt deserved our attention. In the final discussion, Adam Wilkins was asked to play the devil's advocate—to highlight problems, prod, and challenge previous presentations. The animated discussion and the different approaches expounded thereafter are indicative of the stimulating and generative character of his comments.

We hope that the volume conveys some of the excitement and intellectual fun that we had during the meeting. We realize that not all of the people who will be reading it will agree with the interpretations given to the findings described, and they may not share the feeling of some of us that we are at a turning point in our understanding of evolutionary biology. Nevertheless, we believe that even critics and skeptics will agree that the Lamarckian problematics, the developmental-variation-focused view, is returning to the center of evolutionary theorizing, complementing the Darwinian focus on gene selection.