Nothing doing

Keith Stewart Thomson

Science as a Way of Knowing: The Foundations of Modern Biology. By John A. Moore. *Harvard University Press: 1993. Pp. 530. $29.95, £23.95.*

THIS wonderfully readable book has two main components: a blow-by-blow account of some key advances in biology from, roughly, Aristotle to Watson and Crick, and an explanation of the line of reasoning behind scientific discovery in the natural sciences (some Earth history is included). Moore defines the core of biology as the phenomena of self-replication, diversity and change over time. He is concerned therefore with understanding the intertwining strands of genetics, development and evolution.

In time-honoured fashion, the book begins with the Greeks and proceeds steadily to Galen and then Francis Bacon. Most of this first part is a bit tame, particularly because several nuggets of ancient thought are omitted only to turn up in later sections (in a discussion of pangenesis on page 235, for example, we learn that Hippocrates defined the scientific method). Moore gives short shrift to Aristotle's considerations of cause, leaving him as the founder of descriptive science. As a result, not until page 93 do we move from the more vague phraseology of "understanding nature" to an uncompromising search for "fundamental causes or the association of seemingly unrelated events". By this time we are well into Baconian induction and deduction. Similarly, it is not until page 405, in the discussion of Karl Ernst von Baer, that we learn that "scientists assume that there are general rules that apply to natural phenomena" (as if Aristotle never thought about this).

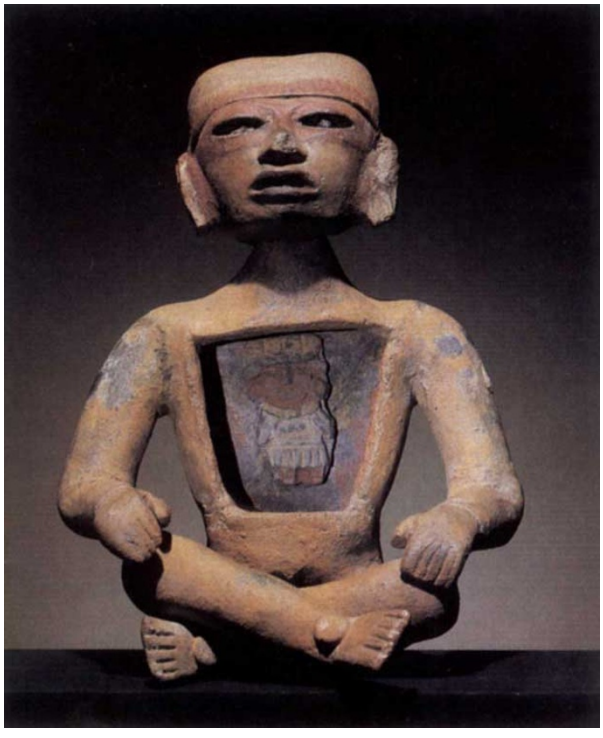
Although such omissions are irritating in a book that otherwise marches from point to point, the general effect is a clever interweaving of ideas that continues to develop right to the end. Moore's writing is marvellously accessible, and scientists and nonscientists alike will enjoy his frequent lighthearted asides, such as (on the Scholastics): "This was the Abelard who had an affair with the beautiful and loving Heloise. Her father felt strongly about that and had Abelard castrated to cool his ardor. It did."

Moore's treatments of genetics and development are superbly clear and read like a mystery story in which the clues are (sometimes too neatly) unravelled one by one, although the informed reader may well wonder, first, what everyone else was doing and, second, whether anything worth knowing happened after Watson and Crick or Hans Spemann. To be sure, in physical science, water always consists of hydrogen and oxygen (p. 136), but biological investigations are never-ending; one can never be sure that we know whodunit, because both 'who' and 'it' keep shifting. Particularly lacking here is any treatment of the emergence of molecular biology as the common language of biology, rather than simply the most reductionist end of genetics. Also lacking, simply because Moore has chosen to write a different, more Polyanna-ish sort of book, is any hint of what the day-to-day practice of science is like — the false starts, mindless repetition, faddishness and clannishness. This book is about science as knowing, not science as doing.

Moore's purely internalist history of biology unfolds in a philosophical–political–socioeconomic vacuum except for the standard posing of religion as the enemy of free inquiry. I was struck, however, by the statement that whereas religion is subject to dogma "forcefully promoted by priests and rulers, who may be greatly rewarded by so doing", science is free from these ills because of the nature of scientific reasoning. Oh really!

Moore's expository method of carefully tracing the logic of the usual process of advance through data accumulation, induction, hypothesis, deduction and testing, is, surprisingly, weakest where he applies it first: to organic evolution and the science of Charles Darwin. In Chapter 8 ("Testing Darwin's Hypotheses"), Moore introduces confusion by forcing the central concepts of evolution and the theory of natural selection into an artificial framework. One can see what he is trying to do — as Darwin himself stated: "[my] line of argument. . . is to establish a point as a probability by deduction and to apply it as hypotheses to other points to see whether it will solve them". Thus, Moore writes: "If all today's species are descendants of a few original forms" then "there should have been connecting forms between the major groups". The fossil record then becomes a test of this deduction. But the deduction that "the species that lived in the remote past must be different from the species alive today" does not flow *from* the hypothesis but is a premise *of* the hypothesis. The same is true for the deductions that "There must be variation among organisms. . ." and that "Natural selection can only be operative if more offspring are born than survive". The deduction that "If the members of a taxonomic group . . . share a common ancestry, that fact should be reflected in their structure" suffers from a different problem, the old one of tautology. Taxonomic groups, ever since Aristotle, are defined by common structure in the first place.

These difficulties apart, this volume is a worthy addition to the literature on the history of biology. It explains the foundations of evolution, genetics and development and the logic behind scientific enquiry with a clarity that will put most writers of elementary textbooks to shame. It both demystifies science and exalts it. □



TEOTIHUACAN figurines such as this one, which dates from between AD 650 and 750, are thought either to express the *nahual* or "double that we all possess and into which we may transform ourselves" or to represent a goddess of the Earth who receives and protects dead warriors. The picture is one of over 250 included in *Teotihuacan: Art from the City of the Gods* edited by K. Berrin and E. Pasztory. The volume is published in conjunction with an exhibition, organized by the Fine Arts Museums of San Francisco, that focuses on the art of this ancient civilization. Thames and Hudson, £28.

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