

way, yes: but this new myth contains no fragments of sharp, particular pain or joy — and does not therefore offer individuals any religious purchase, no point of passage from the exterior and mundane to the inner and spiritual. This book poses an age-old vast generalization: why do humans crave for an abstract structure of nonsensical claims, apparently validated by some higher authority, within which to locate their lives and aspirations? Why, indeed: Anyone for croquet? □

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Darwin here, there and everywhere

Nicholas Mackintosh

The Nature of Knowledge: Concerning Adaptations, Instinct and the Evolution of Intelligence. By Henry Plotkin. *Allen/Lane Harvard University Press (as Darwin Machines and the Nature of Knowledge): 1994. Pp. 269. £20, \$24.95.*

IMAGINE the following improbable scenario. Charles Darwin, is as we all know, a natural historian, but his interests are not confined to geology or the species question. Instead, he is drawn to the study of animal behaviour, and he is struck by the marvellous ways in which not only instinctive but also learned behaviour is so nicely attuned to an animal's needs. Fifty years before Edward Thorndike, he begins to investigate how cats and dogs learn by trial and error, how successful actions are repeated and unsuccessful attempts to solve a problem are eventually discarded. A simple theory occurs to him: animals in novel situations generate a wide variety of novel actions; some of the actions achieve nothing and, although perhaps repeated a few times, are eventually dropped; others, equally blind and random, however, happen to solve the problem; they are 'stamped in' or strengthened, and so repeated on future occasions. Not only has he anticipated Thorndike's "law of effect"; according to Henry Plotkin, he has discovered the principle of evolution by natural selection, and might have published his findings in a book entitled *The Origins of Behaviours by Means of Internal Selection or the Preservation of Favoured Acts in the Struggle for Being Remembered*.

Many readers may find this a surprising, even bizarre, claim. For Plotkin, however, it is no more than a recognition of the power and generality of the principle of evolution by natural selection. We all (well, almost all) accept that it explains the origin of species and much else about

their function, structure and even, in the case of animals, behaviour. And, as we all know, this was the application of the principle that Darwin happened to chance upon. But properly understood, Plotkin argues, it is an entirely general principle, which can be instantiated by a variety of mechanisms and which serves to explain all manner of change. We see evolution by natural selection wherever there is some source of variation, and where some of the variants are more successful than others in passing a test imposed by a selection device and where these successful variants are able to transmit some of their features to their successors. Any systems that generates, tests and regenerates is probably instantiating this principle.

Plotkin's thesis, as he is the first to remind us, is not novel. Huxley, and Darwin himself, saw something of the generality of Darwin's discovery. Macfarlane Burnet's *Clonal Selection Theory of Acquired Immunity* persuaded immunologists that the immune system operated by the generation of a great diversity of lymphocytes, some of which happen to pass a test by fitting an invading antigen and are then clonally reproduced. Many psychologists, most notably B. F. Skinner, have pointed to the analogy between natural selection and the law of effect; thanks to Gerald Edelman, that analogy has been extrapolated to the neural mechanisms underlying all forms of learning. Karl Popper's account of the history of scientific knowledge as conjecture and refutation explicitly relies on the Darwinian analogy.

Plotkin is a psychologist and his book places most emphasis on learning or the acquisition of knowledge and the cultural transmission of that knowledge. It is an extended essay on 'evolutionary epistemology', a phrase coined by D. T. Campbell and rightly seen by Plotkin as a barrier to understanding. Indeed, one of this book's great virtues is that Plotkin writes incomparably more clearly than most others who have ventured into these fields. His exposition, even of complex issues, is beautifully lucid, his arguments well thought through and his illustrations apt. The book can be firmly recommended to anyone who has grappled with, say, Edelman's *Neural Darwinism* and come away defeated, but with a nagging worry that he or she might be missing out on some important ideas. Its very lucidity, however, may leave some readers less convinced.

What do we gain by pointing to these sorts of analogies between the evolution of species, the acquisition of knowledge and human culture? For Plotkin, the answer seems self-evident: "one of the objectives of science is to explain more and more with less and less.... Scientists hope that ever-greater numbers of phenomena in the world can be understood by the smallest possible number of scientific laws or principles." Well, I suppose so, although the history of psychology might serve to remind Plotkin that overarching theories are as often an impediment as a spur to good science. And while we rightly value some analogies because they point to underlying similarities that we failed to

PHOTOMICROGRAPH of thiamine (vitamin B₁), the subject of this week's Commentary (page 683). The picture is one of more than 115 kaleidoscopic images of vitamins, flavours and fragrances, sweeteners, drugs, hormones, moon rocks and superconductors presented by Michael W. Davidson in his *Magical Display: The Art of Photomicrography* (Amber Lotus, \$24.95 (pbk)).

