An ode to adaptive transformation

Niles Eldredge

Darwinism Defended: A Guide to the Evolution Controversies. By Michael Ruse. Pp.376. ISBN 0-201-06273-9. (Addison Wesley:1982.) $12.50, £8.40.

THINGS seem a bit frenetic in evolutionary biology these days. The casual observer might well think that the only theme imposing unity on this sphere of science is creationism: all evolutionary biologists agree that life has evolved, and all become willing allies in the political fight sparked by the recent successes of "scientific creationism" — which, however paltry its specific claims about natural history may be, asserts positively that life has *not* evolved. But beyond this simple and totally understandable closing of ranks, most observers see the current situation in evolutionary theory — where the object is to explain how, not if, life evolves — as bordering on total chaos. Seemingly, no two evolutionary biologists think alike these days, and we are less agreed upon things than we collectively were, say, a decade ago.

There is some substance to this view of disarray, but it has been exaggerated; we are more like a house divided than a potpourri of randomly diversified opinion. The basic problem is this: molecular and developmental biologists, systematists and palaeontologists all think their data have something to do with evolution. This is reasonable on the face of it because, whatever else it might be, evolution involves the modification of DNA sequences, development patterns, and species and higher taxa. And the latest news from Precambrian palaeontology tells us that the process has been going on for a minimum of three-and-a-half billion years.

On the other hand we have an evolutionary theory — the "modern synthesis" — that insists that all such evolutionary phenomena are entailed by the neo-Darwinian paradigm: organisms within populations vary amongst themselves, offspring tend to resemble their parents, and because in each generation more are usually produced than can possibly survive and contribute genes to the next generation, we get deterministic, albeit statistical, patterns of change in genetic representation in succeeding generations. This, of course, is natural selection. We now feel we know more than Darwin did about why organisms resemble their parents, and what the proximate and ultimate sources of variation might be. This understanding, plus Darwin's basic arguments, combine to yield the neo-Darwinian paradigm. No less an authority than Ernst Mayr (for example in his prologue to *The Evolutionary Synthesis*; Harvard University Press, 1980), has written that the "modern synthesis" is simply this paradigm of adaptive transformation plus a single additional concept: all evolutionary phenomena, of whatever scale — from molecules to phyla — are explicable in the familiar terms of population genetics. In the apt (if by now rather trite) phrase, the theory is both necessary and sufficient to explain all known aspects of evolutionary history. However oversimplified such a characterization of the synthesis may be, it fits to a T the viewpoint espoused by Michael Ruse in his new book, *Darwinism Defended: A Guide to the Evolution Controversies.*

The simple statements of the synthesis have long been taken as very general: all sorts of phenomena which hitherto seemed to cry out for separate explanations could all now be explained under one general theory of adaptive change. And, after all, if life has had a single history, it is indeed logical to assume that there must be a single, integrated theory of the process that engendered that single history. But now the synthesis is beginning to look exceedingly narrow. For consider the effect the synthesis has had: contrary to Ruse's enthusiasm for natural selection as a "research tool", the real effect has been the relegation of molecular and developmental biology, systematics and palaeontology to the role of mere reportage. Evolutionarily-inclined members of these diverse disciplines have been told, in effect, to sit back, relax and simply recount the results of the evolutionary process — and leave it to the population geneticists to explain how it all happened. From time to time, members of one or more of these various satellite evolutionary disciplines have objected, insisting once again that their data — their molecules and fossils — must have something more direct to say about the validity of this or that notion about how life really does evolve. Now their voices are becoming more strident.

Michael Ruse is aware of this state of affairs. Hence the book, which has two titles, accurately conveys his priorities. First, it is a stout defence of what Ruse calls Darwinism. Secondly, and only through the glasses of a truly arch-conservative, the book touches upon virtually all the major issues of which I am aware. I call Ruse an arch-conservative advisedly: to this staunch *defensor fidei,* genetic drift is still a heresy. Anything smacking of the stochastic, or even of "neutrality", has him shaking his head and wagging his finger in a trice.

Darwinism, to Ruse, seems to be adaptation through natural selection. I say "seems" simply because his enthusiasm sometimes gets the better of him, and Darwinism in places comes close to meaning simply "evolution". Ruse knows better, of course, and generally makes the distinction between the notion that all living things are interrelated, and specific ideas (of which Darwinism is one) about how life has evolved, satisfactorily explicit.

Ruse has structured his book rather well. There are five main sections; the first three deal with his view of Darwinism yesterday, today and tomorrow. The first section gives us a brisk account of the man and his main works — with emphasis on Ruse's analysis of the *Origin* as a three-part essay. "Darwinism Today" tells us of the "coming of Mendelian genetics", what it is and what it means. Part 3, "Darwinism Tomorrow", is an eclectic grab-bag of topics, ranging from the "origin of life" to the "challenge from palaeontology". By this stage the reader will have no difficulty in predicting Ruse's line of argument. Those areas of contemporary biology stressing adaptive explanations through selection are "good", while he takes a dim view of disciplines and ideas which seem, somehow, to diminish the central role of adaptation. Thus sociobiology is "good", but punctuated equilibrium theory has the malodorous air of yesterday's half-eaten fish and chips. Part 4, "Darwin and Humankind", deals with the notion that *Homo sapiens* has had an evolutionary history, proclaims human sociobiology as on the side of the angels (if only metaphorically) and says that one should not adduce nasty ethics of the dog-eat-dog

variety just because sociobiology can explain so much of our behavioural history. I found this section, and the two-chapter, fifth and final section on creationism, unprepossessing.

The guts of the book lie, appropriately enough, in its middle, in parts two and three. Here Ruse tells us what evolutionary biology really is, and should be, all about. I find it a dismal picture. The approach Ruse advocates is pure storytelling — or, as he himself puts it, continued indulgence in evolutionary biology's "favorite parlor game": concocting plausible scenarios of how the elephant got its trunk, the rhino its wrinkled skin and the giraffe its long neck. To Ruse, we *know* the mechanism, and it's all just a bunch of clever games applying this mechanism of genetic change to explain literally all manner of evolutionary phenomena.

Most critics of contemporary evolutionary theory, myself included, would agree that natural selection is a deterministic mechanism accounting for generation-by-generation change in gene frequencies within populations. It is even testable, given the appropriate data — which involve gene frequencies and generations. But reducing, say, ammonite evolution to a just-so story with natural selection as the hero is, as Ruse says, nothing but a parlour game. The difference between us is that Ruse thinks this state of affairs is just fine. I think parlour games are fine too — but I still cherish the fantasy that I am doing, or at least am trying to do, science when I'm practising my profession.

Ruse uses analogy and circumstantial evidence as his cornerstone criteria for establishing the validity of scientific ideas. Claiming Darwin used Herschel and Whewell as models, and that analogy and inference were what made science "good" in the 1850s, Ruse (as he does so much throughout the book) in effect argues that what was good enough for Darwin should suffice for us as well. There is little here of the spirit of enquiry. We are not enjoined, for example, to hold our notions lightly, to walk humbly before Mother Nature, ready to modify our schemes should the evidence of our senses not rhyme with our fondest notions.

Nowhere in this single-minded tract is Ruse's dedication to the almighty principle of natural selection better displayed than in his little section on trilobite vision. The mathematically "perfect" shape of phacopid and dalmanitid lenses is, to Ruse, exquisite evidence of the power of natural selection. I confess I cannot fathom the difference between Ruse's argument and the older creationist argument from design: see this organ system; observe its intricacy! Only (God, natural selection) could have fashioned such a marvellous organic machine! There *is* a difference, of course: God, as a supernatural being, does not belong in science, whereas natural selection patently does. But used in this inappropriate fashion, natural selection becomes a mere substitute for the Creator. It tells us nothing, really, about trilobite eyes or anything specific or meaningful about how they came into existence.

In short, Ruse is a reductionist — all large-scale evolutionary phenomena are readily explicable in terms of population genetics. But there is more than mere reductionism here: he also dismisses molecular biology, simply because population genetics revealed the contents of Darwin's "black box" of heredity, and molecular biology, Ruse avers, has not changed *that* one whit. All remains secure. That there are patterns of organization with historical implications emerging from molecular and developmental biology that seem to require their own mechanisms *in addition* to those of population genetics is missing in Ruse's world view. Indeed, in his reflexively negative reaction to the winds of change, Ruse fails to see that the newer arguments are nearly all additive: natural selection explains changes in gene content and frequency within populations, but more than populations are involved in evolution. Another example: Ruse doesn't even bother to mention the idea that species are individuals — the ontological claim underlying the view that macroevolution may be something more than just scaled-up microevolution.

Darwin and his ideas need no defence. I agree with Ruse: Darwin was a good scientist. In that spirit I would rather imagine Darwin enjoying the spectacle of biologists vigorously debating his, and descendant, notions over a century after the *Origin*. Ruse, appropriating Darwin's shade as his alone, seems to think that to question some of Darwin's notions is somehow to impugn the man. So he springs to the defence. It is a clumsy defence, one that certainly does Darwin no credit. As a statement of the nature and effective extent of neo-Darwinism, it is nowhere as good as, say, the September 1978 issue of *Scientific American*, or any of a number of recent texts. As a book aimed at a general audience, it projects a jolly *Alice in Wonderland* sort of picture that, I fear, will not do overly much for our collective image in the long run. Darwinism, indeed, the entire field of contemporary evolutionary biology, deserves far better. □

Niles Eldredge is at the American Museum of Natural History, New York. His most recent book, The Monkey Business: A Scientist Looks at Creationism, *will shortly be published by Washington Square Press.*

A new paradigm for evolutionary change?

R.D. Martin

The New Evolutionary Timetable: Fossils, Genes and the Origin of Species. By S.M. Stanley. Pp.222. US ISBN 0-465-05013-1; UK ISBN 0-633-7022-8. (Basic Books/ Harper & Row: 1982.) $16.75, £9.50.

It is, perhaps, appropriate that the centenary of Charles Darwin's death should be approximately marked by renewed controversy over the process of evolutionary change. The latest debate concerns one of the most fundamental features of Darwin's theory of evolution by natural selection — *gradual* change within individual species populations over time. An alternative interpretation, stated with particular clarity by Eldredge and Gould in a seminal paper published in 1972[1], is that most evolutionary change occurs when a new species develops (during a "speciation event") and that there is little change subsequent to establishment of a species.

In some circles, at least, replacement of the Darwinian concept of "gradualism" by the new model of evolution by "punctuation" has been hailed as a fully-fledged scientific revolution (a Kuhnian paradigm change). To date, however, the debate has raged largely among academics, and for this reason Steven Stanley's *The New Evolutionary Timetable* is both timely and welcome. Following hard on the heels of his influential scientific text *Macroevolution: Pattern and Process* (W.H. Freeman, 1979) this new book attempts to present the case in terms understandable to the non-specialist. Stanley achieves his aim with considerable success, carrying the reader along with a style that is at once lively and informative. Penetrating insights abound as the arguments are presented, and frequent touches of wry humour add a special touch. (Any modern biologist struggling for a command of the literature will surely be relieved to learn that Darwin actually possessed an uncut copy of Mendel's monograph on hereditary mechanisms!) Certainly, a reading of this book leaves one with plenty of food for thought, regardless of the correctness of Stanley's own conclusions. This is a particularly productive time for the remodelling of evolutionary theory, and *The New Evolutionary Timetable* conveys the excitement felt by many biologists involved.

Underlying the concept of punctuated evolution is an undeniable fact derived from recent palaeontological studies: numerous fossil species have been found which exhibit a remarkable degree of stability ("morphological stasis") over long periods of geological time. It must at once be added that such statis can only be recorded for certain body parts (molar teeth of mammals or shells of molluscs, for

[1] Eldredge, N. & Gould, S.J. in *Models in Paleobiology* (ed. Schopf, T.J.M.), 82-115 (Freeman & Cooper, 1972).