

mutationist, and orthogenetic theories that were bruited about at a time when natural selection had fallen almost entirely into disrepute. But the synthesizers arrived at a complex body of evolutionary mechanisms. Wright, who influenced Dobzhansky and through him the rest of the company, included genetic drift and interdemic selection in his theory. Simpson sought both to reconcile paleontological patterns with genetics and to explain patterns of diversification and extinction. Mutation was held to be random: not that all variations are equally likely, but that mutations are not biased toward adaptedness. Development, it was clear, constrains the variety of mutant phenotypes, and developmental explanations were offered for phenomena such as parallel evolution. Wright, Dobzhansky, Mayr, and Stebbins emphasized pleiotropy and firmly rejected an atomistic view of development and morphology. And if the neo-Darwinians rejected the inheritance of acquired characteristics and emphasized mutations of small effect over saltations and nuclear genes over cytoplasmic inheritance, they did so on the basis of empirical evidence, not the demands of theory.

No one will argue that neo-Darwinian theory has addressed all evolutionary questions exhaustively or that it cannot be modified by new information on the mechanisms of heredity and development. But it is one thing to call neo-Darwinism incomplete; it is quite another to call it fundamentally wrong. The latter, however, is the view of many of the authors in this book. Their common theme (notwithstanding the editors' denial) is dissatisfaction with the neo-Darwinian framework. Politics has seldom made stranger bedfellows than are found between these covers.

Some of the authors share a preference for holism over reductionism. This presumably explains the inclusion of chapters on artificial intelligence (Boden) and cognitive psychology (Sinha) and a curious chapter on self-organization by Matsuno ("Evolution of matter is a mode of matter constraining itself by itself, not an outcome selected by something else"; p. 85). Ignoring the literature on mutation and protein synthesis, Fox extrapolates from his origin-of-life experiments to the conclusion that protein sequences evolve orthogenetically, mutation being constrained by (undocumented) principles of self-organization. Wicken, in a generally unexceptionable argument for the thermodynamic possibility of increased complexity, carries holism to the ecosystem level: the adaptive strategies of individual organisms

will generally "contribute to the higher ecosystem good—i.e., the power and complexity of ecosystem flow." This view has not been supported by any mechanistic models that I know of.

Vrba and Nelson and Platnick pursue quite different themes. Vrba takes little issue with neo-Darwinism except to lament that it has neglected the role of differential proliferation of groups of species in macroevolution. There is some truth in this charge, although theories of speciation and of species diversity certainly touch importantly on this issue. If Vrba's chapter is innocent, Nelson and Platnick's virulent attack on Darwinism is not. They make the extraordinary claim that Darwinism has been found false because it is impossible to fulfill part of the Darwinian program, tracing ancestor-descendant series of taxa. Paraphyletic groups (those which, like the class Reptilia, have had descendants, such as the Mammalia, excised) are not permissible in Hennig's system of classification. Ancestral taxa are by definition paraphyletic, so phylogenetic ancestor-descendant sequences must vanish. This is, transparently, verbal legerdemain.

The most interesting chapters are by developmental biologists. They rightly emphasize that organisms cannot be atomized into distinct parts, that epigenetic "rules" constrain the field of phenotypic variations, and that some developmental information resides in the egg's cytoplasm. Unfortunately, their arguments are flawed by their caricature of neo-Darwinism as a theory under which all variations are possible and by the utterly unwarranted dualism that Løvtrup, Goodwin, and Webster espouse. These authors reject genetics as the basis for similarities and differences among species. In their view, developmental programs are independent of, and transcendent to, DNA-based information—as if developmental fields or the organization of the egg were immune to alteration by mutation of DNA. And to provide physicochemical models of developmental events is not to replace genes and selection with a sufficient physicalist theory, as Goodwin believes; obviously the constituents of organisms obey physical laws, but these laws permit innumerable developmental patterns, of which only some are permissible under natural selection.

Happily, these dualisms do not as greatly mar the chapters by Saunders, Ho, and Pollard. Ho's description of the role of the cytoplasm in genetic assimilation is interesting, but in his enthusiasm about cytoplasmic inheritance he forgets the evidence for nuclear inheritance of

the majority of variations within and among species. Pollard's review of the fascinating evidence that genetic information may be transferred from somatic to germ cells raises possibilities that should not be dismissed, but, as Fitch (*Evolution* 36, 1133–44 [1982]) has noted, the fundamentals of neo-Darwinism are not violated unless an environmentally altered phenotype can further its continuance by altering its own genetic basis.

So this book is a very mixed bag. No one can fault the editors for their desire, widely shared, to see developmental biology more thoroughly incorporated into evolutionary thought. But they seem to have succumbed to the temptation to revolution, viewing modern evolutionary theory as an oppressive regime to be toppled rather than joined. In doing so, they have gathered together with the dispossessed, the Luddites, and the visionaries in a venture that must be slightly embarrassing.

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Geology of Southern Africa

Mesozoic and Tertiary Geology of Southern Africa. R. V. DINGLE, W. G. SIESSER, and A. R. NEWTON. Balkema, Rotterdam, 1983. viii, 375 pp., illus. \$39.50.

Until the Mesozoic, southern Africa was the hub of Gondwana. Its Paleozoic and Mesozoic basins provide compelling evidence for the former contiguity of the supercontinent. Paleozoic deposition was initially concentrated in a linear downwarp along the southern margin of the craton, but through time the main depocenter migrated slowly northward. This history of basin evolution culminated in the Triassic Cape Orogeny. Large-scale vertical movements, extension, and rifting heralded a new phase in the geological evolution of the subcontinent. The present configuration of southern Africa is the result of the breakup of Gondwana in the early to middle Mesozoic and the spreading of the continental lithosphere to form the southwestern Indian and southeastern Atlantic oceans.

In the last couple of decades research and exploration have resulted in a burgeoning of information on the Mesozoic basins and ocean floors about southern Africa. Dingle and his co-authors have set out to review these data systematically and exhaustively, and they intentionally refrain from detailed interpretation.

The book is divided into seven chapters that trace the evolving nature of post-Paleozoic sedimentary basins from those of Gondwana affinity through Jurassic-Cretaceous rift and post-rift systems to deposition on Tertiary continental margins. The foreign reader will find the introductory chapter invaluable in providing a regional context. Because the book is more descriptive than interpretative, subsequent chapters tend to inundate the reader with local terminology and detailed accounts of local variations in stratigraphic sequences. This is perhaps inevitable, but it may well restrict the book's audience.

The strength of the volume to the serious researcher is that the authors have critically examined a large quantity of data, frequently reexamining outcrops to clarify old descriptions. The bibliography, which contains approximately 750 references, is exhaustive; it is also up to date. However, when interpretations are based on analogy the analogies are poorly selected and frequently dated.

The discussion of tectonic style as it relates to the Cape Fold Belt and subsequent extensional tectonics would have benefited from a more dynamic treatment. The discussion of the Cape orogeny is poorly presented and reads as if it was added as an afterthought. The authors attribute Cape folding principally to gravity-glide processes but concede that this interpretation is contentious. There has obviously been little attempt in the past to analyze this orogeny in terms of preceding sedimentary basins. In perusing the various figures the reader should be suspicious of fold geometry and the bends in the fold belts that cross-cut former basin axes. One wonders whether some of the larger faults have a significant strike-slip component.

The final chapter is a lucid discussion of Tertiary events that emphasizes shelf sedimentation and geochemistry as well as repeated transgressions of the coastal plain. South African geology has many superlatives, so it is naturally disappointing to find that the classic *Australopithecus* localities and the important kimberlites have received short shrift.

The authors have achieved their goal, to publish a source of data and references. This reviewer wishes they had indulged in more interpretation and speculation. Nevertheless, because southern Africa occupied a key position in Gondwana, the serious Mesozoic researcher will find the volume an invaluable source of information.

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