

reviews

Phylogenetic problems

E. J. W. Barrington

Origin and Early Evolution of Animals. By Earl D. Hanson. Pp. ix+669. (Pitman: London, 1977.) £23.

PROFESSOR HANSON brings to fruition in this volume his long-standing interest in problems of animal phylogeny. To do so needs some courage, for many zoologists are likely to sympathise with Hyman's view that "such phylogenetic questions as the origin of the Metazoa from the Protozoa" are "insoluble on present information . . . Anything said on these questions lies in the realm of fantasy." Hanson, however, is concerned with evolution at the lower taxonomic levels as well as with the origins of major groups, and he makes a good case for examining all of these matters in depth.

He rightly insists that a primary requirement is that any proposed scheme must be acceptable in terms of natural selection. But, given this overriding condition, evolutionary phylogeny can lead us to interpret evolutionary innovations "not just as morphological or physiological facts, but as selectively advantageous endowments available to all descendants of that line." Phylogeny thus becomes an analysis of evolutionary potential, thereby enlarging our understanding of the principles underlying the diversification of animal organisation.

He begins by dealing with concepts and methodology, briefly reviewing the evolutionary significance of populations and the gene pool, and emphasising the distinction between anagenesis and cladogenesis. From this he draws the conclusion that although the two sets of potentials cannot be sharply separated, it is predominantly the anagenetic groups that will provide the best keys to phylogenetic analysis. He mentions the Chordata as an obvious example, although he deals only with lower forms, from Protozoa to Turbellaria.

He then reviews what he calls the "informational content of organisms". His aim here is to establish what are the "compositional units" of structure and function, how these units are inter-related, and how many different sets of interrelationships are actually found. In other words, how diverse may be a particular structure or function? This part of his treatment is decidedly uneven. Within the 44 pages devoted to it, he seeks answers to his questions at several levels: molecular, cellular, multicellular organisation, and population. Not sur-

prisingly, some of the generalisations with which he emerges do not advance us very far. It is not really helpful to be told that "the brain . . . is made up of various types of nerve cells and contributes a coordinatory and information storage and retrieval service", and to suggest that "desert animals excrete almost no fluids but aquatic organisms have the opposite problem of pumping out excess fluids", is, to say the least, an underestimate of the achievements of natural selection, to which he elsewhere attaches such importance.

Much more valuable is his review of the procedural steps needed for determining phylogenetic relationships within a group. Using the concept of the seme as a unit of phylogenetic information, and distinguishing conservative ones (plesiosemes) and innovative ones (aposemes), he aims at a comparison of semes in different species, using where necessary the concept of homology according to the criteria of Remane. This should lead to the identification of a plesiomorph, which is the species, or its nearest representative, containing the largest number of plesiosemes. From here it should then be possible to establish the ancestral form from which a given monophyletic group arose.

There is, of course, much more to the argument than this, and zoologists will find it worthwhile to explore the detail with which Hanson defines and justifies his methodology. The greater part of the volume is devoted to his analysis of its results. He correctly recognises that it is study of lower taxa rather than of higher ones that will lead to the more convincing conclusions, and his treatment of protozoan phylogeny (which, as befits his own special interests, is pursued at length) is

in accord with this. His analysis of aposemic change within individual groups is informative, and, as he points out, the phylogenies suggested by it could be the basis for much further specialist research. But when it comes to discussing the origins of these groups we are left little the wiser. The origin of the Acantharia, for example, "is unclear", and the derivation of ciliates from their presumed zooflagellate ancestors presents "a paradoxical problem".

The reason given for this paradox is instructive. Essentially, it is that the selective advantage of ciliate organisation, compared with that of flagellates, has resulted in the disappearance of the intermediate forms. But this is surely the crucial difficulty in handling major phylogenetic problems. It appears with no less force in Hanson's review of the problem of the origin of metazoans, where again he has to comment on the amount of evolutionary history that must have intervened between the presumed zooflagellate ancestors and the earliest cnidarians.

We are surely forced to conclude that when we confront major phylogenetic issues we must expect to find that the secrets of natural selection are concealed from our gaze as an inevitable result of its own actions. Hyman, then, was right, and it is only too easy to enter realms of phylogenetic fantasy. But Professor Hanson is careful not to do this, and there is much benefit to be gained from his scholarly exposition of the constraints which we must accept if we venture on phylogenetic analysis. □

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Osmoregulation in land arthropods

Water Balance in Land Arthropods. By E. B. Edney. Pp. xii+282. (Springer: Berlin, Heidelberg and New York, 1977.) DM78; \$34.40.

WITHOUT any doubt, the survival of the smaller scale terrestrial animal depends on its ability to maintain adequate internal water, and almost every structure and system in an insect appears either adapted to water conservation or compromised by that need. Apart from intrinsic interest in the physical and physiological mechanisms

involved, the subject of Professor Edney's book is therefore fundamental to understanding so much about these animals of great ecological and applied importance.

The virtue of the work is that it reviews most comprehensively, and it reports accurately in clear and simple style, the extensive literature on cuticular permeability in relation to structure, evaporative loss, water uptake, and the phenomena associated with respiration, osmoregulation and excretion, and with feeding. There is a