BOOK REVIEWS

Phylogenetic hypotheses

R. D. Martin

THIRTEEN years have elapsed since the late Willi Hennig's influential textbook *Phylogenetic Systematics*, translated from the German manuscript by Dwight Davis and Zangerl, was originally published in 1966. Republication, with the addition of a brief but useful introduction by three disciples, comes at a time when Hennig's major contribution to the science of phylogenetic reconstruction has more-or-less achieved the widespread recognition that it deserves. This is also a particularly suitable time to take stock of Hennig's approach. Although *Phylogenetic Systematics* is set out with admirable clarity, considerable controversy has accompanied the dissemination and practical application of Hennig's concepts. The issues at stake can only be clearly appreciated by taking a step omitted by Hennig and many others in the field — namely, that of considering separately phylogenetic reconstruction and classification. For the first, Hennig has unquestionably introduced greater scientific precision, while for the second he has arguably generated further confusion.

The attempt to reconstruct phylogenetic history is, or should be, a scientific undertaking involving the identification of past evolutionary relationships ultimately embodied in the process of speciation. One of Hennig's most important innovations here lies in his explicit statement that mere assessment of degrees of morphological (or

Phylogenetic Systematics. By W. Hennig. Pp. 263. (University of Illinois Press: London, 1979.) £12.

other) similarity does *not* provide an adequate basis for accurate phylogenetic reconstruction. Any given group of organisms can be theoretically traced to an original stem species with a certain array of initial (plesiomorphous) characters, and retention of any of these characters as shared similarities among descendant species provides no information about subsequent branching in the evolutionary tree. Only derived (apomorphous) characters developed at some later stage and retained in certain descendants can be used as indicators of phylogenetic relationships within the group. Hennig provides a number of empirical guidelines for the differential assessment of shared similarities (plesiomorphous; apomorphous; convergent) in phylogenetic reconstruction, and concepts such as those of the character transformation series and of the sister group are of considerable heuristic value. However, as Hennig himself recognises, everything in the end boils down to a scientific estimation of probabilities. Thus, the accuracy of phylogenetic reconstruction depends on the validity of the theoretical principles used (hence the value of Hennig's contribution) and upon the diversity of the characters examined.

Unfortunately, Hennig simultaneously maintains that classifications should be directly based upon the evolutionary branching pattern and the dates of divergence inferred. This controversial tenet has proved to have at least two great drawbacks. Firstly, there is no compelling reason to assume that classifications should only reflect inferences regarding the positions and timing of branching points in phylogenetic trees. Secondly, since every phylogenetic reconstruction represents a hypothesis based on estimation of probabilities, Hennig's prescription inevitably leads to a proliferation of alternative classifications and instability of higher taxonomic categories. Since classifications provide, among other things, the terms we use to discuss living organisms, taxonomic instability is associated with linguistic instability. This being the case, any recommendation to read Hennig's excellent logical dissection of the process of phylogenetic reconstruction must be tempered with the warning that classification (which inevitably involves numerous arbitrary decisions) will not necessarily benefit from too close an association with the phylogenetic hypotheses of individuals.

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For the petroleum geologist

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Petroleum Geochemistry and Geology. By J.M. Hunt. Pp.617. (Freeman: San Francisco and London, 1979.) £16.95.

THE application of chemistry to the study of oil generation, migration and maturation has a long history. It is only within the last decade, however, that geochemical exploration techniques have become an accepted tool in the oil industry. Dr Hunt has played a seminal role in these advances both in industry, with Exxon, and latterly at Woods Hole. This book thus merits the attention of every petroleum geologist. It consists of twelve chapters, arranged in four parts: Introduction, Origin and Migration, Habitat, and Applications.

The Introduction begins with a short historical review and continues with an account of the early formation of life on Earth, photosynthesis, the carbon cycle and the preservation of organic carbon in sedimentary rocks. This is followed by a chapter on the chemistry of hydrocarbons, both those which occur naturally and those produced by refineries.

Part II, Origin and Migration, begins with a cursory review of the abiogenic theories of hydrocarbon formation before launching into an account of the chemistry of plant and animal tissues and the diagenetic changes which they undergo on burial. The temperature required for oil generation is discussed from both theoretical and observational points of view. Gas generation is treated in a separate chapter. The final chapter of this section deals with the last great mystery of oil, namely the magic of primary migration from the source rock to the carrier beds.

Part III, Habitat, opens with an account of source rocks, discussing the oil and gas generating potential of the various types of kerogen, and reviewing the various palaeothermometers available from maturation studies. This is followed by a chapter on the variation and distribution of hydrocarbons in reservoirs, with respect to depth, age and degradation.

Part IV, Applications, shows how the data and concepts previously presented