Book Reviews

Nes, W.R.; Nes, W.D.: Lipids in Evolution. New York, London: Plenum Press 1980. 244 pp., 27 figs., 21 tabs. Hard bound $ 29.50.

This is an uncommon book. It raises admiration and criticism. It is essentially an attempt by biochemists, specialized in lipids and especially in that most highly diversified class of lipid compounds, the steroids, to understand the biological meaning of this diversity, and how it has come about. They ventured into paleontology, geology and taxonomy and in the process they have developed a comparative biochemistry of lipid metabolism, which they present as a new tool in the long search for elucidation of evolution in its two main aspects: the establishment of a true natural classification of all living beings according to their phylogeny, and the understanding of the origin of life itself.

The overall impression is that the authors have made a very valuable contribution to the first aspect, broadening the now classical scope of chemotaxonomy from a state comparable to the dictionary of a language to that of its grammar. Consideration of metabolic pathways as elements of evolution may be a very useful approach. It is not entirely new: well known examples are the rather recent, and taxonomically restricted modifications of photosynthetic biochemistry in C_4 plants and in CAM (Crassulacean Acid Metabolism) plants. But the authors also suggest criteria by which metabolic pathways may be classified as primitive or advanced, which may become very important e.g.: 'The dual criteria of the extent of completion of a pathway, and the kinetic control of it such that intermediates are kept to small, steady-state concentrations, may be helpful in assessing the evolutionary status of an organism' (p. 195).

Regarding the second aspect of evolution, the data and analyses as yet permit no conclusions regarding conditions under which life began, notably the oxygen content of the primitive atmosphere, and temperature and acidity of the ancient seas.

The fundamental merits redeem many weak points. Some readers may be shocked by statements that, implicitly or explicitly, demonstrate teleological reasoning, and are summarized in the conclusion: 'We are unable to see how the assumption of "random mutation with survival of the fittest" is helpful in understanding the complexities of lipid biosynthesis, structure and distribution among organisms. Instead, the data suggest to us the operation of a number of principles interacting with each other in a goal-directed manner'. (p. 194). But the present reviewer is not disturbed by this kind of deviation from orthodoxy. His objections may be taken together as differences in opinion on the importance of compartments, the latter being taken in two meanings.

Since lipids and sterols are so important in the intracellular compartmentation, it is remarkable that the authors have so little attention for structural and biosynthetic differentiation within the cell. In Chapter 8 there is an extensive discussion on the phylogenetic meaning of the occurrence of two pathways by which sterols are formed from squalene: one via cycloartenol, the other via lanosterol; the first one being a marker for photosynthetic organisms, the second for nonphotosynthetic organisms. Since non-chloroplastic tissues of plants, and 'white' angiosperms (parasites) also use the cycloartenol pathway, and fungi – with one known exception – use the lanosterol pathway, this is taken as a heavy argument against the idea that higher plants are evolutionary symbionts of fungi and algae since, 'If this were the case, only chloroplasts should use the cycloartenol pathways, but a nonphotosynthetic part of a photosynthetic plant uses only the cycloartenol pathway'. (p. 160; p. 195). This assumes a) that white plants, like dodder (*Cuscuta*) etc. have no plastids at all, which is by no means sure, and b) that chloroplasts synthesize sterols. It is known that chloroplasts make fatty acids, and quite possibly they are the specific site for their biosynthesis, and abundant isoprenoid compounds, but sterols are remarkably low in purified chloroplasts. The essence of symbiosis is mutual dependence and reciprocal control of the symbionts, and it is not far-fetched to suppose that the complete or partial loss or suppression of metabolic pathways which are present in duplo when symbiosis is started, are eminently suitable means to achieve the reciprocal control of the cell and its symbionts. This, of course, compounds the difficulties of 'metabolic taxonomy', but the full force of these concepts, proposed by the authors, will only be achieved if the pathways are localized, not only in phyla, species, or even organs, but if also the intracellular compartmentalization is taken into account. The great physiologist A.V. Hill once said: 'Physics and chemistry will dominate biology only by becoming biology'.

The division of the book in Chapters, being its main 'compartments' is very unequal, both in their lengths and their importance. Within the largest chapters (7. Phylogenetics and Occurrence, and (8. Phylogenetics and Biosynthesis) which cover nearly half the text and contain a great richness of information on which the authors are eminently competent, the subdivisions present data, either grouped by the chemical classification of lipids, or by biological taxonomical principle. This leads to a certain redundancy in topics, which may be inevitable, but does not make for easy reading. The addition of concise summaries at strategic places is quite helpful, though, for readers who risk getting lost in the multitude of data. The inclusion of more tables, to replace long enumerations in sentence form, and a short primer on sterol chemistry and numbering system would have been a great help. The system chemists have worked out is highly ingenious, but quite artificial.

The preceding chapters also contain a great amount of pertinent biochemical information on the various biosynthetic strategies, and their possible evolution, but are generally set in an outline of that science which studies the origin of life, and which is called in some places exobiology, although it contains also many elements which are not biology at all. At least the writer of the jacket text expects that these 'exobiologists' will find this volume a fascinating addition to the literature. This reviewer is not so sure. Before the book is half way through, they are learned that the older biochemistry with all its expertise has as yet no answers to some urgent questions of their young science and may be too disappointed to keep on.

However, biochemists, taxonomists, especially the subspecies chemo-, and geneticists desiring to keep touch with a broader field of science, yet sufficiently close to their primary interests, will find fascinating material in this volume and a fresh stimulus to ponder again on the thematic unity and caleidoscopic diversity which make life so unique. The length of this review proves that a book of less than 250 pages may provoke an engaged interest.

J.F.G.M. Wintermans, Nijmegen