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BOOK REVIEWS

The Biochemistry of the Carotenoids, Volume II. Animals: by T. W. GOODWIN. 2nd edition, Chapman and Hall, London, 1984. 244 pp. £25.

Volume II of the present edition of this book has been published about 4 years later than vol. I, and deals specifically with carotenoids in animals. Although vol. II is complete in itself, vol. I is essential to understand it fully, as the newer techniques used in the chemical studies of carotenoids are in vol. I and the author refers a great deal to this volume. One of the features of this volume is the chapter on caroteno-protein complexes, missing in the first edition, but which is discussed at some length here because more recent information is now available. The author is world famous for his work on carotenoids, and being a specialist, has been able to discuss a number of the more controversial schemes with authority.

There are four very striking themes which run right through this volume:

1. The fact that astaxanthin is widely distributed among animals (except in mammals), that its synthesis is largely unknown, as almost all possible pathways have been proposed for the conversion of β-carotene to astaxanthin in locusts and in other insects. Furthermore, recent studies have shown unexpected reactions on the conversion of 'lutein' into 'astaxanthin' in goldfish which involve a change in configuration at C-3′ and the possible isomerization of an ε- into a B-ring.

2. The stereochemistry of animal compounds which has been determined only recently is of great interest, especially as their food components are usually of a different configuration. To-date, the chirality of a number of carotenoids has not yet been established and the author stresses the point that "it is clear that the stereochemical structural problems must be settled before exact biochemical pathways can be elucidated". Examples of this abound in the text, especially as a number of reactions are observed only in animals and not in plants. Problems are numerous as usually the chirality of the food plant carotenoid is different to the product, e.g. avian ε-carotene which has the opposite chirality to that found in higher plants and algae must be made in the animal from endogenous pigments because none is present in yolk carotenoids. More often than not, the conclusion is the source of the pigments for animals is unresolved.

3. That a number of carotenoids have been wrongly identified. A number of pigments have been characterised further using modern techniques, and it is clear that, e.g. the pigments of *Carausius morosus* originally reported as isocryptoxanthin and isozeaxanthin, are in fact 2-OH-β carotene and 2,2′-diOH-β-carotene respectively; also a number of times 'isolutein' has been wrongly identified as 'lutein'.

4. That on the whole very little is known about the functions of carotenoids, except for the conversion of certain compounds into vitamin A in certain animals. Although a number of possible functions have been proposed, e.g. light perception, reproduction, protection, none of these suggestions has yet been universally accepted.

This volume is without doubt a very good investment as not only is it up-to-date in terms of animal carotenoids but also gives food for thought for future research. Enzyme studies have been neglected on the whole in this field and also a number of compounds need to be characterized properly. This reviewer would like to congratulate the author for producing such a book with hundreds of references and structures with very few errors. One or two have been spotted. The structure for salmoxanthin (8.15) is not correct, and for the carotenoid changes in *Papilio xuthus* the reader is referred to table 7.4 which deals with Orthoptera.

However, this book is written very clearly and is therefore easy to read, as well as being an authoritative work. It should be a very useful reference book for readers of *Phytochemistry*, some of whom, particularly enzymologists and 'chiralists', might be tempted to try and clarify the large number of yet unsolved problems of carotenoids in animals.

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Origins and Development of Adaptation: edited by D. EVERED and G. M. COLLINS, Pitman (for the CIBA Foundation), 1984. pp. 273. £25.00.

When a clone of bacteria derived from one individual is challenged by a new lethal environment, say an antibiotic, it is possible to isolate a few survivors which will themselves generate resistant clones. The new variation, to resistance or tolerance, must have originated during the course of the experiment. The underlying genetics and biochemistry can be studied and often unambiguous statements can be made about the origins and development of the adaptation to the new environment. For most other organisms, however, experiments of this type are not possible because of an inability to determine the time at which the new variation originated. Thus we have to infer the origin from other evidence.

Following custom, the CIBA Foundation Symposium

No. 102 brought together a small number of active researchers from many different disciplines. For this meeting there were, for example, plant and animal ecological geneticists, entomologists, phytochemists, crop protection specialists and bacterial geneticists. The result of their deliberations is a message that we know almost nothing about the precise origin of adaptations.

It is generally agreed that new mutations and the reshuffling of existing genes or parts of genes are the basis of new variation, but when and how they occur is largely conjecture although the informed guesses seem not unreasonable. The vagueness is well summarized in Sawicki and Denholm's comment that 'insecticide resistance is generally assumed to be a pre-adaptation conferred by novel alleles that arise only rarely in untreated populations by recurrent mutation'. Pre-adaptation pervades almost every chapter in the book, prompting B. C. Clarke in his chairman's concluding remarks to weave a story with a moral round the secondary windows in his mother's house.

But to a geneticist there is a strong feeling of *déjà vu*. This is not to deny that old problems need re-examining from time to time in new ways in the light of new evidence. With the 'origins and development of adaptation', however, the re-examination occurs regularly at conferences or symposia on evolutionary biology and still we haven't made much progress. If the authors and readers of this book were to look at an essay by Medawar (Problems of Adaptation, *New Biology* **11**, 10–25, 1951) two papers by Mather and Harrison (*Heredity* **3**, 1–52 and 131–162, 1949) and Kettlewell's *The Evolution of Melanism: The Study of a Recurring Necessity* (Oxford University Press 1973) they would find the few of the principles discussed in the book under review have not already been considered in these earlier works. Some now have fancy names—hitchhiking, the red-queen hypothesis, coevolution etc.—but in the way that Clarke encouraged the participants to read Cain's (1964) *The Perfection of Animals* I commend Medawar's essay.

I would not be surprised if several participants in this symposium are already planning experiments to try to understand more about the origin of variation. The book is an excellent introduction to the problems likely to be encountered and so can be warmly recommended both to potential research students and to established researchers in any of the subject areas covered. The latter, however, must read the chapters and discussions outside their mainline interests. In this field flexibility of thinking is essential. For example, prisons are full of unsuccessful criminals; unsuccessful organisms are extinct.

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