Book Reviews

Genetic Recombination

Mechanisms in Recombination. Proceedings of a conference, Gatlinburg, Tenn., Apr. 1974. RHODA F. GRELL, Ed. Plenum, New York, 1974. xii, 460 pp., illus. $32.50.

T. H. Morgan discovered in 1911 that linked characters in *Drosophila* could "cross-over" in the progeny. Fifty years later M. Meselson and J. J. Weigle demonstrated by isotope labeling in phage λ of *Escherichia coli* that exchange comes about not by copying partly from one parent and partly from the other during chromosome duplication but by breakage and rejoining of parental DNA molecules. The rejoining is believed to be by pairing of complementary strands of DNA, one from each parent, to form a segment of heteroduplex DNA. If such a segment includes the site of a genetic difference between the parents, there will be mismatched or unpaired nucleotides in the double helix. Recently there has been a convergence of outlook among those working on prokaryotes and those working on eukaryotes, with the realization that in both groups of organisms enzyme systems can repair such distorted molecules by a process of excision and resynthesis.

It is gratifying in the present work, which contains nearly 40 contributions to a symposium on recombination, to see further similarities emerging in the recombination mechanisms now favored for different organisms. For example, the occurrence of long heteroduplex segments arising by branch migration, after the initial annealing of short complementary strands from each parent, is now widely supported. N. D. Zinder formerly favored a break-and-copy recombination mechanism for phage f1 of *E. coli* because the alternative hypothesis required such extensive heteroduplex segments. He now prefers the heteroduplex model, because of the unexpected resistance to the *E. coli* B restriction system shown by recombinant progeny from crosses between sensitive and resistant phages when the resistance arises from methylation of nucleotides at the sites in the f1 DNA recognized by the restriction system. The resistance in the progeny is believed to result from methylation of the sensitive strand when the strand is paired with a methylated one in a heteroduplex.

M. S. Fox and R. L. White conclude from density-labeling experiments with phage λ that long heteroduplex segments are formed during recombination and that these segments are of only one kind, with 3′-terminal ends to the overlapping strands. This finding has led F. W. Stahl and M. M. Stahl to modify their model for λ recombination. Although Fox and White's results might be taken to imply that general recombination in λ is nonreciprocal and limited to a particular kind of exchange, studies by W. Wackernagel and C. M. Radding on transformation and transduction in *E. coli* using, among others, the general recombination system of λ, suggest that reciprocal recombination sometimes occurs. These conclusions are not necessarily in conflict, however, since the recombinant progeny observed in crosses between λ mutants are limited to those which get packaged in a phage coat: the peculiarities of this packaging are an important feature of the Stahls' model.

Another example of convergence of outlook is provided by J.-G. Tiraby and M. S. Fox's suggestion, for which they have experimental support, that mismatch correction in pneumococcal transformation does not favor the recipient molecule, as previously supposed, but that the bias arises because excision of one strand of the heteroduplex is lethal when it extends as far as a gap in the other strand. The length of strand excised in mismatch correction in *Drosophila* is the subject of a contribution by A. Chovnick and associates. Previous estimates of this length in yeast were based on x-ray mapping, but C. W. Moore and F. Sherman, using mutants of known separations in the iso-1-cytochrome c gene of yeast, show that this technique is quite unreliable.

These few examples of the contents of this book reveal it to be essential reading for anyone wishing to know the current state of genetic recombination. The book is well produced and contains few errors. I deplore, however, the unnecessary duplication of terms. For example, "crossed-strand exchange," "Holliday structure," "cross-links," "double-bridge complex," "crossed-strand chiasma," "DNA strand chiasma," and, most misleadingly, just "chiasma," are used by various authors for one and the same structure.

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Carbohydrates in Plants

Plant Carbohydrate Biochemistry. Proceedings of a symposium, Edinburgh, April 1973. J. B. PRIDHAM, Ed. Academic Press, New York, 1974. xiv, 270 pp., illus. $18.50. Annual Proceedings of the Phytochemical Society, No. 10.

Its title notwithstanding, this book provides only a limited view of plant carbohydrate biochemistry, a view devoted in the main to polysaccharide biosynthesis and breakdown. Of the 16 chapters, 10 deal almost exclusively with starch, cell wall components, algal polysaccharides, and glycoproteins. Only one, a brief but elegantly condensed chapter by D. A. Walker, examines the central process of carbohydrate biochemistry in plants, primary photosynthetic carboxylation. In this carefully prepared section, Walker defines "primary carboxylating mechanism" and proceeds to outline its essential features. In so doing he renders a great service to those seeking a clear-cut explanation for the functional relationship of Benson-Calvin cycle activity to "C-4" photosynthesis and crasselean acid metabolism.

The following paper by T. Ap Rees *et al.* offers a useful discussion of gluconeogenesis. In plants this process provides a biosynthetic mechanism for mobilizing reserve products. As such, it plays a role second only to that of photosynthesis. Useful experimental findings from this Cambridge group suggest that fine control of interactions between gluconeogenesis and glycolysis, exerted perhaps at the level of phosphofructokinase and pyruvate kinase, regulates the flow of carbon between oxaloacetate and sugar.

A valuable chapter by J. B. Pridham and P. M. Dey on the nature and function of higher plant α-glactosidases reports changes in the level of a low-molecular-weight form of the enzyme during germination of *Vicia faba* seeds. Since little attention has been given to sugar metabolism in plants that use the raffinose series for phloem transport, this study on the α-ga-

lactosidases deserves careful consideration.

This reviewer found much to recommend in a brief, thoughtful chapter on starch metabolism by M. A. R. DeFekete and G. H. Vieweg. Studies of starch accumulation and starch breakdown in detached leaves reveal a fine balance in the control of amylolytic and phosphorylytic activities on the one hand and between phosphorylases and synthetases on the other. The concentrations of low-molecular-weight products, particularly maltose and inorganic phosphate, provide important information regarding the flow of carbohydrate from starch to sucrose and vice versa.

Among the remaining chapters one finds reviews on the plant polyols, glycolipids, sucrose metabolism, starch degradation in cereal grains, cell wall polysaccharides, algal polysaccharides, and glycoproteins. The book should interest all who work with plant carbohydrates but, as so often is the case with collections of this kind, its contents offer a viewpoint in time and prompt reading is essential if the message is to have value.

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Marine Ecology

The Study of Benthic Communities. A Model and a Review. ROBERT H. PARKER. Elsevier, New York, 1975. x, 280 pp., illus. $29.95. Elsevier Oceanography Series, 9.

The study of marine organic communities, begun in earnest about 70 years ago, was initially undertaken for very practical reasons. Early on, the relationship between marine bottom communities and fishery productivity was the chief rationale for undertaking detailed analyses of the benthos. In ensuing years, this practical motivation was gradually superseded by a "pure research" orientation. This book indicates a return to practicality. Parker's purpose in studying relationships between marine benthic communities and their physical environment is to assay the conditions before and after the onset of human activities in coastal areas. He has built a consulting practice based on this approach. This book, in large measure, is a statement of his rationale and method. Almost the entire book is devoted to the techniques of data collection, collation, and interpretation used in the study of the benthic communities of the Hadley Harbor complex which lies just southwest of Woods Hole, Massachusetts, between Buzzards Bay on the northwest and Vineyard Sound on the southeast. In a sense, then, the title might be misleading to a reader who expects a broad general treatment of principles and practices. The book is more specialized, but those principles and practices that have been successfully used by Parker in this and other detailed studies do emerge.

Aside from the detailed treatment of Hadley Harbor benthic communities, three more general aspects of the study strike this reviewer. First, Parker takes a holistic approach to his communities by attempting to study all the common taxa present. In many community studies researchers have simplified the "communities" studied to a few taxa, or even a single taxon, with which they have felt most competent to deal. Often such simplification distorts the situation past all reality. Parker's community spectrum contains (including only those species present in sufficient abundance for significant relationships to be deduced) 14 species of gastropods, 12 of pelecypods, 26 of amphipods, 10 of ostracods, 9 or 10 of decapods, 6 or 7 of smaller arthropods, plus kinorhynchs, polychaetes, foraminiferans, copepods, and others. The author not only attempts a more holistic biological approach but has collected copious data on physical environmental variables at the same stations and at the same time as biological data. From these biological and physical data he has reconstructed by both empirical and computer techniques the communities in the harbor complex and deduced their relationship to controlling environmental variables.

The second striking and unique aspect of the study is the careful and objective comparison of community maps derived from factor analysis of the data with maps drawn by "subjective" collation of species habitat ranges. As the author points out, the two sets of maps are quite similar and the comparison suggests that empirically drawn community distribution maps in other studies are more objectively correct than might normally be assumed. It is especially noteworthy that Parker's "subjective" maps used more of the data (in terms of numbers of species) than the factor-analytical techniques were able to accommodate.

Finally, Parker's data suggest that the four (at least) communities of Hadley Harbor are derived by fragmentation and reorganization from one or two very widespread, level-bottom communities of Buzzards Bay and Vineyard Sound.

The only major shortcoming of this book lies in the illustrations. Some, such as figures 14 and 15, are not needed. Others, such as figures 25, 27C, 30, and 39, could have been made more useful by additions or corrections. The most confusing omissions involve the map pairs of figures 67 and 68 and figures 84 and 85. Figures 67 and 68 show the "subjectively" drawn distribution of communities—nonoverlapping, unique community areas in figure 67 and areas of overlapping communities in figure 68. Several large areas occupied uniquely by the eel-grass community are omitted from figure 67, and their addition would increase by perhaps 20 percent the total area within the complex occupied by nonoverlapping, unique communities. Essentially the same criticism applies to figures 84 and 85, which are similar plots based on factor analysis of the data. Unique areas of the eel-grass community are left off of figure 84 and their addition would increase by about 10 percent the areas occupied by unique "factor" communities.

In conclusion, the reviewer recommends this book to ecologists and paleoecologists interested in the community approach to ecosystem analysis.

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Invertebrates

Myriapoda. Proceedings of a symposium, Manchester, England, April 1972. J. GORDON BLOWER, Ed. Published for the Zoological Society of London by Academic Press, New York, 1974. xxviii, 712 pp., illus. $37.50. Zoological Society of London Symposium No. 32.

The volume at hand is the proceedings of the second International Congress of Myriapodology, and contains the text of 44 papers presented at that congress as well as transcripts of the discussions following each and a summary of an informal session on the phylogeny of "Myriapoda." It is by far the largest volume yet published in the Zoological Society's symposium series and in many ways one of the most significant.

The book will be a disappointment to anyone looking for a modern reference on the classification and biology of the several myriapod classes. It reflects merely the current research interests of the congress delegates, and the coverage is markedly unbalanced. This reviewer counts 28 papers on Diplopoda, eight on Chilopoda,