

into regions and acquire similar properties, sharply demarcated by boundaries from other neighbouring groups of cells.

Morphogenetic gradients are postulated in individual body segments of insects which determine the pattern formation within each segment by both Peter Lawrence and Klaus Sanders. Peter Bryant finds evidence for a gradient radiating from the centre of *Drosophila* imaginal discs, (the larval structures which develop into the appendages of the imago such as antennae, wings, legs and genitalia). Transdetermination in *Drosophila* imaginal discs (the process whereby after culturing for several cell generations out of the larva the fate of a disc changes from, for example, a genital disc to an antennal disc) is also cited as evidence for boundaries formed by overlapping morphogenetic gradients by Kauffman. Gurdon reviews the known biochemical differences in regions of animal eggs and effects of maternal mutants (i.e. 'cytoplasmic inheritance') on development. As yet, no molecules have been identified which definitely establish regional differences in embryos.

Are there any opportunities for biochemists to characterize the postulated morphogenetic substances? It does not seem likely because, as the chairman Sidney Brenner draws attention to in his introduction, the developing systems studies are measured in micrometers, and may require painstaking dissection from other tissues before any experiments can be started. In addition, it is not certain whether all the

postulated gradients are of actual molecules. Support for Lewis Wolpert's hypothesis that the number of cell divisions completed in an organizer zone decides a cell's characteristics comes from Meinertzhagen's studies of neuronal correction patterns in insect retina, and from Hunt's studies on *Xenopus* retino-tectal patterns.

Cell patterning is determined very early on in development, several cell generations before cell differentiation becomes apparent. Because of this limitation, one of the most potentially powerful approaches is the use of genetic markers in chimaeras. With careful interpretation, the past-histories of cells can be inferred from their observed fate at a later stage of embryonic development. This approach is used by Gancia-Bellido with mosaics of *Drosophila* imaginal discs from known genetic mutants, and by Gardner and Johnson with chimaeras of rat and mouse embryos.

The fact that no firm conclusions can be derived from the Symposium is indicative of the difficulties of the field, but this book will give an insight to biochemists of the problems involved in studying developing systems, and it gives a good review of experiments which are presently being attempted by developmental biologists.

P. M. Clissold

Entropy-Driven Processes in Biology. Polymerization of Tobacco Mosaic Virus Protein and Similar Reactions.

by Max A. Lauffer

Springer-Verlag; Berlin, Heidelberg, New York, 1975
x + 264 pages. DM 73.00, \$ 31.80

This book is No. 20 in Springer-Verlag's series on Molecular Biology, Biochemistry and Biophysics and is of a kind that makes one feel that many of the activities of scientific publishers are nugatory. The Preface says that the book's purpose is to bring together, from the fields of chemistry, biophysics,

virology and cell biology, results of research into processes that have the important common feature of being endothermic and, therefore, entropy-driven. The processes discussed are mainly reversible reactions leading to the formation of large structures and the main burden of the argument being that the increase

in entropy occurring in these processes comes from the release of water.

The first chapter discusses the nature of entropy-driven processes and states that we should no longer speak of hydrophobic or apolar bonds but of entropic unions. This is as illuminating as the sentence in the *Financial Times* of 11 August 1965: 'Moralising by those whose industrial entropy is an accepted fact of life is neither likely to persuade the workers nor assist the trade unions in the task of trying to meet the nation's difficulties'. The second chapter, on the role of water, develops the theory of hydration and gives an account of the methods that may be used to investigate the degree of hydration and changes in it. The latter part of this chapter and the next four, comprising almost half the book, are concerned with a detailed account of the polymerization of TMV protein. So the second part of the title must be taken seriously, since so much space is devoted to a subject that has been thoroughly gone over in the past — as witnessed by the dates of many of the references — and which is, in my opinion, no longer very exciting.

The rest of the book outlines a number of entropy-driven structure-forming processes such as the sickling

of haemoglobin S, the in vitro formation of collagen, actin and myosin, the division of fertilized eggs, pseudopodia formation in amoeba, colour change in killifish (*Fundulus heteroclitus*), and a motley collection of others.

We have come a long way since the seminal paper by Frank and Evans ((1945) *J. Chem. Phys.* 13, 507–532). The work and ideas of Kauzmann, Lauffer and Tanford — to mention but a few — have been absorbed into general biochemical thinking and the notion that hydrophobic interactions are entropy-driven processes has even found its way into student textbooks (see, for example, S. J. Edelstein, 1973, *Introductory Biochemistry*, p. 130, Holden-Day, San Francisco). It therefore seems otiose to produce a monograph on the subject in 1975. It is a pity that so much space is devoted to TMV protein and that other topics are given such short shrift; a much more interesting book could have been written if the emphasis had been reversed and the topics dealt with discussed in relation to each other.

S. P. Datta

Gene-Enzyme Systems in Drosophila

Vol. 6 in the series *Results and Problems in Cell Differentiation*

by W. J. Dickinson and D. T. Sullivan

Edited by W. Beerman, J. Reinert and H. Ursprung
Springer-Verlag; Berlin, Heidelberg, New York, 1975
x + 164 pages with 32 figures. DM 58.00, \$ 25.30

The editors of this series of handbooks believe that the study of enzyme behaviour during development merits much study, particularly if carried out on a eukaryote that lends itself to genetic and developmental analysis. *Drosophila* is the obvious candidate because of the very large amount of information available, making it a system that is well-defined both genetically and biochemically. The authors, who work in this field, have performed a very useful

service in collecting together and summarising the scattered literature.

Insect biochemists now prefer to work with single tissues or organs rather than with whole animal homogenates so *Drosophila* is not a popular choice because of the small size. It is now possible, however, to obtain daily batches of 100 gm of insects by synchronous mass breeding and then density gradient centrifugation may be used to obtain gram quantities