chromosome (p. 34).

On p. 41 there is the ambiguous statement that "In higher organisms in which the enzyme patterns of the different cells are fairly constant, the protein genes are not part of operons. They are dispersed in the chromosome, transcribed separately and their expression is in most cases individually controlled". This is the point at which the author comes nearest to discussing the fundamental problem in eukaryotic gene regulation, which is how an apparently constant genome manages to produce such a diversity of cellular structure and function during development and differentiation. However, the theme of coordinate gene regulation in eukaryotes is not pursued. Nor is any attempt made to rationalize known genetic linkage maps in terms of gene regulation. The passage also serves to illustrate a general weakness of the text, which shows a preoccupation with minutiae and failure to state basic problems clearly and extract a useful synthesis of ideas from the welter of information. In particular I had expected a discussion of gene structure on the basis of the discoveries of overlapping and split genes, since this is promised on the dust cover. Although overlapping and split genes are mentioned on several separate occasions, there is no single passage which attempts to draw together all the observations and to deal with their consequences for the control of messenger RNA synthesis and for the evolution of protein structures.

Some specific topics which I would have liked to see mentioned are transposition and insertion elements as model mechanisms for moving DNA within and between chromosomes; a more detailed treatment of lambda phage as a model for switching between two alternate (lytic or lysogenic) types of development; a treatment of gene numbers in terms of rate limits to transcription; consideration of immunoglobulin genes in relation to specific reorganization of DNA during differentiation; and some discussion of secretion which involves a hydrophobic amino-terminal signal peptide enabling proteins for secretion to cross membranes.

For students the reviews of DNA replication, transcription and translation should be useful and are well referenced up to 1978. Although these chapters relate almost exclusively to prokaryote systems they do give comparisons with eukaryote translation mechanisms, eukaryote RNA polymerases and eukaryote DNA replication mechanisms. The other chapters on the structure of messenger RNA, the structure and function of ribosomes and on transfer RNA are perhaps too specialized for all but the devotee of macromolecular structure and function. □

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1937, 1951, 1976 — progress in crystallography

D.W.J. Cruickshank

X-Ray Analysis and the Structure of Organic Molecules. By Jack Dunitz. Pp. 514. (Cornell University Press: 1980.) $55, £36.

THIS BOOK has developed out of the Baker Lectures given by Jack Dunitz at Cornell University in the fall of 1976. Once again the publication of a set of the Lectures allows them to be appreciated by a far wider audience than the chemists of Cornell. This volume immediately brings to mind Linus Pauling's influential Lectures of 1937, "The Nature of the Chemical Bond and the Structure of Molecules and Crystals", and J.M. Robertson's notable contribution of 1951, "Organic Crystals and Molecules". Crystallography and organic chemistry have developed enormously in the last quarter century, so that whereas in 1951 Robertson could discuss a large proportion of the 200 or so organic crystal structures then known, in 1976 it would have been impossible for Dunitz to survey 16,000 structures in like fashion.

Dunitz's book is in two parts: "Crystal Structure Analysis" and "Molecular Structure". The first part is a fairly complete guide to current methods of determining the crystal structures of small or medium-size molecules (not proteins). A score or two of books must have been written on crystal structure analysis, but Dunitz's volume is more attractive than most of the others. This is because of the flowin informal style and the penetrating insights and asides of a master of the craft. I suspect his treatment will prove somewhat too professional for most of those chemists he wants to help read the crystallographic literature, but it will be invaluable for young (or not-so-young) crystallographers seeking an overview of the main parts of the subject.

Among the interesting features is a discussion of the frequency of occurrence of particular space groups and Kitaigorodsky's explanation of this in terms of possible molecular packing arrangements. On p.136 we learn of the caesium salt of boromycin, the absolute configuration of which was established before its structural formula. On p.143 we read of the flurry caused in 1972 by Tanaka's claim that all absolute configurations determined by X-ray analysis were wrong and should be changed into their antipodes. Tanaka's claim proved ill-founded, but his error was a happy one for it led to new and independent proofs of the correctness of the Bijvoet method. There is a helpful and well-titled section on hazards of oblique coordinate systems. Both this and the section on thermal motion analysis contain useful worked examples.

Unfortunately the treatment of Fourier transforms is marred by a misprint at a critical point on p.30, and by a failure to make clear whether the inverse transform relates to the minus sign in the exponential argument or to the transformation from **R** space to **r** space. Dunitz is a Lewis Carroll fan and he concludes his summary of simple theorems about Fourier transforms with a quotation from *Alice*:

> "What *is* the use of repeating all that stuff", the Mock Turtle interrupted, "if you don't explain as you go along? It's by far the most confusing thing I have ever heard!"

Dunitz must have had a premonition of trouble on the printed page!

The second part on molecular structure contains four chapters, of which the first, "Crystal Structure Analysis and Chemistry", is both the most substantial and the one of greatest general interest. Dunitz first traces the explosive growth of information on molecular structures and stresses the utility of the computer-based files of structural data collected by the Cambridge Crystallographic Data Centre. He reminds us of the triumphs of classical organic chemistry in the determination of structural formulae, but uses patchouli alcohol as an example of an unexpected contradiction. He reports on conformational analysis, solid-state chemistry and reaction intermediates — the latter illustrated by the remarkable structure of $CO_2(CO)_4(H_2CBu^t)(C_2H_2)$ determined by Mills and Robinson in 1964. Then comes a discussion of molecular potential energy surfaces, which leads on to Dunitz's structural correlation principle whereby the numerous slightly differing 'still' pictures of the same structural fragment in different crystals are used to infer a chemical reaction path. Nucleophilic addition to carbonyl groups is used as one of the examples of this principle.

The remaining chapters include a good account of investigations into the electron-density distributions in molecules, a very clear exposition of the geometrical aspects of the closure constraints in cyclic molecules and an elegant discussion of symmetry in conformational maps.

Dunitz learnt his crystallography in Glasgow and Pasadena. Robertson and Pauling can be well satisfied with the volume their former protégé has now placed alongside their own in the Baker Lecture series. □

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