

ably applicable to large deep rivers, but I wonder if, in fact, in steep shallow channels with rocky, pot-holed beds, where some water movement is uphill, geomorphologists do measure the true distance travelled by a water particle in a given length between two successive points. Among the many interesting topics mentioned in these introductory pages are relaxation time and feedback in energy systems.

The following chapter discusses at some length the criteria that Earth scientists use to obtain a chronology. Relative morphological vertical position, extent of drainage patterns, stratigraphy, mineral and organic content, weathering, artefacts, radiation, tree rings and lichenometry all find a welcome place, but thermoluminescence might perhaps have been better replaced by palaeomagnetism. The discussion then proceeds to the measurement of variables in time, the analysis of temporal data, and the rates of operation of geomorphological processes. In these the authors rightly consider that awareness of techniques will make the reader more careful in designing experiments for the collection of time-based data and more aware of the inadequate nature of much of the published data on measured rates of processes.

The next three chapters of the text provide information on the various types of models concerned with the way that events change in time. The qualitative temporal variety leads on to the quantitative deterministic type and so to the less certain stochastic models of form evolution. Not surprisingly, as geomorphologists deal with area realities, there follows a discussion on the setting of events or points into a framework wherein spatial characteristics or patterns evolve. A summary of space, and time and a long bibliography of mainly post-1960 literature, form a suitable conclusion.

In brief, this neat and well-illustrated book provides at a reasonable price a commendable introduction to recent conceptual advances in time-related factors in geomorphology. Geomorphologists may have far to go and some time to wait before their recordings on rates of process become truly reliable but this excellent summary will provide students with a clear view of the time-scale aspect of present achievements.

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Collagen biochemistry and biophysics

Biochemistry of Collagen. Edited by G. N. Ramachandram and A. H. Reddi. Pp. xv+536. (Plenum: New York and London, 1976.) \$59.40.

UNTIL some 30 years ago, collagen was of interest mainly to industrial chemists concerned with the properties of leather, glue and gelatine. Since then, there has been a rapid expansion of information concerning collagen structure, metabolism and function. This book, as the title implies, covers the biochemistry of collagen but also contains chapters more properly labelled biophysics.

The chapter by Piez collates the information available on the primary structure of collagen polypeptide chains. Also discussed are the sequences involved in the unique post-translational modifications, particularly hydroxylation and crosslinking. There are brief descriptions of the methods of isolation of the different collagens and of the polypeptide fragments to which the usual methods of sequencing have been applied.

The chapter by Ramachandran and Ramakrishnan provides a general account of the early X-ray diffraction studies which led to the formulation of a triple-helical structure for collagen, together with a more detailed consideration of recent modifications of this basic structure. The chapter on synthetic polypeptide models is largely redundant, much of the material being covered by other authors.

The molecular packing of collagen monomers in fibrils is the subject of a chapter by Miller who discusses critically the methods available for studying this packing, particularly X-ray diffraction and electron-microscopy, and the results obtained by these techniques. More tentatively, he discusses the possible models which can be derived from the data available.

The complex processes by which the collagen molecule is synthesised are dealt with by Prockop and his colleagues. After a short section on collagen mRNA, the manifold post-translational modifications which the primary structure of collagen undergoes are discussed. These include hydroxylation of lysine and proline, and glycosylation of hydroxylysine. Also discussed is the final intracellular process which involves the assembly of three polypeptide chains and the subsequent triple helix formation before the

molecule is secreted. The final section is a stimulating discussion of the regulation of these intracellular processes by which the wide range of chemically different collagens found in the body are achieved.

After secretion the completed molecule is cleaved to form a molecule which can form a fibril by a process of self-assembly. The stabilisation of the fibrillar structure by covalent crosslinks is discussed in a chapter by Tanzer. This deals with the structure and mechanism of formation of these crosslinks.

The enzyme mammalian collagenase, one of several proteases involved in collagen degradation, is the subject of a very useful chapter by Gross. The most interesting section is that concerned with the regulation of collagenase activity and how it is synchronised in time and space with collagen biosynthesis.

The chapter by Timpl on immunological studies is concerned with the diversity and localisation of antigenic determinants on the collagen molecule. There are useful sections on the use of specific antisera to detect anticollagen antibodies and also as tools to study the structure and metabolism of collagen. There is a section on the use of fluorescent collagen antibodies to localise and follow the temporal changes in the appearance of the different genetically determined collagen.

The molecular basis of diseases affecting collagen is dealt with in an excellent chapter by Lapière and Nugens. This contains two tables of data on the cellular and molecular basis of collagen defects, and on the techniques applied to define collagen pathology. Various diseases of connective tissue, both inherited and acquired, are discussed in the light of current knowledge of collagen structure and metabolism.

The chapter by Reddi is somewhat disappointing. It covers rather sketchily an area of research concerning the intimate involvement of collagen in cell differentiation and organogenesis. This is an important topic requiring a more detailed and critical review than that provided by this chapter.

There is evidence of a considerable gap between the completion of the manuscript and final production of the book (compensated in some chapters by addenda). Nevertheless this is a reasonably up-to-date account of the current status of collagen research which should be useful to workers in a wide variety of disciplines.

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