

extraordinarily heavy, with masses of the order of 10^{-10} g. These theories mostly imply that the proton should decay spontaneously (for example, to $e^+ + \pi^0$) and have led to a number of experimental proposals to push up the present limit ($\lambda_p \sim 10^{30}$ years) on the proton lifetime.

This is a book for the quark-model practitioner. It gives all the prescriptions and rules; they are analysed thoroughly but are not always derived (nor even necessarily all consistent). It says something about every idea current today, although some in much more detail than others. The book is somewhat uneven in its treatment, being strongest and most detailed in the areas where the author's own contributions lie (photo-excitation of excited baryons and polarised lepton-hadron interactions). It also has a somewhat dated air, since our picture of elementary particle physics has been changing rapidly. It is now a general belief that the quarks (u,d) are almost massless, whereas most hadron spectroscopy still assumes non-relativistic motion for the quarks in hadrons. The $SU(N)$ symmetries discussed here are now considered accidental, the true symmetry being the flavour independence of quark-gluon

interactions, violated only by the quark mass values. Little is said about 'confinement', the central unresolved question for QCD; indeed, the book says rather little about QCD, beyond implications of the one-gluon-exchange potentials. The book has come too soon to include the recent developments in baryon spectroscopy due to Isgur and Karl, which have brought much order concerning Λ^* and Σ^* states. It would have greater value for students today if it had more about the fundamentals and applications of gauge theories, especially for QCD, since the book would then have appeared forward-looking; its present emphasis is on theoretical aspects from the past, which may be expected to change in the near future. But this is perhaps the fate of any book in this field of physics, where exploration is moving fast; it is easy and unfair to make this judgement in retrospect. There is no doubt that every physics library should possess this book, for there is much to be found on its pages which it is not easy to find elsewhere. □

R. H. Dalitz is Royal Society Research Professor in the Department of Theoretical Physics at the University of Oxford, UK.

Chondrocytes and their matrix

F.N. Ghadially

Biology of Cartilage Cells. By R.A. Stockwell. Pp.329. (Cambridge University Press: London, New York and Melbourne, 1979.) £25.

THIS book is a welcome addition to the literature on cartilage. It is not a book about the chondrocyte only, as the title might lead one to believe; quite detailed accounts of the morphology and chemistry of various components of the matrix are included as well as other topics such as the nutrition and permeability of cartilage and the nature of the articular surface. All this is successfully accomplished in what the author modestly refers to as a "short book", but the concise style of writing has permitted the inclusion of a volume of factual data which one usually associates with much larger works. The well selected references and a carefully prepared index enhance the value of this work.

It is difficult to fault the text in any major respect. The photomicrographs are rather small in size but of good quality; the same, however, cannot be said of the electron micrographs, which are of a variable quality. In contrast to this the line drawings are superb, and the graphs and tables are well planned and informative.

The book begins (chapter 1) with a brief description of the morphological and chemical differences between various types of cartilage. Chapter 2 gives an adequate account of the ultrastructural morphology of the chondrocyte, the effect of hormones on the chondrocyte and the antigenicity of chondrocytes. Chapter 3 deals with the morphology and chemistry of the matrix components. In this excellent chapter we are treated to quite a detailed account of collagen structure and synthesis, elastic fibres and elastogenesis, and the structure of proteoglycans. However, the morphology of proteoglycans (that is, matrix particles) is barely discernible in the electron micrographs presented. Chapters 4 and 5 deal with the metabolism and nutrition of chondrocytes. Chapters 6 and 7 deal with chondrocyte differentiation and proliferation. The book ends (chapter 8) with a discourse on degenerative changes, age — associated changes, and a section on calcification in which an up-to-date account of matrix vesicles and their role in cartilage calcification is presented.

In summary, this book provides a brief review of existing knowledge about the chondrocyte and surrounding matrix. It is up to date, well written and packed with factual data. In my opinion this book should be of value not only to research workers as suggested by the author, but also to rheumatologists, orthopaedic surgeons and postgraduate students (residents) interested in cartilage.

F.N. Ghadially is Professor and Joint-Head of Pathology at the University of Saskatchewan, Saskatoon, Saskatchewan.

Primary energy resources

D.O. Hall

Biological Energy Resources. By M. Slesser and C. Lewis. Pp.192. (E. & F. N.Spon: London, 1979.) £8.50.

TODAY about one-seventh (or possibly more) of the world's primary energy is derived from biomass — this is equivalent to 19 million barrels of oil a day (which is twice the Saudi Arabian oil production and equal to the US daily oil use). However, because most of this biomass energy use occurs in the developing countries (and there predominantly in rural areas) and because it seldom enters the official statistics, it has, until recently, been virtually ignored by planners, politicians and aid agencies alike. A combination of the "energy crisis" and desertification problems has focussed the attention of both developing and developed countries on the importance and potential of 'biological energy resources'.

This aptly titled book is a must for anyone interested in the basics of bioenergy and its conversion, and more especially in the energetics and economics of biomass systems. The concepts of energy ratios, net energy yield, net utilisable energy production, and gross energy requirement are well presented, and a number of case studies are thoroughly discussed. It is clearly pointed out that intensification of natural ecosystems for biomass energy requires both capital inputs and better management — but local industry, skills and energy self-reliance can be built up. Such energy systems are applicable to varying extents in diverse conditions around the world and must be tailored to suit local conditions.

The chapter on economics of biomass systems touches on net present value, energy payback times, and economic costings. It considers some specific examples like ethanol production and biogas generation, and compares costs with other energy sources. These costs are changing so rapidly it seems imperative to update one's analyses and comparisons annually to take account of accelerating costs.

It is a good book and very timely. But please could authors and/or publishers try to list references that can be traced — conference proceedings references are useless unless the accurate source is given and organizations who publish booklets, and so on, have their addresses given. In such a rapidly developing field with wide sources of interest it is important to be able to trace the information. □

D.O. Hall is Professor of Biology at King's College, University of London, UK.