in animal tissues. Far from being a mere catalogue of results, this chapter can be used as a guide in the application of centrifugal fractionation to the investigation of a variety of biochemical processes.

Among the few enzymes of which the amino-acid sequence has been well established is the ribonuclease, which at present receives a great deal of attention from protein chemists as well as enzymologists. The structure and function of ribonuclease form the main topic in the chapter by Scheraga and Rupley, who provide a clear and concise survey of the subject. But ribonuclease enters into discussion also in several other chapters, notably that concerned with mechanisms of enzyme catalysis by Westheimer, and the one by Sri Ram, Bier and Mauror, who deal with chemical modifications of proteins and their impact on enzymology, immunochemistry and related subjects. Ribonuclease again figures prominently in the chapter on peptide structures by Šorm, whose analytical results on proteins form the basis of his evolutionary concept whereby the chemical structure of proteins is seen as a reflexion of the evolution of life on Earth, a record, as it were, of the laws of phylogeny and ontogeny of the distant past.

Of the three remaining chapters, that by Augenstine offers a detailed and very useful account of the six existing models of enzyme radiosensitivity; in the chapter on sperm metabolism, Salisbury and Lodge expound their views and experiments on the subject of the relationship between sperm survival, motility and metabolism, and the response of spermatozoa to a variety of extraneous agents; lastly, there is a review on molecular properties and transformations of glycogen phosphorylase in animal tissues, by Edwin Krebs and Edmond Fischer, dealing with the first step of glycogenolysis, a process significantly more complex than originally visualized, as it now appears to involve no less than four different enzymes, three nucleotides, a vitamin, and several hormones and metal ions.

T. MANN

PHYSICS IN BIOLOGY AND MEDICINE

Advances in Biological and Medical Physics

Vol. VIII. Edited by Cornelius A. Tobias and John H. Lawrence. Pp. ix+457. (New York and London: Academic Press, 1962.) 107*s*. 6*d*.

THREE of the eight topics presented in the latest volume in this series are concerned with techniques for the measurement of trace elements, X-ray spectroscopy by J. W. Gofman, neutron activation analysis by Kwan Hsu and γ-ray spectroscopy by L. D. Marinelli, C. E. Miller, H. A. May and J. E. Rose, the latter restricted to the external measurement of radioactive elements located within the human body. These chapters provide useful descriptions of the physical techniques involved and of the relative sensitivity for different elements. Various medical and biological applications of these techniques are described, but with little indication as to their usefulness in comparison with other techniques. However, this may be due to the fact that they have not as yet been applied very widely.

A chapter by Tor Brustad gives an excellent account of the experimental set-up of the heavy ion linear accelerator (*Hilac*) at the University of California. Applications in the field of radiobiology are presented which illustrate well the usefulness of this machine, and also the complexity of interpretation of the experimental results.

A lengthy chapter on the interrelations between the hypothalamus and the thyroid is provided by P. Blanquet in collaboration with J. Faure. The detailed descriptions of experimental observations by many workers make it difficult, for those new to the subject, to ascertain what the authors consider to be the most likely mechanisms operating between these two organs. However, those working in this field should find the chapter most useful.

With the all-embracing title "The Origin of Life on Earth and Elsewhere", Melvin Calvin describes the properties that are required of molecules so that they can give rise to primitive forms of life. He describes how simple polyamides and nucleic acids may have interacted and evolved to the great complexity of the biochemical processes that are found in even the simplest organisms to-day.

"The Physics of Space Radiation", by Roger Wallace, deals with the various sources of ionizing irradiation found in space and concludes that only that resulting from sporadic solar flares is of real danger in future distant space flights. It is suggested that a few minutes' warning of these flares can be obtained so that spacemen may shelter in some well-shielded part of the space vehicle.

The final chapter, by Niels Arly and Reidar Eker, is entitled "Mechanisms of Carcinogenesis". After an interesting presentation of the complexity of the carcinogenic process, various mathematical models are considered and the need for a stochastic model is argued. Such a model, that has been constructed by the authors, is shown to be able to fit satisfactorily a number of results relating different experimental parameters. The absence of any information concerning the biological mechanisms involved leaves one with the impression, however, that no real advance has been made in this field.

N. M. BLACKETT

NUCLEOPHILIC ALIPHATIC SUBSTITUTION: MECHANISM AND KINETICS

Nucleophilic Substitution at a Saturated Carbon Atom

By Dr. C. A. Bunton. (Reaction Mechanisms in Organic Chemistry, Vol. 1.) Pp. ix+172. (Amsterdam, London, New York: Elsevier Publishing Company, 1963.) 40*s*.

THIS is the first volume in a series edited by (the late) Prof. E. D. Hughes, and sets an excellent standard for the series as a whole. The monograph also occupies a proper position in the series, as the general principles, which are adumbrated in Chapter 1, are useful in other areas of physical organic chemistry, the subjects of following volumes. While ideally it might have been better to treat nucleophilic substitution as a saturated carbon atom in the same volume as elimination reactions, there are good practical reasons for the procedure adopted of limiting this volume to substitution only.

In places this work leans heavily (but rightly so) on parts of Sir Christopher Ingold's magistral volume, now some ten years old, *Structure and Mechanism in Organic Chemistry*. However, in the controversial parts of the subject the author, himself a distinguished member of the University College, London, school, has shown an admirably balanced and fair attitude, especially to the work of American protagonists in the controversies. The book is also noteworthy for numerous critical and illuminating footnotes (unfortunately printed in very small type) for many well-chosen references, situated at the end of each chapter, but easily found, because their location is given on every alternate page of the chapter in question.

After an opening chapter in which mechanistic and kinetic principles are discussed, with special reference to 'duality of mechanism' (the definitions of the S_N1 and S_N2 mechanisms might have been rather more rigidly set out), the author proceeds to the two most substantial parts of his book—a thorough survey of structural effects on the rate of substitution, and a penetrating account of the stereochemistry of the substitution process in relation to mechanism, which is still one of the most satisfying areas of rationalization in physical organic chemistry.