mechanical concepts in biology an analogy is drawn between a quantum mechanical explanation in terms of "phase correlations" for super-conductivity and super-fluidity and a possible explanation for cell division in terms of oscillations of the electric double layer of the cell membrane. In the discussion, it is proposed that the basis for the agreement may be classical rather than quantum mechanical; an attempt is made to clarify the meaning of "phase" in biological concepts and, finally, H. C. Longuet-Higgins finds little attraction in exploring such new possible phenomena because "plenty of strange things happen in biology, without introducing any more". Later on in the discussion some agreement is reached on the irrelevance of the quantum mechanical phase to problems in biology. In this way, especially in the first half of the book, theoretical concepts are refreshingly explored. Pullman's review on quantum mechanical calculations is the most complete part of the theoretical section and much of the discussion is devoted to analysing why the simple Hückel-type molecular orbital theory applied to problems in biochemistry has been so successful; this leads to an interesting discussion of mutagenesis and carcinogenesis. The contribution by Monod, Wyman and Changeux is outstanding on allosteric effects in terms of certain features of protein structure and this, together with the sessions on the genetic code, comprises the more general aspects of the biological side of the meeting. The sessions on physiological mechanisms are necessarily specialized.

I feel that most of this book could be read by the theoretical physicist or chemist interested in biological function. Biologists will find particularly interesting the attempts of physicists to get to grips with their problems and will find most valuable, speaking generally, the sections on transfer of information. R. E. BURGE

SPIN METHODS

Biological and Biochemical Applications of Electron Spin Resonance

By D. J. E. Ingram. (Monographs on Electron Spin Resonance.) Pp. x+311. (Hilger: London, August 1969.) 100*s*.

ALTHOUGH the application of electron spin resonance (ESR) methods to biology began in 1954, this book is particularly timely because there is a growing awareness of the potential of the method at present. The subject is developing rapidly and the author is to be congratulated on the way in which he has conveyed an impression of exciting new discoveries and techniques while also covering the more established methods. His method is one of example, rather than exhaustive review, and appears well justified in an introductory textbook.

Professor Ingram is a physicist who has been concerned greatly with the development of ESR methods and this interest is reflected in the book. Thus one chapter, devoted to basic experimental techniques, is largely taken up with a detailed calculation of the signal-to-noise ratio of a spectrometer without there being a numeric example which would give the biologist some feel for the subject. One might suppose that here the result is more relevant than the derivation which contrasts curiously with the quotation of fundamental results almost without derivation in the first chapter. Another chapter describes spectrometer systems in perhaps too much detail for readers who are most likely to use commercial machines anyway. It also includes, however, useful descriptions of the methods of greatest application in biology.

The final four chapters are devoted to free radical and irradiation studies, enzyme studies, metallo-organic compounds and recent developments and future prospects. These seem informed and contain some brief descriptions of the biological systems; for example, the types and roles of enzymes. Thus the book seems intended to some extent for the person who, being experienced in ESR, wishes to apply himself to biochemistry. This person would find the book stimulating and useful, although the classical biochemist, whilst obtaining a sound appreciation of the type of problem which ESR can solve, might find it somewhat hard going despite the author's attempts at simplification.

Finally, some comments must be made which presumably reflect editorial policy in the series of monographs of which this book forms one: it is disappointing that SI units were not used; there is a distressing tendency for the references given to be internal to the series and many opportunities of reference to better books are lost; meaningless superlatives are used on the dust cover.

Altogether, this is a useful book which may be recommended at its price. K. A. MCLAUCHLAN

IMMUNOLOGY AND NUCLEIC ACIDS

Nucleic Acids in Immunology

(Proceedings of a Symposium held at the Institute of Microbiology at Rutgers, The State University.) Edited by Otto J. Plescia and Werner Braun. Pp. xvii+724. (Springer-Verlag: Berlin and New York, 1968.) DM 88; $22.

UNTIL some years ago it would have been anathema to the central dogma to even consider the mutual recognition (complementarity) of proteins and nucleic acids. The field of protein–nucleic acid interactions became wide open with the advent of nucleic acid polymerases and repressors and with the discovery of naturally occurring or experimentally produced antibodies reacting specifically with nucleic acids.

The book reviewed here gives the proceedings of a most interesting symposium in which for the first time various aspects of the involvement of nucleic acids in immunology were discussed. These included the hard facts of anti-nucleic acid antibodies and of the effect of nucleic acids as non-specific stimulators of immune responses, as well as the soft facts of nucleic acids with an informational role for antibody production. For good measure, several papers were included which have at most a tangential connexion with the main topics of the symposium.

The book starts with reminiscences of Michael Heidelberger, who described experiments carried out almost 40 years ago, but never published because the authors could not bring themselves at that time to believe that they had actually succeeded in inducing antibodies to RNA. The various methods for preparing antibodies of nucleoside, nucleotide, oligonucleotide or nucleic acid specificity are described in detail. The methods make use of antigens prepared either by covalent attachment to proteins and synthetic antigens, or by electrostatic interaction between a nucleic acid and an immunogenic positively charged carrier such as methylated bovine serum albumin. In some cases, antibodies were prepared capable of distinguishing between single and double strands of nucleic acids, and even antibodies recognizing a triple strand have been described.

Antibodies reacting with nucleic acids are produced in several autoimmune diseases, and those present in the serum of many lupus erythematosus patients have been investigated in considerable detail. In some sera, the antibodies react much better with single-stranded DNA, whereas in other cases the interaction with double-stranded DNA is much stronger. Both bacterial and mammalian ribosomes have been shown to be effective immunogens, with the major portion of the resulting antibodies being specific for the nucleic acid components.

Among the uses of nucleic acid-specific antibodies one should mention immunological evidence for the existence