

From metal to insulator

Metal-Insulator Transitions. By N. F. Mott. Pp. xvi+278. (Taylor and Francis: London, September 1974.) £6.50.

In the early days of quantum mechanics a simple model of metals was introduced in which all valence electrons were assumed to be free, or 'nearly' free, when a weak interaction with the static lattice of the positive ions was allowed for. The model predicted that in a perfect crystal the electron states would lie in bands and that each band could accommodate two electrons in every atom. Thus, materials with odd numbers of electrons in each atom, or with occupied and empty bands that overlap, would be good conductors. An insulator could only be changed into a metal (at least at zero temperature) by making its bands overlap. That outstanding prediction survived the test of time. In a real solid, however, the electrons interact with one another and also respond to lattice vibrations and the conditions under which a metal-insulator transition may occur depend to a large degree on the nature of those interactions. The main theme of Professor Sir Nevill Mott's book is to describe the effect of interactions between electrons in inducing magnetic moments and metal-insulator transitions. He reviews the present state of knowledge in the field from both theoretical and experimental standpoints.

The book is divided into six chapters. In the first, the concept of metal-insulator transition is developed within the framework of the model of non-interacting electrons in crystalline and non-crystalline media. The second chapter introduces electron-phonon interaction and exciton formation into the discussion of metal-insulator transition. Chapter 3 deals with the theory of localised magnetic moments in metals, magnetic ordering in non-metallic oxides and metallic ferromagnets, and also outlines the physics of the Kondo effect and its relevance to the main theme of the book.

Chapter 4 covers the metal-insulator transition resulting from correlation. This forms the hard core of the book and includes perhaps its best written passages. It begins with Professor Mott's original argument that at zero temperature a small number of free carriers can always form bound pairs through the long-range Coulomb potential, thereby producing an excitonic insulator. As a consequence, the corresponding metal-insulator transition involves discontinuity in the number of carriers.

Metal-insulator transition can, however, also take place without any reference to the long-range forces. The

Hubbard model, in which only intra-atomic correlation is included, predicts a continuous change in carrier concentration in the region of metal-insulator transition. This theory and its numerous extensions are discussed in some detail. The chapter also describes transitions in highly correlated metals and Wigner and Verwey transitions. The last two chapters apply the ideas of the previous chapter to metal-insulator transitions in transition metal compounds (V_2O_3 , Ti_2O_3 , VO_2 , NiS, and so on) and in disordered systems (doped semiconductors, metal-ammonia solutions).

It must be remembered that although some of the most important contributions to the theory of metal-insulator transition were made many years ago (N. F. Mott, *Proc. Phys. Soc.*, **A62**, 416; 1949) the field is still very much a new one and, as Professor Mott himself points out, there is, among theoretical physicists, no consensus to speak of. Under such circumstances Professor Mott's attempts to give a unified view, embracing a wide variety of experimental and theoretical material, must be highly praised. The book will be a welcome source of up-to-date information (a list of over 500 references to scientific papers and books is also included) to postgraduate researchers in solid state physics. **M. Jaros**

Sequences

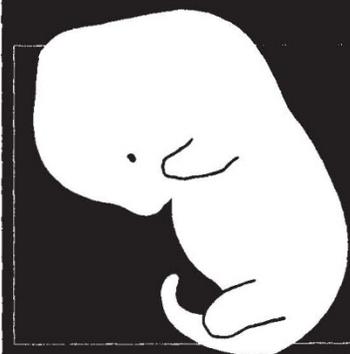
Handbook of Nucleic Acid Sequences. By B. G. Barrell and B. F. C. Clark. Pp. 104. (Joynson-Bruvvers: Oxford, May 1974.) £4.40 cased; £2.50 looseleaf.

This handbook is essentially a comprehensive catalogue of most of the known RNA and DNA sequences so far published and, of necessity, the bulk of the listings refer to the 50 or so tRNA species which have been sequenced. Another attractive target for sequencers are the 5S ribosomal RNAs and although little can yet be said about their function, the primary structures of nine different species of this molecule have been established. Several other low molecule weight (4.5S-6S) RNAs are included as well as the sequences of RNA transcripts from some DNA phages.

A second major section lists all the known sequences from coliphage group I and group III RNAs, and the third section shows the current state of the art of the DNA sequencer and includes a synopsis of DNA restriction enzyme cleavage sites. One would anticipate that the field covered in this section will expand rapidly and it is to be hoped that arrangements are in hand for the regular updating of this collection. **J. Hindley**

Developmental
Biology books

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Development of the Avian Embryo

A Behavioural and Physiological Study
B. M. FREEMAN and M. A. VINCE

December 1974: 380 pages: 15 pages of plates and 110 line illustrations: hardback: 412115204: £10.10

This book considers the behavioural and physiological development of the avian embryo. After describing the physical conditions needed for development both in incubators and in the wild, the first part goes on to describe the major changes which occur in embryonic physique, posture and activity in the course of incubation. The second part discusses the physiological aspects of development in detail. The book is intended primarily for the research student and the established research worker.

Differentiation and Growth of Cells in Vertebrate Tissues

Edited by G. GOLDSPIK

December 1974: 334 pages: 109 tone and 25 line illustrations: hardback: 412113902: £10.30

This book brings to the fore a relatively neglected part of developmental biology as far as textbooks are concerned; namely the development of the cells in different tissues of the body. There are seven specialised chapters, and each chapter is written by an expert in that field and an all-round picture is given of the biochemical physiology as well as the morphological events associated with the development of that particular tissue. The volume will prove invaluable to postgraduates and advanced undergraduates of biology and medicine.

Cellular Interactions in Animal Development

ELIZABETH M. DEUCHAR

February 1975: 308 pages: 12 pages of plates and 126 line illustrations: hardback: 412130106: £6.50

This book provides a broad and critical survey of the many types of interaction that have been shown to take place between cells during the processes of development in animals.

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