the resulting data. An introductory survey of the theory underlying these processes is given with characteristic lucidity by J. D. Jackson. There is also an unexpected gem: a paper on multiple production by K. G. Wilson, written and circulated privately in 1970 and never published before, even though it has had a significant impact on the field. Despite its originality, this contribution is almost free of formulas and can be read by any physicist. A rather more technical, but nevertheless very accessible, description of hadronic interactions by H. Harari also appears here.

Of the remaining lectures, there are two of broad interest. That by P. W. Higgs draws several illuminating analogies between symmetry breaking in relativistic field theories and systems studied in statistical physics, such as superfluids and plasmas. C. H. Llewellyn-Smith describes the seminal attempts, initiated by Weinberg and Salam, to unify the weak and electromagnetic interactions. In Llewellyn-Smith's approach the symmetry properties of the fields are deduced as a consequence of the requirement that the theory be renormalizable. The experimental consequences of these models are also discussed, but here there have been very important developments since the summer of 1973.

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Quantum Mechanics

Orbital Theories of Molecules and Solids. N. H. MARCH, Ed. Clarendon (Oxford University Press), New York, 1974. xvi, 386 pp., illus. $29.50.

Charles Coulson was an applied mathematician, theoretical solid state physicist, and theoretical chemist whose hallmark was clarity of thought and presentation. A group of his friends and former students have put together in his honor this book on the quantum mechanics of electronic energy levels. The chapters on solids deal with band theory, the cellular method, one-body potentials in crystals, and defects in crystalline solids. The chapters on molecules deal with properties of both isolated and interacting molecules. The editor has wisely excluded discussions of isolated atoms and has eschewed the alphabet soup of ab initio molecular calculations.

Each chapter reads like a colloquium lecture. The authors begin with the foundations of their subjects and only later present the details. Most chapters contain judicious evaluations of the relative importance of different developments in the field. This kind of insight is seldom available in the original theoretical literature.

Although suitable as a textbook only for a rather advanced student, this is a book from which one can learn. This reviewer, who is not a solid state theorist, finished Altmann's chapter on the cellular method for metals with a much improved understanding of this often criticized method. The same is true for the chapter by Balint-Kurti and Karplus on the atoms-in-molecules method, which has been improved considerably over its original formulation. McWeeny's chapter on molecular properties is characteristically elegant; it contains a most satisfying explanation of the Jahn-Teller effect. Perhaps the most comprehensive chapter is the one on defects in crystalline solids by Lidiard, who manages in 75 pages to discuss qualitatively the properties of all the principal localized defects and to give for each one an outline of the theory or at least useful references.

These chapters were written while Coulson was still alive. Gentle as he was, Coulson would have asked embarrassing questions about vague or disorganized presentations, and every author seems to have tried especially hard to achieve clarity and coherence with the other authors. *Orbital Theories of Molecules and Solids* is strongly recommended to anyone interested in the subject.

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Virology

Viruses, Evolution and Cancer. Basic Considerations. Proceedings of a conference, Montreal, Aug. 1973. EDOUARD KURSTAK and KARL MARAMOROSCH, Eds. Academic Press, New York, 1974. xxxii, 814 pp., illus. $48.50.

Excitement in particular fields of science is almost invariably reflected in the number of symposiums, conferences, and congresses dealing with those fields. There have been countless meetings dealing with viruses in recent years, and, judging by the proceedings, the Second International Conference on Comparative Virology was an enormous success. The book is over 800 pages long. Its 28 chapters are arranged in seven sections entitled, not always appropriately, Host-Cell-Virus Relationships, DNA Transfer and Virus-Cell Relationships, Comparative Aspects of DNA Oncogenic Viruses, Comparative Aspects of RNA Oncogenic Viruses, Viruses, Cell Surface, and Transformation, Comparative Viral Oncology, Comparative Immunology of Oncogenic Viruses, and Viruses and Their Evolution.

Several aspects of the book stand out. Nearly half of the chapters, and many of the better ones, are multiauthored, undoubtedly reflecting the technical complexity of modern virology. Along with established investigators who perform at nearly every conference, there are recent entrants. I found the chapter by J. L. Melnick, A. L. Boyd, and J. S. Butel on the DNA transfer experiments not only well written but also very interesting; the acquisition of affinity to poliovirus by hamster cells following transfer of DNA from monkey cells is an interesting finding with numerous potential applications. I was pleased to see a well-reasoned, cautious chapter by J. S. Pagano on Epstein-Barr virus and its interaction with human lymphoblastoid cells and chromosomes. Considering the many assertions concerning the role of Epstein-Barr virus in the causation of human malignancy made in the recent past, the objectivity of this chapter is refreshing. A clearly written chapter by R. Sheinin on cell surface virus modification and virus transformation makes up for its brevity by its very scholarly review of the literature. R. Weil *et al.* ably defend the view that papovaviruses are capable of acting as endogenous mitogens and that malignant transformation is a secondary phenomenon. Other notable chapters are by L. Prevec on physiological properties of vesicular stomatitis virus and some related rhabdoviruses, by T. O. Diener on viroids, by D. Solter, W. Biczysko, and H. Koprowski on host-virus relationship at the embryonic level, by M. R. Hilleman on prospects for vaccines against cancer, and by H. S. Ginsberg *et al.* on adenovirus genes and cancer.

The strength of the book is the juxtaposition of animal and plant viruses in the context of properties, gene expression, and evolution; and even here the coverage of bacterial phages could have been expanded beyond the one chapter by W. and E. Szybalski. Its weakness results chiefly from the attempt of the organizing committee to maximize international representation; as a consequence the book conveys little of the current excitement in the molecular biology of papova and oncornaviruses. Many chapters, but notably those on herpesviruses, convey a strong feeling of *déjà vu*. I was disappointed by the printing of halftone illustrations; the electron micrographs of replicating DNA molecules in

the chapter by P. Bourgaux are particularly bad. This is a useful book, although its lifetime, like that of many other proceedings of meetings, will be limited.

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Algology

Algal Physiology and Biochemistry. W. D. P. STEWART, Ed. University of California Press, Berkeley, 1974. xii, 990 pp., illus. $40. Botanical Monographs, vol. 10.

This is an encyclopedic effort to help people who are interested in algae. In 1962 a book called *The Physiology and Biochemistry of Algae* was published, and it dealt with a great range of subjects—many at a very elementary level. The new book is larger and treats many of the same subjects at a much more specialized and detailed level. The science represented here has grown in both factual content and sophistication so that most of us who are interested in algae will find great value in this book. The students of algal physiology and biochemistry are widely scattered in a geographical sense; their publications are widely scattered in the research literature. Thus Stewart's work in organizing this volume is especially useful. Distinguished practitioners review 32 subjects, including natural-products chemistry, subcellular morphology, processes such as photosynthesis and nitrogen fixation that can be described in biochemical terms, and processes such as morphogenesis and reproduction that are described in physiological terms. The review of algal nitrogen fixation by G. E. Fogg is a marvel in both coverage and style. One wishes that all scientific writings were so well done. Further, one hopes that some of the chemists whose work is described in the early chapters will become interested in the physiological processes described in the later chapters. There are fascinating problems in algal physiology that, like the animal pheromone problems of a decade ago, are just waiting for the attention of the chemists.

By some specially meritorious technique, the editor has kept each of the contributors informed in detail of the contents of companion articles, so there is no overlap. The authors have concentrated on the eukaryotic algae (the blue-green algae are covered in a separate volume of this series). This reviewer's only criticism is of the tendency of some of the articles to read like laundry lists. One can't avoid sorting experimental results into taxonomic categories, but every field worthy of review should have some other unifying concepts that the nonspecialist reader needs to be reminded of.

Each review includes an extensive list of references. It is interesting that in such diverse kinds of science there is a rather consistent ratio of references to text. There is also a rather constant and large proportion of papers cited that have been published since 1970, allowing the conclusion that nearly all the fields in algology represented here have been moving at the same accelerated pace.

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Direct Cell Interactions

Cell Communication. RODY P. COX, Ed. Wiley, New York, 1974. x, 262 pp., illus. $22. Wiley Series in the Dynamics of Cell Biology. A Wiley Biomedical-Health Publication.

The coordination of growth and function of individual cells in animal cell populations requires intercellular communication. Such communication can be either indirect (humoral) or direct. Much attention has been paid to hormonal control mechanisms, but until recently the nature and functions of direct cell-cell interactions were largely unknown.

Direct interactions between cells can be classified into two types. The first type involves a general surface-surface recognition of cells in contact, which has been studied, at least in part, as the functional role of cell adhesion. The second type involves the interaction of cells in contact to form specific intercellular junctions. There are several types of junction, each type having a particular function. One type, the gap junction, appears to be freely permeable to small ions and molecules and can therefore provide a direct pathway of communication between the cytoplasms of coupled cells.

This book is a collection of papers dealing with direct cell interactions. It begins with a brief, clear account by N. B. Gilula of what is known of the structures and possible functions of gap junctions, tight junctions, septate junctions, and desmasomes. Gap junctions have a very characteristic subunit structure and can be isolated with little alteration in morphology for chemical analysis. It is proposed that channels in the gap junctional subunits are the routes of intercellular diffusion of small ions and molecules; the evidence for this correlation is summarized by Gilula.

The permeability properties of intercellular junctions have been investigated by electrophysiological and biochemical methods. Papers by J. D. Sheridan and R. P. Cox *et al.* summarize the information obtained from these complementary approaches, and Sheridan (surprisingly the only author to do so) attempts to explain control in a number of biological systems in terms of the known features of junctional communication.

The factors that govern the specificity of synapse formation are unknown, but a form of cell communication must be involved at some stage. G. D. Fischbach reviews the various stages that lead to the formation of the neuromuscular junctions, including the "recognition" stage, which precedes the onset of chemical transmission. Low-resistance junctions (gap junctions) have been detected between nerve and muscle cells, but as yet there is no definitive evidence to implicate them in the recognition process.

Other chapters include a qualitative examination of cell interactions in the skin, a thorough and useful review of contact inhibition of cell locomotion by A. Harris, and an article on cell interactions in the immune response. The remaining authors, unfortunately, have not examined their specialties in terms of cell communication.

This is the first book to try to deal specifically with the new and fascinating problems of direct intercellular communication. The selection of contributions from a range of fields that might be expected to contribute to a better understanding of these problems was clearly made with good intentions. But, as is often the case in multiauthor volumes, not all contributors responded to the challenge.

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Strategies of Prey

Defence in Animals. A Survey of Anti-Predator Defences. M. EDMUNDS. Longman, New York, 1974. xviii, 358 pp. + plates. Paper, $14.50. A Longman Text.

Since the patterns of color, form, and behavior used in avoiding predation reach their greatest diversity in the tropics, it is fitting that a book on predator defense be written by a tropical biologist. Malcolm Edmunds, for 10 years at the University of Ghana, draws extensively upon his African