Book Reviews

Contributions to Chemistry

Boranes in Organic Chemistry. HERBERT C. BROWN. Cornell University Press, Ithaca, N.Y., 1972. xiv, 462 pp., illus. $24.50. George Fisher Baker Non-Resident Lectureship in Chemistry, Cornell University, 1969.

The coverage of this book is not limited to the author's pioneering contributions in hydroboration and the chemistry of organoboranes. It presents an account of his entire research activities over the past 35 years, conveying the true flavor of his discoveries and the personality behind them. It provides the present and future generations of chemists with historical perspective, and with a vicarious experience of the past. Brown's expressed purpose for his approach, in this era of pessimism about the future of basic research in chemistry, was to provide the student and recent graduate with reasons for optimism and a realization that interesting and important research still can be done with only a modest investment in manpower and equipment. In these objectives Brown has succeeded admirably.

In the prologue of the book, the author reminisces about the professors who influenced his early career and describes the many problems he faced as a young scientist in obtaining an academic position and in starting his research program. Part 1 of the book then provides the reader with an account of the author's early studies with diborane and alkali metal hydrides, reagents which in his hands played a key role 20 years later in the development of highly selective reducing agents and the hydroboration reaction. Brown's important early contribution on free-radical chlorinations and chloroformylation, the properties and selectivities of free radicals, and directive effects in free-radical aliphatic substitution are also described in this section.

The next two sections lead the reader into Brown's fundamental work on steric strains and their chemical effects and his contributions on the nonclassical cation problem. His definitive work on steric strains has led to a more quantitative assessment of steric effects in organic chemistry, and thus has brought him the distinction of being the father of modern stereochemistry. The controversy of the nonclassical cation problem, which has dominated the chemical scene for many years, is presented in a fair, factual manner. Brown's demonstrated view that the "unusual" rate and product stereochemical behaviors of many reported chemical systems, especially those containing the norbornyl skeleton, can be attributed simply to steric factors is clearly pointed up.

A section on reductions with borohydrides, aluminohydrides, boranes, and alanes then gives an up-to-date account of Brown's investigations in the development and applications of tailor-made selective reducing agents. These contributions have provided the synthetic chemist with some of his most useful methods for attacking syntheses involving complex stereochemical problems.

The history of organometallic chemistry is punctuated by landmark discoveries which have had a profound influence on the whole of organic chemistry. One of these is certainly the discovery of the hydroboration reaction together with the exploration of the utility of the resultant organoboranes in organic synthesis by Brown and his co-workers. This is the topic of the last two sections of the book. Although only ten years have passed since publication of Brown's *Hydroboration,* the hectic pace and tremendous progress made in this field make these reviews very timely. Especially fascinating are Brown's personal comments which constantly make the reader aware of the influences leading to the initiation of certain research programs and of how by recognizing the significance of and exploiting minor anomalies in experimental results one can open major new research areas.

In summary, the reader of this book must certainly conclude that Brown is one of today's most important figures in chemistry. Few living organic chemists can claim such major accomplishments in such a wide variety of areas. The current status of many of the topics in the book is aptly epitomized in the closing sentences of the epilogue: "There are doubtless additional new continents around us awaiting discovery. They will not be discovered by pessimists, but by optimists, exploring with enthusiasm and hope." Thus, this book is strongly recommended not just to the researcher currently working in the area of organoboron chemistry. One can sincerely hope that every chemist will take the opportunity to read and benefit from this fascinating scientific research autobiography.

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Biochemistry of Development

Critical Variables in Differentiation. BARBARA E. WRIGHT. Prentice-Hall, Englewood Cliffs, N.J., 1973. xvi, 110 pp., illus. $7.95. Concepts of Modern Biology Series.

Genetic and biochemical analyses of gene expression have been eminently successful in defining the temporal sequence of events controlling growth and differentiation of viruses and bacteria. However, it is an open question whether this approach will be effective in the study of differentiation in complex multicellular organisms. The description of developmental changes in transcription and translation of specific genes can point out that these events occur in a well-regulated manner but cannot tell us why they occur. On the other hand, we already know that metabolic processes which affect cellular physiology depend on factors other than the enzymatic complement of the cell, such as compartmentalization, substrate availability, and enzyme activators and inhibitors. In this monograph, Wright emphasizes the role that small molecules may play in differentiation.

Differentiation is considered as an integrated process by which the function of the cell or tissue is redirected. The emphasis is not on the details of each individual biochemical step, but on the interplay of the components. Critical variables are considered to be those which limit the rate of differentiation at particular points in time.

This point of view is applied to biochemical changes which occur during development of the cellular slime mold, *Dictyostelium.* Wright's concern with

the interrelationships of metabolic reactions is emphasized by the presentation of a model of the pathways of polysaccharide synthesis and degradation which can be manipulated by computer. By arbitrarily varying enzyme activity or substrate availability the model can indicate the consequences of such changes on the concentration of cellulose, glycogen, and mucopolysaccharide.

This would appear to be an effective new approach to the sometimes bewildering complexity observed in eukaryotic differentiation, if there were convincing evidence that the model accurately predicts or even describes the changing biochemistry of the cells. Unfortunately, accurate measurements of metabolic rates in vivo are difficult to make. In this presentation, the pitfalls inherent in the measurements are not critically considered. Data supportive of the present model are presented but conflicting results are generally not discussed. To suggest that the physiological steps necessary and sufficient for differentiation are known seems premature, even in as simple a system as *Dictyostelium*. Nevertheless, this book succeeds in reminding us that ultimately we must consider all of the biochemical processes involving both small molecules and macromolecules in the sequence of events from the genes which define the differentiation to the final molecules which give it shape.

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Neuroendocrinology

Steroid Hormones and Brain Function. Proceedings of a conference, Los Angeles, May 1970. CHARLES H. SAWYER and ROGER A. GORSKI, Eds. University of California Press, Berkeley, 1972. xiv, 388 pp. + plates. $30. UCLA Forum in Medical Sciences, No. 15.

The decision of Sawyer and Gorski to organize a conference bringing together the varied research findings of 30 scientists approaching the subject of relationships between the endocrine and the central nervous systems from different disciplines, concerns, and methodologies is itself to be applauded. The proceedings of that conference, now consolidated in book form, offer a valuable synopsis of the work accomplished in this area since the 1963 conference on "The Brain and Gonadal Function." The specific research findings are preceded by an introductory chapter written by Gorski, on "progress, principles, and problems," in which he presents a brief review of recent advances in neuroendocrinology, and the material is summarized in a concluding chapter prepared by Davidson. Rather than being a loose collection of individual research papers, the conference proceedings, and the book, reflect the efforts of Sawyer and Gorski to develop and follow a central theme—how steroid hormones alter brain function—at four levels of inquiry: intracellular, intercellular, systemic, and organismal.

In addition to providing a framework in which to view the research reported, the editors have reproduced the question-and-answer session at the end of each talk, thus preserving the dynamic spirit of the conference without sacrificing coherent and substantive presentation of material.

The effects of steroid hormones on brain function have been explored primarily in terms of electrophysiological and behavioral parameters, although some morphologic, biochemical, and clinical aspects also have been considered. Implicit in the research reported is the dual nature of hormonal action on the central nervous system, that is, regulatory as well as organizational, the latter being predominant during the developmental period. Thus, the effects of steroid hormones on the brain have been investigated during certain "crisis" growth periods—fetal, perinatal, and pubertal.

The mechanisms of steroid feedback and brain-pituitary function have been elaborated in several species—rat, cat, rabbit, monkey, and man—and although, as is reiterated throughout the book, the existence of hypothalamic releasing factors now has been firmly established, the possibility of a direct feedback of steroid hormones on the pituitary has not been eliminated; in fact, it is a primary concern of several of the investigators participating in the conference.

The physiology of hormone receptors and the biochemistry of hormone-binding to cell nuclei and cytoplasmic macromolecules, considered in several chapters, represent one of the most recent directions of research in this area. In fact, more attention to this aspect of the subject would have enhanced the book, inasmuch as hormonal influences on brain development and function have been well documented; our current concern is to seek, rather, the specific mechanisms of action at the cellular and molecular level by which these effects are produced. Such a criticism, however, may reflect the vantage point of one speaking three years later, when much has been added to our understanding of the subject. In any case, the lack should not detract from the excellence of this volume, which is a fine reference text not only for the neuroendocrinologist but for all of those working in endocrinology, neurology, and psychology whose specific research interests are in the relationships between hormones and the central nervous system at different age periods.

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The Dirac Story

Aspects of Quantum Theory. ABDUS SALAM and E. P. WIGNER, Eds. Cambridge University Press, New York, 1972. xvi, 268 pp., illus. $23.50.

This is a collection of essays dedicated to P. A. M. Dirac on the occasion of his 70th birthday. The Dirac story is on the whole a success story. Nevertheless two of the most substantial articles here are concerned with two "suggestions of Professor Dirac that nature does not seem to have used." They are by Amaldi and Cabibbo, on the so far unsuccessful search for the magnetic monopole, and by Dyson, on the lack of evidence so far for any time variation of fundamental physical constants. But several of Dirac's suggestions *have* been used by nature, and several more at least by theoretical physicists. These are very properly celebrated here: the Poisson bracket and quantum mechanics (by Lanczos), the bra and ket formalism (Jauch), the delta function (Schwartz), the quantization of radiation (Jost), the Fermi-Dirac statistics (Peierls), the Dirac wave equation (Wightman), the classical radiation reaction (Pais), and the indefinite metric (Heisenberg). The tone is not entirely one of piety. Thus Peierls mentions an occasion when Dirac was "somewhat naive" (conjecturing Fermi-Dirac statistics for gas molecules); Schwartz recalls the horror of mathematicians at Dirac's delta function; and Jauch argues at some length against Dirac's view that his formalism could be presented with mathematical rigor "only in a cumbersome way which would tend