tion of the future which is rapidly becoming the present. As the proceedings of a conference with recorded paraphrases of the discussion, it condenses a great deal of intelligent thought on problems and uses of computers. The expositions on the logical problems of classification, on data systems for hospitals and large-scale vital statistics, and the commentaries on the extraction of significant wave forms make this another indispensable volume on the reading list of any quantitatively minded biologist, even apart from its use in orientation toward computer applications.

The contributions thus give an excellent perspective on the uses of computation for biomedical research. For many biomedical researchers today, the computer's most important uses are perhaps in signal analysis and in x-ray crystallography, and all of these works pay considerable attention to analog processing and digital numerical analysis. For these applications, the digital machine is simulating an analog device which, except for inflexibility in reprogramming, could well outperform the digital machine. Stress on such simulations might obscure the role of the digital computer as an automaton whose fundamental processes are in fact not numerical but logical. Indeed, great ingenuity has had to be applied to achieve the realization of arithmetic operations as complexes of the logical steps inherent in the computer. This concept is of course underlined as an aspect of engineering design, and it is fundamental to Newell and Simon's chapter "Programs as theories of higher mental processes" (in *Computers in Biomedical Research*, vol. 2). Thus, the utility of the computing machine as a numerical analyst may eventually awaken the biologist's attention to an event of phylogenetic rather than historical significance: the emergence of a symbol-manipulating organism which is now well launched on a distinctive evolutionary pathway. If many a human being congratulates himself that his power to turn off the machine is still the decisive fact of this symbiosis, he may be rudely disillusioned—say by a spell in prison—should he violently attack an economic value on which many hundreds of his colleagues depend.

The phylum Automata is evolving rapidly—doubling its general capability at intervals of about 15 months—according to a new set of rules that we dimly understand. Even more consequential than the hardware are the programming systems and languages which have by no means exhausted the capabilities of last year's hardware. With his concern for the forces that underlie organic evolution, the biologist has a special responsibility to understand the phylogeny of automata as a major component of the orthogenesis of the planet. These works are not directed to such ethereal issues, but a by-product of their educational message to biologists is an appreciation of the microscopic anatomy and system physiology which must underlie the ecology of these new organisms.

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## Photobiology

**Light: Physical and Biological Action.** Howard H. Seliger and William D. McElroy. Academic Press, New York, 1965. xii + 417 pp. Illus. $12.

There is an increasing need for texts that cross interdisciplinary boundaries and facilitate communication between the highly specialized and diverse fields of science. One obvious area in which this sort of communication is essential is photobiology, where the physics of radiation is of direct importance to an understanding of the biological action of light. The authors of this volume, physicist and biochemist respectively, are eminently well qualified to provide such a synthesis and coherent treatment of the diverse approaches to photobiology, so that it was with some anticipation that I received the book. Unfortunately, an overabundance of technical detail and an inadequate handling of organizational detail have detracted from the presentation. Few interdisciplinary gaps are narrowed, and some may be widened.

In the preface the authors state that they intend "to give beginning students a general introduction to the important problems which are usually considered in photobiology." The book jacket adds that this is "an attempt to bridge the diverse fields of the physics of radiant energy, excited states of organic molecules, energy transfer mechanisms, chemiluminescence, bioluminescence, structure of light receptor systems, photosynthesis, photoperiodism, photomorphogenesis, phototropism, phototaxis, vision, photodynamic action, photoreactivation, and photoprotection." It is also predicted that the book will "serve as an up-to-date reference for research workers in other fields." With such a task before them it could almost have been predicted that the result would fall short of expectations. It is questionable whether a textbook can (or should) assume a dual role as an introduction to the subject and as a reference work for researchers.

The "beginning student" may have difficulty with parts of this book because a considerable degree of sophistication is assumed in physics, chemistry, and biology. He will be expected to appreciate the quantum mechanical representation of the transition probability for radiation absorption and emission, and he must also understand the significance of a number of undefined terms such as Hill reagents, DNP, actinomycin D, compensation point in photosynthesis, Johnson noise, and the like. Beer's law is not even mentioned, although the expression is used to define the molar extinction coefficient, and the "reciprocity law" is not adequately treated in the brief reference on page 207. The student may also be confused by a number of inexact descriptions and contradictions. For example, on page 320 he learns that "the light regions effective in photoreactivation . . . exhibit action spectra characteristic of pigment absorption" and 18 pages later he finds that "the chromophore for photoreactivation could be a strained nucleic acid [strained nucleic acid?] or protein." He may wonder what a "limited half-life" is (p. 265), or how "aside from the fact that it is consumed" light "is a 'catalyst' " (p. 82). The absorption maximum for aromatic amino acids is indicated as occurring at about 3600 Å instead of 2800 Å. An appendix provides the useful conversion that 1 ev is equivalent to 12397.7 Å and the not-so-useful one that 1 Å is equivalent to 12397.7 ev.

The more advanced student with sufficient background in physics will find the chapter "Excitation of molecules by light" very clearly written and very informative. The two chapters on chemiluminescence and bioluminescence are understandably complete since this is an area of the authors' speciality. The last chapter (one-third of the book) is entitled the "Biological action of light." In this chapter, my area of specialty, ultraviolet inactivation and recovery phenomena, received a rather spotty and inaccurate treatment.

Research workers in photobiology

who have already "bridged the gap" will find in this book a wealth of practical information on techniques as well as excellent documentation of current knowledge in most of the areas of photobiology. Such researchers may overlook the minor inconsistencies and problems in organization and find the book very useful as a reference work or as a means of broadening their own horizons in photobiology.

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## Biochemistry

**Comprehensive Biochemistry.** vol. 6, *Lipids and Amino Acids and Related Compounds.* Marcel Florkin and Elmer H. Stotz, Eds. Elsevier, New York, 1965. xvi + 323 pp. Illus. $17.

As part of section 2 of *Comprehensive Biochemistry,* this volume, *Lipids and Amino Acids and Related Compounds,* is mainly concerned with the organic and physical chemistry of naturally occurring compounds, in this case, of lipids (part A) and of amino acids, peptides, and amines (part B). The subject matter is most readily summarized by the chapter titles, which are (together with the names of the authors): "Fatty acids, long-chain alcohols and waxes" (by J. F. Mead, D. R. Howton, and J. C. Nevenzel), "Neutral fats and oils" (by J. A. Lovern), "Phospholipids and glycolipids" (by D. J. Hanahan and H. Brockerhoff), "General chemistry of the amino acids" (by R. J. F. Nivard and G. I. Tesser), "Nitrogenous bases" (by N. van Thoai), "Melanins" (by J. Harley-Mason), "Peptides: Synthetic methods and applications" (by G. W. Anderson), "Capsular polypeptide" (by G. Ivanovics), and "Synthesis of bacterial glutamyl polypeptides" (by V. Bruckner).

Unlike all the other chapters, which are limited to organic chemical aspects of the compounds in question, the chapter on nitrogenous bases describes the formation of these substances (that is, amines, betaines, and guanidine derivatives) by "biochemical methods" as well as by "chemical methods." Consequently, that chapter per se provides a survey of the presently available knowledge of the biochemistry of nitrogenous bases, and it can serve as a supplement to Guggenheim's classic, *Die biogenen Amine.*

All the chapters present up-to-date summaries of their fields, with references to literature published as recently as 1964. Although many of the chapters are very well done, the need for a volume such as this one is open to question; all the material presented has been covered in greater detail, and often by the same authors, in one or more recent books or review journals. It is doubtful whether, for example, an organic chemist, or an organic biochemist, interested in the methods applicable to the synthesis of a given polypeptide would choose this volume as his reference source. And, one must admit, the excellent chapter on peptide synthesis is too highly technical to appeal to the nonspecialist.

The volume suffers from a number of defects, not the least of which is its extremely high price. Although American readers will appreciate the fact that the entire text is in English, it is obvious that several chapters were originally written in another language, and in several instances, the translations are barely adequate. The index is not as complete as it should be: For example: there are two entries under "5,6-dihydroxyindole," both of which refer to chapter 6 where the structural formula also is given; however, the same compound is mentioned, and its formula is shown, in chapter 5, albeit under the name "5,6-dihydro-oxyindole" (a term that is *not* listed in the index).

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## The Modjokuto Series

**The Social History of an Indonesian Town.** Clifford Geertz. M.I.T. Press, Cambridge, Mass., 1965. vi + 217 pp. Illus. $7.50.

This impressive book dealing with culture change in an Indonesian town is a continuation of the "Modjokuto Series" published by M.I.T. Press. The present work represents an attempt to portray the social history of one Javanese community from about the middle of the 19th century to the middle of the 20th century. Geertz is well known to specialists for his previous studies in Indonesia, and with the present book he once again proves his skill in portraying the changing social patterns of one Indonesian town. The author's goal is to present the processes of the "interaction of ecological, economic, social structural, and cultural factors over a reasonably extended period of time" and at the same time to reach some conclusions about the "relative importance of these factors in shaping human life" in Modjokuto. In so doing he is not writing a history of that town, but he is presenting us with a controlled analysis of processes of social change by means of the formulation of several theses. One of Geertz's contentions is that the village pattern of mid-1954 Java, characterized by "over-crowded settlements, hyperintensive wet-rice agriculture, a rather flaccid social structure, and widespread cultural disorientation," was the result in some significant measure of interaction between capital-intensive commercial agriculture in Dutch hands and labor-intensive subsistence agriculture by the Javanese. Geertz further holds that urbanization in Modjokuto is not the result of the conversion of the village into a town by gradual elaboration of local customs and institutions, but rather has taken place through the integration of extra-local groups into a new pattern of social organization. Cosmopolitanism in Indonesia, Geertz believes, grew out of the intrusion of already highly cosmopolitan groups into the local setting, rather than being the result of an increased sophistication among the leading elements in the local population. It may be added that, with increasing rapidity of acculturation as part of a universal trend of urbanization, this type of social change and urbanization is taking place in many parts of the developing nations.

In tracing the development of Modjokuto from the colonial to the "free" period, the author attempts to show that as far as this particular Javanese community is concerned, the major development in the postindependence era was the emergence (although halting and often most frustrating) of a novel pattern of political, social, and cultural organization. I feel, however, that rather than being a new form of sociopolitical organization, this development may equally well represent a reformulation of existing structural units made possible by the availability of new post-independence choices for action; the town's people surely recognized new alternatives and possibilities for action, as well as an increased range for restructuring their ideological affiliations.

By way of validating the processes of change in Modjokuto, Geertz uses a local election to document the realignment and the emergence of new be-