Quasi-spin is introduced to treat the creation and annihilation operators on the same footing as that on which isotopic spin treats protons and neutrons. All sorts of odd results for matrix elements of atomic operators, such as absorbing them into the coulomb interaction if the quasi-spin is odd, can be seen to follow from the behavior of quasi-spin. The isolated character of these results, which were originally come upon by chance, is changed to logical connection. The complicated properties of atomic operators, especially some involving long mathematical derivations, become transparent when expressed in the formalism of creation and annihilation operators and quasi-spin.

Perhaps there will be another series of lectures on the applications of Lie groups in atomic spectroscopy which will give us an opportunity to understand that too.

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New Concepts in Biology

Theoretical and Experimental Biophysics. A Series of Advances. Vol. 1. ARTHUR COLE, Ed. Dekker, New York, 1967. 409 pp., illus. $17.50.

This volume represents the first in a series intended "to provide a collection of topics which typify the increasing utilization of the concepts and tools of chemistry, physics, and mathematics in the study and description of biological phenomena." It is aimed at both the specialist and the novice.

In the opening section, entitled Water Structure, H. J. C. Berendsen critically evaluates a number of conflicting theories. He also considers briefly the possible influences of macromolecular surfaces, solutes, and the properties of hydrates. Data otherwise scattered in the literature on the water molecule, the hydrogen bond, ice I, and water are tabulated.

Berendsen judges all existing theories of water structure to be too simple and incomplete. A detailed structural and thermodynamic theory seems not to be in sight. Modified two-state theories, with an ice-like state and a broken-down state (made up of a distorted ice lattice with interstitial sites filled), are deemed to be the most promising. He proposes that interstitial molecules are hydrogen bonded either to the framework (coupled to orientational defects) or to each other (the ice VII model). But in a note added in proof, inspired by the findings of Falk and Ford on HDO infrared absorption, he alters his position. The broad, smooth, single-peaked distribution of hydrogen bond strengths appears to rule out the existence of different distinct kinds of water molecules with different numbers of hydrogen bonds and, accordingly, all two-state and cluster theories. A modified Danford-Levy model with hydrogen-bonded interstitials and a distribution of dimensions (such as Gurikov and Berendsen proposed independently) is not ruled out, and continuum models are supported.

The second contribution is a stimulating and refreshingly impartial discussion of Mechanisms of Biological Motility by W. Thornburg. The thesis presented is that "many types of motility depend upon the coupling of mechanochemical events at neighboring sites [on or between organelles] and, generally, on propagated sequences of such events." Although the author understandably makes little headway in the complex morass of this topic, his approach is much to be commended. Unfortunately, he falls into a well-populated trap. He elevates numerous hypotheses to the status of theories of amoeboid locomotion and plasmasol streaming without explicitly recognizing that the hypotheses generally are aimed merely at single, very limited facets of these enormously complex processes. It is not likely that hypotheses expressible in a few terse sentences are destined to convey much enlightenment on the mechanisms of amoeboid locomotion. Thornburg's treatment can be recommended to both the specialist and the novice, but with the caution that some theories cited are simplified to the point of inaccuracy.

The next section, by L. Stark, Y. Takahashi, and G. Zames, is titled Biological Control Mechanisms: Human Accommodation as an Example of a Neurological Servomechanism. Here an unevenness of treatment in the book breaks surface in a review characterized by overpowering technical jargon that will be intelligible to specialists only. Even in the introduction, terms like "intermittent input adaptive characteristics" and "input-synchronized intermittency operator" appear, and the pace never slackens. Phrases like "only few other-developed devices" should be translated as "only a few devices developed by others." The content, style, and level of this section are conveyed best by the authors' summary:

> Experiments have been designed to demonstrate that the human accommodative system operates with an even-error-signal mechanism under restrictive monocular viewing conditions. Retinal blur is such an even-error input signal, and thus these experimental results add to the evidence considering blur as the effective input signal in accommodation. The random or 50% erroneous initial direction of movement is a null experimental result which should be robust to a variety of experimental artifacts that may have contaminated previously published results.
>
> The 2-cps oscillation does *not* have a physiological role in converting the even-error blur signal to an odd-error signal by some phase-sensitive demodulation operation. The oscillation may rather be understood as the consequence of important nonlinear characteristics of the accommodative servomechanism. Input-adaptive predictive capability of the accommodation system is related to similar capabilities in versional visual tracking and in hand-tracking studies.

There follows a fairly exhaustive section, by G. W. Barendsen, on the Mechanism of Action of Different Ionizing Radiations on the Proliferative Capacity of Mammalian Cells. The impairment of cellular reproductive capacity by ionizing radiations results from a sequence of physical, chemical, and biological changes. Findings are shown to be consistent with the hypothesis that from 10 to 15 ionization-induced chemical changes must occur within a region of the cell roughly 100 Å on a side to initiate lethal damage to mammalian cells. The most sensitive structure is the cell nucleus, but only small parts of it need be affected for lethal damage to result.

C. R. Woese contributes an excellent critical review of The Genetic Code—1964, which presupposes a reasonable knowledge of genetic control of gene expression, the mechanisms of gene replication and transcription, and a good deal of the mechanisms of protein synthesis.

The book is concluded by the editor's chapter on Chromosome Structure, with emphasis on experimental observations and models of fine structure and molecular organization. The author suggests a model for the mitotic chromatid formed by an initial strand "of eight DNA-protein chains with S-S bond continuity," in which the strand "twists up on itself, doubles over, twists up again, doubles over, and twists up again (third-order cohelix)." This structure would provide a reason-

able correspondence with the reviewed observations of structure, function, and chemical properties, but would leave difficulties in deriving "completely pleasing explanations for mechanisms involved in replication, condensation, aberration, genetic expression (transcription), crossing over, etc." Cole ends with the observation that a satisfactory description of the chromosome still is not at hand.

The book is well produced. The writing, being of average quality, would have benefited much from editorial correction. The adverbial suffix continues to cause problems (from England comes "random-connected," referring to a possible type of genetic code), and other grammatical errors are not rare. Humorous aspects are not lacking. For example, on page 345 we learn of studies of sectioned chromosomes of the "rat kangaroo," this beast perhaps being the creation of a well-meaning copy editor. Aside from the few criticisms mentioned in the foregoing, I recommend this first work of the series to interested readers.

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Toxicology

Biochemistry of Some Foodborne Microbial Toxins. Papers presented at a symposium on microbial toxins held during the meeting of the American Chemical Society, New York, Sept. 1966. RICHARD I. MATELES and GERALD N. WOGAN, Eds. M.I.T. Press, Cambridge, Mass., 1967. 183 pp., illus. $7.50.

The ten papers assembled in this book cover the chemistry and toxicology of the toxic metabolites of bacteria, algae, and higher fungi that are of significance as possible contaminants of animal or human food. Some new and unpublished data are contained in the papers on staphylococcal enterotoxin and botulinum toxin, but these toxins have been the subject of several recent reviews. Bongkrek poisonings are less well known outside of Indonesia, so the paper relating the possible role of a bacterium (*Pseudomonas cocovenenans*) and its metabolic products (toxoflavin, bongkrek acid) in the disease should be of widespread interest. The toxic algal products from six species of dinoflagellates, two blue-green algae, and one yellow-brown alga are discussed. Although the algae are toxic mainly for fish, shellfish, and other forms of marine life, some are poisonous to all higher animals. Fungal toxins are also treated. These toxins have gained prominence in recent years, since some (aflatoxin, ochratoxin) are known to be potent carcinogenic agents for experimental animals. Possible derivatives of other mycotoxins (gliotoxin, chetomin, sporidesmin) may become useful antibiotics. And still others, such as a metabolite from *Fusarium graminearum,* produce an estrogenic effect in animals. This book will be useful to workers in nutrition, toxicology, biochemistry, and microbiology, and to persons involved in the protection of foods.

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Polymer Chemistry

Polymerization by Organometallic Compounds. LEO REICH and A. SCHINDLER. Interscience (Wiley), New York, 1966. 750 pp., illus. $25.

This book is the latest volume in a series of specialized reviews in macromolecular chemistry published by Interscience. The authors are to be commended for a worthwhile contribution. They have attempted to give an up-to-date summary of the literature in an area of research where the volume of publication has increased asymptotically. The most useful parts of the book are the chapters Some General Considerations on Catalyst Activity, Mechanism and Kinetics of Polymerizations with Ziegler-Natta Type Catalyst Systems, Metal Organic Catalyst Systems Involving Free Radical Mechanisms, Some Aspects of Cationic Polymerization, and Copolymerization. These chapters present up-to-date reviews such as are not available elsewhere. I do not mean to imply that the other chapters are not useful ones, though a major part of the material in them is covered in other reviews. The authors' attempt to report on most of the serious literature in the field has resulted in a book with rather complete coverage, but, as always when such an attempt is made, one must sometimes make his own choice of point of view. In this field, it is difficult as yet to write a text in which answers are simple and in which attempts to generalize on the mechanisms of these catalyst systems are successful.

Chapter 2, which is entitled General Theoretical Concepts of Polymerization, in my opinion is not particularly well written. It is a condensed survey of theory, primarily polymerization kinetics, copolymerization, and stereochemical considerations of polymers, and it suffers by being loosely organized.

The authors write in their preface that this book should be useful for research workers and graduate students who have been introduced to polymer chemistry and who wish to broaden their knowledge in the field of organometallic-catalyzed polymerization. This may be so in part, but the next statement in the preface, that the book is not a reference work or directed toward the specialist, can be questioned. The book, particularly the chapters mentioned, has helped me review the literature, and I urge that all research chemists or senior graduate students working in the field of macromolecular chemistry have a copy available for ready reference.

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Books Received

Advances in Computers. vol. 8. Franz L. Alt and Morris Rubinoff, Eds. Academic Press, New York, 1967. 357 pp. Illus. $14.50. Six papers.

Advances in Electrochemistry and Electrochemical Engineering. vol. 6, *Electrochemistry.* Paul Delahay, Ed. Interscience (Wiley), New York, 1967. 494 pp. Illus. $19. Five papers.

Advances in Gerontological Research. vol. 2. Bernard L. Strehler, Ed. Academic Press, New York, 1967. 445 pp. Illus. $18.50. Eight papers.

Anorexia Nervosa. Helmut Thomä. Translated from the German by Gillian Brydone. International Universities Press, New York, 1967. 350 pp. Illus. $8.50.

Arms Control and the Atlantic Alliance: Europe Faces Coming Policy Decisions. Karl W. Deutsch. Wiley, New York, 1967. 181 pp. Illus. $5.95.

The Baboon in Medical Research. vol. 2. Proceedings of the Second International Symposium on the Baboon and Its Use as an Experimental Animal (San Antonio, Texas), Fall 1965. Harold Vagtborg, Ed. Published for the Southwest Foundation for Research and Education, San Antonio. Univ. of Texas Press, Austin, 1967. 922 pp. Illus. $15. Sixty-seven papers.

Behavioral Science Frontiers in Education. Eli M. Bower and William G. Hollister. Wiley, New York, 1967. 553 pp. Illus. $8.95.

Calculus. vol. 1, *One-Variable Calculus, with an Introduction to Linear Al-*

(*Continued on page 169*)