

most familiar, recognizing fully their limited applicability. When offered without pretense such data have great intrinsic interest. X. de Planhol, in discussing traditional craft industries in the Sahara and the Middle East, is notably successful in exciting the reader's interest and in presenting well-grounded speculations as to origins and projections of future trends. Still another approach is exemplified by T. N. Jewitt's discussion of desert soils. It is a fine short course on soil genesis and morphology; but it tells little about which soils occur where and to what areal extent.

It is unlikely that a superior group of experts, in terms of topical coverage or individual specialized knowledge, can be assembled to write on arid lands. This reader is forced to conclude, however, that if a satisfying geography of a systematically defined but vast and discontinuous region is to be written it will have to be by a single author. A counterpoint of broad generalization and specific example must recur throughout the topical treatments, but they can be introduced in accordance with some plan, not as a random set of authors' predilections.

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Ichneumon Flies

A Catalogue and Reclassification of the Neotropical Ichneumonidae. HENRY TOWNES and MARJORIE TOWNES. American Entomological Institute, Ann Arbor, Mich., 1966. 371 pp. \$11. *Memoirs of the American Entomological Institute*, No. 8.

This catalog and reclassification is a major work on one of the most important families of insects. The Ichneumonidae are not only, in number both of species and of individuals, among the most abundant terrestrial invertebrates, but also are of great economic value because they parasitize other arthropods, finding hosts especially in the multitudinous and destructive insect orders Lepidoptera and Coleoptera. This family has long been one of the least-known groups of animals, and it is only within the last few decades, and primarily through the efforts of the Towneses, that progress has been made toward a workable classification of this difficult complex. Even in studying the more familiar Nearctic and Palaearctic faunas, it has until recently been neces-

sary to consult the type specimens in order to identify most ichneumonids. With regard to such less-known regions as the Neotropic, anyone who has considered those faunas will attest that before the work of Townes the modern student was little better off than his predecessors in the days of Linnaeus, because most literature on the Latin American Ichneumonidae has consisted only of the random and generally inadequate description of isolated species.

Faced with overwhelming taxonomic and nomenclatural chaos, the Towneses were obliged to examine, in museums throughout the world, almost all extant types of Neotropic ichneumonids. Thus they made authoritative synonymies and assigned the described species to their proper genera in the practical and coherent system they have elaborated during a lifetime of work on the parasitic Hymenoptera. In this way 1771 valid species were cataloged for the Neotropic realm and a secure basis was established for all future research on this fauna. Such research will be voluminous, as the Towneses estimate that 90 percent of the Neotropic species remain undescribed.

This memoir also contains Henry Townes's "A Key to the Genera of Ichneumonidae Recorded from the Neotropic Region." I have used this key on large collections of Ichneumonidae from Costa Rica, Peru, Chile, and Argentina. My experience has been that it permits relatively easy identification of the majority of Central and South American genera. There remains, however, a large unclassifiable residue. This is both because many genera are presently undescribed and because Townes bases his definitions of described genera only upon their published species and, consequently, in certain cases his diagnoses will not quite fit some of the numerous unnamed forms which almost all genera still contain. I point out also that the Towneses are now completing a revisional study of the ichneumonid genera of the world which will contain keys, descriptions, and illustrations of each genus. This, when it appears, will supplement and in part supersede the more abbreviated treatment given here. Meanwhile, the present key opens to study an ichneumonid fauna which previously confounded even those fortunate to work at institutions with comprehensive libraries and collections.

In the words of the Towneses:

"With this catalogue all of the described ichneumonids of the world are now covered except for those in Europe, Asia Minor, and Africa. . . . There are plans for cataloguing the Ethiopian species, and certain European colleagues are working on the species of the western Palaearctic. With these, the taxonomy and nomenclature of the ichneumonids will have become more precise and orderly than in any other major group of animals. . . ."

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Spectroscopy Method

Second Quantization and Atomic Spectroscopy. G. H. Dieke Memorial Lectures. BRIAN R. JUDD. Johns Hopkins Press, Baltimore, 1967. 71 pp., illus. \$5.95.

The lectures which this book contains were presented to commemorate the major contributions of G. H. Dieke to the development of spectroscopy, especially with respect to the configurations of *f*-shell electrons as found in the rare earths. The advantages of second quantization are shown as an amplification of the tensor calculus developed by Racah. Second quantization is introduced with simple illustrations of the commutation of creation and annihilation operators which can be worked out by the reader and from which he can gain a real grasp of what is going on. The correspondence between matrix elements and Feynman diagrams is shown in an understandable way, another of the mysteries of the modern approach being thus dispelled. Diagrams offer an elegant method of writing matrix elements and lead, as usual, to methods of counting to see that all the relevant interactions have been included. In fact the whole idea of applying second quantization to a subject understood in its customary form is an excellent way of introducing the new methods.

The book pulls together many of the results of atomic spectroscopy, bringing out the connections between them and thereby leading to an understanding of the underlying theory. It must be borne in mind that this is a series of lectures, the details of which will be more understandable the better one knows the conventional methods. It helps if the reader is familiar with Racah's work.

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-