though the insect and mite enemies of thrips pest species are numerous few seem to give timely and dependable control. A general evaluation of the extensive tabulations of miscellaneous records of these relationships would have been helpful to the reader seeking to place thrips in their proper perspective.

The omissions are few and minor. Some thrips do feed on roots as well as most other plant parts. With several hundreds of host plants known, it is not strange that such plants as cacti, succulents, hollyhock, pyracantha, and toyon should be omitted. References to many biological studies on agriculturally injurious species of thrips, as well as on species that attack nursery plants and flower seeds, that have been reported in trade journals and experiment station publications obviously had to be omitted. The dispersal of thrips has taken place by rafting as well as by wind currents. From the compilation of distributional records presented, it is difficult to visualize the numbers and diversity of thrips in relation to latitude or biogeographic zones.

This book does very well what the author set out to do—condense "many valuable snippets of published and unpublished information and combine them with major contributions before the task becomes too daunting." However, in traversing the neatly stacked rows of known facts concerning these tiny insects, one hopes for, but does not find, a general summary of their attributes and their place in the insect world.

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Aneuploidy in Plants

Cytogenetics of Aneuploids. GURDEV S. KHUSH. Academic Press, New York, 1973. xiv, 302 pp., illus. $17.50.

The cytogenetics of aneuploidy is a very specialized subject of both theoretical and practical importance. While the doubling of the entire chromosome complement of a plant usually has little effect on fertility, addition of a single chromosome can result in very drastic changes to the phenotype and lead to sterility. On the other hand it is possible to replace a chromosome of one species by that of another (a so-called substitution line) and obtain a modified but often viable phenotype. All these manipulations permit us to discover what effect chromosomes as cellular organelles have on the phenotype and to learn more about interactions among chromosomes and the genes they carry.

Because aneuploidy is a specialized aspect of cytogenetics usually treated cursorily in textbooks, Gurdev Khush undertook to write a textbook solely on aneuploids. It was his hope that the book would (i) supplement standard cytogenetics texts for use in advanced courses, (ii) serve as a reference source for research workers and teachers, and (iii) bridge the gap between plant and animal cytogenetics. The book attains the second objective adequately, the first poorly, and the third not at all.

The greatest value of the book lies in the exhaustive and comprehensive review of the literature of plant aneuploidy. Almost every conceivable aspect has been reviewed. There is a bibliographical list of 25 pages with over 600 references, from Blakeslee's first paper on *Datura* to the latest paper on protein electrophoresis of aneuploids. On the other hand the subject is presented in a highly descriptive fashion, with a possible overemphasis on the technical aspects. As a result the book is hard to read, and the reader has to be prepared to skip over a great deal of very technical and specialized material in order to get an overview of the field. For example, the first chapter after a very brief historical introduction presents a page and a half of definitions of terms followed by five pages of discussion on the most adequate terminology for aneuploids. This chapter is followed by a lengthy and interesting but very specialized discussion of how trisomics can be and have been obtained. It is only in the third chapter that the subject, namely, the cytogenetics of aneuploids, is introduced. If most of the first chapter had been relegated to an appendix or a technical journal and the second chapter had been combined with chapter 7 and put toward the end, the book would have gained much as a didactic tool. Finally, save for a final short chapter of seven pages on aneuploidy in animals and man, the book is devoted entirely to plant cytogenetics and will be of use only to people interested in plants.

In summary, this book is a very thorough, up-to-date and detailed review of the cytogenetics of plant aneuploids. It can be used as supplementary reading in advanced courses, but it has serious deficiencies as a textbook. Finally, the void between plant and animal cytogenetics (if indeed such exists) will not be bridged by this wholly botanical volume.

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Techniques and Their Uses

Plant Tissue and Cell Culture. H. E. STREET, Ed. University of California Press, Berkeley, 1973. viii, 504 pp., illus. $32.50. Botanical Monographs, vol. 11.

In the last decade or so, the cultivation of plant tissues, cells, and protoplasts on chemically defined media has changed from a laboratory curiosity to a useful tool for the probing of basic biological questions as well as for the investigation of important agricultural problems. This book is an authoritative and reasonably up-to-date compendium of basic methods used in plant cell culture. It offers as well some insight into the major questions addressed and in some instances solved by the use of those techniques.

For readers unfamiliar with the field (and in my experience this includes many zoologists and microbiologists who ought to know better) this book will reveal that many, if not most, plant tissues can be cultivated indefinitely on relatively simple, completely defined media. Cultures can be started from single cells, which grow into undifferentiated callus; from such callus, roots and shoots and even flowers can be regenerated, generally through hormonal provocation. Besides providing a useful technique for propagation and multiplication of desirable genomes, this proves the persistence of totipotency, even in differentiated cells. Even further, one can go to enzymatic removal of cell walls, to yield naked protoplasts in bulk. Such protoplasts can reform cell walls and go on to make entire plants; they can also be fused in vitro to make somatic hybrids; and they can pinocytotically engulf virus particles, chloroplasts, DNA strands, and other large objects. Anther cells can be made to grow into haploid cultures, which also differentiate normally. The field thus seems ready to explode into agricultural importance.

Street has received able collaboration

in the form of chapters on selected subjects from eight of his British colleagues and one German investigator. All have worked in the field, and have authoritative things to say. All chapters are illustrated, some with photographs and electron micrographs, others with line drawings and graphs, still others with tables of biochemical data. All cite numerous references arranged conveniently in alphabetical order at the end of the book. The book is thus comprehensive and useful.

The editor provides introductory and final chapters that set the tone and summarize capably. He obviously has good taste and style, and his authors have either learned these good habits from him or have been preselected to fit the pattern. I know of no better recent compendium.

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Physical Chemistry of Water

Water. A Comprehensive Treatise. FELIX FRANKS, Ed. Plenum, New York, 1973. Vol. 1, The Physics and Physical Chemistry of Water. xx, 596 pp., illus. Vol. 2, Water in Crystalline Hydrates; Aqueous Solutions of Simple Nonelectrolytes. xx, 684 pp., illus. Vol. 3, Aqueous Solutions of Simple Electrolytes. xviii, 472 pp., illus. Each volume, $37.50; by subscription, $32.50.

Everybody knows that water is the most abundant compound on the earth's surface, the principal constituent of all living organisms and the perennially largest entry in the *Readers' Guide to Periodical Literature*. But it may be less well known that intensive study of its detailed physical properties dates only from about 1960. As a solvent and even as a pure liquid or solid, water is an exceedingly complex substance, and until quite recently scientists have tended to avoid coming to grips with its structural features on the microscopic level.

This three-volume treatise (a fourth volume, "Aqueous Solutions of Macromolecules; Disperse Systems," is nearing completion) is easily the most ambitious and extended treatment of this ubiquitous material. The only other general reference, *The Structure and Properties of Water* by Eisenberg and Kauzmann, is now superseded except for its chapter on the real vapor. Because most of the research is of relatively recent origin, the 33 chapters in these volumes are much like individual contributions in the *Annual Review of Physical Chemistry*. All the articles in which I read closely are of remarkably high quality, quite readable, and generally useful. On the other hand, it should be realized that there is continuing controversy about and evolution in numerous topics treated, and no claim is made that all viewpoints are included. What is needed, of course, is a review of the reviews, but that is probably impossible at this stage of development. However, Franks goes a long way in providing introduction, background, and overview. His three chapters ("Water, the unique chemical"; "The properties of ice"; "The solvent properties of water") are certainly one of the most attractive and unifying features of this encyclopedia.

The first volume is devoted to water as a pure substance and to spectroscopic studies: findings of Raman, infrared, nuclear magnetic resonance, x-ray, neutron diffraction, and acoustic studies are well treated, as are the dielectric, temperature, pressure, and transport properties. I found the four theoretical chapters—on the water molecule itself by Kern and Karplus, on hydrogen bonding by Rao, on the statistical mechanics of the liquid by Ben-Naim, and on structural models by Frank—particularly enjoyable and thorough. The other two volumes treat water mixed with other molecules: in crystalline hydrates and as aqueous solutions of electrolytes and nonelectrolytes. The topics and technical methods parallel those of the first volume, but now the complex systems that underpin so much of chemical research in other areas, industrial chemistry and biology, are involved. Partly because of my own participation in a very small part of the subject, the long chapter (a monograph in its own right) "Thermodynamics of ion hydration" by Friedman and Krishnan was especially interesting to me. The quantity of data and extent of analysis were far greater than I had known existed. As I noted at the beginning, all this is of fairly recent origin, and I suspect that many scientists working in areas peripheral to, yet basically dependent upon, these topics may find these volumes an important source of insight. It is obvious that this collection is central for workers in the immediate field. Two other books that complement volumes 2 and 3 are also worth noting: *Solvent Effects on Chemical Phenomena*, volume 1, by E. S. Amis and J. F. Hinton (Academic Press, 1973) and *The Hydrophobic Effect: Formation of Micelles and Biological Membranes* by Charles Tanford (Wiley, 1973).

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Resonance and Relaxation

Magnetic Resonance and Related Phenomena. Proceedings of a congress, Turku, Finland, Aug. 1972. V. HOVI, Ed. North-Holland, Amsterdam, 1973 (U.S. distributor, Elsevier, New York). xxxiv, 556 pp., illus. $47.50.

Magnetic resonance is both the subject of a discipline in its own right and a tool for the study of matter, and a conference devoted to it must deal with both of its faces. Viewing it as a form of spectroscopy, one could question its suitability as a conference topic; it is, one of the reviewer's colleagues has remarked, as if the voltmeter were the unifying theme of an international colloquium. The interplay between technical utility and intrinsic interest gives the lie to this irreverent attitude, however, and imparts vitality to the subject.

The 17th Congress Ampere continues the trend of these biennial meetings away from radio-frequency spectroscopy as a whole and toward the study of magnetic resonance and relaxation. Although no "conventional" high-resolution work was reported, the success of this technique as an analytical tool will lead many to ask if developments were presented of similar interest to a wide range of potential users. The most obvious candidate is high-resolution nuclear resonance in solids. It must be appreciated that in liquids high resolution is possible only because of the extreme narrowness of individual resonance lines; comparable linewidths in solids are difficult to obtain. Invited papers by J. S. Waugh and co-workers at MIT and E. R. Andrew at Nottingham describe two approaches to artificial line narrowing in solids and give insight into the progress made to date on this problem. It seems that at least for favorable cases a solution, with its attendant rewards, is in sight.