anisms as multiple sex chromosomes and sex determination by haploidy, mainly in other insects. There is also a chapter on sex chromosomes in plants which adequately covers this limited field. Mittwoch has performed a very useful service in assembling this diverse material under one cover, with references up to 1966, and her style is highly readable.

Unfortunately, the same excellence is not to be found at the beginning and end of the book where the factual and conceptual framework is offered. There are some curious errors. On page 15 we find, "The nucleic acids are themselves composed of large numbers of nucleotides, each of which consists of four chemical entities: a pentose sugar, phosphoric acid, one purine, and one pyrimidine base." On page 29, ". . . if one chromosome carries an inversion and its partner the normal sequence, pairing fails to take place along the length of the inversion and a loop is formed." Actually the term "loop" has been used for over three decades to denote the twist required for pairing, not its failure, in a heterozygous inversion. On page 34, "Although there is no biological definition of the term 'sex,' the differentiation of male and female gametes must be regarded as a basic requisite." Those familiar with isogamy in many algae and fungi will be surprised at this. On page 66, "The male and female parts of gynandromorphs in *Drosophila* are always self-determining as regards the expression of sex-linked genes." In fact, the sex-linked gene *vermilion* provides a classic example of nonautonomy. On page 223 there is a reference to the "nucleolar membrane," a nonexistent structure.

The conceptual material includes the subjects of sex determination, development, and heterochromatin, admittedly some of the most difficult areas of modern biology. The author's handling of this material is not always insightful or critical, and at times is contradictory. For example, on page 215, we find, "By assuming that the second X-chromosomes of females (and of abnormal males) consists of two parts, a major one which becomes inactivated and a minor one which does not, all genetic effects of the X-chromosome could be formally explained." The author assumes, however (p. 231), that the heterochromatin of the inactive X not only does have a metabolic type of function but that the sex chromosome mechanism of mammals provides "the most striking example" of such effects. A formally acceptable explanation certainly does not provide a striking demonstration of its opposite.

This small volume is an excellent sourcebook but cannot be recommended for the novice. The high quality of the format, printing, and illustrations are what we have come to expect of this publisher. So unfortunately is the price.

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Mineralogical Method

Electron-Diffraction Analysis of Clay Mineral Structures. BORIS BORISOVICH ZVYAGIN. Translated from the revised Russian edition by Simon Lyse. Plenum Press, New York, 1967. 380 pp., illus. $19.50.

This book is an important addition to the growing literature on clay mineralogy and is the first to deal specifically with the application of electron-diffraction analysis. The slow development of electron diffraction in this field is easily understood; "ring patterns" contain no more information than can be obtained more easily by x-ray powder diffraction, and single-crystal methods are handicapped by problems of crystal orientation. Between these extremes comes the "oblique texture method," which has been used quite extensively in the U.S.S.R. but relatively little elsewhere. The book provides a good introduction to this method of analysis and contains numerous examples of texture diagrams; though not reproduced as plates, these diagrams are reasonably good. Clay mineralogists are likely to read the book backwards, starting with the final section, which summarizes a great deal of structural data accumulated by Zvyagin and his colleagues. It is claimed that kaolinites exist in well-ordered triclinic and monoclinic forms and that various kinds of disorder produce intermediate situations called "triclinomonoclinic." Robinson and I in 1945 struggled with pseudo-monoclinic forms of kaolinite by x-ray powder methods, but the limitations of the method precluded much progress. Zvyagin *et al.* appear to have a better tool, but whether all their conclusions are correct will be appreciated better when the method has been more widely applied and independent analyses made. Their conclusions regarding halloysites are revolutionary. Halloysites are not poorly organized kaolinites, but have a structure of their own approaching a two-layer monoclinic arrangement. Although there has for some time been evidence pointing in this direction, the concept of halloysites having a prismatic structure is difficult to accept as a general description. As regards chrysotiles, Zvyagin discusses in considerable detail diffraction by rolled and cylindrical structures; for other serpentine minerals, he considers that the "high information content of the texture patterns and the unusual intensity distributions open up a real possibility of determining not only individual structure types . . . but also their combinations." Table 64, pages 305–16, "A structural and mineralogical classification of clay minerals and related structures investigated by electron diffraction," contains a wealth of data on the materials studied by Zvyagin and goes far beyond what can be found in any other text.

Enough has been said to show that this book presents many new points of view to clay mineralogists and to electron diffractionists. The translation reads smoothly and seems to be very good. The book is pleasant to handle and read, but the subject is not an easy one; probably most readers will need considerable activation energy in order to study the finer details.

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Water Transport Phenomena

Movement of Water in Plants. G. E. BRIGGS. Davis, Philadelphia, 1967. 154 pp. $6.50.

This book provides, in concise form and easy-to-follow style, a particularly good account of water-transport phenomena in plants. It begins with a chapter on the escaping tendency of water. The chapter includes an introductory section on chemical thermodynamics, which deals with phenomena such as equilibrium vapor pressure, partial molal free energy, chemical activity, chemical potential, and water potential. This is followed by a section

which deals with the effect of osmotic pressure, solute concentration, and gravitational-force fields on the escaping tendency. The chapter concludes with a discussion of surface free energy which considers force fields generally, and the special cases of capillaries and the tensile strength of water. The second chapter deals first with general principles of water and solute transport and then with phenomena involving interdiffusion, discrimination between water and solute, and movement of water vapor. Special consideration is given to water movement, as related to pressure differences, across systems such as simple membranes and to the problems of composite porous membranes and liquid membranes. The influence of electrical potential gradients and temperature gradients is also considered. The remaining chapters deal with movement into, within, and out of the plant. Consideration is given first to intercellular water movement, extracellular movement, and movement within tissues. Water movement into the root, from leaf to air, and through the soil-plant-atmosphere system is then discussed.

Although the book is short, it contains many valuable ideas and much important information. The approach is that of the physical chemist and biophysicist, but the treatment is such that it should be readily understood by the physiologist or ecologist interested in water-transport phenomena. I regard it as an important and very useful addition to the literature.

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Routes to the Organelle

Enzyme Cytology. D. B. RODYN, Ed. Academic Press, New York, 1967. 607 pp., illus. $25.

For many years cytologists have trudged down pathways into the fertile valley of the cell organelles. Nowadays, investigators, mainly biochemists, traverse a superhighway into the same valley and, while the two routes converge at points, much still depends on the position of the observer and his lingo. Although it is positively ecumenical for a morphologist to refer to $NADH_2$ cytochrome *c* reductase and a biochemist to unit membranes, sometimes they don't speak the language so good.

What comes out for this reader is a sense of ambivalence in this multi-authored book, which includes the following chapters: General Principles; The Nucleus; The Mitochondrion; The Chloroplast; Lysosomes, Phagosomes, and Related Particles; Membrane Systems; Ribosomal Enzymes; and The Soluble Phase of the Cell (which does not have a cytological counterpart). Many aspects of most chapters are well put together. As reviews the chapters are relatively up-to-date and worthwhile collections of integrated information for interested graduate students and for scientific workers whose commitment is peripheral to the field covered by each of the individual chapters. However, I found parts of some chapters within my ken somewhat biased, even incorrect, and repetitious of what has been recently, and better, said elsewhere. As a collection of information concerning enzymology and cytology, the papers appear to slight one or the other of these disciplines, most often the cytological one, and the inclusion of several electron micrographs doesn't correct the deficiency. Although some chapters include significant advances made by cytochemical staining techniques, others ignore this area.

The notion of bringing together information from electron microscopy and from studies on fractions isolated from cell homogenates is good. Too often, however, the information available to the reviewer comes from one field or the other, and it is our (the workers') fault that an adequate "hybrid" (De Duve) state is lacking in some of the information presented. For the moment in this young field, we're stuck with the fact that for years some morphologists have described structure and speculated on function; recently, some biochemists show some preoccupation with the reverse. As a result, a large part of this book would have been better named "Cytological Enzymology."

Thus, I found this volume partly well done, informative but quixotic because sometimes it creaks like rusty armor when facing information situations that are less definitive and more like windmills. Although it is really not too early to get down to vital information in this exciting and growing field, the book in part views the same crossroads through other peepholes, and I wonder how many views of the crossroads have already been recorded by the same publisher. From another viewpoint, the purpose of "sweeping yon clouds from the sky" by combining information of cytology and enzymology is a good one. However, our students who are being trained to think and do in both disciplines may adopt an attitude, concerning parts of this volume, more like that of Sancho Panza.

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The Space Agency as Manager

An Administrative History of NASA, 1958–1963. ROBERT L. ROSHOLT. National Aeronautics and Space Administration, Washington, D.C., 1966. 399 pp., illus. Available from the Government Printing Office, $4.

Our space program has had administrative problems unprecedented in kind and magnitude. NASA administrators have had to innovate in solving such problems as the coordination of the production schedules of thousands of industrial contractors and the allocation of enormous public resources within NASA and among the competing contractors. Other problems have included the creation of an institutional framework within which engineers and scientists would flourish, the maintenance of constructive relations with the Department of Defense, and inspiring the confidence of Congress and the public. NASA, since 1958, has been on the frontier of administering big technology within a complicated context of public financing and private enterprise.

Passage of the National Aeronautics and Space Act of 1958 provided the framework for future administration. The Space Act was the entrepreneurial decision that determined that the nation's space program would be under the jurisdiction of several agencies, with NASA responsible for civilian activities and the Department of Defense for military. It also established that "over-all policy direction" would come from a council chaired by the President (later by the Vice President), and that "Congressional oversight" would be carried on by two new standing committees. It was also assumed from