rine deposits in a filled basin covered by very shallow, concentrated water.

In Part II all known fossils are reviewed and described. One cystoid, 1 gastropod, 14 brachiopods, and 36 trilobites merit specific description, and a number more are placed generically. The paucity and poor preservation of the material is amazing, and more intensive collecting should be done. An *Olenellus* and *Antagmus* horizon date the lower beds as late Lower Cambrian. Horizons of *Alokistocare althea* and *Glossopleura mckeei* and of *Solenopleurella porcata* date most of the Bright Angel and the Muav as early Middle Cambrian. The collections are too small to indicate distinct faunal zones or satisfactory zonal correlations.

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Physical chemistry of cells and tissues. **Rudolf Höber and collaborators. Philadelphia: Blakiston, 1945. Pp. 675. (Illustrated.) $9.00.**

This is the book which we had long been expecting as the American analogue of Dr. Höber's *Physikalische Chemie der Zelle und der Gewebe.* That went through six editions, and the last, in 1926, is encyclopedic and a classic for the cell physiologist. It probably would have been asking too much of the author to have maintained the same scheme of the original edition. Perhaps this may still be done.

The present book follows the current vogue of multiple authorship, the author having enlisted the services of four collaborators. David I. Hitchcock, of Yale, and J. B. Bateman, of the Mayo Clinic, are responsible for the first two sections, which are strictly on physical chemistry. The section by Hitchcock deals with selected principles of particular import for our knowledge of living matter, viz., diffusion in liquids, reaction velocity and enzyme action, thermodynamics, the energy concept, electromotive force, and properties of aqueous solutions. This section of 91 pages and 126 references is clear and concise, depending freely on the references for essential details—an admirable method of presenting fundamentals with lessened risk of becoming lost in too deep a forest of details.

The second section, by Bateman, is on the physicochemical properties of large molecules, with a discussion of their architectural and functional significance in living matter. This extremely valuable section of 121 pages with 534 references includes a discussion of fibers, films, and membranes so widespread as structural forms of living matter.

The sixth section, by David R. Goddard, of the University of Rochester, is an excellent discussion on the respiration of cells and tissues (74 pages and 199 references). The discussion is devoted to the mechanism of cellular respiration, the development of which has been so largely during the last two decades. Dr. Goddard deals with the energetics and kinetics of the process involving a series of graded steps with many distinct enzymes, the whole constituting an integrated reaction system. The writer presents a fascinating story of a general pattern of cellular respiration by emphasizing the physicochemical approach. Coupled reactions permit the storage of oxidative energy in the form of high-energy phosphate bonds which may be transferred, stored, or utilized, as needed. The mechanism of energy transfer is suggested by Engelhardt's discovery that myosin, the contractile protein of muscle may itself be the enzyme to induce the hydrolysis of adenosin triphosphate. This case of a catalyst accepting the energy liberated by its substrate would appear to be the first biochemical reaction discovered which directly converts the potential energy of a chemical compound into mechanical work.

Another well-developed section is by Wallace O. Fenn, on contractility (79 pages with 316 references). A very brief discussion of protoplasmic streaming, ameboid and ciliary movement as phenomena of contractility is followed by an excellent account of muscle contractility. Interesting experimental data are presented, and the section ends with a discussion of muscle contracture and a survey of theories of muscle contraction historically developed, ending with the significance given by the newer knowledge of the configuration of protein structure. The phosphate cycle provides the energy, and the change in configuration of the myosin from a partial to a more complete folding causes the shortening. The shortening may result from a phosphorylation of the myosin serving as an enzyme for the removal of PO_4 from adenylpyrophosphate.

The four remaining sections are by Dr. Höber and occupy somewhat less than half of the book. A brief section deals with introductory remarks on the architecture of protoplasm. He offers an interesting concept of a chemodynamic machine having a submicroscopic structure which is so spread as to form a very large area for adsorption catalysis.

The section on permeability follows somewhat the classic lines and deals with organic nonelectrolytes, weak bases and acids, dyestuffs and water. From this discussion is deduced the chemistry and physics of the plasma membrane for the structural basis of which he offers evidence. Regarding the permeability of nonelectrolytes, their passage is related to molecular volume and lipoid solubility. In an analysis of experiments dealing with pore size, consideration might have been taken of the fact that many nonelectrolytes exist as molecular aggregates varying in size according to the nature and pH of the medium. Moreover, the determining characteristics of the medium may change on approaching surfaces, such as those of cells. The chapters on permeability attest to the great variability encountered with different types of cells, a valuable feature to be pointed out in the face of those who may attempt too sweeping generalizations. Dr. Höber is to be commended for the carefulness of his survey. The only question which arises is whether the subject may have been more easily handled if, instead of grouping various cell types under headings of permeability to different substances, the different types of cells had been taken

up separately with respect to their permeability to various substances.

In the section dealing with extracellular factors on cellular activity, the author discusses the influence of inorganic ions on hydration and dehydration of cell colloids, on fiber and cell potentials. This leads into selective ion-permeability and bioelectric membrane potentials. One chapter discusses the influence of ions on cell potentials in plants, and is an excellent summary of the work of Brooks' and Osterhout's groups. The chapter on narcotics again brings up the concept of the plasma membrane as lipoid in nature with a sieve structure.

The last section deals with a favorite field of the author's extensive research activities. Here the author distinguishes between passive penetration and active transfer, the latter appearing to be "enforced" by energy ordinarily derived from cell metabolism and indispensable for the process. Good chapters follow on intestinal absorption, the formation of urine, and the elaboration of digestive juices. Passive and active transfer are also discussed in relation to the body surface of aquatic animals and of plant cells. The last chapter is an excellent discussion of the energetics of active transfer and possible mechanisms in the localization of enzymes constituting a chemical organization comparable to the morphological organization of cell structure.

In many places the author gives free play to his imaginative genius and makes us wish he had greatly expanded his part of the book for us to profit more by the broad background of his knowledge and the wealth of his own contributions. This is a book which should be in the hands of all students of fundamental problems in physiology. One would wish that, for books such as this, funds were available to subsidize their publication so as to bring the price within the range of the usual scientific worker.

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