troduced by the investigators and writers of other countries for evident reasons. To be permanently valuable to science, and to effect for the world a real saving, such measures must needs be international in character.

The admirable cards of the International Bibliographical Bureau at Zürich still continue to add in abbreviated form the words referred to above. Some such rules as those adopted by the Botanical Congress could be promulgated by the Bureau, with the hope that they would be generally understood and in time generally adopted. Am I wrong in believing such a movement for simplicity and uniformity in citation (1) desirable, (2) possible, (3) most likely to succeed under these circumstances?

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SCIENTIFIC LITERATURE.

Pflanzenphysiologie, ein Handbuch der Lehre vom Stoffwechsel und Kraftwechsel in der Pflanze. Zweite völlig umgearbeitete Auflage. Dr. W. Pfeffer. Leipzig, Wilhelm Engelmann. 1897. Erster Band. Stoffwechsel.

It is safe to say that no handbook of plant physiology has yet appeared which, for comprehensiveness and breadth of treatment, keen criticism of conflicting researches, truthfulness of perspective, accuracy of detail and logical delimitation of the subject and its branches can be compared to Pfeffer's encyclopedic work, which now comes to the second edition. Perhaps no greater tribute to the merit of this great work and the master mind that planned it can be given than the fact that, after sixteen years of the most productive research in the history of botany, the author does not find it necessary to alter his method of treatment, although the establishment and development of many important principles have taken place in this period. The first volume is devoted to chemical physiology, and the second, now in preparation, to physical physiology, or phytodynamics. The treatment is strictly inductive, with no lapses into speculation, or leanings toward vitalism, and, moreover, all the subjects included are fairly physiological, but scant discussion being given to ecological adaptations, though the method of variation is necessarily pointed out. The ten chapters of the first volume, now at hand, discuss the province of physiology, the nature of irritability, variation and hereditary, morphological-physiological considerations, swelling and molecular structure, mechanism of interchange of matter, mechanism of interchange of gases, the movements of water in the plant, nutrition, organization and energy of metabolism, respiration, fermentation and translocation. The contents of the separate chapters afford a ready appreciation of the development of the subject from 1881 to 1897, a record of progress in which Dr. Pfeffer and his students have taken an important part. The keen critical faculty of the author has enabled him to express clearly the condition of important questions yet in controversy, and, throughout the entire volume, generous and just estimate is made of the work of physiologists outside of Germany.

The author does not accept the term 'Energid,' of Sachs, as the physiological unit, and finds that 'cell' or 'protoplast' is still useful in that capacity. Barymorphose, photomorphose, etc., by the same author, are shown to be inapplicable to the influence of external agencies upon form and development. The foam structure of protoplasm, as described by Butschli, finds place in the discussion of the composition of protoplasm. Cilia and vacuoles are described as organs which may arise *de novo*, while no decision is reached as to the much harassed centrosome question.

Full place is given to recent researches showing the invariable connection between nuclei and the formation of wall membranes, and the facilities afforded for the translocation of plastic material, as well as of the protoplasm itself by means of the interprotoplastic threads, is pointed out. A new lease of life is given this theory by the adduction of evidence from recent researches that such substances as the oils are known to pass membranes in a finely divided condition.

The micellar theory of Nageli is used as a basis of the discussion of molecular structure, although the enlargement of the section devoted to this subject is due to collection of detail rather than development of principles involved.

The mechanics of absorption, excretion and secretion, diosmotic and osmotic properties of the cell with regard to fluids and gases have received such numerous and important additions that it would be possible to point them out only by recounting the summaries of the sections, which space does not permit, but much of the author's own work is briefly summarized here for the first time.

This is the first general text issued since the researches of Boehm, Askenasy, Strasburger, Schwendener, Dixon and Joly upon the ascent of sap were published, and the Jaminian chain, the intermittent activity of living cells, the lifting power of transpiration and the tensile strength of water are alike shown to be incompetent to account for the facts. Professor Pfeffer believes that whatever the impelling force may be, and the participation of living cells is not barred, the path of the current lies through the tracheal lumina and pits.

Transpiration is recognized as a necessary means for the distribution of the mineral elements in the plant, as a facilitation of gas diffusion, as a regulator of temperature, and the surmise is hazarded that it also may exercise a general tonic effect necessary for the maturity and welfare of the plant. A clear presentation of the relation of stomatal, cuticular and lenticular transpiration is made, as well as of the factors influencing these processes and the principal adaptations.

Bleeding and the phenomena of root-pressure are held to be due to the active secretory agency of living cells, in the root and stem, though plasmolytic agencies, as in nectaries may sometimes play a part in the process; and no essential difference from 'guttation' is exhibited. The water-pores and hyathodes of plants in moist localities may provide an outlet for water to maintain the upward stream, impossible by transpiration.

The chapter on nutrition contains 168 pages, in which all of the more important literature of the subject finds place, and it is impossible in the limits of this review to cite even a majority of the new and modified points of view given. In the consideration of the general metabolic activity of the organism all material is divided into three groups, viz.: constructive substances in the permanent structure of the organism, plastic substances capable of participation in the metabolic processes, and aplastic substances incapable of being used further in the nutrition of the organism. The last group naturally overlaps the first named.

Assimilation is used in the broadest sense to denote all physiological processes, or progressive chemical metamorphoses by which plastic or trophic substances are built up. According to the source of energy specific processes are designated as 'Photosynthese,' 'Chemosynthese,' 'Electrosynthese,' etc.

By photosynthesis is meant the formation of plastic material from carbon compounds, CO_2, (possibly $COCL_2$, COS, CO $(NH_2)_2$,) and water by the agency of the chlorophyll apparatus and sunlight, a sense in which it has been used by the reviewer since 1894, though not in agreement with the proceedings of the Madison Botanical Congress. (See editorial review, Botanical Gazette, Vol. 19, p. 341. 1894.)

Professor Pfeffer points out that the relation of chorophyll to the ground substance of the chloroplast is unknown, that the optical extinction of portions of the spectrum may or may not be coincident with photosynthetic activity, and that the intermediate steps in the formation of carbohydrates in this manner are unknown. The recent results of investigation upon the independent action of chloroplasts are detailed.

The nitrobacteria are instanced as the only organisms having the power of formation of carbohydrates from CO_2 by synthetic methods and by means of chemical energy.

The author distinguishes between saprophytic and symbiotic nutrition, using the former term only in connection with plants which take up organic food unaided. According to this classification the only seed-forming plants truly and entirely saprophytic are confined to a single genus. With regard to the general relation to organic food, plants are allotropic, mixotropic or autotropic. The results bearing upon the acquisition of nitrogen are brought together in orderly array, but our information on this phase of nutrition is at best very incomplete.

The discussion of the metabolic changes in the organism is enriched by the addition of an enormous mass of detail, yet it is to be said that

the diagram of chemical activities is largely suppositious, and that substances may be located here and there, with no indication decisive of synthetic or analytic origin.

The author includes many energy liberating processes under respiration, whether attended by excretion of CO_2 or not, and emphasizes the fact that it is only a link in the chain of metabolic metamorphoses. It is, therefore, not always possible to determine the subjects or products of respiration.

A comparison of the editions of 1881 and 1897 reveals the fact that Professor Pfeffer no longer deals with the organism as a purely chemical and physical machine, but regards it from a physiological point of view. Nowhere is this more vividly apparent than in a paragraph dealing with translocation, which is freely translatable as follows: "In general, translocation is regulated by the vital activity. By this the functioning apparatus is controlled, and apparently the organism is capable of modifying the permeability of the protoplast temporarily in many ways. Indeed, it is not improbable that the living protoplast, by its own activity, not only conducts solid particles and oil drops, but also under some circumstances dissolved substances for which it is not diosmotic. Furthermore, diosmose is not dependent entirely upon the size of the dissolved molecules, since many colloids may be easily taken up and given off."

The terse, vigorous, concise style and generally high literary quality make this volume a classic in botanical literature. The author has rendered an inestimable service to biological science by his masterly criticism and arrangement of the accumulated results of research upon the physiology of the vegetal organism, and his vivid clear-cut delineation of the problems awaiting investigation will give a new impetus to research in this and related lines.

Arrangements have already been made for the translation of the book into French and English. The English edition will be prepared under the direction of Dr. Ewart, whose intimate acquaintance with the author and important researches in the Leipsic Institute make him especially well fitted for the task.

D. T. MacDougal.

Trail and Camp Fire, the Book of the Boone and Crockett Club. Editors: George Bird Grinnell and Theodore Roosevelt. New York, Forest and Stream Publishing Co. December, 1897. 8vo. Pp. 353. Illustrated. Price, $2.50.

Beginning in 1893, the Boone and Crockett Club has published on alternate years a volume made up of articles on big game and big game hunting, with tales of exploration in little known lands. While written primarily for the sportsman, these books contain much of interest to the naturalist; and to the student of the larger mammals they are indispensable. The new volume, 'Trail and Camp Fire,' contains the following: 'The Labrador Peninsula,' A. P. Low; 'Cherry,' Lewis S. Thompson; 'An African Shooting Trip,' Wm. Lord Smith; 'Sintamaskin,' C. Grant LaFarge; 'Wolves and Wolf Nature,' George Bird Grinnell; 'On the Little Missouri,' Theodore Roosevelt; 'Bear Traits,' George Bird Grinnell, J. C. Merrill, Theodore Roosevelt and Henry L. Stimson; 'The Adirondack Deer Law,' Wm. Cary Sanger; 'A Newfoundland Caribou Hunt,' Clay Arthur Pierce; 'Origin of the New York Zoological Society,' Madison Grant. To these is added a chapter on 'Books on Big Game'—one of the most entertaining and useful in the volume—treating of the more important works on big game hunting in Africa, India and America.

Trustworthy information relating to the interior of the Labrador peninsula is so scarce that Mr. Low's article will be widely welcomed and will reach a different audience from his much more elaborate official report (Annual Report Geological Survey of Canada, N. S., Vol. VIII., pp. 1-387, Ottawa, 1897). It is a pity that his important notes on big game are marred by antiquated and inaccurate nomenclature.

Without attempting to point out the many good things in the book, it may be said that the chapters on Wolves and Bears are intensely interesting, and that Mr. Wm. Lord Smith's account of his 'African Shooting Trip,' in company with Dr. A. Donaldson Smith, is an important addition to the literature of the rapidly diminishing game of the 'Dark Continent.'

The editors' statement that "coyotes try to