

herd, sheep, crops, the latter account being occasionally specialised for a few years in order to ascertain whether a particular crop or field is paying its way. But we commend to the teachers of book-keeping in such of our agricultural colleges as possess a farm the problem of devising with an open mind an improved system of farm accounts, which shall be simple, actual, and helpful.

OUR BOOK SHELF

The Rôle of Diffusion and Osmotic Pressure in Plants.
By B. E. Livingston. Pp. xiii+149. (The University of Chicago Press, 1903.)

BIOLOGISTS who attach importance to the bearing of physics on their science must be gratified with the increasing number of books now appearing on such subjects as are treated in the book before us.

Mr. Livingston's short book is clear and readable, and contains a simple and concise sketch of much of the physics of diffusion and solution. The matter is well put, and difficulties are avoided. But concise treatment has its disadvantages, and, in one or two places, a false conception might be obtained from the author's descriptions. Thus there are notable exceptions to the rule that the particles of substances are brought closer together during the change from the liquid to the solid state. And it is scarcely fair to assume that the greater closeness of the particles is the cause of the greater rigidity of solids.

The limited space available in the book has apparently led to the exclusion of matter which it would be essential for the biologist to be acquainted with, and he should supplement it with the study of some text-book of physical chemistry. With regard to recent work, it must be regarded as unfortunate that the writer leaves out all mention of Brown and Escombe's work on diffusion through perforated septa from the physical part of the book, while in part ii., on physiological considerations, this investigation receives a bare mention by name in a small footnote. One would have thought that these authors' results would have been fully discussed as having a most intimate connection with the subject, and as bringing a completely new light to bear on our ideas of the diffusion of gases and of dissolved substances in plants.

The chapter on the terminology applied to solutions of different concentrations is very lucid, and should prove most useful to biologists.

In part ii. an account of turgidity and of absorption and transmission of dissolved substances in plants is given. Much information is imparted in a small space considering how nebulous are our ideas on the actual part played by the vital osmotic membranes of plants.

In the reviewer's opinion, far too much weight is accorded to Westermeier's and Godlewski's hypothesis explaining the ascent of water in trees. These writers assumed that the elevating force is to be found in the exudation pressure of the cells of the wood, cortex, and medullary rays. The physical relations of these cells to the water capillaries of the plant render the idea that the cells at different levels act as relay pumps impossible.

The theory of a tensile transpiration current is alluded to, but unfortunately it is criticised in the light of Copeland's undoubtedly misleading experiment.

The later chapters of the book are devoted to the osmotic effects of the medium on plants, and summarise most interestingly the recent results of osmotic and chemical fertilisation.

H. H. D.

Mechanical Refrigeration. By Hal Williams, A.M.I.Mech.E., A.M.I.E.E. Pp. xiii+406. (London: Whittaker and Co., 1903.) Price 10s. 6d.

THIS book, which is devoted mainly to practical study of mechanical refrigeration and cold storage, should have a wide circulation, dealing as it does with a growing industry of which the literature, so far as text-books are concerned, is remarkably scanty. It opens with two chapters on the theory of heat engines and refrigerating machines. The first of these might well have been omitted, as it merely contains a series of definitions which can only be intended for a trader who is totally ignorant of the elementary theory of heat, and are somewhat apt to convey a wrong impression. The second chapter, on thermodynamics, is carefully worked out, the section dealing with the heat change consequent on the performance of internal work by the fluid being particularly interesting. A chapter devoted to the history of the subject leads to a short study of the methods of preparing the modern refrigerants, liquid carbonic acid and ammonia, and a description of the more important type of refrigerating machinery. In the latter section the author has confined himself to an account of ammonia and carbonic acid plant, and in this, considering the dimensions of the work, he is undoubtedly justified. Fifty pages of the book deal with the auxiliary plant necessary in a cold storage works. Finally, insulation, ice making, the construction and arrangement of cold storage works, and the application of methods of refrigeration to commercial processes are fully dealt with. The author wisely omits all mention of liquid air and its problematical applications. The book is well illustrated by means of photographs and diagrams, and the text is clear and concise.

M. W. T.

Die stammesgeschichtliche Entstehung des Bienenstaates sowie Beiträge zur Lebensweise der solitären u. sozialen Bienen (Hummeln, Meliponinen, &c.). Herausgegeben von Dr. H. von Buttel-Reepen. Pp. xii+138. (Leipzig, 1903.) Price 2.40 marks.

THIS is a book that should not be overlooked by those who are interested in the many important questions that are opened up by the habits of social insects. The author points out that the highly developed organisation of the life of the hive-bee does not stand alone, but may be traced up from the commencement of mere association of solitary species, through the less organised communities of humble-bees, &c., to its perfection in the hive-bee. A great number of outlying questions respecting parasitic bees, wax-secretion, &c., are also more or less fully discussed. The author is very anxious to eliminate, so far as possible, the natural tendency to anthropomorphise the actions of bees to too large an extent, and appears to take the view that inherited tendencies have to a large extent rendered their actions subjective and automatic. The index is very full, and is preceded by a list of nearly 200 books and papers dealing with the subject, which cannot fail to be of great value to any serious student of bee-life.

The Mind of Man. By Gustav Spiller. Pp. xiv+552. (London: Swan Sonnenschein and Co., Ltd., 1902.)

MR. SPILLER suffers apparently from the constitutional defects of extreme prolixity, and a marked contempt for the views of psychologists who have the misfortune to prove themselves "unscientific" by disagreeing with himself. The reader who is ready to overlook these deficiencies will find much interesting discussion of the principal problems of psychology in his book, though scarcely, I think, any considerable fresh contributions to the science. The author's fundamental point of view may be indicated by his definition of