to assimilate and act upon the stores of knowledge which have been accumulated through the centuries, then it is the gamete that we must consult. The saving grace is with the gamete, and with the gamete alone.

W. E. Castle

Harvard University

Plant Physiology, with Special Reference to Plant Production. By Benjamin M. Duggar. 13 × 20 cm. Pp. xv + 516, frontispiece and 144 figures. The Rural Textbook Series. New York, The Macmillan Co. May, 1911. Price $1.60.

The growing realization that a rational agriculture must rest upon the principles of plant physiology finds definite expression in the appearance of Professor B. M. Duggar's new text-book. As the title implies, this book is intended for agricultural students and those primarily interested in "plant production," and it should occupy a very necessary and permanently useful place in American agricultural colleges and experiment stations.

The choice of subject matter is governed by the centering of the entire treatment about the idea of the usefulness of plants in human affairs, so that relatively great importance is accorded those aspects of physiology which enter into present agricultural, horticultural and silvicultural theory and practise. Plant physiologists may be surprised to find that other portions of our present physiological knowledge are often but briefly and summarily treated. Thus, the whole subject of movements due to growth receives only about ten pages, while over twenty-six pages are devoted to variation and heredity, subjects as yet hardly to be considered as more than purely descriptive physiology. Many topics not usually treated under physiology find place here, and many illustrative examples are drawn from agricultural experience, so that the book should serve not only as an introduction to things physiological for those who care mainly for the practical manipulation of plants, but also as a key to many important agricultural points for those to whom etiological physiology is of primary interest. The book should therefore find a considerable use, also, in university laboratories. Enough excellently chosen titles are cited from the literature so that the more thorough-going student may find the book an adequate point of departure in the acquisition of a first-hand knowledge of the deeper aspects of the subject.

The literary style of this treatise is frequently abrupt and fragmentary, sometimes ambiguous. Technical terms are now and again introduced without previous explanation, the reader being left to surmise their meaning from the context; also the paragraph often lacks unity. A few examples of ambiguity may be noted. On page 58, regarding *Tillandsia,* we read that it "is provided with much the same type of water-absorbing hairs which give the entire surface a glistening appearance." Hairs have not been mentioned previously in this section, so that the reference of the word *same* is not evident. A comma should precede *which.* Again, on page 65 we find, "this diffusion is wholly independent of any convection currents due to changes in temperature, and it is true for all such soluble substances as sugar, common salt and the like." Here the personal pronoun is without antecedent. On page 195, in the sentence, "As organic matter so called, this element is linked chiefly with hydrogen," etc., "this element" has been mentioned only in the chapter title, "The intake of carbon," etc.

Some surprising inaccuracies occur, several of which may be mentioned here. At the bottom of page 207 "bioses" is obviously intended to denote *disaccharide hexoses.* The word "hydroscopic," page 245, should be *hygroscopic.* In the last paragraph of page 264 the word "hemlock" is used to refer to *Abies alba,* which it is not. On page 294, *à propos* of certain "roots or root branches which seem to be important in aeration," it is stated that "to these organs the term hydathodes has been applied": this word is applied to certain peculiar foliar openings or water pores, through which guttated liquid escapes. On page 402 barley is mentioned as "almost unknown southward," yet it is one of the main hay crops of the southern portions of Arizona,

and California and the latter region is prominent in the production of barley grain for malting. The Imperial Valley produces large quantities of excellent barley.

The ancient and still commonly prevalent, though clearly illogical, confusion of osmotic with hydrostatic pressure finds, on page 69 of this text, its most recent expression. We are told that so long as water may be absorbed there is exhibited in plant cells "an hydrostatic pressure known as turgor. . . . Turgor is then the expression of the osmotic pressure of the cell." The Van't Hoff theory of osmotic pressure (gas-pressure theory) has been briefly stated in the preceding paragraph, so that the reader will picture turgor as brought about by the tendency of the solutes of the cell to expand within the limits of the solvent, the former substances being imprisoned within the plasmatic membrane, through which they do not pass. But the reader is now told that the internal pressure which produces turgor is *hydrostatic,* which can only mean that it is due to *water.* He remembers that the plasmatic membrane is permeable to water and becomes hopelessly muddled.[1]

Serious misconception may arise from the following, which occurs on page 440: "The method of reducing toxicity by solid particles [in water-culture solutions] is usually denoted [*sic*] adsorption." Of course the general phenomenon of adsorption is well-known physically and receives a large amount of attention in the recent hand-books of colloid chemistry, so that the implication that this phenomenon is known only, or even mainly, in connection with physiological solutions, is much to be regretted. Following the above sentence comes a brief statement of the usual explanation of adsorption, and then we enter again upon troubled ground, in the statement that "another explanation is that the solid substances offer obstacles to the free movement of the solvent particles." Obviously, "solvent" should be replaced by *solute,* but, even with this modification, the sentence can not stand, for it is well established that the effect of solid particles (such as lamp-black and quartz flour) upon a toxic solution remains manifest after their complete removal from the solution.[2]

In general, Professor Duggar's treatment of the subject is exceptionally *safe;* we find no dogmatic statements in the entire book, and the careful wording will hardly fail to impress upon the student the importance and desirability of that inestimable attribute of the trained thinker, the habit of suspended judgment. The fact that the author employs the word *suggest* where many others would have written *show* or *demonstrate,* indicates clearly the wholesome tendency of the treatment. Indeed, some critics will probably find fault with many paragraphs because of the indefinite conclusions reached; the method of caution is carried farther than it need be at certain points. The reviewer believes, however, that we touch here upon one of the most commendable characteristics of Professor Duggar's work.

Another admirable quality which deserves special mention here is the almost complete avoidance of teleological or anthropomorphic implications. We find no "adaptations" here discussed, and seldom is a process said to occur "for" future "needs." While not absolutely free from teleological lapses—here and there occur such statements as this, that "the seed and tuber are effective propagative devices"—yet the work of Professor Duggar has clearly shown, once for all, that it is quite possible and practicable to discuss plant phenomena without indulging in those anthropomorphic colorings which characterize a still very prevalent type of biological writing. At the same time, our author does not make his book unreadable to the beginner by seeking to put all statements in terms of pure energetics. The secret of his success in this direction lies perhaps mainly in the fact that he develops human interest by emphasizing the usefulness of plants to man, rather than by virtually

[1] For a discussion of a similar statement, made years ago, see Livingston, B. E., "The Rôle of Diffusion and Osmotic Pressure in Plants, p. 31, Chicago, 1903.

[2] For example, see Bulletins 28 (1905) and 36 (1907), Bureau of Soils, U. S. Dept. Agric.

humanizing or personifying the plant through attributing to it various human concepts, such as fear, reason and the like.

BURTON E. LIVINGSTON
THE DESERT LABORATORY

NOTES ON METEOROLOGY AND CLIMATOLOGY

RAPID progress is being made in the United States in the opportunities for instruction offered to students in meteorology and climatology. Moreover, college students, especially those in medicine, engineering, agriculture and forestry, are showing an increasing interest in these sciences. At the University of Minnesota, where instruction in meteorology was first given only four years ago, the classes under Professor E. M. Lehnerts last year numbered eighty-seven students, being the largest in this branch of science in the country. At the University of Wisconsin there is now a separate department of meteorology in which three courses open to undergraduates and four courses open to graduates and undergraduates are given by Mr. Eric R. Miller, of the U. S. Weather Bureau. As a result of the policy of the university to cooperate with the scientific branches of the national government, the local office of the Weather Bureau is located in one of its buildings, North Hall, and the official in charge lectures in the university. A similar situation is found at Johns Hopkins University. At the University of Nevada instruction in meteorology will be offered for the first time during the coming college year. It will be given by Mr. S. P. Fergusson, formerly of Blue Hill Observatory, who during the past year has had charge of the meteorological work at the Experiment Station in Reno. Mr. W. G. Reed, Jr., for several years past an assistant under Professor Ward in Harvard University, goes to the University of California at the beginning of the new year to teach meteorology and climatology.

A NEW edition of the "International Cloud Atlas" has just been prepared by MM. A. Hildebrandsson and L. Teisserenc de Bort, to whom the publication of the work has been entrusted by the International Meteorological Committee. The first edition of the atlas, which appeared in 1895, was soon out of print, but it accomplished its purpose—international uniformity in cloud nomenclature and the recording and publication of cloud data by means of symbols. At the International Meteorological Conference at Innsbruck in 1905 certain improvements were suggested, and these have been incorporated in the new edition. The latter consists of complete definitions of the various kinds of clouds and instructions to observers, all printed in three languages, together with twenty-nine photographs of the various types of clouds, which, with their backgrounds, are shaded and colored as in nature. Only clouds of typical form are shown, making it an easy matter for one to recognize the various kinds of clouds and to learn the names by which they are known. The more important changes made in the second edition as a result of the resolutions of the Innsbruck Conference are the following: (1) Stratus cloud is defined as "a uniform layer of cloud resembling a fog but not resting on the ground," instead of "a horizontal sheet of lifted fog." The complete absence of details of structure differentiates stratus from other compact cloud forms. (2) A new term, lenticularis, is used for certain cloud forms, particularly frequent on days of sirocco, mistral or foehn, which have an oval shape and occasionally show irisation. Clouds of this kind are cumulus lenticularis and stratus lenticularis. (3) Observers are urged to designate, by means of a special symbol, a cloud which is specially characteristic of its type, or a cloud from which rain falls. (4) Distinction is also made between a fog which wets exposed surfaces and one in which exposed surfaces remain dry.

REPRESENTATIVES of the weather services of two foreign countries visited the United States recently to study the methods used here. One was Professor Torahiko Terada, of Tokio, Japan, who is at present on a tour