Bacteriology applied to the Canning and Preserving of Food Products. By EDWARD W. DUCKWALL. Baltimore, *The Trade.* 1899. Pp. xi + 111. 17 colored plates. 7 figures in text. Price, $5.00.

There is great need of a good manual of bacteriology in its applications to the food-preserving industries. The arts of refrigeration and sterilizing have probably done nearly as much as has improved transportation towards abating that unfortunate state of affairs described by Macaulay in which, owing to bad roads, it was no uncommon thing in England, in the seventeenth century, for the fruits of the earth to rot in one place, when only a score of miles away people were suffering from a scarcity of the very food which was spoiling almost within their reach. The author of this 'Bacteriology' is to be commended, therefore, for his recognition of this need and for his evident desire to meet it. The announcement of the work, however, aroused apprehension when it stated that "After some unavoidably long delays, due to the nature of the work which of necessity must be minutely correct and exact * * * the book you have been waiting for * * * is now ready * * * This work, handsomely bound in leather, and printed on heavy paper, contains 24 microscopical views of the living germs found in canned goods in their *natural color*, and just as they appear to the eye under the cover glass. The whole work is written with the express purpose of enlightening and teaching canned-goods packers and preservers of food-products the highest and most scientific method of handling all kinds of foods." It was not encouraging to be thus informed that we were to see 'views of the living germs * * * in their natural color,' and the appearance of the work itself has not been reassuring. A careful examination leads to the conclusion that it has been hastily and even carelessly prepared; that it is full of errors both of substance and form; and that the author, while enthusiastic in his appreciation of the importance of bacteriology to his favorite industries, is not himself a trained bacteriologist, but only an amateur filled with zeal rather than knowledge. If, as stated in the announcement, "the whole work is written with the express purpose of enlightening and teaching," it must be frankly said that it is not a success, and that there is danger that it shall darken rather than illuminate understanding among those for whom it was prepared. A few citations will suffice.

In describing certain microscopic observations upon sour tomatoes, the author says on page 2: "I found quite a number of small round globules, which at that time I was unable to understand. They seemed to be motionless, except a slight quivering which is termed Brownian motion. There were small rods and little fine dots sometimes alone, sometimes in pairs, and looked like ants. There were also small forms barely perceptible and one or two specimens of a very large germ. The view given in the accompanying plate is just as it was taken." The 'view' referred to shows some yeast-like bodies, bacilli and spherules, but the yeast cell walls are colored blue, and the contents of the yeast cells are a mixture of blue dots and red lines. Passing over a multitude of ill-digested and more or less muddy statements, drawn apparently from various authors, but rarely quoted with precision and seldom if ever attributed to the proper source, we may notice one of the more surprising statements in regard to the physiology of bacteria (p. 13): "Sometimes an acid is generated which will kill them, and that acid may be due to their own action. The condition will become favorable, too, when the organisms have performed their work." Of the butyric acid bacteria the author says (p. 20): "They are so small in this dried-up form that we can almost conceive of them being able to pass through the juice without becoming wet." And again, on p. 39, " * * * the flavor which is imparted to the beer and wine and the peculiar flavor of cheese and butter we know is due to the products of the butyric ferment, amylobacter." The serious blunder made in this statement appears in another place (p. 7): "The butyric ferment * * * is so useful in ripening cheese and making butter that this form is cultivated and employed in some of the best creameries."

In regard to Bacillus prodigiosus we find some equally astounding statements (p. 23): "This is the organism which gives the odor of herring brine or fish to putrefying substances, and is

also named 'bleeding bread' because it is a pigment bearing bacillus of red color, and forms spots when growing on bread, potatoes and onion that resemble blood. It is an egg-shaped germ about 1/25000 of an inch in diameter, which is very small * * *. This organism is very common * * *. The drawing here represented was taken from life * * *. [It] is also a germ causing unsoundness in bread and bakers have to guard their dough against this action to prevent souring * * *." The plate which occupies the page opposite this remarkable description is something wonderful to behold. Within a large ten-sided polygon indicated by a thin blue line we have a dozen or more of what appear to be long, stout bacilli or hyphæ, also blue, but showing a reticulum, or chromatin-like substance, of a bright red color. The main background of the field is nearly filled with small, oval, red-colored dots or circles, and besides these there are present n large numbers thin and almost invisible bluei lines which seem to be intended for delicate and very slender bacilli. The legend beneath reads: "Figure 13 Magnified × 1000. One part bouillon, 99 parts water. Rank putrefaction. Bouillon, prodigiosi." The whole effect of this plate must be seen to be appreciated.

Woodhead's excellent book on 'Bacteria and their Products' seems to have been the author's principal source of information, and if he had only quoted correctly, and copied Woodhead's figures with accuracy, there would have been little occasion for the present criticism. One of his worst blunders—to call it by no stronger term—is that in which the author gives as his 'Figure 19. Magnified × 1000. Kleles Loeffler Bacilli, × 1000,' a figure which so far as a careful comparison can determine is a copy of Woodhead's figure not of diphtheria, but of *anthrax* bacilli, and this, too, turned upside down. After discoveries of this sort the intelligent reader may be pardoned for regarding, with a certain cynicism, a rhapsody like the following (p. 31): "What a study it is, then, this science of bacteriology. It opens up a new world to us (*sic*) and we are permitted to gaze upon it and behold the scheme of Nature giving us object lessons day by day in the tearing down and building up process. Life begetting new life and new life flourishes on the dead; seed developing into form, form producing seed, decay of form, and development of seed. This is true of the germ and also of every living thing." As we peruse this strange deliverance we are compelled to agree with the author that form, here at least, readily goes to seed and even to rot.

It would be easy to extend the present review, but the whole work comes dangerously near to a burlesque of bacteriology and extended comment is unnecessary. Only one point more need be made. The author evidently quotes extensively from various writers and investigators without giving them credit. For the most part these statements have long since become the common property of bacteriologists, but toward the end of the book he apparently uses freely the recent and important monographs of Messrs. Prescott and Underwood, of the Massachusetts Institute of Technology, on the history of the canning industry and on bacteriological investigations of canned foods, especially of sour corn, of which a preliminary account was published in SCIENCE, Nov. 26, 1897, and yet never once mentions these authors.

We are tempted to close with the familiar warning that a little knowledge is a dangerous thing, and a reminder to those into whose hands the book may fall that blind leaders of the blind are apt to be untrustworthy. The author himself, in discussing the vacuum which exists in most well prepared and hermetically sealed food-cans, has, however, given utterance to a similar warning, in quite original metaphor: "We thus see that packers who are pinning their faith to a vacuum are depending upon a broken reed." Those who pin their faith to the author's kind of bacteriology will, we fear, discover to their cost that they are leaning not even upon a broken reed, but only upon a vacuum.

BOOKS RECEIVED.

Lehrbuch der Botanik für Hochschulen. EDUARD STRASBURGER, FRITZ NOLL, HEINRICH SCHENCK, A. F. W. SCHIMPER. Jena, Fischer, 1900. Fourth revised edition. Pp. viii + 588. 7 Mark, 50 Pf.

The Nature and Work of Plants. DANIEL TREMBLY MACDOUGAL. New York and London, The Macmillan Company. 1900. Pp. xvii + 218. 80 cts.