general laws of human energetics, have been long established. But details which are of great importance when any exact view of the subject is desired, still escape us. To express the energy requirements of agricultural laborers in terms of food with the precision attainable by an actuary in estimating their average expectation of life is still an ideal of the remote future. This is only in part due to the greater difficulty of measuring energy transformations as compared with the measurement of longevity. It is now quite possible by means of relatively simple apparatus to carry out such determinations on a large scale. But the task is not one that any private investigators can be expected to undertake. The mere compilation of statistics of family consumption, a less laborious affair, occupied much of the time of the United States food investigators for years. Here is a proper object for the team work of which so much is heard in these times. It involves physiological skill both in making the measurements themselves and in paying due heed to the attendant circumstances, such as the cooling power of the air in the factory or workshop, a point scarcely heeded by many past students; industrial knowledge is needed to decide what factory processes are *in pari materia* so that representative samples may be chosen for experiment; lastly, some experience in the handling of numerical data is required to decide the significance of departures from the average and the limits of precision of the averages themselves. Nor does it suffice to enroll a suitable team of investigators and send them out into the factories to collect data. The routine application of a physiological technique is the death of science. When a method is intelligently applied upon a large scale anomalous results must emerge, the analysis of which upon a laboratory scale and with the attendant simplification of the conditions may lead to the discovery of new and important truths. The investigating staff must be attached to a headquarters laboratory controlled by a physiologist competent to sift real anomalies from mere technical errors and to cause them to be sedulously investigated. We conceive that in this way alone a really adequate knowledge of the energy requirements of muscular work can be attained.

When it is remembered that this problem, important as it is, is only one of the problems of human nutrition which are still unsolved, we do not think more need be said in support of a national laboratory of nutrition. No doubt the time will come when the intelligent citizen will find it difficult to understand how any nation could neglect to make such a provision for its literally vital needs.—*British Medical Journal.*

SCIENTIFIC BOOKS

An Outline of the History of Phytopathology. By HERBERT HICE WHETZEL. Philadelphia and London, W. B. Saunders Company. 1918. Pp. 130, with 22 portraits.

The domain of plant pathology is rapidly taking shape as a highly important part of the contribution of botany to the economic life of the world, as well as a department of botanical science demanding recognition from students of the modern aspects of science in general. The enormous losses which crops suffer from parasitic and predatory fungi have long been recognized in a general way, but only in recent years, since numerous investigators have undertaken to study the causes which inhibit the optimum development of cultivated plants, has the great diversity in the etiology of plant diseases been so clearly shown. With the recognition of the diseases and their causes has grown up practical means for controlling or avoiding many of them. The economic returns have reacted upon the opportunities for investigation, and consequently great progress has been made in this department of botany within the few decades just past, more especially in America. The epidemic of the chestnut blight, the fight against the white pine blister-rust, the barberry-wheat campaign, and the government and state quarantine acts against the importation of diseased plants, have brought the subject home to every one.

The pioneer work by Professor H. H. Whetzel, of Cornell University, on the history of

phytopathology is therefore a timely and serviceable contribution. The subject is treated by Professor Whetzel in an attractive and perspicuous manner, and covers from the most ancient times to the present. Both the development of concepts regarding the nature and treatment of diseases as well as the dominating influence of phytopathological writers are taken into consideration in dividing the time into eras, and again into periods.

Scarcely thirty pages are given to the three incubation eras, called the Ancient, Dark and Premodern Eras, but they are most readable pages, and clearly point out the course of the early development of the subject.

The Modern Era, extending from 1853 to 1906, was one of great activity in all scientific lines. During this time phytopathology became a distinctive science. Many investigators of forceful personality and marked ability gave direction to the work of discovery, and in consequence the boundary of knowledge in the field of plant diseases was enormously extended. The center of pathological activity in its academic aspects was at first in Germany, and in its practical and commercial aspects in France, but in both aspects the foremost advance began to shift to America in the eighties, and soon this country became the leader in initiative as well as in the amount of investigation.

The present era, now just entering its second decade, has seen the establishment of chairs of phytopathology in many universities, the rise of the American Phytopathological Society and of the journal *Phytopathology*, the enactment of effective quarantine measures against the international and interstate movement of diseased plants, a new class of fungicides with sulphur in place of copper, the discovery of the canceroid nature of crown gall, and in general the recognition by men of affairs as well as by the cultivator of the vast importance of the utmost detailed information regarding plant diseases and of cooperative and efficient means for making such knowledge available in protecting all sorts of crops and plant life.

This orderly presentation of the evolution of a science destined to play an increasingly wider and more important part in the affairs of human well-being and achievement is particularly timely. Professor Whetzel has compressed into the hundred and thirty pages of his book a well balanced and helpful outline of the historical aspects of the science. It is a valuable addition to botanical literature.

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SPECIAL ARTICLES

RESISTANCE IN THE AMERICAN CHESTNUT TO THE BARK DISEASE

DURING the past summer, in connection with the Office of Forest Pathology, U. S. Department of Agriculture, the writer investigated conditions in the American chestnut looking toward immunity or disease resistance to the well-known bark disease. A thorough search was carried on, which, for obvious reasons, was restricted mainly to the immediate neighborhood of New York City. The results are deemed of sufficient importance to warrant publication here in advance of a more detailed account.

No immune trees were found, but a considerable number of resistant trees were located, some of them on the island of Manhattan itself. The following points are considered evidence of a resistant quality in these trees.

1. The result of inoculation tests. The average lateral growth of the fungus in 289 inoculations was 0.6 cm. for a period of from 5 to 6 weeks—mainly in August. This is about one fourth the figure (2.2 cm.) given by Anderson and Rankin for normal trees during the month of August at Napanoch, New York, and about one fifth the figure (2.83 cm.) given for the same month by the same investigators at Charter Oak, Pennsylvania.[1]

2. The occurrence of the trees in a neighborhood long subject to the disease, and the presence among the trees of individuals long since dead.

[1] Anderson, P. J., and Rankin, W. H., "Endothia Canker of Chestnut," Cornell Univ. Agric. Expt. Sta. Bull. 347, pp. 574, 575, 1914.