multitude of experiments made by the writer and his assistants" and that "it has often happened that the ink on some chapters would scarcely be dry before the results obtained from new experiments would require some part of it to be rewritten." We are further told that in this way some chapters were "rewritten a dozen times, in whole or great part." These quotations will serve also to give some idea of the method of science, and of the infinite pains which must be taken before final results are attained.

As indicated by the title of this volume, it deals with the history of the subject, that is, with the successive investigations of workers in this field of science. Some of the pronouncements of the earlier pathologists now make "mighty interesting reading," as shown by the quotations which are liberally given on pages 9 to 20. Then follow nearly two hundred pages of "general considerations" in which are discussed such questions as "the supposed normal occurrence of bacteria in plants" (which is decided in the negative); "bacteria on the surface of plants"; "parasitism"; "inception and progress of the disease"; "reaction of the plant"; "symbiosis," etc. The remainder of the book (about 150 pages) is devoted to "Vascular Diseases," that is, the diseases which have to do with the vessels of plants.

Three vascular diseases are fully discussed, namely, the "Wilt of Cucurbits," the "Black Rot of Cruciferous Plants" and the "Yellow Disease of Hyacinths." These are severally due to the invasion of the tissues by *Bacillus tracheiphilus* Smith, *Bacterium campestre* (Pammel) Smith, and *Bacterium hyacinthi* Wakker. As one reads the pages of descriptions he is impressed with the thoroughness with which the work upon which they are based was done. At every step one sees the results of the most painstaking investigation, much of which extended through many years. And with it there grows the feeling that here at last we have contributions to plant pathology that rest upon solid foundations and from which guesses and inferences have been wholly omitted.

In the introduction (page 4) we are given a convenient grouping of the diseases of plants due to bacteria, viz.: (1) The vascular diseases, (2) the parenchyma diseases without hyperplasia and (3) cankers, tubercles and tumors in which there is a more or less distinct hyperplasia. It will appear from this that the author has treated but one type or group of diseases, and from this we may infer that this volume is to be followed by one or more others, although no hint is given us by the author as to his intentions. It is to be hoped that Volume III. will appear in due time and that if this be not enough still others may follow. We can not help wishing that the plant diseases due to the fungi might find an investigator who would do for them what Dr. Smith is doing for those due to bacteria.

Charles E. Bessey
The University of Nebraska

Corrosion of Iron and Steel. By J. Newton Friend, Ph.D. Longmans Green & Co. 1911. Pp. 300; 62 figures.

Of the many references to the literature of the subject cited by the author, none is more interesting than the following from Pliny written some 2,000 years ago. In his "Natural History" Pliny writes "there is a kind of hallowing iron within the city called Zeugma, seated upon the Euphrates, wherewith King Alexander the Great some time bound and strengthened the bridge over the river there; the links whereof, as many as have been repaired and made new since, do gather rust, whereas the rest of the first making be all free therefrom." Evidently at this very early date the observation had been made, not only that iron rusts, but that different pieces may rust at different rates. The general subject has received so much attention from men in widely differing fields, and their publications have appeared in so great a number of places, that there existed a need for a work which would thoroughly digest this literature and gather together that portion which seemed sufficiently reliable to be of service to the investigators of the present. This task, which has not been an easy one, Dr.

Friend has accomplished in a thoroughly satisfactory way in the present volume.

The action of air and water and also steam upon iron is discussed at length, together with the various theories which have been advanced to explain corrosion. The author's experiments to prove that a trace of carbonic acid, however minute, is essential in order that rusting will take place, are of but academic interest, since such conditions can never be duplicated except with the refinements of a laboratory; and his conclusion that the electrolytic theory of iron is untenable is not warranted. In fact, the so-called acid theory which the author vigorously defends is none other than the electrolytic theory, where the assumption is made that the hydrogen ion concentration in pure water is not great enough to produce a speed of reaction sufficiently high to make the rusting of iron at low temperatures obvious; while by the introduction of carbonic acid the concentration of the hydrogen ions is increased to such a point that iron will pass into solution rapidly enough to appear as rust. The book in many places suffers somewhat by the author's unwillingness to make use of the conceptions introduced by the electrolytic theory which, were they used, would simplify the treatment.

The chapters on the factors influencing the rate of corrosion exposed to natural forces, the action of acids and single salts and other electrolytes upon iron are most complete and give the reader a clear idea of the existing knowledge of this phase of the subject. Chapter XII. is devoted to the passive state of iron, and while it seems to contain all that we know upon the subject it emphasizes the fact that our present knowledge is far from giving us a satisfactory explanation for this peculiar phenomenon. The later chapters deal comprehensively with the influence of chemical composition upon the durability of iron, electrical and galvanic action, and the relative rate of corrosion of iron and steel.

It is a matter of regret that the author has been misled, as have also the reviewer and others, by giving credence to statements and data supplied by the American Rolling Mill Co., of Middletown, Ohio, which he publishes on pages 114, 250, 276 and 251, regarding the purity of this firm's products. For example, the material said to have the analysis published on page 114, as containing 99.954 per cent. iron, and which on page 276 is proposed as a standard for *pure iron* on which to base a corrosion factor, was later found by the author himself, much to his surprise, to contain .172 per cent. copper.

The book constitutes a distinct and valuable contribution to the literature on the subject of corrosion, and will prove of interest to the general reader as well as of great service to those particularly interested in this field.

WILLIAM H. WALKER

Principles of Electrical Engineering. By HAROLD PENDER, Professor of Theoretical and Applied Electricity in the Massachusetts Institute of Technology. New York, McGraw-Hill Book Company. 1911. Pp. xviii + 438.

Convinced that the principles of electrical engineering are the principles of physics—a fact too frequently overlooked—and recognizing that a clear conception of these principles is essential for a proper understanding of the complicated reactions that take place in electric machinery and transmission circuits, the author of this book in an admirable manner deals successively with the more important phenomena of electricity and magnetism, continuous and alternating currents. On the whole the treatment is satisfying and thorough. The mathematical discussions are adequate but, being merely a means to an end, are not too extensive. Descriptions of machinery and apparatus—even of the transformer—are entirely omitted, the book having the same relation to electrical engineering as a first-class treatise on mechanics has to mechanical engineering. There has long been a demand for a comprehensive and thorough treatise of this kind. It has been customary either to shirk the matter and use descriptive texts, or to use separate texts, on the elements of electricity and magnetism, electrostatics, alternating currents, etc.