

amination and the four which mention the spectroscopic control of the Bessemer, could not have been found without the index.

All of this merely proves that a cyclopedia article cannot do duty as a text-book, and it is to be hoped that the first five chapters will be recast for subsequent editions. The latter part of the work shows admirable industry in the collation and recalculation of material, and good judgment in the elimination of superseded and unsatisfactory data. Exception might be taken to the omission of Michelson's work with the refractometer, of reference to hypotheses concerning fluorescence, and of discussions over atom-spectra and molecule-spectra. On the other hand, praise must be given to the lucid and impartial exposition of researches into the mathematical relations of spectral lines and their connection with chemical properties, as well as to the discussion of solar and astral spectra. It would be a valuable addition to the reference library of every chemist.

Dr. Tingle's translation is easy and idiomatic, the only solecisms being the persistent use of 'discovery,' for 'Erfindung,' and of the indefensible term 'magnetic current,' on page 75.

MORRIS LOEB.

ON LABORATORY ARTS. BY RICHARD THRELFALL, M.A., Professor of Physics in the University of Sydney. New York: The Macmillan Co. 1898. xii + 338 pp. Price, \$1.50.

The rather indefinite title of this book and the purpose for its existence, may be explained by quoting from the preface: "It is true that in a well-appointed laboratory, where apparatus is collected together in greater or less profusion, the appeal is often indirect, and to a student carrying out a set experiment with apparatus provided to his hand, the temptation to ignore the mechanical basis of his work is often irresistible. It often happens that young physicists are to be found whose mathematical attainments are adequate, whose observational powers are perfectly trained, and whose general capacity is unquestioned, but who are quite unable to design or construct the simplest apparatus with due regard to the facility with which it ought to be constructed. . . . It is the object of the following pages to assist the young physicist in making his first steps towards acquiring a working knowledge of 'laboratory arts.'"

The book is divided into four chapters, and the material con-

tained therein may be judged from the titles: Hints on the manipulation of glass and on glass-blowing for laboratory purposes, with an appendix on the preparation of vacuum tubes for the production of Professor Röntgen's radiation; glass-grinding and optician's work; miscellaneous processes; electroplating and allied arts, with an appendix on platinizing glass.

About one-third of the book is devoted to the many different manipulations of glass, as the use of blowpipes, glass-blowing, welding, grinding, fusing electrodes into glass, etc., in which the directions are, for the most part, clear and concise. Many of the methods offered differ from those already published, and with few exceptions only those methods are given which have met with success in the author's hands. This is more or less true of all processes given in the book. The appendix to Chapter I is a concise treatise on the preparation and the exhaustion of tubes for the production of Röntgen rays, the making of terminals and mercury pumps.

In the preface it is stated that "physical research is too difficult in itself, and students' time is too valuable, for it to be remunerative to work with insufficient appliances," but in spite of this, the greater part of Chapter II is devoted to lens-grinding, certainly a time-consuming operation, and which can hardly be classed as a laboratory art. In this chapter are also directions for making mirrors of glass and speculum metal.

Chapter III is devoted to such generally useful subjects as coating glass with aluminum and gold, cutting rock sections and sections of softer substances, soldering, etc. Thirty pages of this chapter are devoted to an excellent treatise on the preparation and properties of quartz fibers, and fifty pages to electric insulators and the properties and value of many substances used as insulators.

For the most part the directions throughout the book are well stated and to the point. An exception to this, however, is on the preparation of solutions for silvering mirrors (p. 151) in which the statement is awkward and unnecessarily involved. It is much to be regretted that a uniform system of measurement has not been adopted. Inches and millimeters, degrees Fahrenheit and Centigrade, are indiscriminately used. The index is well arranged and complete.

HENRY FAY.