

pleted (so far as anything in a museum can be said to be complete), while the Edentata, which was one of the first groups taken in hand, had been arranged at least a couple of years previously.

Limitations of space forbid fuller notice, and we may conclude by mentioning that while special chapters are devoted to his favourite subjects, anthropology and cetaceans, the three final chapters deal with the later and closing scenes of Sir William's life. Of four excellent portraits, those taken in his later years serve to remind old friends of Flower's striking personality. Bearing in mind the limitations already mentioned, the author is decidedly to be congratulated on the attractive manner in which he has laid before the public the main features of a very interesting and highly successful scientific career.

R. L.

#### THE IDENTIFICATION OF ORGANIC COMPOUNDS.

*A Method for the Identification of Pure Organic Compounds.* Vol. i. By S. P. Mulliken, Ph.D. Pp. xii+364. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1904.) Price 21s. net.

THIS is the first of a series of volumes which are intended to facilitate the identification of organic substances. The scheme commonly, though not invariably, adopted by organic chemists in this connection is to determine the molecular formula of the compound under investigation, and then to refer to Richter's "Lexicon," in which all known organic compounds are tabulated according to their molecular formulæ. Further agreement is established by a comparison of physical and chemical properties. The author considers that the difficult technique of conducting an ultimate organic analysis, upon which the above system mainly depends, "is fully mastered only by long practice," and that there is a shorter cut to the same result. This short cut consists in finding, in the first instance, to what class of compounds—hydrocarbon, alcohol, aldehyde, acid, &c.—the substance belongs, and, when this has been done, in determining such simple physical characters as melting-point, boiling-point, specific gravity, colour, smell, &c., which will lead to its identification. It is therefore necessary for purposes of reference that all the known organic compounds should be grouped into separate classes. This is what the author has done. In each class the individual members are arranged in the order of increasing boiling-point or melting-point. For example, let us suppose that the substance, the identity of which is required, proves to be an acid. All the known organic acids are divided into tables of liquid and solid acids, and these again into categories, which are either soluble or insoluble in water. Suppose that the acid under investigation is a liquid which is soluble in water. Having turned to the table containing the liquid acids soluble in water, an examination of the first column of boiling points will lead, perhaps, to the discovery of one corresponding to the unknown acid. Under this compound a series of characteristic reactions are described which will enable the investigator

to fix the identity of his compound by means of a few simple tests.

There is very little that is new in the above method. It is one which is adopted, consciously or otherwise, by the majority of chemists, whether they possess the skill requisite to conduct an ultimate organic analysis or not. That carefully elaborated methods are at present in use for determining the constitution of a substance by chemical tests is clearly shown by the existence of such a volume as Hans Meyer's, which has been translated into English, and has already reached a second edition.

In point of fact, when a substance has been obtained in a state of purity, its identification is as a rule not a serious undertaking. The character of the substance from which it is derived will usually furnish a clue to its nature, and a few characteristic tests will soon set the matter at rest. If the identification of a compound is a crucial matter, few chemists would rest content with anything less than a direct comparison of the product with the known substance, for melting- and boiling-points are apt to vary a little with the apparatus and form of thermometer employed, and colour reactions do not always produce quite the same tint unless the conditions of the experiment are the same.

It is the separation of a compound from a mixture and its purification which make the greatest demands on the skill and experience of a chemist. Compared with this, an ultimate organic analysis and the characterisation of a compound by chemical tests offer little difficulty.

There is no intention to disparage the labour which has been expended on this work. The careful revision of the reactions of many of the substances found in the tables would entitle the book to grateful recognition, in addition to which there is much useful and practical information on the method of applying the different reactions which every organic chemist will appreciate. It would be incorrect, moreover, to state that the tables will not serve the object for which they have been compiled. The question is only whether the object is worth the labour which it entails, seeing that most of the information may be derived indirectly from other sources.

The biological system of classification of substances into orders, genera and species cannot be commended. It is unnecessary and undesirable. There is no analogy in the application of these terms in the two sciences, and their use may be misleading. Chemical nomenclature still suffers in this country from such a false analogy, when *radicle* was adopted in place of *radical*.

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#### THE MIND OF THE CHILD.

*Educational Psychology.* By Edward Thorndike, Adjunct Professor of Genetic Psychology in Teachers' College, Columbia University. Pp. vii + 177. (New York: Lemcke and Büchner, 1903.)

THIS volume embodies the results of investigations in which Prof. Thorndike has interested himself and his pupils for some time past, applying the methods