

*Eine Discussion der Kräfte der chemischen Dynamik. 3 Vorträge von Dr. Ludwig Stettenheimer. H. BECHHOLD. Frankfurt, 1895. 6 Marks.*

This pamphlet of 85 pages is certainly revolutionary in character, as the author proposes to abandon some of our fundamental conceptions of chemistry, and to deal with the subject purely mechanically. Chemistry, according to the author, is the mechanics of the smallest bodies, as Astronomy is the mechanics of the largest, while Physics is a connecting link between the two.

In chemistry we have to deal with matter, with equilibria, and with forces. In chemical reactions energy is set free, and we know in many cases its mechanical expression in calories. All the groupings and unions which we express in our chemical formulæ do not necessarily have their counterpart in the substances themselves, but are only conditions of equilibrium, not general but special cases of equilibria. The molecule ceases to be a fundamental conception. Chemistry of to-day is a molecular chemistry, but we must now give up this conception, and, in the place of the molecular or chemical compound, we must introduce, as in astronomy, a 'system,' a 'chemical system.' Atoms combine to form groups due to the action of the various forces, but why not have these groups go on combining until we have something which can be perceived by the senses? If the same force of attraction which binds the atoms together also causes the groups to unite, what conditions the limits of the molecule? In a substance like potassium oxide we do not know whether two or several molecules are combined, but why may not hundreds, thousands or all the molecules be combined? This does not conflict with Boyle's law, since we may regard a gas as if it were only one molecule and having no inter-molecular spaces.

A system composed of a few well-defined atoms and groups is termed a molecular

system. These combined systems, and not the ordinary molecules, represent conditions of equilibria. In the second chapter considerable space is given to the consideration of equilibria, both stable and unstable, and the third and last is devoted to the conditions of union in the solid, liquid and gaseous states. As a result of these considerations, the author concludes that chemical forces differ in no wise from mechanical, but that everything points to a mechanical interaction between the smallest particles of matter.

While scientists are always ready to consider new ideas which will lead to wider generalizations, yet it is always a fair question to ask whether a given suggestion will accomplish this. In the present case it seems quite proper to consider whether all the chemical evidence of the existence of atoms and groups forming definite units, called molecules, has been taken into account. If so, then will this method of regarding chemical phenomena enable us to advance further or faster than that involving atoms and molecules? It can be safely predicted that chemists will be somewhat adverse to giving up conceptions upon which their whole science is built, at least until something more than abstract ideas are offered in their place, something about which they can think definitely and clearly, and which will suggest new lines of work. It is doubtful whether the work published by Dr. Stettenheimer will meet with pronounced success in removing these conceptions of atoms and molecules from chemistry, since they have proved so fruitful in the past, and seem to meet the demands of most of the working chemists of to-day.

The book, while clearly printed, contains a remarkably large number of typographical errors. Nearly a full page of corrections is given, yet the reader will encounter many mistakes in the text which form no part of

this tabulated evidence of careless proof-reading.

The reviewer has found it difficult to give a satisfactory account of the contents of the second and third chapters in a short review, so that those who may wish to follow the author's applications of his fundamental ideas must read the original.

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*Text-book of Organic Chemistry.* By A. BERNTHSEN. 2d English Edition, translated by G. MCGOWAN, from the 4th German Edition. London, Blackie & Son. New York, D. Van Nostrand. 1894.

The general excellence of this work is indicated by its reception both in German and in English speaking countries. Four German editions in six years have been found necessary, and the second English edition will probably be even more extensively used than the first. The present book is a work of about 575 pages, fifty more than the previous edition, and occupies a position between the elementary and the encyclopedic text-book. As stated in the preface, the descriptive part is condensed as far as possible, and special emphasis put upon summarizing the characteristics of each class of compounds. There are frequent valuable tables of the principal properties of important classes of compounds. The subject-matter is treated in a way showing the intimate knowledge of the literature to be expected from a chemist like Bernthsen, though it seems strange that he makes no reference to American periodicals, but seems content to use the often imperfect abstracts in the foreign journals. The fourth German edition was published in 1893, and the subject is well brought to that date. A point would have been gained, and the value of the book greatly enhanced, had the translator brought to the date of publication of the English editions at least those chapters

which treat of classes of compounds on which important work was done in 1893 and 1894. I refer particularly to the sugars, terpene, etc. The translation is good, though sometimes too literal. Many German expressions have crept in, and do not make the matter any clearer. In the text, formulæ of substances are frequently used instead of names. It would be better to use names only, but if  $P_2S_5$  is used in one place because it occupies less space than Phosphorus Pentasulphide, it should be used always, and the one should not appear on one page, and the other a few pages further on. On the whole the work is well adapted to the needs of those American colleges in which organic chemistry can receive the time and attention it deserves. With it a mature student can easily get a good working knowledge of the subject. For undergraduate work, as carried on in most of our colleges, a less ambitious course, thoroughly given and embodying the use of a smaller text-book, seems desirable.

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*Systematische Phylogenie der Protisten und Pflanzen.* ERNST HAECKEL. Jena, 1894, Pp. 400.

Prof. Ernst Haeckel, of Jena, has recently begun an extensive work on the systematic evolution of animal and plant life. It is to be in three parts, the first of which has just appeared as the '*Phylogeny of the Protista and the Plants*.' The second part, on the phylogeny of invertebrates, and the third part, on that of vertebrates, are also promised during the present year. In the present volume the author outlines his plan and presents in the opening paragraphs the main data upon which his phylogenetic trees are based, namely, the three branches of natural science, palæontology, ontogeny, or the life history of individuals, and morphology. The work as a whole is in