order has not in every case been adhered to, the main idea and its subsequent development being frequently treated together; but the sequence of epoch-making events is strictly maintained. The work is quite up to date; when advisable, the author has introduced facts which have only been established by recent investigations.

The book is tastefully bound, and the illustrations are numerous. The latter are varied, and embrace cuts from "Die Zwölf Schlüssel," apparatus historic and modern, and portraits of celebrated chemists. To the reader possessed of some chemical knowledge the volume will be most useful, and to the uninitiated its earlier chapters, at least, cannot fail to be inviting.

LUMINOUS ORGANISMS.

Les Animaux et les Végétaux Lumineux. Par Henri Gadeau de Kerville. (Paris: J. B. Baillière et fils, 1890.)

THIS little book is a semi-popular summary of what is known in regard to the photogenous structures of the various kinds of luminous animals and plants, commonly (but improperly, as the author points out) known as phosphorescent. As it is on the whole fairly complete and accurate, being based largely upon the important researches of Panceri, Sars, R. Dubois, Emery, and others, it will probably be useful not only to amateurs, but also to students who wish to get a general knowledge of the range in organic nature of light-producing forms, and of the more important investigations on the subject which have been made since the days of Aristotle and Pliny.

Although the title-page of this book bears the date 1890, the important discovery by Giard, in September last, of luminosity in Amphipods which is due to an infectious disease is, it may be supposed, too recent to have been included—at any rate, it is not referred to.

After a short historical *résumé*, the first half of the work (170 pages) is occupied by a systematic account of those plants and animals which are luminous, commencing with the plants and then working up through the animal series from Protozoa to Vertebrata. More animals than plants are photogenous, and most of these are marine. Few observations have been made upon freshwater forms, and none are known from brackish water. M. Gadeau de Kerville takes care to point out, what is undoubtedly the case, that many supposed instances of luminosity, especially in dead animals or in the neighbourhood of harbours, &c., where there is much decaying organic matter, are due, not to any "phosphorescence" of the animal observed glowing, but to the presence of luminous Bacteria on the surface, in mucus, or in the tissues. Several species of light-producing micro-organisms (*Bacilli* and *Micrococci*) are already known, and the list will probably be largely added to in the future. It is, however, an excess of caution to doubt the claim of *Ceratium* (*Peridinium*) to be placed amongst photogenous genera, as two or three of the species appear to be responsible for a good deal of the "phosphorescence of the sea" around our western coasts in autumn—a phenomenon which is usually attributed even by naturalists to *Noctiluca miliaris*, although at such times it often happens that not a single *Noctiluca* is caught by the townet!

The well-known observations and experiments of Panceri on *Pennatula* and other forms are given, and the figures reproduced, and it will no doubt be useful to many to have the information obtained by various investigators thus collected into one volume. On p. 83 is given an observation by Quatrefages upon certain luminous *Talitri* (Amphipod Crustaceans) on the beach, which he supposed had derived their luminosity from contact with *Noctiluca*. Is it not more probable that, like Giard's diseased Amphipods at Wimereux (which, by the way, have turned up lately at Jersey, and will probably be found to be widely spread), they were infested by a photogenous microbe?

In connection with the remarkable "luminous globules" of some Schizopods (*Euphausia*, *Nyctiphanes*, &c.), M. Gadeau de Kerville suggests that these organs are light-perceiving, as well as light-producing, and that, therefore, the old designation of "accessory eyes" was not improperly applied. This view is supported by several observed cases where the true eyes of higher Crustacea were luminous; but it should be remembered that it is entirely opposed to the matured opinion given by G. O. Sars in his Report on the *Challenger* Schizopods.

Chapter xiii. is devoted to an account of the anatomy and physiology of the photogenous organs, in which, however, little of importance is added to what was given in the preceding part of the book. The author adopts the view of Dubois (founded upon experiments on *Pholas dactylus* made at the Roscoff Laboratory), that in all cases the luminosity is a purely physico-chemical phenomenon, and is dependent on the presence of two substances—the one (*luciférine*) soluble in water and obtainable in the crystalline state, the other (*luciférase*) a soluble ferment (like diastase)—which must be brought in contact in order that light may be produced. This seems going further than our present knowledge really warrants. The light-producing organisms and organs are so varied that it is possible that the causes of the luminosity may be manifold; and, at any rate in the higher forms, the bringing together of the *luciférine* and *luciférase* must be under the direct control of the nervous system, as the production of light is a reflex, perhaps in some cases a voluntary, action.

In a short chapter, entitled "Philosophie naturelle," the author considers, from the evolution stand-point, such questions as the origin of luminosity, the reason why only relatively small numbers of animals and plants are luminous, why the majority of luminous animals are marine, &c.; but for a discussion of these points, and also of the various uses (both to animals and to man) which the luminosity may have, reference must be made to the book itself, which, although some of the illustrations are poor, and there is unnecessary repetition and verbosity in the text, forms a readable and useful introduction to a very interesting and important subject.

W. A. HERDMAN.

OUR BOOK SHELF.

The Chemistry of Photography. By R. Meldola, F.R.S. (London: Macmillan and Co., 1889.)

THIS work is well worthy of study by serious devotees of photography. It enters, as its title indicates, into the chemistry of photography, and that in a very thorough and