SCIENTIFIC BOOKS

Triumphs and Wonders of Modern Chemistry. A Popular Treatise on Modern Chemistry and its Marvels, written in Non-Technical Language for General Readers and Students. By GEOFFREY MARTIN, B.Sc. (Lond.), M.Sc. (Bristol), Ph.D. (Rostock). New York, D. Van Nostrand Company. 1911. $2.00 net.

Popular treatises on science are generally regarded with disfavor by scientific men. This is not unnatural; for the most part those who are competent do not write and those who write are not competent. The scientific authority seems loath to demean himself by writing for the unscientific public, and the popularization of science is left to the newspaper reporter and the penny-a-liner. The reporter is catering to a popular demand and we ridicule or despise or ignore his futile but often honest efforts at interpretation in a field where he is clearly not at home.

It is unquestionably the scientist himself who is most largely to blame for this situation. He will not write himself, he looks askance at his fellow scientist if he ventures to write for the public and possibly dubs him a quack. We forget the marvelously fine work of Tyndall and of Huxley in popularizing science. After all, perhaps most men who are qualified from a scientific standpoint are really unable to put their knowledge into words which can be understood and enjoyed by the mass of mankind.

Of all the sciences possibly chemistry has suffered most from lack of popular interpreters. In Germany, Lassar-Cohn and Blochmann have in recent years presented chemical ideas successfully to the non-scientific mind, but there is little of value in English which can be called popular chemistry.

The book before us is a rather ambitious attempt to present the field of atomic and sub-atomic chemistry, as well as much of the chemistry of the non-metals, "in non-technical language for general readers and students." That the attempt is ambitious is apparent from the titles of the fifteen chapters, viz.: The Mystery of Matter; The Underworld of Atoms; Distribution and Evolution of the Elements; The Wonders of Chemical Change; Water; The Element Hydrogen; The Air; Oxygen, the Life-supporting Element; Nitrogen; Carbon—a chapter which concludes with The Wonders of Atomic Structure of Carbon Compounds; Carbon Dioxide; Silicon and its Compounds; Sulphur and its Compounds; The Phosphorus Group of Elements; Fire, Flame and Spectral Analysis.

The first five chapters are thus occupied with the most difficult problems of theoretical chemistry. How far they will be comprehended by non-scientific readers is a question. It would be interesting to try them as collateral reading for a class of beginners in chemistry. If an hour's interesting reading could be substituted for weary weeks of lectures, recitations and laboratory, it would be a great saving to both instructor and student.

Truly, there is not a page that can be considered dull reading. It is well that "Wonders" is a part of the title, for there is hardly a "wonder" in all the field treated, which is not introduced in vivid, often perhaps lurid, language. The style and scope of the book are best shown by a few quotations, which speak for themselves.

In the chapter on Air, we read of the future of this earth:

> Last of all, when the temperature falls below —210° C., the air will freeze to a solid layer of an ice-like transparent mass about thirty-five feet thick. No gaseous atmosphere will then exist upon the earth. This will become an intensively cold dark wilderness. Then, after untold ages of ceaseless movement and gigantic change, the surface of our planet will at last rest in supreme repose, motionless and utterly silent. For, in the absence of a gaseous envelope, no moan of wind or roll of thunder, no splash of rain, no roar of torrent, no sound of voice of man or beast or bird, can pierce the blackness of the night and break its everlasting calm. The surface of the world will be a vacuum as perfect as that prevailing in Dewar's vacuum-jacketed flasks. The stars will shine out of a coal-black sky upon a lifeless world, set stiff and hard in the rigid grip of death, circulating

unseen and ghostlike in the darkness around a burnt-out sun. Yet, only a few miles down in its interior, in strange contrast to the dreadful death-bringing cold of its surface, the gigantic furnaces of the deep, immense reservoirs of power and energy, will still gleam and glow. So the world will continue for long eons of ages, until its matter dissolves away and rushes into the oblivion of the ether, or until it is shattered in some mighty cosmical collision and resolved into a glowing nebula again, only to begin anew another vast cycle of life (p. 159).

Again, of the electrons:

This primary stuff is negative electricity, which is therefore a true chemical element. A flash of lightning consists of the swift rush of innumerable myriads of these negative electrical atoms, flying with the enormous speed of a hundred thousand miles and more a second. An electric current flowing along a wire consists likewise of a torrent of these particles flashing along between the atoms which make up the wire. Light is but the swift shudder of the ether set up by the rapid whirl of these negative electrons round their tiny orbits in matter atoms. All the atoms of the elements consist of aggregations of many thousands of these bodies and originated in very different quantities, as follows: In the very beginning of time, long before Man, Earth, or Sun had come into existence, before even there was a suspicion of their formation, space was filled with a vast sea of electrical vapor. The vapor was composed not of atoms, for matter atoms had not yet come into existence, but of the tinier electrical particles mentioned above, the measureless speed of whose motions caused the whole to thrill with a faint crepuscular light, and appear from a great distance as a faintly luminous cloud, like one of the nebulæ which gleam nightly at us down from the sky.

The vapor, being composed of electrical atoms, was electrified beyond all measure, and stretched gleaming with its electrical fires, through the darkness of space like a flaming sword.

. . . In the earliest nebulæ—the first stage of matter of which we have any knowledge—there exist only four elements, namely, two still unknown upon the earth, together with hydrogen and helium. These are the four elements from which all the others have been formed, and these authors (A. C. and A. E. Jessup) term them "protons" to distinguish them from the other elements. The electrons are supposed to condense about the atoms of these protons in concentric rings; so that in order to imagine the appearance of an atom, we must look upon it as composed of a series of rings of various sizes, whose particles are in exceedingly rapid motion, and indeed, as we shall see presently, the stability of the rings is a consequence of the rapidity of the motion of the particles of which they are composed (pp. 37, 39).

Of the velocity of electronic motion:

Tremendous as the velocities reigning in the molecular world may seem to us at first sight, yet they are quite insignificant when compared to the swiftness of the whirling motions going on within the atoms themselves; the particles building up the atoms flash through over a HUNDRED THOUSAND MILES A SECOND! Incredible, you will say; nevertheless it is a sober fact of science. In every stone and stick about us, ceaselessly, second by second, day by day, century by century, age by age, these terrific motions are going on. In the tiniest grain of dust in the millionth part of a second the rush of atomic events is so incredibly swift as to defy all conception and calculation (p. 21).

If an intelligent inhabitant of our electronic microcosm were suddenly transferred to our world, and managed to retain his mental characteristics unchanged, our life here, busy as it seems to us, would represent to him a changeless eternity, since in a single second of our time the electronic world has time to revolve billions of times round its central sun. His atomic years are almost infinitely shorter than ours and his sense of time almost infinitely finer. Time and space are, after all, merely relative conceptions (p. 81).

Under Hydrogen is the story of some fragments of zinc carelessly left inside the boiler of a German warship:

The hold was filled with busy stokers, and the great engines throbbed, driving the mighty vessel swiftly through the sea. All this time the water was heated in the boiler to an exceedingly high temperature and the zinc was dissolving rapidly in it, giving off a large amount of hydrogen gas. This mingled with the air in the boiler to form a terribly explosive mixture, so, all unknown to the men working around, the great boiler was gradually filled with the deadly gaseous mixture. Suddenly, without a moment's notice, with a blinding flash of light and a roar like an enormous thunder peal, the great boiler blew to pieces, killing or

maiming all the men in the room and filling the vessel with a cloud of scalding steam (p. 111).

These quotations will suffice to show the characteristics of the book. It can hardly be considered as other than somewhat sensational and often perhaps exaggerated, but to the student of chemistry it will afford much food for thought and reflection, and this, we think, is its chief value. The title of "Modern Chemistry" is well chosen, for the book is brought thoroughly down to date.

The illustrations are unequal. Some of the half-tones are excellent, while some of the wood-cuts are execrable, wholly unworthy of the book, and others have evidently been handed down from early times. Quite unique are the three cuts representing the reaction between phosphorus pentachlorid and sulfuric acid, which have a decidedly astronomical appearance, cometic, one might say.

The book is printed on thick, light paper and the typography is good. The only error we have noticed is the name of F. W. Clark instead of Clarke, and this is several times repeated.

J. L. H.

Ctenophores of the Atlantic Coast of North America. By ALBERT GOLDSBOROUGH MAYER. Publications of the Carnegie Institution, 162. 1910. Pp. 58; pl. 17.

Dr. Mayer is well qualified to give an account of our ctenophore-fauna by many years observation at numerous localities between Newfoundland and the West Indies, all but three of the 21 species here recorded having come under his own observation. And his book is made doubly welcome by the fact that American ctenophores have received little attention in recent years.

The first few pages are devoted to a brief statement of geographic distribution, three groups of species being recognized on our coast: "cold-water forms," "intermediate" and "tropical." The first are described as common north of Cape Cod, and occasional as far south as Hatteras, the second extending from Cape Cod to northern Florida, while the records of the tropical species are chiefly from the Tortugas, though some of them "drift northward in summer to the region of Vineyard Sound." The recognition of these three groups is justified; but exception must be taken to the limits assigned the first, for two of its members, *Pleurobrachia pileus* and *Beroe cucumis* are by no means exclusively cold-water species, as is shown by the presence of the former at Bermuda, in the Mediterranean and at the Seychelles, and of the latter near Madagascar and in the Malay archipelago. Mayer suggests that the Mediterranean "Pleurobrachias" might be young Lobatæ, but specimens from Naples prove to be typical *P. pileus*. If we remove these two species from the Arctic group, the extreme southern limit of the latter in winter appears to be New Jersey. The tropical group includes the noteworthy species *Hormiphora plumosa, Eurhamphea vexilligera* and *Folia parallelum,* not previously recorded from this side of the Atlantic. An interesting fact pointed out by Dr. Mayer is that we are far less rich in ctenophore species than the Mediterranean; though certain ones swarm on our northern coasts.

The general organization of the ctenophores has so often been discussed that Dr. Mayer limits himself to a brief summary of the features of the gastrovascular system of the six orders, and then proceeds to the descriptions of the species, which occupy the greater part of the volume. These are generally satisfactory, the lists of references full, and the figures numerous and unusually beautiful, and there are numerous notes on habitat and on physiology. No families are recognized, the only divisions being orders, genera and species. The following generic names are abandoned, because preoccupied, *Bolina, Eucharis, Ocyræ* and *Vexillum;* as substitutes Dr. Mayer proposes *Bolinopsis, Leucothea* (Mertens), *Ocyropsis* and *Folia.* Four species are described as new, *Pleurobrachia brunnea, Tinerfe lactea, T. beehleri* and *Leucothea ochracea.* But the first is so close to the *Hormiphora spatulata* described by Chun from the Plankton expedition that I believe the two are identical. *Leucothea ochracea* is interesting because, to