

ed, and when dry reflecting nothing, but, when immersed in a shallow dish of water, by their blackness forming a very effective means of reflection. A few rude idols and phalli are included among the objects illustrated, but the mass of such material is reserved for a future contribution on Worship. Professor Brigham warns the peripatetic collector against stone articles prepared for sale by the resident Portuguese stone-cutters, and often offered as antiques, sometimes even buried in likely sites to be dug up by archaeologists who employ the deceivers, native or other, as guides for a consideration.

THORPE'S ESSAYS IN HISTORICAL CHEMISTRY.

Essays in Historical Chemistry. By T. E. Thorpe. The Macmillan Co., 1902. 8vo, pp. 582.

The subjects of these eighteen essays, barring one or two, are all distinctly great. There is one upon Boyle, concerning whom nothing quite adequate has ever been written. Half-a-dozen relate to the better threshed-out subjects of chemists of Lavoisier's time. Five discourse of precursors of modern chemistry, Faraday, Graham, Wöhler, Dumas, and Kopp; two of modern chemists, Victor Meyer and Mendeleef; one of Cannizzaro, who was not quite modern. The remaining three are sketches of general nineteenth-century or Victorian progress in synthetic chemistry, in British chemistry, and in technological chemistry. With the exception of Cannizzaro, and perhaps Kopp, there is none of these subjects that is not a mine of instruction, although not much that is novel remains to be added about Cavendish, Priestley, or Lavoisier. One can hardly say that the author has extracted from any of his subjects its full lesson, unless it be from that of Victor Meyer. The portraiture of his character, life, and works is fine. To appreciate it, however, the reader needs to be familiar with the chemistry of the aromatic bodies.

Or nearly as much value is in the long chapter about Graham, occupying nearly ninety pages, and composed of two independent papers. One would not antecedently suppose that so much not generally known remained to be said of so prominent a figure. It is shown that Graham was one of those who enter upon their experimental careers filled with some idea sufficiently fecund to produce great and inexhaustible work. This, in Graham's case, was the idea of atomcules in motion—an idea whose career has, at this day, perhaps not fairly been initiated. He was a pupil of Thomas Thomson, a disgracefully bad analyst, but a good vehicle for the dissemination of Dalton's doctrine, and, what is more, a discernier of men and of scientific genius. Thomson was impressed by Graham from the very first, and from the first treated him with something like deference. Such conduct on the part of a man of European celebrity—for such Thomson was—without a doubt greatly stimulated the development of his pupil's powers. Let the world pay its debt of gratitude to Thomson for this. The modern doctrine of valency virtually contents itself with a modification of the Berzelian idea that chemical forces are polar; and no doubt there is some truth in that, so far as it

goes. Only it is pertinent to inquire how they come to be so. But Graham conceived that even the atoms of hydrogen, much more those of the other elements, were composed of many parts moving without absolute constraint. We need not say how much reason has since been found, some of it recently, for accepting that opinion. But it is difficult to imagine how, say, a thousand atomcules of hydrogen can be held together in one molecule without a chance agglomeration of a thousand and ten or more in another. Why should it be, then, that all the molecules of hydrogen, or any other simple gas, are equal or nearly so, as Graham's experiments proved them to be? As soon as anybody shall so much as suggest an adequate hypothesis to explain that fact and the observed approaches to Prout's law, the real quality of Thomas Graham will begin to shine out. Over his thought from boyhood there towered a misty shape which was always becoming compacted into the consistency of that puissant Jinn, the whole vast kinetic theory of matter. These reflections, and many others suggested by Dr. Thorpe's account of Graham, lead us to accord a high esteem to that chapter.

The first chapter is on Boyle. An account of Boyle's broader conceptions, with their previous history, and that of their subsequent influence upon philosophy and upon science (which, in both directions, has been greater than is generally known), would have formed no small contribution to our comprehension of ourselves. But all that, if the author was able to furnish us with it, has been crowded out by long extracts from one of the most intolerably long-winded writers who ever abused our language. To the prolixity of garrulous conversation, Boyle added a pedantic choice of words whose only good excuse might have been that they effected compression. The "Reflexions on a Broomstick" is hardly a caricature. Dr. Thorpe understands Boyle the chemist very well; but technical chemistry is quite the smallest side of that original and prepotent mind.

The essay on Scheele makes use of Norvald's book; and since few of us have time to go through that volume, this meagre account of its contents will not be unwelcome. This is not the only case in which Dr. Thorpe has drawn the substance of a sketch from a single well-known source, quite legitimately.

Cavendish, Priestley, and Lavoisier, who, together, occupy considerably over a hundred pages, have all of them been pretty thoroughly understood for a long time. Of course, an irresistible inclination will induce a Frenchman to overrate Lavoisier or misground his appraisal. This manifests itself even in Berthelot, himself a great man, and as fair a Frenchman as could be found. Lavoisier never made an original experiment in his life, but he saw which the decisive experiments were, he repeated them with such high precision, and such circumspect precautions that confidence was commanded, he coordinated them with a clear, scientific logic of which no contemporary was the master; thus he gave the death-blow to a theory of extraordinary vitality, and he enthroned in its place a theory, partly his own, which was mainly true. The account which Dr. Thorpe gives of him and of his work is perfectly just. Dr. Thorpe has no other explanation to offer of Priestley's adherence to phlogiston

than the old one, that Priestley was incapable of placing himself in an unwonted point of view. We doubt whether the history of Priestley's opinions in metaphysics and theology sufficiently supports that explanation. There seems to be something worth considering in another view that has been broached, namely, that the vitality of the doctrine of phlogiston was, in some occult or subtle manner, due to the circumstance that it was true in its way.

One of the more striking of the essays is that on Jean Baptiste Dumas. It is largely drawn from Hoffmann's *Eloge* in the *Beichte*; but not so the following:

"If," says the author, "we compare the chemistry of to-day with that of the stirring times when Dumas, half a century ago, was matched almost single-handed against the German school—against such Titans as Berzelius, Liebig, Wöhler—we are amazed at the wealth of material which has been opened out. The change, thus directly or indirectly traceable to the labors and conceptions of Dumas, is as great or even greater than that achieved by the overthrow of the Phlogistons. If Lavoisier was the author of the first French Revolution in Chemistry, Dumas was the creator of the second."

Unquestionably, Dumas was a very considerable genius; and there is none of the many men of science who came into contact with him during the period of his secretaryship of the Academy of Sciences but must remember the delightful old gentleman with warmth and with a sense of obligation. Nevertheless, truth is truth; and even so much as a claim that his relation to the present conception of a chemical compound molecule was that which his baptismal name might suggest, would be definitely inadmissible. But was he not the author of the doctrine of substitution? So Dr. Thorpe represents him to have been; and there is just this much truth in it, that, while it had previously been known that chlorine could drive hydrogen from various compounds, it was Dumas who first showed that this happens if almost any organic body is treated with chlorine; and he added that an analogous reaction would occur if the body was exposed to the action of bromine, of iodine, or of oxygen. But when Berzelius attacked him for maintaining the monstrous proposition that chlorine could behave like hydrogen, Dumas replied:

"M. Berzelius m'attribue une opinion précisément contraire à celle que j'ai toujours émise, savoir que, dans cette occasion, le chlore prendrait la place de l'hydrogène. Je n'ai jamais dit rien de pareil. . . . Si l'on me fait dire que l'hydrogène est remplacé par du chlore qui joue le même rôle que lui, on m'attribue une opinion contre laquelle je proteste hautement, car elle est en contradiction avec tout ce que j'ai écrit sur ces matières."

Thereupon he goes on to say very explicitly that the opinion attributed to him is neither more nor less than a ridiculous (*outrée*) theory which has been urged by one Laurent. He means Auguste Laurent, who, in fact, had said:

"Un composé organique constitue un ensemble, formé par la réunion d'un nombre d'éléments simples ou composés, éléments que l'on peut remplacer à volonté dans ce composé par des groupes analogues [the context shows that he means what we should now call groups of the same valency], sans altérer la physionomie générale, l'harmonie, ou le type de ce composé."

It was this Laurent who, in consequence

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of the bitter resentment of Dumas against the man who had ventured so to modify his doctrine, died, as has often been said, and with little exaggeration, substantially of inanition and almost at Dumas's door, and who, by the above sentence, voluminously expounded and elaborated, has established his clear title, with clear-headed chemists, to being considered the father of the leading conception of modern chemistry.

The truth is, that in all the several scenes of life in which Dumas was busy, he ever showed himself to be an adroit man. He introduced the word "substitution" into chemistry, while loudly proclaiming his rejection of the only meaning that word was fitted to convey. He, one of the Forty—he, the fastidious selector of words—did this. So, then, should it turn out, in process of time, that there really was a substitution, it would be remembered that he had first said so, and his disclaimer would be forgotten (just as we see Dr. Thorpe forgetting it); while, should it turn out that there was no substitution, the inappropriateness of the word would be lost sight of when it had become familiar, and at all events his declaration would be borne in mind. Just so, in regard to Prout's law, Dumas managed to take up such a position that both parties claim his support. But he was a little too adroit on the day when he bethought him quietly to appropriate certain results of Liebig's, for he found himself straightway transfixed, nailed to the counter, without a reply to make. As for his waging war, single-handed, against all the chemists of Germany, it is as easy to understand Dumas's looking upon the situation in that light as it is St. Thomas Aquinas's anticipating as a chief felicity of heaven the triumph of looking over the battlements upon rivals to sanctity frying beneath; but the one is as near a true religious aspiration as the other is to a true scientific sentiment. He was so far from arguing single-handed, that he tardily adopted, and endeavored to pass as his own, Laurent's "outré" doctrine.

We have endeavored to impart to our readers a sufficient prenotion of the matter of this volume. We ought to add one word of warning against not a few small misstatements of facts of chemistry and chemical history, mistakes utterly trivial and hardly worth more than the mere mention, were it not a curious psychological fact (or must we, nowadays, say a *psychical* one?) that so excellent a chemist as Dr. Thorpe should make so many indisputable slips. We will just mention one as a specimen. The author has been saying how brilliant for England in chemistry were the first two decades of the nineteenth century. So they were, since Davy's work and Dalton's were done then. But he goes on to give two or three instances by way of proof, and among these he names the discovery of acetylene, although it has only recently been brought to the attention of chemists and non-chemists that acetylene was first discovered in 1836. But the author probably had it in his mind that acetylene was discovered by Davy, momentarily forgetting that this Davy was not Sir Humphry, but his obscure protégé Edmund, otherwise known principally for some early activity in applying chemistry to agriculture.

LINN'S STORY OF THE MORMONS.

The Story of the Mormons. From the date of their origin to the year 1901. By William Alexander Linn. The Macmillan Co. 1902. Pp. xxiv, 637.

Mr. Linn's elaborate volume on the Mormons we are inclined to call the best that has appeared. None shows itself to have been written in such a special library, with extracts on every page from original witnesses. Nowhere do we find their testimony more compactly stored, or more fairly interpreted and weighed. The bibliographical sources of knowledge were a collection of which our author might have said more. His readers would gladly have learned that it was accumulated by Miss Helen M. Gould during her crusade which did so much to prevent the seating in Congress of the polygamist Roberts, and that, she having presented it to the New York Public Library, it is now garnered in the Lenox branch. Its contents were 451 books, 325 pamphlets and 52 volumes of newspapers. These figures seem strangely similar to those of a collection in the same line in the Wisconsin Historical Society's Library, where the books are catalogued 448, newspaper files 43, periodicals and pamphlets more numerous than in New York, making in all 1,273 titles. A bibliography of his sources, as well as more guiding dates, is what we most desiderate in Mr. Linn's all-round monumental monograph.

Mr. Linn, so far as we perceive, never mentions the name of Gibbon, and yet often reminds us of that historian. Like Gibbon, he abounds in citations, with references to verse as well as chapter in the originals. Like Gibbon, he enlivens dull pages with pat and sprightly scraps from French favorites. Yet he is most of all Gibbon-like as the lord of irony. His sneers are so solemn that what he says in jest will be construed by some as sober earnest, or near it. In tracing the progress of Mormonism, while making no allusion to Gibbon's notorious secondary causes of the growth of Christianity among pagan Romans, Mr. Linn brings forward many analogous facts, and those pointing the same way. Thus, belief in miraculous gifts was no less prevalent and influential in Latter-Day Saints than among those of the primitive era. Mormon apostles rivalled scriptural miracles as Pharaoh's magicians rivalled, or mocked, the mighty works of Moses, "doing also in like manner with their enchantments." Brigham's gulls, which fulfilled his prophecy and ended the plague of crickets (p. 400), is a type of countless others which, if they did not convert sceptics, satisfied credulous simplicity. The undeniable virtues of the first Christians were also of power to draw outsiders into their communion. "A generous intercourse of charity united the most distant provinces, and the smaller congregations were assisted by the aims of the more opulent" (Gibbon, xv, 141, note). Equally magnetic were the good lives of Mormons, who were noted for peace with surrounding Indians, for lives of labor, for charities to the poor and helpless among themselves, so that these never became a public charge. In 1869, a city of over 12,000 souls with no gambling halls, no obscene dance-halls, and scarcely a single whiskey saloon, satisfied the writer as well as other visitors that Mormonism, though its "iron was mixed with miry clay," re-

tained, at least, truth enough to make a lasting life.

Again, the doctrine of life beyond life brought many to join the early Christians because their faith was firm that a foretaste of its beatitude was at hand in the millennium which would begin, in their judgment, before their own generation had passed away. This identical tenet was equally widespread and operative among Latter-Day votaries. No wonder the Mormon temples or head-centres and the homes of all around them were transfigured, through plausible declamations or fond imaginings, into paradise regained; and that most of all among converts on the farther shores washed by the farthest seas. Distance lends enchantment. A pilgrimage to such a heaven on earth stirred up an enthusiasm not surpassed among mediaeval crusaders. The fortitude of the brigade which, at Brigham's bidding, pushed their handcart through a thousand-mile wilderness to reach their New Jerusalem, was a supreme test of the more than electric omnipotence of an ideal, no matter how illusive. The further west the saintly van advanced, the more who perished by the way, the more it was disencumbered of impostors and apostates, and the nearer it came to the Islands of the Blessed to tell of which demanded the hyperboles of millennial apocryphas.

Another secret of Christian success among pagans in Gibbon's eyes had been organization. Order, and government to enforce it, began with the gathering of the first church. This initiative, fertilized by persecutions, rapidly developed into a system which has made itself immortal, and a propaganda through all ages and continents. As embodied in the Catholic hierarchy, it was copied or mimicked by Mormons in those features best suited to their era and conditions. In this worldly wisdom, which some would call devil-wit, they outdid whatever had been achieved by the orthodox. Their prophets inspired their followers with a faith (*sancta simplicitas*) greater than had been felt in bishops or even popes. Through this subtle persuader they mastered and manipulated their property. They ruled them with a rod which no political boss, no general of the Jesuits or general military, could wield. They extorted services exhaustive, dangerous, hateful, and even criminal. Mormon increment has owed and still owes much to its hierarchy. Its prophets were without honor in their own country, and so compassed sea and land for proselytes. Converts have been mostly made at a distance—a large percentage beyond seas, and through the press as well as by preaching. The capital indispensable for working this machinery demanded for raising it a despotic executive. Viewed as an immigration agency, the missionaries were a success. The labor of the converts, however unskilled, was worth more than their transportation had cost. They had bread enough and to spare, and their change of worlds was uplifting—a physical blessing.

The migrations of Latter-Day Saints which, as we follow them on a map, appear a mighty maze and all without a plan, Mr. Linn contends have never been so clearly accounted for as by him. The exodus from the Missouri to the mountains, within three years after the first prophet's death,

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