

THE BIRTH OF CHEMISTRY

V.

The Alchemists.—Origin of Alchemy.—Hermes Trismegistus.—Greek MSS. on Alchemy.—Their probable authorship and age.

WE speak here of the alchemists almost for the first time, and we must now turn our attention to the origin and growth of their dogmas, and to their work. We have already seen that the word *χημεία* is first found in the Lexicon of Suidas, and that he defines it as "the preparation of gold and silver." He further tells us, under the same heading, that the books on the subject were sought for by Dioclesian and burnt, lest the Egyptians should become rich through their knowledge of the art, and should thus be able to resist the Romans. Now, the people who professed a knowledge of the art of making gold were called *alchemists*. The word *alchemy*, as we have previously shown, consists of a Coptic root united with an Arabic prefix, and signifies the *hidden or obscure art*. Alchemists were those who practised this mysterious art. We can well understand why the professors of such an art should maintain the utmost secrecy; to divulge such magic would be to make all men equally rich; hence it was necessarily a hidden art. Neither did the books on the subject avail much, for they are filled with some of the most incomprehensible nonsense that ever was written. Yet the literature of the subject is enormous. The volumes on alchemy in our large libraries are to be counted by the hundred. In 1602 Zetner published, in Strasburg, a "Theatrum Chemicum," containing more than a hundred tracts on alchemy, selected from various notable authors. A century later Mangetus published his "Bibliotheca Chemica Curiosa," in two large folios, containing a hundred and twenty-two alchemical treatises. We have previously given the titles of a few Greek MSS. on alchemy. The list has been extended to eighty-three. Arabic and Persian MSS. on the subject are not uncommon. There are treatises in Spanish, Italian, German, Dutch, and English on alchemy, and, more numerous than all, treatises in Latin, in every large library. Let us endeavour to get from the tangled mazes of this hieroglyphical literature some idea of alchemy, and of its influence upon chemistry.

We are, perhaps, puzzled at the outset to comprehend how any one man, much less thousands of men, could have deluded themselves with the belief in the possibility of transmuting one kind of matter into another:—crude lead, or tin, or mercury, into weighty, lustrous gold. But this was not the greatest wonder of the age. At the time when alchemy arose, and throughout the period during which it most flourished, the belief in theurgy, witchcraft, necromancy, and magic of all kinds was rife among all classes; and surely it was less wonderful to change lead or tin into gold, than to call up the spirit of one's ancestor, or to confer perpetual youth upon a nonagenarian! It is, for wonderment, as compared with the greater magic of the day, as the process for the conversion of benzine into aniline compared with spirit-rapping; or, as a demonstration of specific inductive capacity compared with a manifestation of psychic force. Alchemy was considered to be perfectly rational not two centuries ago, and was among the lesser forms of magic, inasmuch as it did not require the influence of supernatural causes.

The growth of the idea is not difficult to trace. The ancients had persistently asserted the change of one element into another. Thales, as we have seen, evolved the ten thousand forms of nature and kinds of matter, from water, Anaximenes from air, by successive transmutation. Aristotle, whose physical views were accepted without question by the alchemists, had endeavoured to show by clever argument that, if you transfer a quality of water to fire, you obtain air; while if you transfer a quality of earth to air, you get water; and so for fire and earth, and that from these elements all things proceed. This was readily accepted by Middle Age thinkers. The alchemists reasoned, plausibly enough:—if fire becomes air, air water, and water earth, why may not one kind of substance formed from these elements be changed into another kind of substance of somewhat the same nature, and certainly more similar than air and water, or water and earth? Why may not lead, compounded of these elements in certain proportions, be changed into gold, compounded of these elements in certain other proportions? There have been false modes of reasoning than this in the history of science.

Let the ancient Greek theory of the transmutation of the elements be once literally accepted, and the alchemical belief in

transmutation follows naturally; it is a minor application of the major proposition. There is nothing to wonder at in this; the human mind seldom moves by fits and starts; an essentially new mode of thought and new form of belief is rare, and many apparently new dogmas are united with older dogmas in the closest manner, and are in fact direct emanations from them. Such was the alchemical idea of transmutation. Admitting the possibility of the process, a man would naturally ask himself "What do I most desire to make?" What in this world procures the greatest amount of happiness, and of power?" For what have men slaughtered each other by the thousand in open war, or singly and secretly in the dead of night? For what have kingdoms been sold, great tracts of land ceded, and people been ground into serfdom till they rose and rioted against their oppressors? For what have princes and cardinals been created, emperors and kings destroyed, and the eternal peace of troubled souls promised? In a word, for what will man dare all things, sacrifice all things; for what will he toil during a lifetime; to what will he devote all his intellectual energies? This is surely the thing for the ready acquirement of which we may devote much time and thought, and this thing is *gold*. This is the key to the prodigious masses of alchemical literature, and to the mysteries and anomalies connected with men who often wasted their whole lives and all they possessed in the endeavour to change baser metals into gold.

If we consult alchemical MSS., no matter the date or author, or language, we find constant mention of Hermes Trismegistus, who was indeed considered, and sometimes designated, the *father of alchemy*. In a treatise attributed to Albertus Magnus we are told that the tomb of Hermes was discovered by Alexander the Great, in a cave near Hebron. In this was found a slab of emerald which had been taken from the hands of the dead Hermes by Sarah, the wife of Abraham, and which had inscribed upon it in Phœnician characters the precepts of the great master concerning the art of making gold. The inscription consisted of thirteen sentences, and is to be found in numerous alchemical works. It is for the most part quite unintelligible, and in style closely resembles the great mass of Middle Age alchemical literature.

The following is cited as the inscription of the "Smaragdine Table," and is to be found in very early MSS. in various languages:—

1. I speak not fictitious things, but that which is certain and most true.
2. What is below is like that which is above, and what is above is like that which is below, to accomplish the miracles of one thing.
3. And as all things were produced by the one word of one Being, so all things were produced from this one thing by adaptation.
4. Its father is the sun, its mother the moon; the wind carries it in its belly, its nurse is the earth.
5. It is the father of all perfection throughout the world.
6. The power is vigorous if it be changed into earth.
7. Separate the earth from the fire, the subtle from the gross, acting prudently and with judgment.
8. Ascend with the greatest sagacity from the earth to heaven, and then again descend to the earth, and unite together the powers of things superior and things inferior. Thus you will obtain the glory of the whole world, and obscurity will fly far away from you.
9. This has more fortitude than fortitude itself; because it conquers every subtle thing and can penetrate every solid.
10. Thus was the world formed.
11. Hence proceed wonders, which are here established.
12. Therefore I am called Hermes Trismegistus, having three parts of the philosophy of the whole world.
13. That which I had to say concerning the operation of the sun is completed.

The story and the inscription, together with all books attributed to Hermes, are no doubt the production of monks of the Middle Ages, albeit they are attributed to Hermes, who is asserted to have lived about 2000 B.C. In spite of the obvious worthlessness of the inscription of the emerald table, men have not been wanting who have laboured long and lovingly to prove its authenticity, to interpret it, and to show that it is in good sooth a marvellous revelation, full of sublime secrets of considerable import to mankind.

Hermes Trismegistus is generally asserted by the alchemists to have been a priest who lived a little after the time of Moses. According to Clemens Alexandrinus he was the author of forty-

two books containing all the learning of the Egyptians; others tell us that he was the author of several thousand volumes. Plato speaks of him in the "Phædrus" as the inventor of numbers and letters. He was in fact the Egyptian god of letters, and as such of course could be described as the author of multitudinous works. He was the deified intellect, and hence has often been confounded with Thoth, "the intellect." Sir Gardner Wilkinson speaks of Hermes as an emanation of Thoth, and as representing "the abstract quality of the understanding." The woodcut (Fig. 6) representing Hermes, is from a temple at Pselcis, which was erected by Erganum, a contemporary of Ptolemy Philadelphus. It may be well to note the extent of the symbolism associated with the sculpture; in one hand Hermes holds the *Cruz ansata*, the symbol of life, in the other a staff, associated with which are a serpent, a scorpion, a hawk's head, and, above all, a circle surrounded by an asp, each with its special symbolical significance. On the Rosetta stone Hermes is called "the great and great," or twice great; he was called *Trismegistus*, or thrice great, according to the twelfth aphorism of the emerald table, because he possessed three parts of the wisdom of the



FIG 6.—Hermes Trismegistus; from the Temple at Pselcis.

whole world, which in his light of deified intellect he might well do.

Perhaps no author is more often quoted by the Alchemists than Hermes, the supposed father of their art. They called themselves *hermetic philosophers*. Alchemy is often called the *Hermetic Art*, or simply *hermetics*. To enclose a substance very securely, as by placing it in a glass tube and fusing, or sealing, the mouth of the tube, was called securing with "Hermes his seal," and the echo of the idea lives amongst us yet; for, in our most modern treatises, the expression "to seal hermetically" may be found.

Petrus Hauboldus, of Copenhagen, was surely one of the most enterprising publishers of his day, for he had the temerity to publish a book entitled, *Hermes Egyptianorum et Chemicorum Sapientia*. A book square as to its dimensions, small as to its type, drier than dust as to its contents, of four hundred odd pages, of two centuries of age, writ in Latin, with a sprinkling of contracted Greek, and floridly dedicated to Jean Baptiste Colbert. A book wherein the author endeavours to prove that alchemy was known before the flood, that Hermes Trismegistus was a real personage, the inventor of all arts, the father of alchemy, and much else besides. We may well imagine that the author of such a treatise was no ordinary man, and our conjecture proves a tolerably correct one. Olaf Borch, whose Latinised name because

the more resounding *Olaus Borrichius*, was apparently the great mainstay of the University of Copenhagen; at all events, he was simultaneously Professor of Philology, Poetry, Chemistry, and Botany, and we must either imagine that in 1660, professors were difficult to procure in the Kingdom of Denmark, or else that Olaus Borrichius was such an astounding genius that he could readily undertake the duties of four diverse professorships at the same time. We can scarcely imagine three greater antitheses than the philological faculty, the poetical faculty, and the chemical faculty; but here we find them united, or assumed to be united, in one man. Yet more, Borrichius was appointed Court Physician, and Assessor of the Supreme Court of Law. He was the very personification of all learning, if we may judge by the treatment he received from his countrymen. In addition to the work mentioned above, he wrote several on philology, on the quantity of syllables, on the Greek and Latin poets, on medicine, chemistry, and botany. It is strange that a man who, presumably in his capacity of judge, was in the habit of sifting evidence, and of avoiding hasty generalisation, should have endeavoured with much elaborate argument to prove that Hermes Trismegistus was a real personage; that his Smaragdine table was really found by the wife of Abraham, and that it contained matter of the highest import to mankind. We must imagine that in this matter Borrichius allowed the imaginative faculty due to his poetical temperament to exert an undue influence over his more sober judgment. He is equally at pains to assert the authenticity and antiquity of the various Greek MSS. on alchemy in the libraries of Europe. He specially mentions a MS. by Zozimus of Panapolis, on the art of making gold, in the King's Library in Paris; and Scaliger tells us that this same MS. was written in the fifth century. M. Ferdinand Hoefler is apparently penetrated by the Borrichian spirit of faith and imagination, and he unhesitatingly accepts the early date attributed to the Paris MS.

M. Hoefler traces the rise of Alchemy to the fourth century of our era; it was then known as the "sacred art" (*ars sacra*; *τέχνη Ἱερα*), and one of the chief writers on the subject was the said Zozimus of Panapolis. The principal Greek MSS. attributed to Zozimus, which exist in the Bibliothèque Nationale, have the following titles:—(α) On Furnaces and Chemical Instruments; (β) On the Virtue and Composition of Waters; (γ) On the Holy Water; (δ) On the Sacred Art of making Gold and Silver. In the latter, Zozimus mentions that if the "soul of copper," which remains above the water of mercury, be heated, it gives off an æriform body (*σῶμα πνευματικόν*), and this (says M. Hoefler) was probably oxygen gas, while the soul of copper was oxide of mercury. A second author of early Greek MSS. was Pelagius, who alludes to two writers named Zozimus—one the "Ancient," the other the "Physician." A third author, Olympiodorus, who calls the "sacred art" chemistry (*χημεία*), quotes Hermes, Democritus, and Anaximander as alchemists.

Democritus (not to be confounded with the Greek philosopher of that name), in his "Physics and Mystics," informs us how he invoked the shade of his master, Ostane the Mede, and how the spirit appeared and accorded him mystical communings. Synesius, the commentator of Democritus, lived, according to M. Hoefler, about fifty years after Zozimus (say 450 A.D.); but a treatise on the Philosopher's Stone is in existence which claims Synesius as its author, which mentions Geber, who lived at least 400 years later. Mary the Jewess, who is often alluded to by later alchemists, was a contemporary of Democritus, and a writer on alchemy; she also invented various chemical vessels, among others a bath, to gently transmit heat by means of hot sand or cinders, which (according to M. Hoefler) is still called after her, a *Bain-Marie*.

We cannot assign to the Greek MSS. in the Bibliothèque Nationale the antiquity which M. Hoefler and others so readily accept; and we must still hold to our opinion that they and all other known Greek MSS. on alchemy are the production of later centuries, and are probably the work of Greek monks. In the first place, who was Zozimus? Was it Zozimus the Anti-pope, who succeeded Innocent I., or Zozimus the Sophist of Alexandria, or Zozimus the historian? No one can tell. It cannot be pretended that any of the Paris MSS. are in the actual writing of Zozimus. One of them is entitled "Zozimus the Panapolite, on the Chemical Art, to his Sister Theosebia;" but, according to the "Biographie Universelle," it was Zozimus of Alexandria who dedicated books to his sister Theosebia, and he lived in the third century B.C., while Zozimus of Panapolis lived in the fourth century A.D. Here, then, we

have a discrepancy of 700 years, and a clear confounding of Zozimus of Alexandria with his namesake of Panapolis. Suidas attributes chemical works to the former, but we must remember that the word *χημεία* does not occur before the eleventh century, A.D. The director of the Bibliothèque Nationale,* in a recent letter for which we have to thank him, writes as follows:—"La Bibliothèque Nationale ne renferme aucun manuscrit grec de Zosime de Panapolis qui puisse attribué à une époque antérieure au XIII. Siècle. Le plus ancien de ceux qu'elle possède ne remonte pas plus loin que cette date." Everything tends to prove that the MSS. were not only written, but composed at a period posterior to the fifth century. The fanciful titles of some of them show us that their authors adopted any name they pleased; thus we have "the Epistle of Isis, queen of Egypt, and wife of Osiris in the sacred art, addressed to her son Horus," in which we find a solemn oath dictated to Isis by the angel Amnaël, who swears by Mercury and Anubis, by Tartarus, the Furies, and Cerberus, and by the dragon Kerkouroboros. The whole thing is plainly a blending of eastern and western thought: personages of Egyptian, Greek, and Roman mythology, with angels of the Talmud, and genii of Arabic lore. We are glad to find that M. Hoefler breaks freely away from the too confident Olaus Borrichius, as to the authenticity of Hermes Trismegistus. He admits that the books which bear his name are spurious, and concludes that their author, "vivait probablement à l'époque critique du Christianisme triomphant et du paganisme à l'agonie." But if we take this as the time of Constantine the Great, we must venture to attach a later date to these writings.

We recently had an opportunity of examining the MS. in the Bibliothèque Nationale, attributed to Zozimus and to the fifth century; a MS. which, from its frequent mention in both ancient and modern works on the history of chemistry, possesses special interest. It is entitled "Zozimus on Chemical Instruments and furnaces, and on the Holy Water" (*Ζωζιμου περι ὁργάνων καὶ καμίνων καὶ περι τοῦ ἁγίου ὕδατος*), and it is a well-preserved MS. of the thirteenth century, written on vellum. The few drawings which it contains are asserted to have been taken by the author

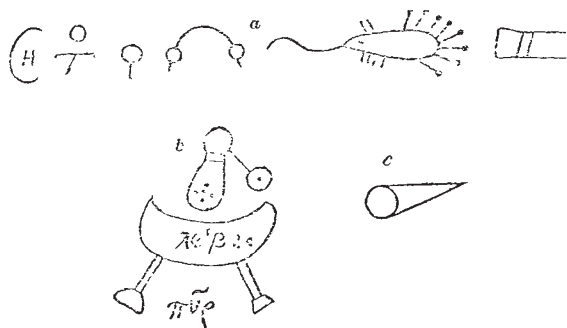


FIG. 7.—An Alembic, and Symbols from Greek MSS. on Alchemy.

from a temple at Memphis. The Alembic (*b* in the accompanying woodcut, Fig. 7) is copied from this MS., in which also the line of symbols (*a*) is found. These symbols occurred in almost every Greek MS. on alchemy which we examined, but we could find no clue to the curious porcupine-like animal. The symbol *c* is clearly of astronomical origin, and is not often met with in later works. The MSS. are for the most part devoid of figures, and not so full of symbols as later alchemical treatises.

We have endeavoured to prove (*a*) that no reliable date can be assigned to existing Greek MSS. on alchemy, and (*b*) that the accepted date is too early. Even if we could prove that a man named Zozimus, living in the fourth century, wrote treatises on alchemy, we could not use the existing MSS. for any exact purpose connected with the history of science with safety; for, since we have no such MS. earlier than the tenth or eleventh centuries, it would be quite impossible to determine whether

* This library has so often changed its name of late, that we think it necessary to mention that we mean the library in the Rue Richelieu, which is called by old writers the *Bibliothèque du Roi* sometimes the *Bibliothèque Royale*, lately the *Bibliothèque Impériale*, still more lately the *Bibliothèque Communale*, now the *Bibliothèque Nationale*. Juncker in his *Conspectus Chæmici*, in speaking of various writers on alchemy cites "Zozimus Panapolites celeberrimus et magni cognomen adeptus, cujus varia scripta exstant in Bibliotheca Regia Parisiensi."

additions had been made during transcription. The facts are simply these:—There exist in various parts of the world Greek MSS. on alchemy, none of which are older than the tenth century. Many of these bear the names of mythical personages of Egyptian mythology, some of ancient Greek philosophers, some of people who are supposed to have lived in the fourth or fifth century, A.D. When we remember that no ancient writer makes mention of alchemy or chemistry, that the word *χημεία* is first used in the eleventh century, and when we further bear in mind the condition of the intellectual world in the fourth and fifth centuries, we think we may well admit that further evidence is necessary before we can assert that alchemy arose in the fourth century. Indeed we are of opinion that, in spite of all that has been written on the subject, there is no good evidence to prove that alchemy and chemistry did not originate in Arabia not long prior to the eighth century, A.D. G. F. RODWELL

ON THE ECLIPSE EXPEDITION, 1871*

II.

I MUST now state very briefly some of the results of our work; and first, the certain results.

We were able to make out the structure of the corona. We know all about the corona so far as the structure of its lower brighter strata, that portion, viz., which I referred to in my lecture last year as being visible both before and after totality, is concerned. You may define it as consisting of cool prominences; that is to say, if you examine a prominence any day without waiting for an eclipse, and then go to an eclipse and examine the lower portion of the corona, you will find the same phenomena, minus the brightness. You find the delicate thread-like filaments which you are now all so familiar with in prominences—filaments which were first thrown on a screen in this theatre; the cloudy light masses, the mottling, the nebulous structure, are all absolutely produced in the corona, as far as I could see it with a telescope with an aperture of $6\frac{1}{4}$ inches; and I may add that the portion some five minutes round the sun reminded me forcibly in parts of the nebula of Orion, and of that surrounding η Argus, as depicted by Sir John Herschel in his Cape observations.

We have shown that the idea that we did not get hydrogen above 10 seconds above the sun is erroneous; for we obtained evidence that hydrogen exists to a height of 8 or 10 minutes at least above the sun; and I need not tell you the extreme importance of this determination. One of the proofs we have of that lies in this diagram, showing the observations made by Prof. Respighi, armed with an instrument the principle of which I hope you are now familiar with.

Just after the sun disappeared Prof. Respighi employed this prism to determine the materials of which the prominences which were then being eclipsed were composed; and he got the prominences shaped out in red, yellow, in blue, and in violet light; a background of impure spectrum filling the field, and then as the moon swept over the prominences these images became invisible; he saw the impure spectrum and the yellow and violet rings gradually die out, and then three bright and broad rings painted in red, green, and blue, gradually form in the field of view of his instrument; and as long as the more brilliant prominences were invisible on both sides of the sun he saw these magnificent rings, which threw him in a state of ecstasy. And well they might.

These rings were formed by C and F, which shows us that hydrogen extends at least 7 minutes high, for had we not been dealing with hydrogen we should have got a yellow ring as well, because the substance which underlies the hydrogen is more brilliant than the hydrogen itself, and in addition to the red ring and the blue ring, which indicate the spectrum of hydrogen, he saw a bright green ring, much more brilliant than the others, but lit up by the unknown substance which gives us the Kirchhoff line, 1474.

Now at the time that Prof. Respighi was observing these beautiful rings by means of a single prism and a telescope of some four inches aperture, some 300 miles away from him—he was at Poodocottah and I was at Bekul—I had arranged the train of prisms which you see here so that the light of the sun should enter the first prism, and after leaving the last one should

* A Lecture delivered at the Royal Institution of Great Britain, Monday, March 22, 1872, by J. Norman Lockyer, F.R.S. (concluded from p. 58).