

William R. Newman. *Newton the Alchemist: Science, Enigma, and the Quest for Nature's "Secret Fire"*. Princeton and Oxford: Princeton University Press, 2019. 537 pp. ISBN: 9780691174877. Cloth: \$39.95 / £30.00

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This book was a long-term project made over fifteen years of study and research. It is linked to the editorial work the author undertook on the *Chymistry of Isaac Newton* project (www.chymistry.org) at Indiana University, and contains a huge amount of new data and insights that should put it on the reading list of every Newton scholar. There are several reasons for this.

Firstly, the book makes an introduction to a difficult area that may be of interest to anyone researching the history of chemistry, and alchemy in particular. Whilst Isaac Newton (1643-1727) cooperated with others, he did so pretty rarely, as he kept his interest in chrysopoeia, the transmutation of metals, very private. To enable him to do this, he both adopted the existing, and developed his own, system of language and symbology. Alchemy's language and graphic symbols developed, by various authors of different intellectual and other abilities, would not have been, in itself, so interesting, perhaps, to modern scholars, had this not been for Newton. Newton, one of the most famous scientists of all time, and his pursuit of the supreme task he set himself – to learn of the nature of substances and forces that would enable one to master them – is an key person in the history of sciences, and his obsession with alchemy is an important aspect of his opus.

The question of language, symbols, and their interpretation and reinterpretation, is treated in a number of places in this book. First, the book lists the 'chymical' symbols used by Newton. There are, following this, a number of issues that are further clarified within the book. One of them is the issue of alchemical terms and symbols; another is the use of terms which may seem to a general reader familiar, but are in fact alchemical: for example, the 'menstruum' means a dissolvent, and has a history in alchemy extending as far back as the fourteenth century (Newman, p. xvi).

In the matter of alchemical language and symbology, the reader will revisit the known and learn many new facts, and certainly gain a deeper meaning and significance of what they meant to Newton and his work. An example is the fact that Newton, following the tradition of John Dee (1527-1609) and Andreas Libavius (c. 1550-1616) – the former an Elizabethan scholar, the latter a Saxon schoolmaster – devised his own system of symbols that he used in his laboratory. As the notes he kept were never meant for publication, there is also the question of how he interpreted the alchemical language of others. This is perhaps the most interesting piece of information I found in this book, and

I wouldn't do it justice to try to summarise such a complex system of practice in a single sentence or two. Newman, however, gives this topic due, and possibly overdue, attention, clarifying many of the significantly difficult aspects of the opus of Newton's alchemical work that has been pieced together over many years.

All the while, Newman also keeps reminding us of two very important facts: that Newton had first to decipher the writings of others, which he did by devising a scientific method that was useful to him beyond alchemy itself; and secondly, that he had set himself a task to make his own writings on alchemy significantly opaque for the reasons of secrecy. In 1676 Newton, for example, wrote to Henry Oldenburg (April 26, 1676) that the 'chymical' tools and the processes he had learnt from others, if he had mastered them and made him a 'true Hermetick Philosopher', must be kept hidden as they could cause 'immense damage to ye world' (Newton, Correspondence, 2:2). Of course, there are things known to all who have studied the history of science and their more recent manifestations: that the 'adepts of occult' sciences are not easy companions. But the decoding of their language and the translation of an allusive occult dictionary is also linked to the fact that Newton was, for the most part of the last couple of decades of the 1600s, an inheritor of a unique and widely spread blend of mining lore linked to alchemy that had reached its pinnacle the century beforehand.

The book's second great contribution to Newton scholarship is certainly the survey of previous treatments of Newton's alchemical work. The work of David Brewster (1855), John Maynard Keynes (1947), and their interdependence (or, rather, the influence the former had on the latter) are discussed in detail. The descriptions of Keynes, in particular, are important for current scholarship on Newton's alchemy as they points out the difficulties Keynes had in distinguishing Newton's work in this context. Whilst Newton kept the two categories of alchemy and his 'quest for secret correspondences in nature' rigorously distinct, Keynes, perhaps influenced also by the Victorian Sir James Frazer (1890), assimilated different aspects of the more 'occult' work of Newton in the same category, bringing them under the common term and category of magic. Among many further references, Dobbs' work (1975) too is mentioned, as is Westfall's (1971), who both receive precise and critical reviews. Here an important update given by Newman is that which relates to the significantly growing knowledge in the history of sciences in the past half century in relation to the pursuit of alchemy in the time of Newton. It is now a well-known fact that Newton was not the only successful (in our modern interpretation of the word) scientist *and* alchemist. John Locke (1632-1704), Robert Boyle (1627-1791), Gottfried Wilhelm Leibniz (1646-1716) were all involved in alchemy in different ways.

A further important aspect of this book is certainly its own historical-scientific method. The author uses, as much as it is possible, an 'experimental history' approach to test, examine, and validate Newton's alchemical writings. This involves a fascinating new approach to the history of science: undertaking experiments to rework or reconstruct old techniques and experiments based on the notes and writings, in the case of this work, of Newton. This methodology gives further credence to the understanding and

interpretation of Newton's work: for if terms such as 'liquor of antimony' and 'sophic sal amoniac' can mean many different things, by analysing them and validating all different possible versions in a laboratory experiment, we move closer to understanding the actual work Newton undertook in his alchemical laboratory.

Newman is quite aware that his book, although giving many above mentioned innovative and original new approaches to Newton's alchemical opus, cannot be the last or the final study with the same focus, and that it certainly cannot be considered 'light reading'. The book therefore aims at the scholarly public, but also those who do want to know the exact, rather than imagined, opus of Newton in this respect.

In the final three chapters, the book boldly goes where others, as far as I know, have not gone before – perhaps the single most important contribution of this work. Here the author shows that Newton developed a theory of refraction based directly on his work on the 'chymical principle sulfur': Newton replaced the aerial niter, which had 'accounted for phenomena ranging from combustion and respiration to the fertilization for the earth, with a growing reliance on sulfur' (Newman, p. 18).

It is probably fairly easy to see that I have admired the author and his work on *Newton the Alchemist* since first receiving this book in my hands. This is of course for all the reasons stated above, but also because this diligent study, apart from having presented numerous critical assessments that have left me wanting to learn more about the relationship of Newton's alchemy and his religion, has also brought to light new, detailed accounts of Newton's practical work and his correspondence not seen before.

The book is amply illustrated, precise in its referencing, and constitutes an atlas worthy of any student of Newton's work, his alchemy in particular. Perhaps the only negative issue I have is that the bibliography is not given separately at the end of the book (although the index is). This may be off-putting for someone wanting to consult the book for further reading, but this is, of course, the consequence of the adopted referencing system.

Finally, the increasing and always present pressures of funding and ethics in equal measure (or fairly well balanced) that often appears in contemporary centres of learning and research in the sciences and mathematics, make this book a good reading for a more general public too. To be able to freely devote time to something that one does not always understand perfectly as Newton did with his 'chymistry', but diligently attend to it, may lead to results as in his case did, contributing to some incredibly useful results such as was his work on Optics. And if that was not important enough, then considering that such life-long dedication to a question of substance as Newton had with alchemy, is considering what it may do for the future generations. There is certainly a value in exploring new areas of knowledge that, if nothing else, may show us where the blind or near-blind alleys lie.