

Reviews

Prospero's America: John Winthrop, Jr, Alchemy and the Creation of New England Culture, 1606–1676. By WALTER W. WOODWARD. Pp. xi + 317, index. University of North Carolina Press: Chapel Hill. 2010. \$45 (hbk). ISBN: 978-0-8078-3301-8.

Unlike Shakespeare's Prospero, John Winthrop Junior (governor of Connecticut from 1657 to 1676) emigrated of his own volition to become master of a strange new land. In other respects, however, he cut a very Prospero-like figure, with all the ambivalence entailed by this. He was extraordinarily intelligent and energetic, stern but charismatic, and genuinely benevolent to native people so long as they acknowledged his superior status, and possessed of skills that to his contemporaries — both white and Native American — seemed nothing short of magical.

In 1702, Winthrop's first biographer dubbed him "Hermes Christianus" (p. 307), but subsequent chroniclers downplayed the importance of alchemy in his life and thought. Walter Woodward returns it to centre stage. He coins the term "Christian alchemy" (pp. 11–13) to denote a particular *strand* of late alchemy that combined genuine empirical expertise with a deeply religious interpretation of experimental results. I have reservations about the term itself, but the philosophy that it designates was indisputably real and influential.

Woodward shows how Winthrop's expertise in alchemical medicine, and his charitable use of that expertise, won him the respect and gratitude of fellow settlers and natives alike — despite the fact that most of his remedies can have had no real medical value (p. 161). Winthrop genuinely believed that his cures worked, and convinced his patients that they did, so recovery was ascribed to the effects of the medicine, while deterioration or death was put down to the will of God overriding the treatment.

Winthrop approached native people with respect, although never quite as equals, and used his supposed alchemical prowess to win their respect in return. The fact that imported diseases such as smallpox decimated the natives, while leaving English settlers largely unscathed, served at once to convince the natives of Winthrop's extraordinary medicinal powers, and to reassure the settlers that God was on their side (pp. 168–69).

Woodward is no apologist for colonialism. However, his account of settler–native relations shows that by no means all colonists were consciously setting out to exploit the natives. His nuanced analysis of Winthrop's personal friendship with the Pequot Robin Cassacinamon — the Ariel to Winthrop's Prospero — is a marvellous piece of historical reconstruction, portraying through the eyes of both parties the honeymoon of what, for the natives, would ultimately prove a disastrous union.

More vivid still is the account of the New England witch-hunts of the 1660s. Winthrop's resolute, and usually successful, defences of alleged witches have often been cited to illustrate his Enlightenment rationalism. Woodward, however, argues that it was precisely Winthrop's own perceived mastery of natural magic that persuaded him — and enabled him to persuade others — that such accusations were either malicious or deluded.

Similarly, it was because he was such a successful colonist that Winthrop was alert to the risk of being colonised in turn. Woodward describes Winthrop's adroit tightrope-walk between obedience and insubordination when instructed by fellow members of England's Royal Society to produce a "Natural History" of New England. Knowledge is power, and Winthrop could see precisely why that knowledge was wanted. He adopted a policy of "loyal noncooperation" (p. 287), professing himself willing but unable to comply with such requests, and fobbing his inquisitors off with token gestures that appeased without acquiescing.

Woodward clearly finds Winthrop an engaging character, and convincingly portrays him as such, but his eyes are open. All the ambivalences of colonisation, whether of one race by another or of nature by humanity as a whole, are scrutinised here. Woodward's prose is elegant and often witty, and his research is original and meticulous. This is an important contribution to the understanding of alchemy and colonialism — and the connection between the two — in the early modern period.

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JOHN T. YOUNG

La Chimie et l'Encyclopédie. Edited by CHRISTINE LEHMAN and FRANÇOIS PÉPIN. Pp. 255, illus. Nanterre La Défense: Université Paris Ouest. 2009. Special issue of *Corpus: Revue de Philosophie*, No. 56. €16.00. ISSN: 0296-8916.

This volume of the philosophy journal *Corpus* comprises a collection of articles (all in French) on chemistry in Diderot and d'Alembert's *Encyclopédie*. In the introduction, the volume's editors, Christine Lehman and François Pépin, put the two in parallel and bemoan the difference between historians' interest in chemistry and the *Encyclopédie*. Indeed, the *Encyclopédie* has become a solid reference in the history of enlightenment culture, while the history of chemistry remains something of a poor cousin in the history of science. In the context of this collection, however, the essays do not, for the most part, have very much to say about the *Encyclopédie*, but tend to focus on the history of eighteenth-century chemistry. The two that treat the *Encyclopédie* most directly are the article by Jean-Claude Bourdin about Baron d'Holbach's contributions to metallurgy, and François Pépin's exploration of chemistry in its widest sense through an analysis of articles from the early volumes. Thus, Bourdin underlines the controversial status of the *Encyclopédie* and its association with d'Holbach's materialism, while Pépin uses chemistry to explore the structure of and tensions within the *Encyclopédie*. Looking at a variety of articles in which chemistry is mobilised, Pépin highlights the multifaceted nature of chemistry, which is amplified by the very different agendas of Venel, Malouin, Diderot, and d'Holbach. The paradox of the *Encyclopédie* is that the system of individual articles in alphabetical order interconnected by cross-references gives a very organised structural form to a remarkably diverse and conflictual field of thought.

Rémi Franckowiak opens up the issue wider, offering an overview of chemistry in dictionaries starting from 1690. He argues that they often present an outdated vision of a science that was undergoing profound changes in the eighteenth century. Patrice Bret's article takes us to the follow-up project of the *Encyclopédie méthodique*, where responsibility for the chemistry volumes was transferred from Guyton de Morveau to Fourcroy. Enlarging upon chemical debates touched on in the *Encyclopédie*, Bernadette Bensaude-Vincent pursues her interest in the "mixt." This is a philosophical reflection about the nature of chemistry at the time, in which she argues that the concept of the "mixt" is at the heart of chemists' concerns. This article resonates with Mi Gyung Kim's contribution, in which she discusses the place of affinity in chemistry at the time. She turns this into a consideration of the importance of chemical combination and the attempts to understand the nature of chemical union in eighteenth-century chemistry.

In his contribution, Gilles Barroux discusses some ideas about the relationship between chemistry and medicine based on a reading of the relevant articles in the *Encyclopédie*. In her article, Christine Lehman writes specifically about Venel's teaching in Montpellier in order to compare the chemistry presented in his course notes with the version he presented in the *Encyclopédie*, contrasting Venel's "public" and "private" chemical discourse. Indeed, this issue of *Corpus* coincides with the publication of Lehman's edition of Venel's course (see below for further details).

University of Lyon 1

JONATHAN SIMON

The Historiography of the Chemical Revolution: Patterns of Interpretation in the History of Science. By JOHN G. MCEVOY. Pp. xiii + 328, index. \$99. Pickering & Chatto: London. 2010. ISBN: 978-1-84893-030-8.

John G. McEvoy accomplishes three things with this book. First, he surveys scholarly studies of the eighteenth-century Chemical Revolution produced over the last few decades. Second, he argues that scholarship in the history of science in this period has relied upon prevailing theoretical models of science. These models have derived from philosophy and (particularly in the last few years) from sociology. And third, he offers a new approach to the subject that will supposedly allow historical study to escape from the confining frameworks of philosophical, sociological or, for that matter, scientific preconceptions of the past.

The survey begins with the positivist philosophy and what McEvoy terms “the hybrid, positivist-Whig historiography of science” that it inspired. This shaped notions of the Chemical Revolution until the 1960s, emphasising the genius of Antoine Lavoisier and the “eureka moments” of his major discoveries. McEvoy’s characterisation of this approach is drawn with a broad brush; he tends to lump together specialist historians of science with chemists who wrote about history, and he draws rather indiscriminately from their writings and those of commentators on them. The narrative becomes more focused when it reaches those whom McEvoy classifies as “postpositivists,” including Karl Popper, Imre Lakatos, and Thomas S. Kuhn, along with Louis Althusser and (the early) Michel Foucault. These philosophers recognised that empirical discoveries depend for their significance on a prior structure of theoretical interpretation, and that theoretical frameworks might change quite rapidly in the course of history. Because they viewed the history of science as a succession of worldviews or paradigms, the postpositivists were inclined to ascribe importance to the Chemical Revolution, even to accord it primacy among scientific revolutions in general. McEvoy assimilates a lot of influential scholarship on the history of chemistry to this outlook, and he summarises pertinent studies by Maurice Crosland, Robert Siegfried, Henry Guerlac, Carleton E. Perrin, Frederic L. Holmes, and others.

If the Chemical Revolution enjoyed its heyday under the auspices of postpositivism, it has suffered less respectful treatment at the hands of the more recent scholars, whom McEvoy categorises as “postmodernists.” The postmodern view of science, which has come to prevail in recent decades, regards it as a material practice rather than a structure of ideas, as a form of discourse produced in a certain rhetorical situation, and as a kind of performance conducted before an audience. Influential here have been the works of sociologists of science, including Harry Collins, Bruno Latour, and Andy Pickering, and those of such leading historians as Steven Shapin and Simon Schaffer, who have followed the sociologists’ lead. Among historians of chemistry, McEvoy sees postmodernism as having shaped the works of Bernadette Bensaude-Vincent, Ursula Klein, Lissa Roberts, Mi Gyung Kim, and Jan Golinski. He criticises the approach for the restricted range typical of its case studies and its refusal to generalise beyond the particular individual, laboratory or controversy under scrutiny. To overcome this limitation, McEvoy, in his final chapter, introduces an alternative approach, which he calls “robust contextualism,” which promises to situate the events of the Chemical Revolution within an account of the large-scale forces operating in eighteenth-century Europe, especially the Enlightenment.

McEvoy’s book has the limitations of a certain philosophical style of historiography. He locates work on the Chemical Revolution in relation to the philosophies that supposedly provided its guiding assumptions. But it is not clear that all historians have been significantly influenced by such assumptions, or that such a categorisation helps in every case to explain what they have been doing. The book is also hampered by an unremittingly dense style. While it explains philosophical and sociological theories judiciously and in detail, it gives no basic introduction to the chemical issues being debated in the late eighteenth century. It will therefore be hard for those who are not already well informed about the Chemical Revolution to get

much out of it. In addition, there are quite a few typographical errors, especially in foreign words and names (“Michael” Serres, “Giles Deluze” for Gilles Deleuze, “Christopher Mienel” for Christoph Meinel, and so on). The suggested new approach, robust contextualism, remains admittedly underdeveloped. On the basis of the exposition given here, it is hard to see what exactly it can contribute to further studies of the Chemical Revolution.

Although the way ahead may not be clearly delineated, McEvoy’s book makes a valuable contribution in its insistence that the Chemical Revolution should be considered in relation to historiography. The concept of the revolution cannot be understood without reflection on the approaches of the scholars who have invoked it and the general notions of science that — at least in some cases — informed their inquiries. This book should serve to stimulate more of such reflection.

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JAN GOLINSKI

A Professor, a President, and a Meteor. The Birth of American Science. By CATHRYN J. PRINCE. Pp. 254, illus., index. Prometheus Books: Amherst, NY. 2011. \$26. ISBN: 978-1-61614-224-7.

On 14 December 1807, the first documented meteorite fall occurred in the USA, in the vicinity of Weston, Connecticut. Benjamin Silliman, a young Yale professor, and his associate James Kingsley quickly investigated the incident and interviewed witnesses, and Silliman conducted chemical analyses on the samples collected in the field.

Their work was first printed in a Connecticut newspaper, and the communication then made its way across the Atlantic, where it received an enthusiastic reception from the European scientific community, which was particularly interested in meteorite falls and their origins, a subject of considerable debate. When President Jefferson learned of Silliman’s report, he allegedly remarked “I would more easily believe that two Yankee professors would lie than that stones would fall from heaven” (p. 129). On the basis of the available evidence, Jefferson never made the statement, but it does reflect the political tensions between the president and New England at the time of the fall.

The Weston meteorite study, which was eventually published in the *Transactions of the American Philosophical Society* in 1809 and *Memoirs of the Connecticut Academy of Arts and Sciences* in 1810, brought Silliman international fame and focused European attention on scientific developments in the young American nation. Silliman went on to lecture extensively, start a school of chemistry at Yale, and initiate the *American Journal of Science*.

Cathryn Prince deals with this fertile subject matter in her book, a work that is intended for a general audience. Unfortunately, the author is unable to distinguish between Silliman’s accomplishments as scientist and as educator, and lavishes such unfounded praise on his scientific work that it verges on caricature. Two investigators who set the stage for Silliman’s meteorite work, Edward Howard and Jean-Baptiste Biot, are not even mentioned. Howard performed a ground-breaking chemical study of various meteorites in 1802, and Biot interviewed numerous witnesses to the L’Aigle meteorite shower in 1803, and it was their work that had much to do with the acceptance that meteorites do indeed fall from the sky.

“Everything scientists know today about meteorites — the different types, the various minerals, trace elements, and isotopes contained within — began in Silliman’s laboratory” (p. 114) asserts Prince. In actuality, Silliman simply confirmed the findings of other European investigators, reporting the usual silex, iron, magnesia, nickel and sulfur in his samples. Silliman’s work on the Weston meteorite was professional but unexceptional.

Another example of Prince’s reverential approach is her claim that “thanks to the work of Professor Benjamin Silliman, people now know that meteorites come from outer space” (p. 178). It is not Silliman, but Ernst Florenz Friedrich Chladni, who is universally credited with the theory, published in 1794, that meteorites are extraterrestrial. Silliman was one of the few

who clung to the belief that meteorites were debris that fell from comets orbiting the earth, and to assert that this embodies extraterrestrial origins is misleading.

Prince is not only on shaky ground when discussing the history of meteoritics, but is apparently not well versed in the history of chemistry either. For example, the author incorrectly states that it was Silliman who was the first American to have his work published in the French journal *Annales de Chimie*. Robert Hare had his paper on the oxyhydrogen blowpipe published in the journal in 1802.

In the end, the book fails to provide a thorough, balanced and accurate treatment of a unique event in American science, the first documented meteorite fall in the young nation. Anyone familiar with the history of meteoritics or the birth of American science will unfortunately find *A Professor, a President, and a Meteor* a disappointing and, at times, frustrating read.

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MARK GROSSMAN

Aux origines de la chimie organique. Méthodes et pratiques des pharmaciens et des chimistes (1785–1835). By SACHA TOMIC. Pp. 322, illus, index. Presses Universitaires de Rennes: Rennes. 2010. €20.00. ISBN: 978-2-7535-1018-0.

From 1789 to 1830, the number of organic substances extracted from the vegetable and animal kingdoms grew five-fold, rising from about fifty to more than three hundred. To cope with this proliferation, chemists and apothecaries innovated by developing original experimental apparatus capable of separating these new substances, and by selecting solvents to purify them and specific reagents to identify them. The progress of experimental techniques is illustrated throughout the book by many diagrams from the chemistry treatises listed in its very rich bibliography.

The “new principles” of immediate analysis are discussed in the second chapter. Colouring matters are used as an example to show the role played by the solvent trilogy water/alcohol/ether. Sacha Tomic highlights the need for purity and the variability in the operating methods required for the discovery of new substances. In addition, this immediate analysis led to the abandonment of the old eighteenth-century principles such as *extract* and *extractif*, now considered to be mixtures. The fineness of the analysis allowed the detection of substances present as traces, and also found application in forensic medicine.

The discovery of alkaloids symbolises the birth of this new chemistry. After the missed discovery of morphine by French chemists in 1816, there was an intense race for alkaloids and frantic Franco-German competition. Their identification and nomenclature were the subject of polemical disputes. The naturalistic approach of relating chemical properties to botanical classes was baffled by cinchona, all species of which did not contain quinine, while a simple substance such as opium could contain several active principles such as morphine and meconine. The scale change induced by medical applications and the industrialisation of alkaloids led to the invention of new preparation techniques. In their turn, these enabled the discovery of new substances present at trace levels only.

The basicity of alkaloids challenged the French analysts, because it contradicted their tradition: did alkaloids form a new class of organic substances? Was not this basicity due to the base used to isolate them? These questions were only answered through elementary analysis, which allowed their chemical structure to be determined and which, again, required new apparatus. Chemists and pharmacists proposed different criteria, the former based on chemical properties, and the latter on the theory of radicals.

It was the intense combined activity of chemists and pharmacist-chemists during the early years of the nineteenth century and the hybridisation of their cultures that gave birth to the new organic chemistry taught as a recognised discipline from 1830 onwards. Interesting

quantitative data on this community are given in the appendix. Sacha Tomic does not limit his enquiry to well-known scientists: as shown by his bibliography, he establishes the active participation of analytical chemists and unknown pharmacists.

This work is an original account of the chemistry of the beginning of the nineteenth century. Studying the practical laboratory dimension is one of the significant contributions of this book, which focuses on a short period. However, it does require a good chemical understanding on the reader's part. The synthetic tables are valuable, but the many diagrams are difficult to interpret, owing to the lack of captions: in order to understand them, one must refer to the chemistry treatises that they are taken from.

This meticulously researched and clearly structured book contains numerous footnotes. It will be an invaluable aid to scholars studying chemistry in the nineteenth century.

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CHRISTINE LEHMAN

Mental Images and Molecular Realities: Kekulé, Kopp, and the Scientific Imagination. By ALAN J. ROCKE. Pp. xxvi + 375, illus., index. Chicago & London: Chicago University Press. 2010. \$45.00, £20.00 (hbk). ISBN: 978-0-226-72332-7.

Rocke appropriately summarises *Mental Images* as a demonstration of how the history of chemistry can contribute “to a fuller understanding of the creative powers of the human mind” (p. 340). In fact, there are three overlapping themes. In the first place, the book can be read as a peerless history of the development of the theory of structural organic chemistry, with August Kekulé as its principal character. Viewed in this way, *Mental Images* completes Alan Rocke's trilogy on the history of nineteenth-century organic chemistry by examining the “investigative pathways” explored by Hermann Kolbe, Adolphe Wurtz, and now Kekulé. [I am referring here to his two previous books, *The Quiet Revolution* (University of California Press, 1993) and *Nationalizing Science* (MIT Press, 2001).] Second, *Mental Images* is a valuable philosophical study of the wellsprings of scientific creativity, and, in particular, it is an original analysis of the roles played by visual imagination in scientific research and discovery. As articulated by Rocke, the faculty of imagination and visual thought was a key factor in the emergence of nineteenth-century atomic-molecular modelling, and was largely responsible for the creation and academic (and industrial) success of organic chemistry. Third, the book is a long, reasoned response to the claims of the late John H. Wotiz and his acolytes [*The Kekulé Riddle* (Cache River Press, 1993)] that Kekulé was a gigantic fraud who told lies to evade the fact that he lacked originality and that his discoveries were “stolen” from his predecessors and contemporaries. Rocke demonstrates that this interpretation is without foundation and quite wrong.

The work is firmly based on primary sources, many of them from unpublished correspondence in German archives that throw new and original light on many aspects of what historians had thought they knew in detail. It is extremely readable, the more so because of its use of attractive and apposite quotations, which have been freshly translated by Rocke to bring out irony, gossip, and criticism. The prose is also made lively by the fact that Rocke does not eschew the use of the personal pronoun, and frequently addresses the reader directly.

As the author freely admits, the subject (namely the development of nineteenth-century organic chemistry) covers a lot of the same ground as his two previous books. However, a great deal of new material has been recovered from German archives, and the author provides a fuller treatment of hitherto neglected figures such as Thomas Graham, Emil Erlenmeyer and, especially, Hermann Kopp. In any case, the pitch is quite different. Whereas Rocke's earlier studies were primarily concerned with the development of chemistry in mid-nineteenth century Germany and France, and the roles played by Kolbe and Wurtz in creating and sustaining organic chemistry, *Mental Images* is centrally concerned with how nineteenth-century

chemists pictured atoms and used atomic and molecular models to create an academically and industrially significant discipline. While the chemical detail is concerned with the scientific papers and textbooks published by Alexander Williamson, Kekulé, Kopp, and a cast of other distinguished and less familiar chemists, the aim is always to reveal how “paper chemistry” and chemists’ imagined worlds of molecules aided their studies and progress. The organic chemistry involved in exploring the phenomenon of transduction (as philosophers call the problem of inferring the microworld from the macroworld) is inevitably quite technical and demanding, although Rocke succeeds brilliantly in explaining difficult concepts in layman’s language. Nonetheless, the ideal reader will be a historian who has studied organic chemistry to at least first-year university level. Chemist-historians and historians of chemistry will appreciate the study, because the book is “chemist-friendly” and *not* filled with the sociological jargon that puts many scientists off reading books on the history and philosophy of science. Historians of science should tackle the book because it makes a thought-provoking contribution to their understanding of how scientists “think,” and incidentally provides them with the finest study of the development of structural chemistry to date. And, because of the book’s leitmotif of mental imaging, it should be of great interest to philosophers of science, psychologists, and neurologists.

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WILLIAM H. BROCK

Much Ado About (Practically) Nothing: A History of the Noble Gases. By DAVID E. FISHER. Pp. x + 264, illus., index. Oxford: Oxford University Press. 2010. \$24.95. ISBN: 978-0-19-539396-5.

When William Ramsay and Lord Rayleigh announced the discovery of a new gaseous element, named argon, in early 1895 it created a sensation. For a while the discovery was controversial, but with the subsequent discoveries of new inert gases it was understood that argon was a member of a whole new group of elements in the periodic system. Only little has been written about the history of the inert or noble gases, and there exists no monograph offering a comprehensive and historically reliable account of the subject. Given that David Fisher’s book is subtitled “A History of the Noble Gases,” historians of science may think that it is such a historical exposition. If so, they will be disappointed, for this is not really what the book is about. Although it does include pieces of the historical development, these are presented selectively and incoherently, as appendixes to the author’s own life story and engagement with the noble gases.

The author is a retired nuclear chemist with a distinguished career in nuclear physics, geochemistry, cosmochemistry, and the environmental sciences. He has also been a playwright and actor, and is the author of several novels. Much of his research has dealt with the noble gases, and this is what forms the framework of the book. It interweaves two components or stories, the first an entertaining story of a scientist’s life and career, and the second a historical account of the noble gases. With respect to the first component, the book is eminently readable and offers several insights in how real science works. But readers of *Ambix* will probably be more interested in what Fisher has to say about the six elements in the eighth group of the periodic system. Unfortunately, this is not very much, and what he has to say is not always reliable. Moreover, he seems to include only those aspects of the elements with which he has had some personal experience or that he can tell good stories about. This may be the reason why there is not a word about krypton in the book — what has krypton done to be left out of the good company? The book is equally silent about the chemistry of the noble gases, which “don’t react either chemically or biologically” (p. 209). Yet it has been known since 1962, when Neil Bartlett synthesised XePtF₆, that several of the noble gases form compounds and do react chemically. The historical parts of Fisher’s book are well written but generally unreliable and lacking in context, as a few examples will illustrate.

Fisher states without reservation that helium was discovered by Pierre-Jules-César Janssen, who in 1868 “announced that he had found a new element in the sun, an idea so ridiculous that it evoked laughter in labs around the world” (p. 10). Apparently, he has obtained this information from the Wikipedia article on Janssen, but it is no less wrong for that. (Incidentally, the same misinformation can be found in the supposedly authoritative *Encyclopaedia Britannica*.) Another example is provided by liquid helium, which is said to have been discovered in “a messy laboratory in Groningen,” whereas in fact Heike Kamerlingh Onnes made the discovery in his modern and well-equipped laboratory in Leiden. In his account of how Ernest Rutherford used alpha particles to establish his nuclear model of the atom, Fisher says that Rutherford realised the electrodynamic instability of his model. This is free imagination. Perhaps Rutherford should have realised that his model was inconsistent with Maxwellian electrodynamics, but in fact he did not comment on the problem at all (of course, Niels Bohr did so two years later). As I have made clear, Fisher’s book is of limited interest to historians of science. It is a popular book intended for a general audience, and as such it has many qualities. But why be so careless about historical information in a book for the general reader? Don’t they deserve better? I see no reason why popular books on science have to distort the history of science and convey false information about what really happened.

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HELGE KRAGH

Popularizing Science and Technology in the European Periphery, 1800–2000. Edited by FAIDRA PAPANEOPOULOU, AGUSTÍ NIETO-GALAN and ENRIQUE PERDIGUERO. Pp. xix + 284, illus., index. Ashgate: Aldershot. 2009. £65. ISBN: 978-0-7546-6269-3.

While many historians and sociologists of science investigate the “boundary work” of scientists, it would be appropriate to use this analytical category also for self-reflection. There are historians who want to establish new categories, such as the traditional distinctions between “centre” and “periphery” and between “science” and “popular science” or “science popularisation.” And there are those who see their mission in questioning, undermining or blurring these categories. Individuals of both camps struggle for methodological authority or even hegemony in defining what is a serious approach in the profession as opposed to the “naivety” of the others.

The book under review, at least the editors and those authors who claim methodological authority, belong to the camp of the boundary blurrers. The theoretical section of the first paper (by J. R. Topham), which appears to be a substitute for the nonexistent introduction, reiterates the old critique of the “dichotomy” between science and popular science, and revives Ludwik Fleck’s idea from 1935 according to which popular science and science popularisation belong to the general category of science communication. (Because the book totally ignores hands-on science popularisation, from science kits to exploratory science museums, the communication model must have been particularly appealing to the authors.) Topham argues that this categorisation would move the history of science popularisation from an allegedly marginal status to the centre of professional interest. Of course, that is true in an almost tautological sense. However, as the distinctions fade out, the specificity of studies on science popularisation in the periphery disappears. As a consequence, the book has the appearance of an arbitrary collection of case studies, with no other structure than the chronological (!) order of the cases, without an introduction and with only brief “concluding remarks” by the editors that are like a collection of abstracts. Only the extensive bibliography and the useful index provide some umbrella function at the end of the book.

Once the (admittedly problematic) distinction between geographical centre and periphery is given up, nobody asks about the inclusion of two studies on Britain and three on Spain (out of eleven in total) in a book on the “European periphery,” whereas east and southeast Europe

are completely absent, with the exception of Hungary (the others being on Portugal, Italy, Belgium, Denmark, and Sweden). In addition, ignoring the particularity of science popularisation allowed the editors to include studies on textbooks and professional monograph series, while, for instance, the popularisation of science for industrial workforce mobilisation and the entire field of chemistry popularisation are missing.

As readers are left alone to pick from the book what they personally find interesting, I first highlight a few aspects and then two papers. Despite the diversity of historical and geographical settings, many studies point out strong relationships between science popularisation and political movements, including the Enlightenment, republicanism, patriotism, socialism, and democratisation. Because science popularisation in the periphery frequently occurred through ideas being imported from the centres, the obstacles and failures of such transmissions are particularly telling, such as when a British model eventually failed in early twentieth-century Italy because of the very much higher rate of illiteracy there. A case study on early twentieth-century Swedish astronomy by Johan Kärnfelt finds illuminating differences between the personal and professional motives of researchers for science popularisation (money for their living and for expensive instrumentation, as well as for employing voluntary amateurs for the astronomical legwork) and the public rhetoric of a strong political movement for adult education.

My favourite study is from the Mexican historian of science Matiana González-Silva on the more recent Spanish newspaper coverage of two different fields of human genetics — one in which Spanish researchers formed part of the professional centre, and one in which they were in the periphery. She convincingly argues that science journalism turns into uncritical science popularisation once local researchers are invested and belong to the international centre, whereas critical journalism survives best in the periphery, where the pressure for popularisation is absent. We need more such fresh studies that creatively employ analytical categories rather than playing the power game of “boundary work.”

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JOACHIM SCHUMMER

La fabrique d'une nouvelle science: La biologie moléculaire à l'âge atomique (1945–1964).
By BRUNO STRASSER. Pp. xxxiii + 450, illus., index. Leo S. Olschki: Florence. 2006. €48. ISBN: 88-222-5496-1.

What meaning should we attribute to the advent of molecular biology after World War II? This is the bold question that Bruno Strasser, assistant professor at Yale University, asks in the book. This very stimulating and well-documented work is not just about the molecular characterisation of the particles of heredity that Mendelism had called genes. Neither is Strasser telling us a story about the role of physicists and physics in the rise of molecular biology, even though, in his Swiss case study, physics played an even stronger role than in Cambridge or at CalTech. Neither is it just a story about interdisciplinarity and the role of instruments in the making of new scientific practices, even though electron microscopy became the heart of Geneva's molecular biology. Nor does Strasser add anything to the historiographical genre of the national monographies documenting national styles in molecular biology. While documenting these four aspects, Strasser is rather interested in the advent of molecular biology as a “total social fact.” The author presents a very convincing argument that molecular biology was at once a new epistemology, a new set of techniques and practices, and a new legitimate social space. Particularly fascinating is Strasser's account of the rise of a new way of practising science and being a scientist, of new sociabilities, of new boundaries between the professional and the private spheres, of an Americanisation of European science, of a new role of the state in the life sciences, and of a new role of instrumentation in the coordination of biological research.

The choice of Switzerland, a peripheral country (as compared with the USA, the UK, Germany, or France), helps Strasser to achieve a wider objective and offer this new historiographical take on the rise of a new scientific discipline. The first chapter places Switzerland in the post-World War II atomic era and the new social role played by physicists. Chapter 2 introduces the scientific trajectory of Jean Weigle from Geneva physics to the CalTech Phage Group. Chapters 3–6 describe in detail the development of electron microscopy as the main strength of Geneva’s molecular biology. Strasser’s masterful study combines microhistory and the social and cultural history of science to follow the sociotechnical trajectory of the instruments and associated practices and skills that turned this instrument into one of molecular biology’s key technologies — along with X-ray crystallography, radioisotopes, and ultracentrifugation. He also shows how the instrument — as it was developed by Werner Arber, Eduard Kellenberger, and Emile Guyénot — helped to constitute a new professional identity: the biophysicist. Mobilising approaches for the sociology of collective action, Strasser also offers an extensive and fascinating analysis of three successive regimes of coordination of interdisciplinary work practices around the electron microscope (see table on p. 389). Chapter 7 focuses on the rise of phage genetics in Geneva, thanks to exchange of personnel with Caltech and the Pasteur Institute, and the decline of the primacy of electron microscopy as Swiss molecular biology shifted from structure to sequence from 1957 onwards. Finally, Strasser provides new insights on the process of institutionalisation of a discipline in Geneva (chapter 8), Paris, Cambridge, and Köln (chapter 9), and its wider historical significance as “a radical transformation in the social order of life sciences” (p. 378) and a new way to be a scientist in Europe. This is the point where Strasser’s “microhistorical” choice to focus on an “ordinary” laboratory in a peripheral scientific setting that made no great discovery delivers its fruits: a path-breaking analysis of the creative tension between a *local* setting (institutionalisation is always local in the first place) and the new *global* (epistemic, material, social, and political) order of molecular biology in the Cold War.

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Empty Pleasures: The Story of Artificial Sweeteners from Saccharin to Splenda. By CAROLYN DE LA PEÑA, Pp. 279, illus., index. University of North Carolina Press: Chapel Hill, N.C. 2010. \$32.50. ISBN: 978-0-8078-3409-1.

Since the publication of *Sweetness and Power: The Place of Sugar in Modern History* by the anthropologist Sidney W. Mintz, scholars have been very conscious of the relevance of sugar in the history of food and, by extension, of humankind. The story of artificial sweeteners is much more limited in time, but it still raises central issues that go beyond the interests of food studies scholars. As is stated in the book, these sweeteners “have made and lost fortunes, forged new partnerships between businesses and destroyed others, transformed the landscape of women’s magazines, given birth to a food industry, made consumption without consequence a viable pursuit, and changed the meaning of the term ‘diet’ itself” (p. 227). *Empty Pleasures* is an excellent book that deals with each of these topics while introducing the reader to the specific US biography of the main artificial sweeteners: saccharin, cyclamates, and aspartame.

The approach to the history of artificial sweeteners of de la Peña has given priority to “how consumers make their own meanings, how producers and marketers amplify and alter these meanings, and how both groups are frequently steered by larger cultural forces” (p. 7). In doing so, de la Peña has left “the study of chemical compositions and physiological effects to other researchers.” However, the book is still certainly valuable to those historians of chemistry interested in topics such as food and drugs regulation, lay appropriation of technology and scientific knowledge, the biographies of foodstuffs and drugs, and the role of gender in science and technology.

The book is organised in six chapters. The first one deals with the early twentieth century, and considers how saccharin evolved from consumer rejection to its acceptance as a desirable commodity. The new value that nutritionists ascribed to calories, World War II and the new “craze for slimmness” became special ingredients for this transition. The second chapter moves on to the 1950s, and focuses on women’s appropriation of saccharin and cyclamates in order to shed new light on the recasting of artificial sweeteners. The reader is then introduced to the period in which the book shows its main strengths, from the 1950s to the 1980s. The third chapter deals with canned “diet” fruits containing cyclamates, and shows the important role played by food technologists in order to “bridge laboratory and pantry.” The analysis is thus redirected over a sort of invisible technician who is usually absent in traditional historical accounts. Nevertheless, we still find a clear continuity with those latter accounts: technology remains a manly activity.

The fourth chapter reassesses this issue, and tackles the history of artificial sweeteners by focusing on the contribution of women. In this chapter, as in chapter 5, women are presented in the central place that they deserve in the history of food. As de la Peña states, women created a set of meanings around the new artificially sweetened products. These meanings were essential in order to make sweeteners attractive to the masses, and thus were as important as the technical expertise frequently attributed to men. The fifth chapter is important not only for its gender perspective, but also for its analysis of the public, of those lay women who campaigned against the banning of saccharin in 1977. The chapter builds on relevant sources, including a huge number of letters written by consumers in defence of saccharin. Finally, the last chapter deals with the development of NutraSweet and offers a different approach, one that tackles the role of industrialists and influential politicians in the promotion of artificial sweeteners.

All in all, we have an excellent book that will certainly be of interest to specialists. Moreover, as the author skilfully exploits her appealing case studies without engaging in heavy historiographical analyses, it will also satisfy students and the general public.

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XIMO GUILLEM

Merchants of Doubt. How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming. By NAOMI ORESKES and ERIK M. CONWAY. Pp. 368, illus., index. Bloomsbury: New York. 2010. \$27. ISBN: 978-1-5969-1610-4.

Merchants of Doubt chronicles cases of induced uncertainty. These are matters of health, security, and stability, on which the independent experts most immediately involved have arrived at considerable consensus, but which are kept wedged open by concerted campaigns to reinstitute uncertainty. The cases deal with politically sensitive aspects of the atmospheric commons during the last half-century. Resistance to the Intergovernmental Panel on Climate Change’s recognition of anthropogenic climate change is the most immediate of these issues; other chapters deal with resisting closure on tobacco dangers (both to smokers and through indirect exposure), the Reagan-era Strategic Defense Initiative, resistance to recognition of acid rain and ozone holes, and a more recent effort to reverse the legacy of Rachel Carson, and thereby undercut environmentalism generally. The tactics documented here included intimidation, distraction, persistent misrepresentation or partial representation of the scientific literature, the imposition of false dichotomies, and re-representation of the appropriate border between expert authority on the one hand and personal liberty or majority opinion on the other. All of these are enlisted in the promulgation of doubt.

But most remarkable, and previously underappreciated, is the involvement in all of these discrediting campaigns of a small network of persons and institutions: the primary persons are William Nierenberg, S. Fred Singer, and Frederick Seitz. Others involved in a smaller range of

issues include Edward Teller, Dixie Lee Ray, and Robert Jastrow. Fixtures in American science policy-making, these shadowy figures, the authors suggest, have been more effective than single-issue partisans such as Julian Simon or Bjørn Lemberg, whose values and assumptions are clear and consistent. Acting in concert with such persons have been a group of like-minded organisations and think-tanks. These are based around industry interests (e.g. the Tobacco Research Council), political views within professions (e.g. the Association of American Physicians and Surgeons), and broad ideologies (e.g. the Heritage Foundation and the Cato Institute). Some of them, which are subject- or sector-specific, hide agendas beneath titles of vacuous benignity (e.g. the Advancement of Sound Science Coalition). Authors and institutes together exploit sympathetic media outlets, and feed copy to the generally unsophisticated and story-hungry community of science journalists. Adroit manipulators of images, they also inflame populist, libertarian and anti-intellectual traditions in American culture.

In exploring such topics, experts on science and technology studies such as these authors face a tough choice. One may carefully document, putting one's faith in an informed electorate operating through existing institutions. One may analyse, as a political philosopher of science, structures for applying expertise to public issues, recognising, as Plato did millennia ago, both the necessity and the practical problems of maintaining an adequate system of guardians. Or one may engage directly, recognising that one is opposing a political campaign rather than an academic position; that complexity and qualification will, on this occasion, be counterproductive.

Merchants of Doubt is a bit of each. Its documentation of the involvement of a highly placed cadre of ideologues who use scepticism to intervene in matters well beyond their immediate expertise is impressive and disturbing. The book is written for, and marketed to, a general reader, who will not miss the authors' positions on the issues under discussion. Most problematic is the analytical aspect, which is addressed in fleeting allusions to the nature of an idealised "science," and only slightly more systematically in the epilogue. Here, the key issue is the status, utilisation and implications of doubt. Oreskes and Conway recognise a real problem: if one discredits, or simply renders as "not proved," a sufficient number of policy-relevant generalisations of modern science, the applicability of science as a whole is vitiated. If there is no knowledge, expectations of responsible disclosure of sellers to a global public of buyers, whether they be cigarette addicts or polities wanting a stable climate, will be unenforceable because unreasonable, not merely in some areas, but in all.

And yet doubt itself is not the problem: Merton's norm of organised scepticism is an essential element not just of science, but of all critical inquiry, a vital component of accountability. In the case of the Strategic Defense Initiative, Oreskes and Conway defend the doubters; and doubt is regularly brought to bear on such matters as the design and siting of nuclear power stations, or the overly sanguine claims of the results of pharmaceutical trials. Similarly objectionable is the sanctification of "peer review": there, what really matter are the range of criteria and the rigour of their application. A consensus of pesticide experts found DDT to be unproblematic; Rachel Carson, an outsider, doubted, and, in doing so, shifted the transdisciplinary centre of gravity to include public health and ecology rather than just short-term agricultural productivity.

Despite its title, the issues of this book are not primarily epistemic. What Oreskes and Conway are concerned about is not scepticism, but something approaching a Pyrrhic state in which doubt ceases to become a tool of reason and becomes an excuse to indulge unreason. It is better to regard their cases as instances of the tactical deployment of doubt. At best, those deployments simply reflect differing assessments of how to balance probabilities of environmental dangers against other valued goods (differing political philosophies); at worst, they represent irresponsible neglect, error, or moral evil — lying, or intentionally misrepresenting knowledge in a way that would violate ethical obligations in a medical setting, for example, where a professional has a clear duty to a client, but that is evidently permissible in the free-wheeling domain of policy-relevant science, where clients are abstractions. The appropriate response to scientific uncertainty *is* ultimately a political problem, noted Alvin Weinberg, an

author praised in this book; investing confidence in the Intergovernmental Panel on Climate Change may be a matter of respecting consensus or applying prudential criteria, but it should not require denial of doubt.

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The Routledge Companion to Literature and Science. Edited by BRUCE CLARKE with MANUELA ROSSINI. Pp. xviii + 550, index. Routledge: London and New York. 2011. \$175/£110. ISBN: 978-0-415-49525-7.

Scientists talk about “the literature,” and we all know that the style of scientific books and papers is an important feature of them. Writing that is compressed, full of tables, symbols and equations, is clearly aimed at a professional group expecting to pick up information speedily. For adepts, in the past and today, such esoteric communications are expected and appropriate. For wider readerships, it is different: up to about 1800, chemists addressing academies or learned societies had to get through to natural philosophers and natural historians; Joseph Priestley and Humphry Davy, and even Antoine Lavoisier, did not and could not write exclusively for chemists. As societies and journals became more specialised, such authors as Justus Liebig and James Finlay Weir Johnston became expert in making chemistry palatable and, indeed, momentous for a wider public. Different ways of communicating science to different publics now seems an exciting field for historical inquiry: there have been, and still are, authors who convey and arouse enthusiasm for chemistry and other sciences by using literary skills of a high order, and publishers with a keen eye for writers and markets. Such writings brought (and bring) science into the public domain, to those who, directly or indirectly, pay for it, use it, and can respect, enjoy and (partly at least) comprehend it, as a way of understanding and then changing the world.

We might have hoped that this *Companion* would have engaged seriously with scientific literature: but its footing is definitely of the imaginative kind, its tone is solemn, its gurus are Foucault and Derrida, and its engagement with the history of science is partial and fitful. So, while there are good things to be found in its five hundred large pages, and anything that makes those engaged in literary studies more aware of science is to be welcomed, the book will be rather disappointing to most readers of *Ambix*. There is a good deal of what John Herschel, referring to the BAAS, called “mutual be-buttering.” Its first section is on sciences, including alchemy and chemistry (along with nanotechnology and psychoanalysis, but, curiously, not astronomy): *Frankenstein* keeps popping up here and elsewhere, and Goethe and Erasmus Darwin make appearances, but the focus is on what “arts” people find in science: imagery, terms, and metaphors. We are usefully reminded of the problems that such people have, arising from the rapid obsolescence of scientific knowledge, and the way in which scientists could be said to aim for clarity, while artists deepen mystery. The second section is on disciplinary and theoretical approaches. Here, clarity is certainly a desideratum: but Alfred Nordmann’s essay on the philosophy of science could be a useful way in for outsiders, and Henning Schmidgen’s on history is valuable for its Continental focus in a volume generally rooted in Anglo-American traditions. The final section, on periods and cultures, is more rewarding for the historian of science, with essays on the Scientific Revolution, romanticism, and industrialisation, usefully emphasising religious concerns, the absence of “two cultures” until relatively recent times, and the dangers of talking about “revolutions.” The book ends with essays about Japan (with the useful suggestion that the Japanese had the advantage of getting Western science in positivist mode, without cultural baggage), and Russia, and then on modernism and postmodernism. As an indicator of how literary people think and have thought about science, this is a useful and compendious volume.

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Short notices

Les Alchimistes Grecs. Tome XI. Recettes Alchimiques (Par. Gr. 2419; Holkhamicus 109). Cosmas le Hiéromoine. *Chrysopée*, Edited and translated by ANDRÉE COLINET. Pp. cxxxvi + 258, index. Les Belles Lettres: Paris. 2010. €55. ISBN: 978-2-251-00559-1.

The eleventh issue of the series “Les Alchimistes Grecs” is a fully annotated edition of three Greek manuscripts containing alchemical recipes. As in previous issues, the edited texts and their French translations are preceded by a long introduction with relevant information about the different copies of the manuscripts, their authorship and sources, the terminology, and other philological features. A detailed comparison between the documents is offered and common alchemical recipes are listed in a special section. The edition is completed by a comprehensive bibliography of primary and secondary sources and two detailed Greek and French indexes.

Gender and Scientific Discourse in Early Modern Culture. Edited by KATHLEEN P. LONG. Pp. 330, illus., index. Ashgate: Surrey. 2010. £65. ISBN: 978-0-7546-6971-5.

This collection explores alchemical and medical discourses in relation to questions of gender and broader cultural domains (literature, philosophy, court life, etc.) in early modern Europe. Many chapters are potentially interesting for the readers of *Ambix*, such as those by Kathleen P. Long on images of the human body in Michael Maier's *Atalanta fugiens*, Penny Bayer on manuscript representations of women alchemists, Alain Ekorong on the Christian cabbalist Guillaume Postel, and Penny Bayer on several French alchemical manuscripts that were attributed to female authors (and somehow connected to the circle of the Paracelsian author Joseph du Chesne). Other appealing chapters are focused on the alchemical information provided by a broad variety of manuscripts attributed to women, from household recipe books to poetry and emblem books. Many chapters provide interesting clues concerning female authorial identity and authority in early modern medicine and alchemy. The book includes a full bibliography of primary and secondary sources.

Essays zur Chymie in 18. Jahrhundert an der Universität Leipzig. By LOTHAR BEYER. Pp. 168, illus., index. Leipzig Universitätverlag: Leipzig. 2010. €22. ISBN: 978-3-86583-504-8.

Celebrating three hundred years of the first chair of chemistry at the University of Leipzig, this book describes the biographies of the eighteenth-century professors and analyses some of their chemical writings. The first three chapters are devoted to Johann Christoph Scheider, the first professor of chemistry, Gottfried Rothe, a physician who wrote a textbook on chemistry [*Anleitung zur Chymie* (Leipzig, 1717)], and Anton Ridiger, professor of chemistry and author of another textbook on chemistry. The rest of the book is focused on Christian Gotthold Eschenbach, professor of chemistry during the late eighteenth century and founder of the Leipzig chemical laboratory in 1805. This last section includes a new edition and a German translation of the inaugural lecture delivered by Eschenbach in 1785. The lecture dealt with compounds of gold (*aurum fulminans*) and salts of mercury, whose history and preparation are discussed by the author in the last part of the book. A glossary of old chemical terms helps the reader to follow the eighteenth-century texts. These interesting sources deserve to be analysed in conjunction with current research on eighteenth-century chemistry and the development of chemistry courses and chemical pedagogy in Europe.

Gabriel-François Venel. Cours de Chimie. Edited by CHRISTINE LEHMAN. Pp. 450, illus., index. Editions Universitaires de Dijon/Corpus: Dijon. 2010. €22. ISBN: 978-2-915611-64-9.

This volume, which is part of the *Corpus des oeuvres de philosophie en langue française*, contains a transcription of a notebook written by Claude-Denis Balme, who attended Gabriel-François Venel's lectures on chemistry in 1761, that is, around the years in which Venel wrote his famous chapters for the *Encyclopédie*. Even though he was a very successful professor in Montpellier, Venel never published a textbook on chemistry, so the preserved student notebooks are precious sources for the study of his lectures, and offer additional information about mid-eighteenth-century chemistry. The transcribed notebook contains sixty-four lectures arranged according to the usual three-kingdom division — plant, animal and mineral chemistry — with a full section on “halotechnie” (chemistry of salts). Unfortunately, the transcription is not annotated, but it includes a brief introduction by Christine Lehman (who has published many papers on Venel) and a useful name index.

Über Galvanismus und deutsche Träumereien: Zur Rezeption romantischer Naturforschung in Frankreich zwischen 1800 und 1820. By BERND KLENGEL. Pp. 180, illus., index. Franz Steiner Verlag: Stuttgart. 2010. €40. ISBN: 978-3-5150-9780-2.

This book deals with the reception of *Naturphilosophie* in France during the early nineteenth century. The main focus is on electricity, but many chapters include interesting information for historians of chemistry. In fact, topics related to electricity were usually included in chemistry textbooks during the analysed period, when many chemists discussed the relationship (if not identity) between chemical and electrical forces, and introduced electrical instruments into chemical laboratories. The main protagonists of the narrative are Johann Wilhem Ritter, Christian Samuel Weiss, and Hans Christian Ørsted (whose work on electricity and chemistry is discussed in several sections). The author analyses a substantial number of papers published in German and French journals, but largely neglects recent historiography on related topics (for instance, on the circulation of science, scientific travels, and go-betweens), which could have probably encouraged a more sophisticated approach and additional questions concerning channels of circulation, intended audiences and contexts of appropriation of *Naturphilosophie* in France. The volume is the sixty-fourth issue of the series “Boethius,” which is focused on history of mathematics and science.

Territori delle Acque. Esperienze e teorie in Italia e in Inghilterra nell'Ottocento. Edited by GABRIELE CORSANI, illus., index. Leo S. Olschki: Firenze. 2010. €20. ISBN: 978-88-222-5988-2.

This edited volume contains critical studies and primary sources on topics related to water in nineteenth-century Italy and England. After an introductory chapter by Gabriele Corsani, who reviews the different “territories of water,” the next chapter, by Antonello Boatti, deals with irrigation technology and navigation in Lombardy, and includes two brief contemporary texts by mid-nineteenth-century Italian authors. Another chapter, by Marco Geddes da Filicaia, analyses the work on cholera by the Italian physician Corrado Tommasi-Crudeli, and reproduces one of his most significant texts. In a similar vein, the last two chapters review the work of the economist Aldred Marshall and the urban geographer Ebenezer Howard, including an edition of two brief but relevant writings by these English authors. With this original combination of primary sources and critical studies, the editor attempts to cover a wide scope of issues concerning water in the nineteenth century, from hygiene, public health and urban geography to economy, engineering and agriculture. Regrettably, scarce attention is paid to recent scholarship on similar topics, particularly those related to the history of chemistry and medicine.