BOOK REVIEWS

The Boyle Papers: Understanding the Manuscripts of Robert Boyle. Michael Hunter, Ashgate Publishing, Aldershot, England, Burlington, VT, 688 pp, ISBN 978 0 7546 5568 8, $99.95.

Robert Boyle (1627-1691) has never lacked for scholarly attention. An eclectic and prolific author, his books were widely disseminated in his lifetime and remained accessible long after his death. Of his scientific books, *The Sceptical Chemist* has been almost continuously available and was even included in Everyman's Library in 1911 with an eloquent but not entirely reliable introduction by M. M. Pattison Muir. Boyle's "collected works" were first published by Thomas Birch in 1744. They comprised 5 volumes. J. R. Partington quotes one commentator to the effect that "no one but the proof reader had ever been through the whole of Boyle's works in the immense folios of Birch." The normally indefatigable Partington slyly adds, "I am in no position to contradict him." One wonders what either would say about the 14 volumes of *The Works of Robert Boyle* that appeared in 1999-2000.

Indeed there has been an efflorescence of scholarly books on Boyle during the last two decades. Many of these are thesis-driven monographs; the rest are bibliographic and documentary such as the 6 volumes of *The Correspondence of Robert Boyle*. Unfortunately, no one so far has attempted a biography of Boyle to bear comparison with Robert Schofield's magisterial treatment of the equally complex and polymathic Joseph Priestley.

The present volume is for the most part strictly for Boyle scholars. It focuses on a large cache of Boyle manuscripts that have been at the Royal Society of London since the 18th century. Approximately one half of the book is comprised of a detailed, fine-print catalogue of the 20,000 items in the collection. One wonders if even the proof reader has read and digested all of this material.

Commentary is to be found in five chapters written by the principal author, Michael Hunter, and several coauthors.

1. Robert Boyle and his Archives.

2. The Lost Papers of Robert Boyle (with Lawrence M. Principe)

3. The Workdiaries of Robert Boyle: A Newly Discovered Source and its Internet Publication (with Charles Littleton)

4. Robert Boyle's *Paralipomena*: An Analysis and Reconstruction (with Harriet Knight and Charles Littleton) [A "paralipomena" is essentially a supplement.]

5. The Making of Robert Boyle's *Free Enquiry into the Vulgarly Receiv'd Notion of Nature* (1686) (with Edward B. Davis)

With the exception of Chapter 1, these are very heavy going and are fodder only for a Boyle specialist. Chapter 1 does give a useful overview of the progress of Boyle studies over the centuries. In addition it provides a vivid account of the trials and travail of mastering such a huge archive.

One might think that this would exhaust the Boyle legacy but, there are intimations that more is yet to come.

Derek A. Davenport, Purdue University, W. Lafayette, IN 47907.

The Periodic Table: Its Story and Significance. Eric R. Scerri, Oxford University Press, Oxford, 2007; hardcover, xxii + 286 pp, ISBN 0 19 530573 6, £ 19.99, $xx.xx..

New Ideas in Chemistry from Fresh Energy for the Periodic Law. Henry Bent, Author-House, Bloomington, IN, 2006; softcover, xxv + 195 pp, ISBN 1 4259 4862 6, $xx.xx.

After its inception in the 1860s, the Periodic Table soon began to occupy a position of central importance in chemistry. Following its rise to prominence, the virtues of the Table have been so widely extolled that it has become one of the great scientific icons of our modern age. The Periodic Table can certainly hold its own alongside other notable monuments to our scientific prowess such as the doubly helical coil of DNA or the frequently quoted Einstein equation that relates mass and energy: $E = mc^2$. In spite of its celebrity, however, the responses to the Periodic Table of those most involved with it—the chemists—have often been strangely conflicted. Although chemists, like other scientists, generally applaud the monumental achievement that the Table represents and are only too happy to have it adorn their workplace, the Table has somewhat surprisingly been the object of an inordinate amount of wrangling and dissension over the years; and the quarrelling has unfortunately continued down to the present day.

Just what is it about the Periodic Table that makes it so contentious? It is probably fair to say that most chemists hold the Table in such high esteem that it is accorded almost quasi-religious status. The Table is viewed by many as something akin to an object of veneration, and it is embraced by virtually everyone as the foundation stone of the doctrine of chemistry. But chemists who uncritically admire the Table tend to be those who make comparatively little direct use of it, such as teachers of chemistry. For others, especially those whose research has a direct bearing on or relevance to the Periodic Table, the story tends to be quite different. Simple admiration for the Table all too often becomes transformed into a notable zeal to modify the Table in ways that match the needs of individual researchers. The latter thus become advocates of a restructuring of the Table, the changing of its shape, or the repositioning of certain elements, or alterations of some other kind that will render the Table more appropriate for their specific area of application.

Since it is now part of the folklore of chemistry that we have continual disputes and confrontations over the Periodic Table, a situation has been reached in which we have currently in existence something approaching 1,000 different versions! Perhaps it is only to be expected that the sense of conflict surrounding the Table forms a leitmotiv that runs through both of the books under review here. In each book much of the text is taken up with a focus on issues, problems, and challenges that have arisen with the Table, some of which are still ongoing. Rather unexpectedly, however, books that address such controversies and cover in depth the early history and the subsequent development of the Table are a great rarity and in fact only three such books have ever been published in the English language. These three exceptional books are Venable's *The Development of the Periodic Law* (1896), van Spronsen's *The Periodic System of the Chemical Elements: The First One Hundred Years* (1969), and Scerri's *The Periodic Table: Its Story and Its Significance* (2007) under review here. If we compute the rate of appearance of these rare books since the formulation of the Periodic Table, we find that on average only one book of this kind appears every fifty years—a rather startling conclusion that might suggest that Scerri's book is something of a special treat.

In reality Scerri's book does little more than continue and elaborate upon the story told in the two pioneering works that preceded it in 1896 and 1969, and especially that of van Spronsen. Scerri seems to adopt and take for granted many of van Spronsen's ideas, arguments, and even his illustrations. In most cases, he makes use of them without special acknowledgment. Thus, Scerri admits van Spronsen's contentions that there were so-called "precursors" as well as actual "discoverers" of the Periodic Table, that there were precisely six independent discoverers, that the six discoveries were made during the years 1862-1869, and that the specific discoverers in chronological order were the Frenchman Alexandre Beguyer de Chancourtois, the two Britons John Newlands and William Odling, the Danish American Gustavus Hinrichs, the German Lothar Meyer, and, finally, the Russian Dmitri Mendeleev. Scerri also supports van Spronsen's assertion that Mendeleev was by far the most important discoverer in terms of his lasting impact.

In addition to covering this familiar terrain, Scerri also delves into a range of contentious topics, though he usually ends up by reaching conclusions that might be described as hedging one's bets. On the issue of the placement of hydrogen and helium in the Periodic Table, for instance, he rather confusingly states that "[p]erhaps

there is a 'fact of the matter' as to the optimum placement . . . Perhaps this question is not a matter of utility or convention that can be legislated . . ." Not surprisingly, he never goes on to reach any verdict on this issue. Similarly, on the question whether chemistry—and specifically here the Periodic Table—has been reduced to and fully interpreted by quantum mechanics, we are again given an equivocal answer. Scerri states that the "reduction of chemistry to quantum mechanics has neither failed completely, . . . nor has it been a complete success." When it comes to the matter of the most optimal representation of the Periodic Table, Scerri is equally tentative. On this subject he declares "with some trepidation" that he advocates "general adoption of the left-step periodic system," namely the system first put forward in 1929 by the chemist Charles Janet, in which hydrogen is placed above lithium and helium above beryllium.

In moving on to Henry Bent's self-published book, one is immediately struck by the fact that it contains none of the hesitancy and uncertainties that characterize Scerri's book. Bent knows what he believes and believes what he knows, and there are no two ways about it. In particular, Bent is very strong in his advocacy of the left-step periodic system, the one that Scerri so diffidently suggested as the optimal system. Bent asserts that it would be in everyone's best interest if scientists were to start using the left-step system forthwith. To buttress his support for this system, Bent comes up with dozens of reasonable sounding arguments in its favor. In fact, Bent offers us an astonishing 57 reasons why helium must be located above beryllium rather than neon. The fundamental reason for his assertion appears to be that this placement of helium represents a natural classification of atoms whereas placing helium above neon amounts to an artificial classification of simple substances. Throughout his book, Bent never ceases to try to convince us that the left-step system is by far the best way to exhibit both the primary kinships that exist among the elements within the same group as well as the secondary kinships that exist among the elements of differing groups. Many of his arguments are well constructed and thought provoking.

Although Bent's book is outrageously polemical in nature, it has the great advantage that it is much more forthright and engaging than Scerri's work. Moreover it is also witty, colloquial, informal, and on occasion even a little wacky. But one always knows where one stands with Bent: his arguments are persuasive, his explanations voluminous, and his confidence is boundless. Bent's book is certainly a very unusual one and I can't help wishing there were more like it. His enthusiasm for his topic and the sheer joy he has in discussing chemistry are infectious and he comes across as an author who has thought long and hard before ever putting pen to paper. Typical of the style he adopts is the reason he gives for the great proliferation of Periodic Tables referred to above. He speculates that "God made the initial conditions for the Big Bang such that the evolution of the universe would lead to many-electron atoms and a wacky s-block, in order that chemists and physicists would not be bored." We can safely say that neither chemists nor physicists nor any other interested parties will ever be bored by reading Bent's book. *Dennis H. Rouvray, University of Georgia.*

From Alchemy to Chemistry in Picture and Story. Arthur Greenberg, Wiley Interscience, Hoboken, NJ, 2007. Cloth, xxiii + 637 pp, $69.95.

As indicated in the preface, this book is the result of having consolidated the author's previous two books, *A Chemical History Tour* (Wiley 2000) and *The Art of Chemistry* (Wiley 2003). In so doing, the author has eliminated redundant contents, revised others, and added a few new items as well. The net result is a series of 84 mini-essays or brief historical vignettes, mostly between two and five pages in length, each of which is inspired by various graphics or drawings taken from old chemical books, pamphlets, or advertisements and organized into ten thematic sections in roughly chronological order. Since the selection of subjects is driven by the novelty of the art work rather than the art work serving to illuminate necessarily important historical subjects, the result falls far short of being a proper history of chemistry and more

closely approximates a collection of chemical curiosities whose purpose is less to illuminate history than to exploit it as a source of amusement and entertainment. The closest approximations in the older history of chemistry literature would probably be Edgar Fahs Smith's 1927 volume, *Old Chemistries*, and John Read's 1947 volume, *Humour and Humanism in Chemistry*.

To the author's credit, each vignette is properly referenced, though the historical commentary is generally based on standard textbook sources, such as the general histories of chemistry by Ihde and Partington, rather than on specialty articles found in the history of science literature. Indeed, judging by the number of allusions to such writers as John Emsley, Oliver Sachs, and Pierre Laszlo, the author's eye in writing this volume was directed more at the successful writers occupying the popular science section of Barnes and Noble than at the scholarly university community, though both the book's textbook-like format and high cost almost automatically preclude it from ever reaching the same audience.

The book reflects the author's obvious love of all things chemical and especially of those which are in some fashion either novel or even bizarre. Though it has little to offer the serious historian of chemistry, it has much to offer the student or chemist who has only a passing interest in the subject. Indeed, it is a book that the reviewer would have been delighted to have discovered as a student in high school or college when his own interest in chemistry and history of chemistry was just beginning to mature. My only serious criticism is the low quality of many of the black and white line drawings. Several, such as those of Hales' apparatus on pages 270-271 or those of Scheele's apparatus on page 293, are of such poor quality as to be illegible in places, whereas in other cases the images are either dark and murky through overexposure (pp 477-478), out of focus (p 564), or full of extraneous marks betraying their origin on a photocopying machine (p 142). This is almost tragic in a book so explicitly driven by its art work, and one can only wonder that a publisher such as Wiley was willing to tolerate such a low technical standard. *William B. Jensen, University of Cincinnati.*

IG Farben and ICI, 1925-1953: *Strategies for Growth and Survival*. Kim Coleman, Palgrave/Macmillan, Houndmills, UK, New York, 2006, xxiv + 225 pp, ISBN 13:978-0-230-00329-3), £ 50, $74.95.*

The period between World War I and World War II was a time of tremendous change in the European chemical industry. To a large extent, the story of this evolution is related to the formation and growth of two massive chemical conglomerates, IG Farben in Germany and Imperial Chemical Industries (ICI) in England. Coleman does an excellent job of analyzing the economic history of these two companies during the period from the end of WWI to post WWII, providing a useful insight into the factors that affected their development and did so much to create the modern chemical industry.

Armament production for World War I forced the chemical industry to expand on a scale that would previously have been inconceivable. Following the war, the situation changed drastically and many companies were confronted with severe overcapacity. The German chemical industry in particular seemed to face the most severe challenges because it had lost many of its overseas markets, the national economy was in disarray, and the peace treaty that ended the war was specifically intended to cripple German ability, especially in chemicals, to support a new war effort. Although the chemical industry in England faced a less obvious set of problems, there was a series of mergers in both countries that ultimately formed the two giant companies, which are the subject of this book.

Both German and English companies shifted focus from armaments to producing products like dyestuffs and nitrogen compounds, which were required for the peacetime economy. Germany lacked many natural resources and so focused on synthesizing substitutes for materials that were either expensive or not readily avail-

able. English industry was constrained by a combination of internal management problems, poor planning, and German competition. Ultimately, economic conditions became so bad in both nations that it became necessary to pursue cartels and secret noncompetitive agreements to divide up what markets were still available. Of course, as the threat of another World War loomed, these economic problems were superseded by a need to support the rearmament efforts.

In both countries the governments recognized that the chemical industry would play a key role in a war, and that this would require the large-scale application of pure science to practical problems. Both companies cooperated with their respective governments, but IG Farben formed an especially close working relationship with the Nazi government. Farben created much of the arms and resources that supplied the German war machine. Coleman suggests that German industry may have been better prepared for this combination of pure and applied science than was industry in England because the leadership of IG Farben was more sympathetic to scientific research than were the directors of ICI. The English failure to recognize the importance of basic research may have placed them at a continuing disadvantage after WW II.

The end of the war seemed to be a disaster for IG Farben. Aside from the economic problems, extensive disruption, and challenges to overseas markets, world opinion also judged Farben to be a major contributor to the German war machine as well as a willing partner in the use of slave labor and the creation of the death camps. Not only did the postwar partition of Germany effectively dismember IG Farben, but the Allies took specific steps to further dismantle the old industrial structure. Despite these problems, Coleman agrees with the conventional wisdom that the German chemical industry rapidly reestablished the significant lead over their English competition that had prevailed throughout most of the period covered by this book. The greater success of German chemical companies, especially IG Farben, has long been recognized; but there has been less agreement about why this happened. The cause of German success is a continuing focus of academic research, in part because answering this question may offer helpful insights into what social and political policies facilitate the success of the chemical industry.

A number of reasons have been suggested to explain the greater success of Germany, but thus far none of the proposals seems totally convincing. The traditional explanation, mentioned above, that the German chemical industry formed stronger alliances with academic research is probably accurate but not sufficient by itself. Another suggested explanation is that Germany's facilities, destroyed by the bombing during WW II, were rebuilt with U.S. money from the Marshall plan, while the British industry had to make do with outdated equipment. Coleman points out (pp 159-60), that this argument is unpersuasive, since English industries received twice as much Marshall Plan aid as their German counterparts.

Coleman does suggest some other factors that may have been important. Since IG Farben made it a priority to find ways to synthesize artificial substitutes for materials that were unavailable, the German chemical industry invested more effort on chemical innovation to create specialty products. The English seemed to continue to produce bulk chemicals that were less research intensive but had a smaller profit margin. In addition, she also points out that IG Farben was led by chemists like Duisberg and Bosch, whereas ICI was led mainly by men who were more experienced in business than science. Despite these suggestive hints, Coleman finally concludes that the lack of adequate documentary evidence, in combination with the complexity of the process, makes it difficult to offer a completely satisfactory explanation.

Economic analysis provides a powerful tool for analyzing the chemical industry, but economics is by no means the only important measure that needs to be considered. A complex combination of other factors is involved, such as government policies, feedstock availability, investment in new technologies, and availability of a strong local market. Coleman might have profitably given more consideration to these other factors; but even so, this little book is an interesting case study for those interested in industrial policy in general or, more specifically, in the history of the chemical industry. Despite the fact that this book does not emphasize chemistry, industrial chemists and historians of chemistry will probably find it to be interesting. *Harry E. Pence*, *Department of Chemistry and Biochemistry*, *SUNY Oneonta*, *Oneonta, NY 13820, USA*, *Pencehe@oneonta.edu*

* The publisher's web site indicates that publication of this title has been cancelled, but it is still available for purchase.

Der Briefwechsel von Johann Bartholomäus Trommsdorff (1770-1837), *Romershausen-Sertürner*, Vol. 9. Hartmut Bettin, Christoph Friedrich, and Wolfgang Götz, Ed., Wissenschaftliche Verlagsgesellschaft mbH, Stuttgart, 2006, 309 pp, incl. name index for Vol. 1-9 + bibliography & subject index for vol. 9, €19.95. *Acta Historica Leopoldina*, Nr. 18: Lfg. 9 (2006).

Although many of the *Bulletin*'s readers may not know his name, Trommsdorff gained renown in Germany between the mid-1790s and early1830s as editor of the *Journal der Pharmacie* and director of a "chemical-physical-pharmaceutical boarding school" attended by more than 300 students. These endeavors put him at the center during his day of an already vigorous movement there to transform pharmacy from a tradition-based craft into a science-based profession. Trommsdorff's immense correspondence provides an excellent window on an important stage in this reforming movement. Realizing its value in the early 1980s, Wolfgang Götz and others took up the large job of editing and publishing this epistolary treasure. The volume under review is the ninth in a series that commenced in 1987 and will probably wind up—after some 3,500 pages!—circa 2013.

It presents 141 letters—95 from archives and 46 from Trommsdorff's *Journal*—from and, very occasionally to, 39 correspondents. More than half of these letters were from less than a fifth of his correspondents—pharmacists J. C. C. Schrader (20), G. W. Rüde (18), D. P. H. Schmidt (13), and F. W. A. Sertürner (9), chemist A. N. Scherer (9), and parson-inventor E. Romershausen (8). While this pattern accords well with Trommsdorff's orientation to pharmacy, two other patterns suggest that the letters found comprised but a small fraction of his overall correspondence. Well more than half of the letters were written between 1815 and 1830. Moreover, Trommsdorff himself is only represented by letters to physicians H. R. Schinz-Zeller (3) and P. Scheel (2) and to publisher J. L. Schrag (2).

The editing is excellent. The correspondents are reliably introduced with brief biographical essays supplemented by references to existing scholarship and, if need be, archival sources. Only one slip caught my eye—Rüde's year of death is given as 1830 (pp 7, 30-31); but his son's poignant report of his passing reveals that the year was 1831 (pp 72-73). Images, including those of Scherer, Schrader, and Sertürner, accompany several of the thumbnail sketches. The commentaries on details in the letters are useful and well referenced. The volume's foreword ably highlights themes illuminated by the letters presented—Trommsdorff's attention to advances in chemistry and technology, his involvement in efforts to improve the welfare of unfortunate apprentices, his interest in the early gatherings of the Deutscher Naturforscher und Aerzte, and his curiosity about developments elsewhere in Europe. The editors rightly suggest as well that the volume touches on numerous issues beyond Trommsdorff's central concerns. I, for one, was intrigued by the minor place given to religious sentiments when Trommsdorff's correspondents reported the adversities of family and friends and when they offered him comfort in similar circumstances.

To judge from the quality of this volume and from its index to names appearing in earlier volumes, I strongly recommend that individuals interested in German chemistry and pharmacy during the first third of the nineteenth century have their university libraries acquire this series, or do so themselves! *Karl Hufbauer, University of Washington, Seattle*.

Labors & Legacies: The Chemists of Penn State 1855 –1947. Kirsten A. Yarmey, The Pennsylvania State University Department of Chemistry, University Park, PA, 2006, 216 pp, ISBN 1-59971-410-8, $19.95.

This delightful volume is an account about the chemists at one institution, Penn State, as it developed from the Farmers High School in the 1850s into a college and, later, a university. It is a story about the men and women who struggled, dreamed, and sacrificed to build, in words of the author, "A haven of chemical education and research in the middle of rural Pennsylvania."

Sized 23 x 28 cm, the book easily could find its way onto coffee tables as well as the bookshelves of students of history. It is written in a narrative style that is engaging. Once picked up by the reader, it becomes difficult to put down. The stories bring out the conditions that existed on campus and elsewhere; and they depict the personalities of both faculty and students. There are numerous quotations and excerpts from letters, memos, reports, and newspaper articles (including student publications) written by those who were on the scene at the time. They offer insight into conditions as they existed and tell us much about the individuals who were involved.

The book is divided into five chapters. The first, "Evan Pugh and the Farmers in the Lab," begins with establishment of the Farmers High School as the second Land Grant College in the country, trailing Michigan State by 10 days. It describes the early beginnings that were crowned by the arrival of Dr. Evan Pugh to be the first President. Fresh from classical training in chemistry in Germany, he had superb abilities and lofty plans. Unfortunately, he died of typhoid fever after only 4½ years. He was an essential player in the founding of Penn State and was responsible for starting a curriculum that emphasized chemical education.

Chapter II describes a period of difficulties for the young institution. Financial woes multiplied. Recognition and acceptance by the public were almost nonexistent. There was a succession of presidents who served short tenures. The chemistry program suffered. At least eight men held the position of Chair of Chemistry and Physics during the period 1846-1888.

Chapter III describes the era of George G. "Swampy" Pond (1888-1920). Colorful, able and effective, he emphasized undergraduate training. Many of his students and associates went on to distinguished careers. Stories about him are legion; many have lasted through the decades. Just prior to his untimely death, at age 57, he had prepared a plaque to be presented to Albert M. Keiser citing him as, "My ten thousandth enrolled student in chemistry."

Gerald L. Went was Dean for five years during the 1920s. He had strong ties to the chemical industry throughout the country. He led the department into a greatly expanded research program with emphasis on graduate training.

In Chapter V we meet Frank C. Whitmore, who was Dean from 1929 until his death in 1947. Building upon the foundation of an already established graduate program in the School of Chemistry and Physics, Whitmore transformed it into one of the best in the country. He was adept in procuring funds for both teaching and research. He recruited and developed a remarkable group of faculty members. Most worked to exhaustion in efforts to support the nation during World War II. Their contributions were many and of lasting importance.

The account ends with the death of Dean Whitmore not long after the end of the war, except for a 10-page epilogue. It provides a glimpse of what became of a number of the main players who were on board at the time – names such as Chandlee, Simons, Fenske, Dorothy Quiggle, Mary Willard, Aston, and Marker. This reviewer was privileged to know a few of them and to have shared the legacy of numerous others.

There are approximately 160 figures, 80% of them photographs. Emphasis is on people, but appropriate buildings and laboratories are included. Of interest was a photo of the entire college faculty in 1887-88. There were 17 men and 2 women. William Hale Herrick was listed as Professor of Chemistry.

There is a very extensive bibliography, conveniently divided to coincide with the chapters of the volume. Almost all are from the collection of the Pennsylvania State University Archives located in the Special Collections section of Paterno Library.

The book will provide enjoyable reading for all who are in some way connected to or interested in Penn State. For others it provides an accurate account of the birth of a Land Grant institution and of its colorful but often difficult journey toward greatness. Kirsten Yarmey leads us through the epic by depicting the personalities, character, foibles, sacrifices, and accomplishments of the persons involved. *Earl M. Kesler, 534 Beaumont Drive, State College, PA 16801.*