BOOK REVIEWS

Tools and Modes of Representation in the Laboratory Sciences. Ursula Klein, Ed., Boston Studies in the Philosophy of Science, No. 222, Kluwer Academic Publishers, Dordrecht, Boston, London, 2001, xv + 251 pp, ISBN 1-402-00100-2, $89.

Anyone who has taught an introductory chemistry course, especially organic chemistry, can perhaps relate to the problems students have in interpreting the paper "tools" used to describe the properties and behavior of chemical species. The words and diagrams used by the instructor to describe a simple chemical formula such as water are seldom understood by the student with the same depth of meaning projected by the instructor. Try asking students to picture what is inside of the bubbles in a beaker of boiling water. Or why are there not two atoms of oxygen in the formula of water, "H_2O"? The editor of this monograph of 14 essays suggests in her opening introduction that the purpose of these paper tools was not always clear to the chemists who developed and used them:

> Why did experimental scientists implement theoretically loaded sign systems, such as chemical formulas, in their practical activities, and what were the functions of such sign symbols in experimental practice?

This is all in the way of saying that this monograph may have some interest to the practicing chemist who might wish to understand a bit more about the development and use of graphic formulas and paper tools, which only came into wide-spread use by the third quarter of the 19th century. These graphic 2- and 3-dimensional tools had by then become the primary means by which chemists communicated with each other, unencumbered by the restrictions of the older "natural philosophy." The evolution of the use of new ways of visualizing these invisible atoms in a time of skepticism about even the existence of atoms was a slow and confusing one. The reader who finds this difficult to comprehend will do well to start with Alan Rocke's definitive essay on "Chemical Atomism and the Evolution of Chemical Theory in the Nineteenth Century." Contemporary chemists might have some difficulty in understanding why structural organic chemistry took some 50 or more years to establish itself after the introduction of Dalton's atomic theory. Ursula Klein and Pierre Laszlo provide the reader with insights as to the philosophical difficulties that needed to be overcome for acceptance of this paradigm. About half of the papers deal with the 19th- and early 20th-century development and use of graphic formulas and molecular models in organic chemistry. Graphic formulas and models used by Alexander Crum Brown and Jacobus van't Hoff are extensively discussed by Christopher Ritter and Peter Ramberg. Stephen Weininger reminds us how much structural organic chemistry is dependent on our understanding of what was understood by a chemical bond in his contribution, "Affinity, Additivity, and the Reification of the Bond." Carsten Reinhardt and Anthony Travis provide, it would seem, the only example of how the use of these new paper tools influenced academic-industrial research in the emerging dye industry.

Mary Jo Nye's discussion of the paper tools used by Linus Puling will be of interest to all varieties of chemists, while Eric Francoeur provides us with an interesting discussion of the background of the early "space-filling" models developed by chemists such as Pauling.

Discussions of the graphic representations used in the formulations of the periodic table are the focus of two papers by Bernadette Bensaude-Vincent and Eric Scerri. Three essays move a bit far a field, at least to this reviewer. Buhm Soon Park and Emily Grosholz, respectively, show us how diagrams and representations are used to illustrate the *Aufbau* Principle and the reorganization of genetics as interpreted through Fedoroff's translation of McClintock. The application of quantum-theoretic models to the explanation of chemical structure is provided by Robin Findlay Hendry's essay on "Mathematics, Representation, and Molecular Structure".

I can recommend this book to those chemists who would like to catch up on what scholarship has transpired among historians and philosophers of science these past 20–30 years. Of course, as these disciplines have become more specialized in chemistry, one may find the terminology a bit heavy going–at least this ground-level organic chemist did.

Those who would like to explore further the use of molecular models might do well to look at the Special Anniversary Issue of "Models in Chemistry" – HYLE: *International Journal for the Philosophy of Chemistry*, **Vol. 6 (**2000) that includes contributions from several of the authors in this monograph. I can particularly recommend Pierre Laslo's provocative essay, "Playing with Molecular Models" and Peter Ramberg's updating of Van't Hoff's contributions to structural organic chemistry in "Pragmatism, Belief, and Reduction: Stereoformulas and Atomic Models in Early Stereochemistry." *Bert Ramsay, Eastern Michigan University, Ypsilanti, MI 48197.*

The Art of Chemistry: Myths, Medicines, and Materials. Arthur Greenberg, John Wiley and Sons, New York, 2003. xx + 357 pp, 188 figures, index, ISBN 0-471-07180-3, $59.95.

The author, who is dean and professor of chemistry in the College of Engineering and Physical Sciences at the University of New Hampshire, offers here a rousing sequel to his *Chemical History Tour: Picturing Chemistry from Alchemy to Modern Molecular Science*, Wiley, 2000 (see review, *Bull Hist. Chem.*, **2000**, *25*, 133). Similar in style and substance to the earlier book, this large-format work packs in even more visual treats while romping through chemical history. His purpose is to entertain as well as to educate, while exemplifying "our very human need to visualize and try to understand the fundamental nature of matter." The writing is sprightly, imaginative, and informal; like his first book, it is a good read for anyone interested in chemistry and the humanities.

The book is divided into eight sections: "Spiritual and Mythological Roots," "Stills, Cupels, and Weapons," "Medicines, Purges, and Ointments," "An Emerging Science," "Two Revolutions in France," "A Young Country and a Young Theory," "Specialization and Systematization," and "Some Fun" (actually, it's all fun). Alchemy receives much attention, and rightly so. Greenberg does not purport to be a historian of alchemy, but his approach to the subject is sympathetic, and he has a good eye for interesting visuals.

As with his first book, the selection is proudly and deliberately idiosyncratic, but it works. It should be of real value to those of us who attempt to enliven the teaching of chemistry and its history with amusing anecdotes, rare books, and interesting art. The only real disappointment is the unsatisfying quality of reproduction of many of the black-and-white figures, apparently the result of scanning with insufficient resolution (this reservation does not apply to the 19 figures that are impressively reproduced in full color). But this is a minor complaint considering all that Greenberg gives us. *Alan J. Rocke, Department of History, Case Western Reserve University.*

Chromatography: A Century of Discovery 1900-2000: The Bridge to the Sciences/Technology. Charles W. Gehrke, Robert L. Wixom, and Ernst Bayer, Ed., Elsevier Science, Amsterdam, 2001; xxix + 709 pp, clothbound, ISBN 0-444-50114-2, $375.

Chromatography: A Century of Discovery 1900-2000, is a unique journey that promises to provide the "bridge to the sciences/technology." It is a book whose pages are filled with love, respect, and admiration for both the scientists who built the art of chromatography and brief introductions to their work. The editors are Charles Gehrke and Robert Wixom, University of Missouri/Columbia, and the late Ernst Bayer, Universität Tübingen. They have provided excellent summaries of the earlier work of the 20th century, collected contributions concerning those now deceased, collated individual contributions from about 125 scientists who have been active in the area, and proffered about 25 offerings from young scientists who are the field's future. The latter section is not in the printed book, but on the web at http://www.chemweb.com/preprint/, apparently to make insertions simple. This makes the work one of a growing trend to adapt print-publication to the e-world of the web.

The 700-page book, printed and bound in the splendor so typical of Elsevier, is replete with historical photos, line drawings, and touches of sketch humor. If the reader wants to grasp a quick biographical overview of the people and scientific concepts of this multi-faceted area, this heavy tome is seminal. The editors claim that, "This book is recommended for students in the sciences and research, chromatographers at all levels: professional scientists, research chromatographers in academia, government, and industry; science libraries in academia, industry and professional societies; historians and philosophers of science; and educators and students at both high school and university levels." With such enthusiasm for their targets, one is prompted to recall some of the poetical lines of George Barlow (James Hinton), 1847-1913, who used the word science in many of his works:

> "God, thou art not dead, as some men say,
> Men who preach the saws of Science and they win
> the people to their way—
> And for the man of science strong and proud,
> Who peered beneath the billows of the sea,
> And pierced beyond the walls of mist and cloud,
> And read the past, and read futurity."

Barlow's words are preserved largely through the e-reference source: *The Full Text English Poetry Data Base*. *The Bulletin for the History of Chemistry* deserves equal respect from our academic and industrial research libraries, or we will rapidly lose the connectivity between creative scientists, their social and professional milieus, and the bridges between their works.

As Volume 64 of the *Journal of Chromatography Library*, this current volume will be preserved in many institutional libraries, particularly those that also subscribe to the related *Journal of Chromatography*. Its price will preclude widespread exposure to many of the individuals acclaimed by the authors. A quick look at Virginia Tech's Main Library circulation figures for the previous 15 volumes in the series (~ a decade) shows an average "check-out" of six patrons/volume. While not exactly flying off the shelves, that is still quite respectable, and of course does not reflect any in-house usage. This may bring a deep feeling of regret, since the editors have done a splendid job of highlighting the best work and workers in the western world, but have also included the meteors in areas such as Russia, Japan, China, and South America. Many western workers are often provincial and unaware of the synergistic connectivity between various countries. A few minutes a day reading about each worker's contributions and digesting their biographies makes the bewildering chromatographic world burst into new colors.

One cannot claim that the book flows as easily as Primo Levi's *The Periodic Table*, but the editors have come close through their use of careful architecture, clean editing, and clever use of sketches of toucans, bears, dragons, and bonzai trees—all juxtaposed with typical chromatograms, head-shots of the heroes, and informal photos of groups of people at meetings. The book also lists award winners of the various international and national awards that recognize seminal contributions and describes the professional societies that have supported them.

In all, the book is a carefully crafted volume that melds people, history, science, and the future. It is an ideal source book for those wishing to integrate the history and chemistry of the last 100 years of separation science, and it places steep escarpments and plateaus in proper perspective.

The subject material complements somewhat that in *A Century of Separation Science*, H. J. Issaq, Ed., Marcel Dekker, 2002, ISBN 0824705769 (hc), 755pp, ~$225. This book also records some of the advances in separation science that took place in the 20th century. The 35 experts chosen cover the most recent advances

in chromatography, electrophoresis, field-flow chromatography, supercritical fluid chromatography for high-speed and high-throughput analysis, current techniques in solid-phase extraction, microfluidics, capillary and slab-gel electrophoresis, gas-, ion-, affinity-, and thin-layer chromatography, as well as modern detection and purification processes for biomedical compounds. *Dr. Raymond E. Dessy, Chemistry Department, Virginia Polytechnic Inst., Blackskburg, VA 24061-0212.*

Robert Burns Woodward: Architect and Artist in the World of Molecules. O. T. Benfey and Peter J. T. Morris, Ed., Chemical Heritage Foundation, Philadelphia, PA, 2001, 497 pp, cloth, ISBN 0-941901-25-4, $45.

It is difficult to believe that nearly six generations of Ph.D. organic chemists have graduated since R. B. Woodward passed away in 1979. Among chemists of a certain age (perhaps over 50) Woodward will be forever revered as the leader of the Golden Age of Synthesis. However, one need only interview a postdoctoral candidate to realize that his remarkable contributions to synthesis are slowly fading from memory. Among younger chemists the name Woodward is probably more closely associated with the Woodward-Hoffmann Rules, a seminal contribution in their own right.

How would Woodward view the current state of organic synthesis, with its emphasis on combinatorial chemistry and libraries? My guess is that he would be very pleased, not only with the variety of new directions, but also with the extraordinary accomplishments of a younger generation in synthesizing complex molecules. The "art" of organic synthesis is alive and well! The contributors to the book *Robert Burns Woodward: Architect and Artist in the World of Molecules* do an excellent job of tracing this art back to its most distinguished practitioner.

An especially pleasing aspect of this book is the range of individuals who have contributed perspectives on the life of RBW. Most appropriately, daughter Crystal Woodward leads off with *"A Little Artistic Guide to Reading R.B. Woodward."* Crystal is an accomplished artist in her own right whom I met briefly in 1973 and later in 1992 at a symposium honoring the memory of her father. In the nearly twenty years separating these events it was clear that her appreciation for both the art and science of organic synthesis had increased greatly. Now, some ten years later, we are treated to a discussion of Woodward as artist that only a fellow artist could deliver. As Crystals notes, *"For a nonchemist, trying to understand the artistic quality of Woodward's work would be like trying to read poetry in a foreign language one does not know."* Nevertheless she succeeds admirably in drawing together *"shared qualities similar to the fine arts,"* and raises an intriguing question at the end: *"Is there still an art of chemical synthesis? Do you use words like* delight, delectation, inspiration, imagination*? Or* large pretty, bold prism*…?"* Of course, these are descriptions of the type RBW employed freely to express his enthusiasm for the science and which were sometimes criticized for being out of place in a scientific journal (in some quarters referred to as "Woodwardian"). To the delight of generations of organic chemists, Woodward did not bend to these criticisms.

In a following section Peter J. T. Morris and Mary Ellen Bowden provide a brief biographical introduction to Woodward's life and times. A photograph on page 7 sums up what you either loved or found distasteful about RBW. On the occasion of his 60th birthday Woodward is being transported to the festivities in a sedan chair, carried in part by a youthful Stuart Schreiber and Howard E. Simmons III. He was truly a showman in every sense of the word. As an aside, the "unidentified bystander" referred to in the caption is Max Tishler, a close personal friend of Woodward and a winner of the Presidential Medal of Science for his many contributions to modern drug development.

Robert C. Putnam contributes an interesting 1-2 pages titled *"Reminiscences from Junior High School."* Who would have imagined that a youthful RBW would barely survive the toxins and explosive concoctions he was producing in his basement lab? In *"Robert Burns Woodward: Scientist, Colleague, Friend,"* Frank H.

Westheimer describes a playful, exuberant RBW that only those most close to him would recognize. This "Harvard insider" also provides a glimpse into the intensity level and commitment of the RBW research group at its zenith, where Thursday evening seminars often extended well into Friday morning. Although these were essentially group meetings, they routinely attracted many chemists from the surrounding area. Westheimer describes them as *"… the most remarkable class in advanced organic chemistry that has ever been taught by anyone, anywhere."*

This leads us to perhaps the defining chapter of the book, *"RBW, Vitamin B_{12}, and the Harvard-ETH Collaboration,"* by Albert Eschenmoser. What does one giant in the field have to say about another? It goes without saying that their relationship was built upon mutual admiration, although Woodward was much the senior and on the verge of winning the Nobel Prize (1965). In fact, Leopold Ruzicka warned his young colleague (and former student) against collaborating on Vitamin B_{12}, feeling perhaps that the dominating presence of Woodward might overshadow Eschenmoser's contributions. What actually developed, though, was one of the most fruitful partnerships yet to transpire in synthetic organic chemistry. The total synthesis of Vitamin B_{12} is widely regarded as one of the highpoints of 20^{th} century organic chemistry, and various accounts of this feat have been published elsewhere. However, nowhere else is this story told with such a personal touch, providing vivid descriptions of moments of both euphoria and despair (Black Friday!). Woodward and Eschenmoser were always generous in their praise each of the other, and the current chapter is no exception. Eschenmoser closes with the desire that *"The book will widen the access to the treasures of Woodward's art and science and will help keep alive the memory of this great scientist and man for the coming century."*

It was a pleasure to re-read the selected papers of RBW included with this volume, as well as the 1973 Cope Award Lecture and Notes published in their entirety for the first time. Although not for everyone, Woodward's writing style conveyed his sense of wonderment, enthusiasm, and delight for each synthetic venture. Not to mention drama! Browse through the opening lines of any of these papers, and you will get a feeling for the attachment he had for his art (my personal favorite - strychnine, found on p 136). Regrettably, Woodward's colchicine synthesis was not included. Surely this is one of the most colorful accounts of total synthesis in the literature. In any event, there is little else to criticize in this fine effort and the authors are to be congratulated for bringing this much overdue account to fruition.

Woodward died a relatively young man by today's standards, in part a victim of the intensity with which he pursued life. Several years after his death I was invited to present a lecture at a meeting in Ljubljana (then part of Yugoslavia). As a relatively new member of the "club" I was thrilled (and quite nervous) to be associating with speakers that included Sir Derek Barton and Vladimir Prelog, both Nobel Laureates in organic chemistry. After my lecture Sir Derek and Vladimir greeted me with a simple sentence: "The Master would have been proud." This was high praise and needed no further explanation. It also served to place into context the special stature that Woodward enjoyed even among other giants in the field. *Peter A. Jacobi, Dartmouth College, Hanover, NH 03755.*

The Changing Image of the Sciences. Ida H. Stambuis, Teun Koetsier, Cornelis De Pater, and Albert Van Helden, Ed., Kluwer Academic Publishers, Dordrecht, 2002; 189 pp, ISBN 1402008473, $65.

This multi-authored volume presents presentations given at a conference in the Netherlands in 2000. The conference subject was chosen by the organizers at the Vrije Universiteit in Amsterdam because of concerns about decreasing public interest in the sciences, and the decreasing number of university students majoring in scientific disciplines. It is a challenging book to review because of the very different directions taken in response to the conference theme by the various authors.

Michael S. Mahoney, in "In Our Own Image: Creating the Computer" (19 pp), includes a broad, but nec-

essarily abbreviated, historical account primarily of the development of software and of human interfaces with computers. He argues that "...to scientists the image of the world has been changing. It has become ...the image of computation."

In the chapter most closely concerned with chemistry Bernadette Bensaude-Vincent, a past Dexter Award winner, discusses "Changing Images of Chemistry" (13 pp). The image of chemist as creator implicit in the successes of organic synthesis in the 19th century gave way to "chemistry as a cornucopia of material plenty" in the mid-20th century. The latter part of the 20th century led to critiques of synthetic chemistry, as most powerfully embodied in the disaster at Bhopal, and a new image of chemistry as "the key to life."

The longest chapter is by Garland E. Allen on "The Changing Image of Biology in the Twentieth Century" (41 pp). He explores successfully the move of biology from a descriptive and qualitative science to a "conscious attempt to introduce rigorous experimental, analytical, and reductionist methods from the physical to the biological sciences." This was a move from natural history to molecular biology. The chapter contains an interesting section on eugenics as an interface between biology and society.

The late Abraham Pais contributed "The Image of Physics" (19 pp), which is rather narrowly focused on relativity and complementarity, the Einstein and Bohr views of the philosophy of physics.

Sally Gregory Kohlstedt and Donald L. Opitz contribute "Re-imag(in)ing Women in Science: Projecting Identity and Negotiating Gender in Science" (35 pp), which I found to be the most engaging contribution in this volume. By discussing the lives and careers of seven well-chosen women who undertook scientific pursuits, from Margaret Cavendish in the 17th century to Marie Curie in the 20th century, they show how women were viewed or wished to be viewed by their societies.

David Christian on "Science in the Mirror of Big History" (30 pp) takes the broad view. He reminds us of the short time scale during which science has been cultivated in human history—let alone the history of the earth or the universe. He tries to connect science with creation myths of many cultures. This excellent essay does not fit well into the overall theme of the conference.

Finally Steve Fuller, in "The Changing Images of Unity and Disunity in the Philosophy of Science" (23 pp), discusses how evolving schools of the philosophy of science have moved from unified to disunified views. He hopes for some reunification in a textual image of nature as a multi-authored encyclopaedia rather than a single-authored book.

The text is well produced and includes a full index. Each chapter has extensive notes and references. As befits a book with this title, there are many illustrations in black-and-white. In their foreword the editors hope for the use of this volume "as a text book in undergraduate courses in the history of science and in science and society." Because of the varying approaches and depth of the individual chapters, I cannot support that recommendation; but I see value in this book as supplementary reading in such courses. *Harold Goldwhite, California State University, Los Angeles.*

The Holland Sisters. Eugene G. Rochow and Eduard Krahé, Springer-Verlag, Berlin, 2001; x + 180 pp, Cloth, ISBN 3-540-41604-8; $33.95.

William Henry Perkin, Jr., Frederic Stanley Kipping, and Arthur Lapworth were three of the leading organic chemists at the beginning of the twentieth century. Perkin Jr. (the "Jr." always was included to distinguish him from his father, founder of the synthetic dye industry) excelled in many areas of organic chemistry. Kipping is considered to be the founder of the field of organosilicon chemistry, and the American Chemical Society has chosen to name its international award in this field after him. Lapworth was one of the founders of the field of physical organic chemistry, laying the groundwork needed later by Ingold and Robinson. The remarkable factor common to these gi-

ants of organic chemistry is that they married three sisters, daughters of William T. Holland and Florence DuVal. Kipping was the linchpin, as he was the first cousin of the three women (their mothers were sisters), and his academic connections brought the other two chemists to the Holland family.

The authors had very little beyond the bare vital statistics for the sisters, until they found Brian Kipping, a grandson of Frederic Stanley. He provided them with photographs and some firsthand stories with which to launch their book, which they called a "biographical historical novel." Mina, the oldest, was the wife of Perkin; Lily, the middle, of Kipping; and Kathleen, the youngest, of Lapworth. The authors chose to center their story around Lily. The Kippings were the only couple to have children, and the relationship between Lily and Kipping developed earliest because of the family connections.

The Hollands lived in Bridgwater, Somerset, in Southwest England, where William T. Holland was involved in the brick and tile business. His work must have been very successful, as their house, The Lions, was one of the most impressive in town. The house left the family early in the twentieth century and served as a restaurant and club. It is currently under restoration. The sisters, provided with the sobriquet "The Sisterhood" by the authors, moved all over England and Scotland as they supported their husbands' academic careers. In contrast to the dearth of primary information about the sisters, extensive biographical information is available on the men, but this was not their story.

The narrative covers the period corresponding approximately to the life of Lily Holland Kipping, from 1867 to 1949. The authors include considerable commentary about current events, particularly the two world wars. Lily's two years at public school are described in great detail, including a list of all items she was required to bring with her. Her performance in all her subjects is described, and her outside interests in music and tennis emphasized. The authors imagine how each of the three sisters was courted by their respective chemist, leading to the three marriages.

The authors invoke strong involvement of the wives in their husbands' careers. Perkin and Kipping coauthored the classic text *Organic Chemistry*, which passed through many editions. The authors considered that Mina and Lily were prominently involved in the production phase, involving proofreading and indexing. The wives "made houseparties out of the necessary meetings, sharing the chores and celebrating the completion of the operation until the first copies of the completed book arrived from the publisher" (p 109). More remarkably, the authors give Lily a prominent role in Kipping's work: "Through their 35 years together, Lily had absorbed enough chemistry to understand what was going on, to feel the thrill of uncovering new knowledge for its own sake, and to know the satisfaction of writing papers to tell the scientific world what one had accomplished" (p 129). On an imagined train trip during the 1920s, the three sisters discuss Kipping's newly prepared organosilicon materials, which he had termed silicones. In five pages of text (pp 130-135), the three sisters solve the fundamental structural problem of the reaction of dichlorosilanes with water, namely that the product is not a ketone analogue implied by the name Kipping had given the products but rather a concatenation of silicon-oxygen units. Kathleen even proposes the names "monomer" and "polymer" from her classical education, meaning "one time" and "many times." Then she comments that "we (women) contribute words and ideas discreetly to our men, and then the ever-present male ego will insist that they must have arisen in the fertile mind of a man" (p 135). All these scenarios, the reader should keep in mind, are imagined, not documented.

During World War II, the Kippings moved to the west of Great Britain to avoid German bombing. Kipping foresaw no practical application of his work and became discouraged. In the United States, chemists at Owens Corning Fiberglass discovered that Kipping's silicones could be used to cure glass fibers so that they could withstand high temperatures required for military applications such as insulating electrical equipment for engine ignition. Corning needed the chemical resources of Dow Chemical Company to synthesize the materials by the Grignard method, so the Dow Corning Corporation was formed as a collaboration. Plants were built, and suddenly Kipping's worthless polymers were an essential war industry. General Electric developed a method to make silicones directly from silicon metal. The man who made the discovery of the "direct method" was, of course, the author, Eugene Rochow. He is mentioned only as "a young laboratory assistant" and "an upstart young squirt" who created competition for Dow Corning.

Perkin died in 1929 and Lapworth in 1941, so that for several years only Kipping remained. Kathleen joined the Kippings in their refuge in Wales. By the end of the war, silicones had found extensive applications

to the war effort, including waterproofing utilities on ships and insulating motors and generators. One more edition of Perkin and Kipping's book came out after the war, achieving 50 years of continuous publication. Kipping died in 1949 and Lily soon thereafter. She presumably was survived by her sisters.

There is only a little chemistry in the book, and only a little more chemical history. We see none of the work of Perkin or Lapworth. The book strives primarily to define the roles of the wives of these three chemists during their nearly 70 years of professional activity, from Perkins's initial work in the 1880s to Kipping's final work just before 1950. The prose is simple and straightforward rather than elegant, as the authors describe the lives of young girls and their later understanding of their husbands' chemistry. The reader learns a little silicone chemistry, reviews English history of the period, and gains some insight into the role of women up until 1950. *Joseph B. Lambert, Department of Chemistry, Northwestern University, Evanston, IL 60208-3113.*

Transmutations: Alchemy in Art. Lloyd DeWitt and Lawrence Principe, Chemical Heritage Foundation Press, Philadelphia, PA, 2002, $25.

Arnold Thackray's foreword to this booklet really gives a sensitive description: "HEALTH AND WEALTH. These two have always lain close together near the heart of human desire. The progress and the promise of the chemical and molecular sciences is one of the great good-news stories of our day. It is a story worth telling and retelling—not least because of the deep roots of these sciences within the history of humanity and the long centuries of struggle that lie behind our good fortune. Nowhere are the rootedness of the sciences and the reality of the struggle better revealed than in the magnificent Eddleman and Fisher Collections of alchemical art, which the Chemical Heritage Foundation is now privileged to possess. Here, in a group of almost one hundred paintings, one can see the modern chemical sciences struggling to be born…"

For almost 2,000 years alchemy has aimed at the transmutation of base metals into silver and gold, but it was more than that: since the Middle Ages the search for health, for medicinals, and for a better life. In a lecture given at the ETH in Zürich in 1931, Tadeus Reichstein, later a Nobel Laureate, expounded on all these aims of alchemy. It began in Egypt and Greece and then spread to the Middle East and Europe. There was none in North America, but Reichstein pointed out that the first person to refer to alchemy in modern times was an American, Ethan Allen Hitchcock, whose book *Remarks upon Alchemy and Alchemists* was published in Boston in 1857. [Copies of Reichstein's paper, both in German and English, are available on request from the reviewer at no cost.] Over the past century and a half the interest in alchemy and alchemical paintings has grown, particularly among American chemists. A few thousand such paintings were produced in Europe from the 16th century onwards. Two of the finest collections of these have been put together in America by Chester G. Fisher and Roy Eddleman.

The Fisher collection, formed between the 1920s and 1965, was housed at the Fisher Scientific Company in Pittsburgh and became famous through the thousands of reproductions sold by the company. The second great collection was built during the last thirty years by Roy Eddleman, the founder of the Spectrum Laboratories. Both of these collections have now found a home at the Chemical Heritage Foundation in Philadelphia; this booklet, written by Lawrence M. Principe and Lloyd De Witt, describes twenty of these. Professor Principe teaches history of science at Johns Hopkins and De Witt is a doctoral student working on Jan Lievens at the University of Maryland. They give fine descriptions of twelve Dutch and Flemish alchemical paintings mainly from the late 17th century, one Italian work of about 1700, and seven 18th- and 19th-century works of chemists and apothecaries, as well as a portrait of Robert Boyle. Of particular interest are discussions of related prints and especially of "chymical apparatus" and infrared reflectography. I particularly enjoyed the essay on

reflectography, written by the painting conservator, Nica Gutman, which shows the genesis of Adriaen van der Venne's *Rijcke-Armoede***.** This painting is one of my favorites in the collection, and I had always understood it to represent simply "*Wealth???Poverty*"; *i.e.*, the alchemist trying to move from poverty to wealth, whereas, in fact, he and his family move into deeper poverty. The authors, however, provide a detailed explanation of the elaborate symbolism in this particular painting. Clearly there is much more meaning than met my eye.

It is good to see a text with so few errors, none of them important. Cornelis Bega's alchemist, for instance, does hold the balance in his right hand, not his left. A real weakness is the quality of the reproductions. Unfortunately, most alchemical paintings are dark and so are extremely difficult to present satisfactorily. The *Rijcke-Armoede* has been reproduced best, perhaps because it is a brunaille. The poorest is the Italian still life on page 28, which is so dark that it is almost impossible for the reader to see "a boy delivering raw materials to the left." We can barely see the ghost of the boy. To appreciate the real beauty of these paintings, we need to go to the Chemical Heritage Foundation.

The greatest painting in this unique collection came from Roy Eddleman, David Teniers' *Alchemist in his Workshop*. Sadly, for the cover the designers picked a second rate pastiche of a Teniers which is ill-drawn and busy. Teniers was copied for generations, right into the 19th century, and the lower right quadrant of the beautiful original on page 15 would have made a far better cover.

I know of no exhibition of alchemical paintings ever, anywhere, and I hope that this booklet will inspire some curators in cities with important chemistry—Philadelphia, Basel, Frankfurt, Oxford—to consider showing the best of the almost one hundred paintings now at the Chemical Heritage Foundation. Such a traveling exhibition would be a wonderful appreciation of Roy Eddleman and Fisher Scientific for their generosity. *Dr. Alfred Bader, 924 East Juneau, Suite 622, Milwaukee, WI 53202*.

CALL FOR NOMINATIONS FOR THE 2004 EDELSTEIN AWARD

The Division of the History of Chemistry (HIST) of the American Chemical Society solicits nominations for the 2004 Sidney M. Edelstein Award for Outstanding Achievement in the History of Chemistry. This award honors the memory of the late Sidney M. Edelstein, who established the Dexter Award in 1956, which was succeeded by the Edelstein Award in 2002.

The Edelstein Award is sponsored by Ruth Edelstein Barish and Family and is administered by HIST. In recognition of receiving the award, the winner is presented with an engraved plaque and the sum of $3,500, usually at a symposium honoring the winner at the Fall National ACS meeting. Nominations are welcome from anywhere in the world.

Each nomination should consist of:

- A complete curriculum vitae for the nominee, including biographical data, educational background, awards, honors, publications, presentations, and other service to the profession
- A letter of nomination, which summarizes the nominee's achievements in the field of the history of chemistry and cites his/her unique contributions that merit a major award
- At least two seconding letters.

Copies of no more than three publications may also be included.

All nomination material should be sent *in triplicate* to

Dr. John Sharkey, Office of the Provost
Pace University, Pace Plaza
New York, NY 10038