the chemical causes of color are outlined in a historical context, dealing with the development of current theories of bonding in organic and inorganic compounds and the mechanisms by which they can give rise to color. Chapter 4, labeled as "from antiquity to the Perkin era," relates the historical development of the materials and processes used in coloration of a range of substrates, such as human skin and hair, glass and artists' colors. There is, of course, special mention of the development of dyes for textiles, from the Tyrian purple of antiquity through to Perkin's mauveine, the first synthetic textile dye produced on an industrial scale. This link illustrates how the color purple and its association with wealth and opulence played such a pivotal role. Chapter 5 takes up the next phase of the story when the Western European textile dye industry blossomed, with the processes involved in the search for new dyes evolving from a semi-empirical to a theoretical approach, as knowledge of structural chemistry advanced. The notable contributions from such as Hoffman, Kekulé and von Baeyer are discussed. The chapter concludes with a summary of the legacy of the dye industry, its recognition of research as such an essential sustaining feature, and its broad influence on political, educational and social structure within society. The final three chapters deal with some selected specific color-related themes, bringing the story through to modern times. Chapter 6 discusses the role of color in analytical techniques, for example those using the human eye as a detector of color change, and also in chromatography, spectroscopy and color measurement. Chapter 7 deals with some applications of color in biology and biochemistry, including staining techniques and chemotherapy. The book concludes, in chapter 8, with a series of miscellaneous topics, related by alliteration—foods, photochemistry, pharmaceuticals, fireworks, fun and the future.

This little book is not expensive and I would recommend it as essential reading for anyone with an interest in color. That probably includes most of us. The book will be of interest not only to those seeking a readable introduction to the fundamental principles of the science of color, in the context of its historical development, but also to individuals already familiar with the subject who will find gems of new or clarifying knowledge. I have reviewed many books on color over the years, generally positively, but I can honestly give this one my most enthusiastic recommendation. The author quotes Benjamin Franklin as saying "About light, I am in the dark." After reading this book, no one will be making such a statement.

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King of Poisons: A History of Arsenic, John Parascandola, Potomac Books, Washington, DC, 2012, ix + 197 pp, ISBN 978-1-59797-703-6, $27.50.

John Parascandola, a distinguished historian of chemistry, pharmacy and medicine, has produced a learned and accessible volume on perhaps the most notorious of the elements—arsenic, the king of poisons. The book begins with two chapters on the source of arsenic's fascination for many, its role as an intentional poison in fact and fiction. The next two chapters can also be considered as a pair, discussing hazards posed by arsenic exposure to those who work with it and to the larger public. The book closes with a chapter on the possibly beneficial side of arsenic's toxicity: its applications in medicine, broadly construed.

Chapter 1, "King of Poisons: *Arsenic and Murder*," begins with some of the chemical basics of arsenic as an instrument of homicide. The arsenic compound of choice for deliberate surreptitious poisoning is arsenic trioxide (As_2O_3), which is white, easily soluble, odorless, tasteless, and fairly readily available for much of the past few centuries. The more common naturally occurring sulfides of arsenic, realgar and orpiment, on the other hand, would be difficult to get victims to ingest, since they are highly colored and insoluble. The effects of ingesting arsenic are unpleasant and often lethal. A victim is likely to experience vomiting and diarrhea, and possibly burning in the mouth or gut. These symptoms could be confused with those of common diseases, such as cholera, making homicide difficult to diagnose, particularly before the availability of forensic tests for arsenic. The chapter

mentions the tests devised by James Marsh in 1832, then a quicker and simpler test a decade later by Hugo Reinsch.

The bulk of the first chapter treats specific famous and notorious instances of proved and suspected arsenic poisoning, from Renaissance Italy through twenty-first century America. The chapter closes with a brief overview of arsenic in chemical warfare, particularly the work of the US Chemical Warfare Service during the first World War. Several chlorinated arsines were developed and tested at the time, of which the best known came to be called Lewisite, after Winfred Lee Lewis, head of one of the units of the Chemical Warfare Service.

The second chapter, "Poison in the Plot: *Arsenic in Fiction*," treats arsenic in fictional rather than actual homicides. I found the descriptions of fictional poisonings much more interesting than those of actual or suspected ones in the previous chapter. The fictional cases often involve imagination, clever or convoluted plots, exotic characters or artifacts, and of course no actual victims. The real or suspected cases, on the other hand, usually struck me as sordid and banal.

Parascandola points to the 1875 Wilkie Collins novel, *The Law and the Lady*, as possibly the first work of detective fiction to feature arsenic. Another relatively early appearance of arsenic in detective fiction was in R. Austin Freeman's story, "The Moabite Cipher." Dr. John Evelyn Thorndyke, Freeman's physician-detective, finds his way through the thicket of mysteries, including a sample of arrowroot in which he finds lots of arsenic by the Marsh test. The prolific mystery writer Agatha Christie was apparently fond of poison—as a plot device. Someone is poisoned in over half of her novels, and arsenic is mentioned in nearly a quarter of them. Her first use of arsenic as the murder weapon was in the 1932 story, "The Tuesday Night Club." Christie's famous detectives Miss Marple and Hercule Poirot both deal with cases of arsenic poisoning. Outside the detective genre, arsenic figures prominently in the plot of Gustave Flaubert's masterpiece *Madame Bovary*. And the comedic possibilities of the poison are explored in Joseph Kesselring's play *Arsenic and Old Lace*. In addition to the relatively well known works listed above, Parascandola describes several more obscure and more recent examples of arsenic in fiction.

Arsenic and its compounds are toxic, whether or not they are administered with malevolence. Chapters three and four treat the hazards of occupational and environmental exposure. The oldest of these hazards are associated with mining and smelting. Because arsenic is often found in copper deposits, mining and smelting copper frequently exposed its workers to arsenic. Bernardino Ramazzini mentioned arsenic in mining and pharmacy in *De Morbis Artificium Diatriba* (*Of Diseases of Tradesmen*), which is generally considered the first general work in occupational medicine (1700). In the 19th century, however, arsenic itself became more frequently mined for a variety of applications, and not surprisingly, those who extracted and processed it were also at risk of exposure. So were those who made and used arsenic-containing products. Among the most widely diffused such products were pigments, including Scheele's green (copper arsenite) and Paris green (copper (II) acetoarsenite). Among the workers exposed to these pigments were those who made artificial flowers or who decorated hats and clothing with them—not to mention those who made such pigments or made or used paints or wallpaper containing them. Arsenic's toxic properties were deliberately used in products intended to kill pests or to preserve objects prone to putrefaction. Thus makers and users of pesticides could be exposed to arsenic, as could taxidermists and enbalmers.

Some of the hazards of arsenic-containing products were more widely diffused, affecting not only those who made or used such products for their livelihood. Arsenic released by smelting often went directly into the atmosphere, spreading beyond the workplace the possibility of exposure to the toxic element. Arsenical pigments were used in garments and wallpapers widely used by the public. Similarly, arsenical pesticides could find their way into the food supply. Wood impregnated with chromated copper arsenate to inhibit rot was widely used in the 20th century in telephone poles, railroad ties, and even in playground equipment. Although the US Environmental Protection Agency does not believe that the arsenic in such wood poses an unreasonable risk, some local authorities are choosing to replace it in playgrounds.

Some arsenic in the environment is natural, including arsenic released by volcanoes into the atmosphere. Of far greater impact to human health, however, is arsenic from naturally occurring minerals turning up in drinking water. This phenomenon has become evident most tragically in Bangladesh in the late 20th century. There, the government and international aid agencies constructed millions of tube wells in order to provide rural Bangladeshis with drinking water free from disease-carrying microorganisms. The wells were indeed effective in dramatically cutting rates of infant and child mortality from water-borne diseases, but they introduced a new

problem because many of the wells delivered water high in arsenic.

Parascandola's final chapter turns to the area for which he is best known, history of pharmacy and medicine. Thomas Fowler, an 18th-century Englishman and Edinburgh-trained physician attempted to duplicate and then modify a patent medicine of the day. He called the resulting potion Solutio Mineralis. Under the name Fowler's solution, it found its way into many pharmacopoeias in the 19th century, and it became a widely used remedy for a variety of ailments. Paul Ehrlich's research into chemotherapeutic agents, including some containing arsenic, is also described. Ehrlich's "compound 606," patented under the name of Salversan, was an effective treatment against syphilis and trypanosomal diseases. A section of this chapter is devoted to the arsenic-eaters of Styria (a region now part of Austria). Reports of rural inhabitants of the area who deliberately consumed and tolerated arsenic in quantities that are generally harmful circulated widely in the middle of the 19th century. Such reports caused considerable debate in medical circles about their accuracy and plausibility—debate that continued into the 20th century. Meanwhile, the reports were so widely diffused that they appear to have influenced the use of arsenic in 19th-century cosmetics and inspired a key plot point in Dorothy Sayers's 1930 novel *Strong Poison*. Arsenic in homeopathy is also mentioned in this chapter. Arsenicum album is a homeopathic remedy based on arsenic trioxide (albeit diluted to submolecular concentrations).

Parascandola refers rather frequently to two other recent books in which arsenic figures prominently. John Emsley devotes one of the five major sections of *The Elements of Murder* (Oxford, 2005) to arsenic. As one might gather from Emsley's title, perhaps the greatest overlap of his material is with the first chapter of Parascandola's book, but Emsley treats a great variety of other applications of arsenic as well, at least in overview. James Whorton's, *The Arsenic Century* (Oxford, 2010) touches on the toxicity of the element as both a deliberate and inadvertent poison. Its subtitle, "How Victorian Britain was Poisoned at Home, Work, and Play" suggests the breadth of the applications of arsenic it considers and the limitations to its geographic and temporal scope. A reader of more than one of these volumes should not be surprised to find quite a bit of material in common.

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Early Russian Organic Chemists and their Legacy, David E. Lewis, Springer, Heidelberg and New York, xii + 136 pp, ISBN 978-3-642-28218-8, $49.95, softcover (978-3-642-28219-5, $39.95, eBook).

When one considers the history of organic chemistry in the nineteenth century, the names that most quickly come to mind are those of German chemists like Liebig, Wöhler, and Hofmann. In this excellent book, Professor Lewis (University of Wisconsin-Eau Claire) makes a strong case for the inclusion of the significant and sometimes overlooked contributions of Russian chemists. As an example the rules of Markovnikov and Zaitsev are introduced in most organic chemistry courses during the study of alkenes. Professor Lewis is well known to readers of the Bulletin. This book is based in part on a series of thoroughly researched and well written articles that have appeared in its pages.

The initial chapters cover concisely the evolution of higher education in Russia particularly after the reforms introduced by Peter the Great. In 1725 he established the Russian Academy of Sciences and his work of modernization and secularization of Russian higher education was continued by the rulers who immediately followed him. New universities were established in Moscow, and at the start of the nineteenth century at Dorpat, Vilna, Khar'kov, Kazan, Warsaw (at that time part of the Russian empire) and St. Petersburg. Later universities were opened in Kiev, Odessa, and Tomsk. All these universities were charged with developing advanced studies and research.

The first great figure in Russian science, including chemistry, was Lomonosov (1727-1797), a founder of Moscow University, and an anti-phlogistonist before Lavoisier. Many Russian university posts were initially occupied by German scientists but by 1830 there was a nationalist movement towards Russification of the universities, and more and more Russian professors were appointed during the nineteenth century. The principal loci of Russian organic chemistry in that period were the