

She describes the advantages and disadvantages of the various poisons available in considerable detail, and also evaluates the charges of using poison that have been brought against various figures of the time, including Lucrezia Borgia (possibly innocent) and Caterina de' Medici (more likely guilty). It was particularly impressive that the author not only sampled the odor of a piece of arsenic ore, but also trained her dog to find a piece of the ore in a pile of debris. This is the sort of behavior that might get her included in a future volume about characters in chemistry.

Carmen Giunta's chapter on chemists as characters in fiction will be particularly useful to teachers who wish to assign out-of-class readings to supplement the topics on their syllabus. He suggests several resources that catalogue chemists in fiction, including WorldCat and Lab Lit.com. If a teacher would consider adding some popular references to his or her reading list, an additional source would be the ACS Undergraduate Blog on the topic, "Who are your favorite fictional chemists?" (<http://acsundergrad.wordpress.com/2012/03/06/who-are-your-favorite-fictional-chemists-here-are-ours/>). Some teachers may look askance at this web site, since it includes Walter White, who is a well-known example of a chemist using his knowledge for evil purposes. Another possible supplement to the excellent information that Giunta offers

is the online article called *Literature and Chemistry* by Jay Labinger. (<https://www.its.caltech.edu/~bi/labinger/nontechpdfs/16chemlit.pdf>)

The history of chemistry is a fascinating field of study, and one of the reasons for this appeal is the diverse character of those who study chemistry. As this book demonstrates, chemistry has attracted poets, pacifists, amateur thespians, bridge masters, humanitarians, spiritualists, and yes, even poisoners. Perhaps equally important, those who have made important discoveries have included both scientists trained at the best institutions of their time as well as those who had little formal training. Patterson and Rasmussen urge teachers to celebrate this diversity so that young people thinking about making chemistry their career will better understand that there is potentially a place for them regardless of who they are. This is a powerful message which deserves to be heard. It is to be hoped that many chemistry teachers will be inspired by this book to enliven their classes by sharing some of these stories about the characters who are responsible for creating the field of chemistry.

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Toxic Airs: Body, Place, Planet in Historical Perspective, James Rodger Fleming and Ann Johnson, Eds., University of Pittsburgh Press, Pittsburgh, 2014, xiv + 284 pp, ISBN 978-0-822-96290-8, \$28.95.

Toxic Airs is a collection of essays that investigate a wealth of worries about "bad" airs. Ranging from medieval worries about witches' breath to contemporary concerns with the rising levels of carbon dioxide, the essays of this book reveal a persistent anxiety about and fascination with the air we breathe. As the editors explain, "Humans are, not surprisingly, threatened by compromises to their air, and they have reacted by wielding their full arsenal of understandings on toxic airs" (p ix).

Humans' many and varied reactions to compromised air are what motivate the book and will interest readers. Taken as a whole, this is not merely a catalog of aerial

concerns, but a full examination of how humans, in different times and places, have tried to address perceived problems with the air they breathe. Detailed case studies of tear gas, smog, acid rain, deadly airs, ozone, radiation, and automotive emissions reveal a wide range of attempts to contain or cope with compromised airs.

The majority of these cases are twentieth and twenty-first century issues, but there are three outlier chapters on earlier periods that deserve considerable attention because of the counterpoints they offer to contemporary studies. Brenda Gardenour Walter contributes an essay on the late medieval period that provides a useful overview of how longstanding medical traditions imbued airs with both natural and supernatural powers. Christopher Hamlin's close reading of Reginald Orton's discourse on cholera and deadly air yields a powerful insight for modern medicine and medical historians: that medicine should

consider the chemical qualities of environmental airs as well as microbes in searching for the causes of disease. James Rodger Fleming's chapter on the long and varied history of "carbon die-oxide" takes readers on a lively tour of the human fascination with CO₂ from ancient sites of prophecy and divinity through contemporary schemes for storing the gas. Taken together, these three chapters make an argument for thinking about the atmosphere and toxic airs in holistic terms over the *longue durée*, rather than considering atmospheric toxins as new and discrete problems, the more common approach of the twentieth and twenty-first centuries.

The reader will have to draw connections between the three articles mentioned above and the remaining nine, eight of which focus on how governments and politicians have reacted to specific air concerns since World War II. Scholars with interests in the interaction between the scientific community and governments will find many of these essays useful, as they mine the fruitful ground of science policy creation.

Some of these essays expose politicians and governments as tone deaf and slow to listen to the concerns of their publics. Historian Roger Eardley-Pryor tells an interesting and paradoxical story of how tear gas became safe for domestic policing while simultaneously considered inhumane in warfare. While the scientific community argued against tear gas as a gateway chemical weapon that would lead to the use of other, deadlier chemicals in international warfare, scientists and the federal government seemingly ignored the war that was starting in America's cities, where police departments regularly employed tear gas against the urban unrest and race riots of the 1960s. Anthropologist Susie Kilshaw turns to the victims of chemical weapons, focusing on Britain's Gulf War veterans and their health fears. Though soldiers may never have been exposed to chemical weapons—a point that bureaucrats and physicians often stress—memories of the constant chemical threat have strongly influenced how veterans understand their own health and environmental dangers.

When governments have responded against atmospheric threats, as in the history of automobile emissions control and the fight against smog, their actions have not yielded the desired results because regulatory methods have not kept pace with scientific discoveries. Victorian anti-smoke reformers understood that there was a linear relation between smoke production and increasing levels of air pollution, so they created a regulatory model that focused on controlling emissions. Chemist Peter Brimblecombe's chapter on the history of under-

standing photochemical smog explains how scientists working on Los Angeles's smog realized the limits of linear regulation. As they better understood the multiple sources of photochemical smog, scientists switched to urban monitoring networks, but policy makers remained locked in a regulatory model that targets primary emissions production. Similarly, the engineering history that Richard Chase Dunn and Ann Johnson have uncovered reveals how the linear understanding of emissions and air pollution hindered engineers in their goal of reducing pollution without reducing miles driven. This account dovetails nicely with Brimblecombe's, even as it reveals that engineers and chemists were not often in conversation as they worked on the same problem. Taken together, these chapters make excellent points about the need for flexible legislation and regulation to respond to modern atmospheric concerns.

If misunderstanding and miscommunication between scientists, engineers and politicians have hampered regulation, one might conclude that scientists should directly shape regulatory policy. Four case-studies of scientists as politicians and bureaucrats disprove this conclusion. Jongmin Lee, a scholar of science, technology, and society, contributes a chapter on the early efforts of the Environmental Protection Agency to combine epidemiological research and air quality monitoring. While this interrelated approach to health and environment made sense to scientists, it was hard to organize and slow to provide the evidence that Congress wanted from a regulatory agency. In historian E. Jerry Jessee's chapter on nuclear weapons testing and radioactive fallout, the divide between scientists within and outside of the Atomic Energy Commission—all of whom were doing atmospheric research—is vexed. The political imperative to test nuclear weapons led AEC scientists to present their research and suggestions differently from independent scientists. Historian Rachel Rothschild tells a similarly depressing story about international cooperation and the limits thereof in the history of acid rain. Despite the creation of an international organization for scientific collaboration in the 1960s, the political cultures of the different nations prohibited true and open cooperation to reduce acid rain. Historian Matthias Dörries considers the public debates about saving the ozone layer in the 1970s, which he characterizes as "a considerably more cooperative political environment than ... the nuclear winter debate of the 1980s or current climate change discussions" (p 209). Even in this relatively cooperative moment, the disagreements between scientists who favored modeling and those engaged in empirical research were deep and arrested action in many of the same ways

that early misunderstandings between scientists and politicians had. While uncertainty is a useful and necessary principle in science, these chapters reveal its limits for policy and regulation.

After a series of chapters that emphasize the miscommunications between scientists and politicians, Andrea Polli's exploration of how art can communicate science and policy to the public is refreshing. Polli, the artist behind *Particle Falls*, a real-time visualization of air quality data that has been displayed in San Jose, California, and Philadelphia, introduces readers to artists and artworks that directly raise questions about the state of the air. The many examples of productive collaborations between artists and scientists might not offer regulatory answers, but they provide hope for bringing public pres-

sure to demand action on air quality and climate change.

As editors, Fleming and Johnson had explicitly interdisciplinary goals of crossing temporal, geographic and disciplinary boundaries. While successful in assembling an interdisciplinary group of scholars, the editors might have done more to bring cohesion to the collection. The essays often operate on different registers—while they speak to similar issues, the authors rarely speak to one another. As a result, readers might pick up this collection for a single essay and fail to see a reason to read further, thereby missing the many valuable perspectives that the editors carefully assembled.

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The American Synthetic Chemicals Industry: War and Politics, 1910–1930, Kathryn Steen, The University of North Carolina Press, Chapel Hill, 2014, 418 pp, ISBN 978-1-4696-1290-4, \$39.95 paper.

In 1920, in the wake of World War I, a collective of chemical manufacturers urged the Senate Committee on Finance to maintain rigorous protections established during the war for their industries against potential German resurgence and encroachment (p 195):

The manufacturers testified that tariffs alone would be inadequate to protect their industry for the next several years. They knew that the German manufacturers still surpassed the Americans in chemical knowledge, research and experience, and they had to make the case that Americans, while not yet equal to the Germans, could catch up in a reasonable time-frame.

The chemistry—and chemical manufacture in question—was the aromatic organic chemistry of synthetic dyes and pharmaceuticals.

A decade later, the situation had changed profoundly. Although continued high tariffs (and wartime confiscation of patents) had insured a modest domestic success of US manufacturers of these products, resurgent German manufacturers “had recovered many of the international markets where Americans had ventured during the war.”

However, the American synthetic organic chemicals manufacturers had taken the industry in different directions, where “the Germans had little or no head start on American rivals, and the two sides competed with relative parity” (p 237, both quotations).

What Steen styles a “new ‘American’ industry” (e.g., p 280) consisted of a concatenation of new raw materials, new methods and new synthetic organic chemical products. The spectrum of new raw materials derived from petro-chemicals (among others). Regarding the new chemical products: these were now aliphatic (e.g. ethylene and its compounds) rather than aromatic. They were utilized to make commercial materials such as artificial fabrics, plastics and rubber, and were intended for different industries than the aromatic organic dyes, most notably the rapidly-developing automobile industry. New physical-chemical techniques, employing very high temperatures and pressures were deployed to create the products and they were mass produced. These changes of direction were attended by industrial innovations (or at least enhancements), notably, the development of in-house industrial research, the hiring of American academically trained chemists, the utilization of university chemists as consultants, and the ascendancy of chemical engineering. Particularly in her last chapter (chapter 8: An “American” Industry, 1919–1930), Steen traces these