BOOK REVIEW

The Chemists' War, 1914-1918, Michael Freemantle, Royal Society of Chemistry, London, 2015, 342+xvi pp, ISBN 987-1-84973-989-4, $45.88.

In September 2013, the Government of Syria launched a chlorine gas attack on its own population, killing 1429, including 426 children. Since then, the humanitarian tragedy in the Middle East has reached epic proportions. Almost three hundred thousand have died, and the conflict looks likely to worsen. Reports come in of the use of a variety of chemical weapons. For over three years, the United States has led in helping dispose of Syria's declared CW stockpile, 1300 metric tons, and dismantling its 23 CW production facilities, and has overseen the neutralization of 600 metric tons of sarin, VX, and mustard gas. We have reports that as of October 2015, about 90% of the world's declared stockpile of chemical weapons had been destroyed. But the world remains unsure about the future use of what the US Senate Armed Services Committee has called "the world's worst weapons," and the April 2017 attack in Syria has demonstrated that stocks remain in active use.

What has become, we may ask, of modern society, of the legacy of the Geneva Protocol of 1925 and its successor, the Chemical Weapons Convention, to which 190 states—including Syria—have given their assent? More generally, what has happened to the international prohibition of chemical weapons, the odium that surrounds their use, and the norms that this has inspired?

These norms were born from the use of chemical weapons in the Great War and the appalling legacy left to generations on both sides.

This is the legacy that formed the subject of Michael Freemantle's earlier book, *Gas! Gas! Quick Boys!: How Chemistry Changed the First World Wa*r (Spellmount: The History Press, 2012)—his title drawn from Wilfred Owen's famous poem, and his subtitle perceptively suggesting "How Chemistry Changed the First World War." The present book returns to the subject, and re-captures the Great War in popular memory as "the chemists' war"—a sobriquet attributed to Richard Pilger, Registrar of the Institute of Chemistry in London.

Whilst historians now share chemistry's infamous fame with all the other sciences that contributed to the war effort, it is clear that chemical weapons, even more than the damaging effects of aerial bombardments, artillery barrages, submarine attacks, and the ravages of hunger and disease, have left an indelible impression on modern memory. In its narration, science lost its moral status, and was reduced to such memories that such author-soldiers as Siegfried Sassoon and Wilfred Owen could parse and summon. But with Freemantle's earlier book, this book is not only about chemical warfare, but also about the war of applied chemistry and chemical industry. Behind the Front lay the mobilization of a vast international chemical industry, prominent in Germany, but soon dramatically impressive across France and Britain as well, and with everlasting consequences for the United States.

In twenty chapters, Freemantle builds upon his earlier work, and familiarizes the reader with the making of shells and explosives, and with the leading men and women chemists who shaped this aspect of modern warfare. In so doing, he does not fail to do justice to the increasing uses of chemistry in caring for the starving,

sick and wounded, in fighting infection, and in killing pain. As such, the Great War (as other wars before and since) graphically stimulated the "dual uses" of science—a phenomenon well illustrated by a Gordon Cain Symposium held at the CHF in 2008, and attended by representatives of the State Department and policy studies institutes in the US and the UK.

As Freemantle writes, America's principal contribution to the *materia chemica* of gas warfare was chlorovinyldichloroarisine, better known as Lewisite, and subsequently dubbed by the US Chemical Warfare Service "the dew of Death." But, as always, there was another side. The "double-edged sword," with which Freemantle ends his story, sees chemistry in wartime use in protecting health and preventing disease. We know that chlorine, released to purify drinking water and sterilize swimming pools, has found appalling applications in barrel bombs. But we cannot mistake the value of life-saving antiseptics and disinfectants.

Like Freemantle's earlier book, this is a highly professional account—like many, especially in Britain and Australia, deriving from family experience of the War. His professionalism as a science writer (of journalism and textbooks) shines through his prose as he explains—in approachable, layman's terms—the basic ingredients of wartime gas chemistry. Inevitably, the story focuses on organic chemistry, and on features that are—like the manufacture of acetone— comparatively well known. Readers will also recognize at least some of the many "fractured friendships," in Freemantle's phrase, which first soured, then destroyed long-standing relationships between British and American chemists and their German teachers and colleagues. At the end, whether by accident or design, the book ends poignantly with two chapters, one commemorating the sacrifice of the fifty-five British chemists memorialized in marble at the Royal Chemical Society in London; and the other, listing the leading "Fifty Chemicals of the Great War" that many of them helped produce.

Perhaps the book's most original contribution lies in drawing attention to the "metals of war," such as nickel, tin, tungsten, chromium, manganese, and zinc. In the emerging materials science of industrial war, such metals took a "starring role" on the battlefield—as did aluminum in the making of Zeppelins, and phosphorus in making the Pomeroy bullets that brought them down. The celebrated use of platinum as a catalyst—key to making sulfuric acid, thence nitric acid, ammonium nitrate, and high explosive—joins a story ennobled by the applications of silver, essential to photography, and of calcium and tungsten in medical X-rays. And so the chemical catalogue continues, through the history of the tank—made of iron, copper, nickel and zinc—with pistons of aluminum, machine guns housed in phosphor-bronze mountings, and shell cases packed with amatol. The lesson is clear—warfare had become a case of chemistry and industry compounded.

Like its predecessor, *The Chemist's War* is a good introduction to the subject in its widest dimensions. Just a few shortcomings might be mentioned. First, surprisingly little attention is given to the vast chemical-industrial corporations that contributed to the war, whether in Germany, Britain, France, or America. Just as the Great War was the making of modern chemistry, so did modern chemical industry emerge in its wake. Second, the structure of the book tends to recall a sequence of articles rather than an unfolding narrative. Some chronologies are reversed, and some topics are duplicated. But readers can easily take such matters into account. Both these books are well worth including in any working library on "The Chemists' War."

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