evolution has neither religious nor metaphysical implications, and should therefore not be extrapolated into such areas as evolutionary ethics. Although many practising scientists will support his position, it cannot be implemented because, as Bowler's study shows, reflection on the wider connotations of scientific theories has proved both important and attractive to many writers, including some scientists. Alexander's strategy of guarding science against questionable implications nevertheless enables him to combat both the anti-religious scientism of atheists such as Dawkins and the anti-evolutionism of creationists. Proponents of both positions, he claims, have misunderstood both science and religion. Indeed, proponents of these twin heresies have misinterpreted the opening verses of Genesis, which should not be read as a proto-scientific account describing how the world came into existence, but should be understood in the context of the creation stories that were current at the time it was written.

Alexander also provides a long and informative overview of the history of science-religion interactions from the ancients to the Victorian controversies surrounding darwinism and materialism. From this survey he draws the possibly over-optimistic conclusion that, in the past, science and religion have interacted in many different ways and to the benefit of both parties. Interestingly, his historical survey stops short of the period that is illuminated by Bowler's book. Although some of Alexander's arguments reflect those used in the period discussed by Bowler, Alexander's contribution to science and religion helps to move the subject into the twenty-first century. ■

Geoffrey Cantor is at the School of Philosophy, University of Leeds, Leeds LS2 9JT, UK.

Washing one's hands of controversy

Prometheans in the Lab: Chemistry and the Making of the Modern World

by Sharon Bertsch McGrayne
McGraw-Hill: 2001. 243 pp. \$24.95

Martyn Poliakoff

When Prometheus stole fire from the gods, he had to endure their wrath. But he did not have to worry about the effect of fire on the environment when he released it on Earth. That was the users' problem. Things were different for the revolutionaries of industrial chemistry, the 'Prometheans' of the title. The gods did not interfere but the environmental consequences came back to haunt them.

However, the Prometheans fought back. When Thomas Midgley, the inventor of lead-

ed petrol, was asked at a press conference whether his new additive was dangerous when spilled on the hands, he "called for tetraethyl lead. Pouring it into his palms, he washed his hands with it, and then held the bottle to his nostrils for more than a minute. Drying his hands on his handkerchief, he announced, 'I'm not taking any chance whatever.'" Midgely knew it was untrue but it was the message the public wanted to hear. Lead cured the knocking that crippled car engines and reduced petrol consumption. Lead was needed to drive the United States through the twentieth century.

The balance between consumer benefit and environmental impact is not clear-cut, and this is the crux of Sharon Bertsch McGrayne's ambitious book. Her case is built around the lives of outstanding chemical inventors from the eighteenth century to the present day. Their lives illustrate the interplay of consumer demand, corporate greed and environmental fallout.

The inventors are not all well known but they have been chosen with care, albeit with a slight bias towards the United States. They include: Nicolas LeBlanc, the inventor of an extremely smelly and polluting method for producing washing soda, who lost his patents during the French Revolution; William Perkin, the 18-year-old English inventor of the first synthetic purple dye, who retired a millionaire at the age of 35 to devote himself to scientific research; Norbert Rillieux, an African-American chemical engineer and cousin of the painter Degas, who introduced a revolutionary steam evaporator for refining sugar; Edward Frankland, the British founder of analytical chemistry and champion of clean water, who suffered from the life-long stigma of his illegitimacy; Fritz Haber, the German inventor of the eponymous process for making ammonia from atmospheric nitrogen and chief proponent of chemical warfare in the First World War, whose first wife committed suicide in disgust at his war role (or was it at his infidelity?); Thomas Midgley, the 'lead handwasher', who also invented ozone-depleting CFC refrigerants and arranged to be strangled by the contraption that he devised to turn him in bed after he was struck down by polio; Wallace Carothers, inventor of nylon and founder of polymer science, who was an alumnus of the same little-known college as Carl Djerassi, inventor of the contraceptive pill; Paul Müller, the Swiss inventor of the insecticide DDT, whose boss contested his Nobel prize; and the US geochemist Clair Patterson, who established the age of the Earth and then went on to show that it was polluted even at its utmost ends by lead from gasoline.

Bertsch McGrayne is a science journalist and really comes into her own when the book moves into the twentieth century. She has missed some well-known anecdotes that could have enlivened the earlier chapters,

such as Perkin's luxuriant beard from which debris was reputed to fall into his solutions to nucleate crystallization. But many fascinating stories are there, including Haber's vain and highly secretive attempt to fund Germany's war reparations by extracting gold from sea water.

One of her main arguments, which I strongly support, is that we should not apply environmental judgements to historical situations without considering their humanitarian context. Thus, the first large-scale application of DDT was made during a typhus epidemic in Naples in December 1943. Within three weeks, the civilian death toll had halved, the first time that a typhus outbreak had been controlled in winter. Similarly, one of the main benefits of CFCs was safe refrigeration, which not only reduced food poisoning but also allowed the widespread use of vaccines, for example in eradicating smallpox. That said, the book contains several examples in which the needs of corporate profit and human welfare clearly diverge.

Bertsch McGrayne explains how, as a Jew, Haber was airbrushed out of history by the Nazis. However, his former colleagues circumvented the Nazi boycott of his memorial service by sending their wives in their place. But she fails to point out the interesting moral contradiction in Haber's work. His ammonia process was invented to make fertilizers to relieve hunger, yet it was used for explosives that killed millions. He invented mustard gas as a weapon, but its derivatives have saved the lives of more cancer patients than it ever killed soldiers on the battlefield.

This is not a chemistry book; the chemistry it does contain is painfully spelled out. It is well researched, but the author eschews footnotes and her sources are hidden in a somewhat idiosyncratic "annotated bibliography". There are a few line diagrams but no pictures, which is a pity in a book that is so centred on personalities. From the prelude to the quaintly named "postlude", it is a compelling read, provided that you persist beyond the opening chapters. ■

Martyn Poliakoff is at the School of Chemistry, University of Nottingham, University Park, Nottingham NG7 2RD, UK.