

Feet of clay

There's more to science than doing the research.

Leaps in the Dark: The Making of Scientific Reputations

by John Waller

Oxford University Press: 2004. 304 pp.

£18.99, \$24.95

Walter Gratzer

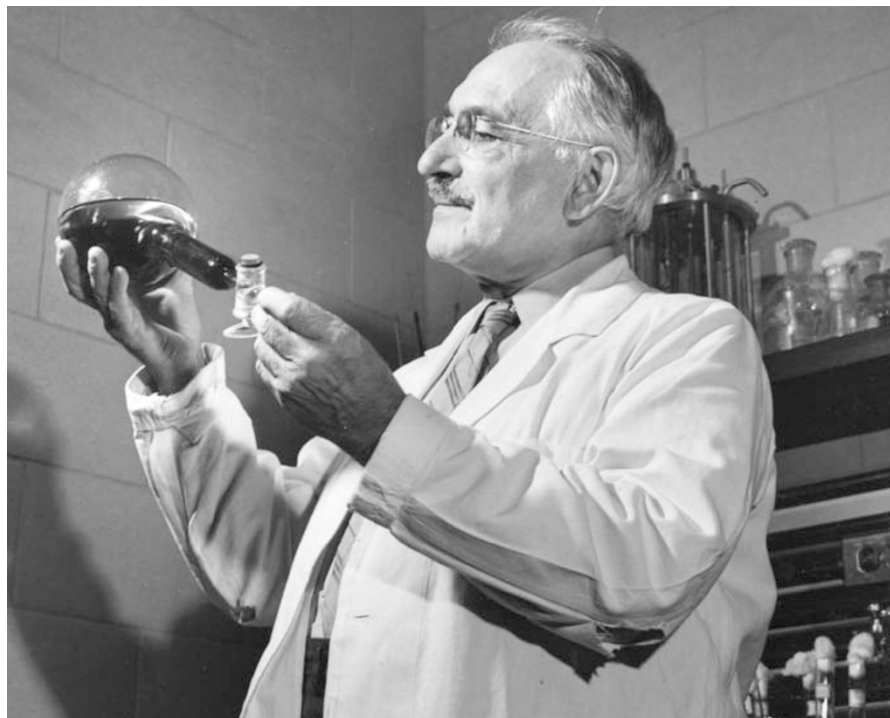
"The next day Koch was bending nearsightedly over the body of this little creature on his dissecting board; giddy with hope, he was carefully flaming his knives... Not three minutes later Koch is seated before his microscope, a bit of the dead creature's spleen between two thin bits of glass. 'I've proved it,' he whispers, 'here are the threads, the rods — those little bacilli from my hanging drop were just as murderous as the ones right out of the spleen of a dead sheep.'" Such was the style of popular science writing in the dawn of the genre some eighty years ago. Paul de Kruif's reams of incandescent prose, hard to stomach today, inspired two generations of schoolchildren to follow in the footsteps of Robert Koch and other heroes.

John Waller finds such romantic images of the scientific process pernicious, and he is a man with a mission: he wants to rip the laurels from the brows of the scientific conquerors, and to place their achievements in a more realistic, even at times sordid, context. *Leaps in the Dark* is his second foray into this territory, and follows on from *Fabulous Science*.

We know of course that no important discovery ever emerges from an intellectual vacuum, for it is a truism that every advance rests on what has gone before. Even Newton, Waller reminds us, admitted to having seen further than his peers because he had "stood on the shoulders of giants" — though the remark is generally interpreted as a dig at his detested rival, the diminutive Robert Hooke, rather than a mark of modesty, an attribute wholly alien to Newton's temperament.

Waller excoriates the sin of 'presentism' — the interpretation of historical events in terms of the social, moral and intellectual norms of our own time. So, he avers, it was the intellectual constraints of the period that drove the great biologist and polymath Lazzaro Spallanzani to reject the (to us self-evident) implication of his own remarkable experiments: that an animal's genetic composition does not derive solely from its mother.

The attempt to supplant an existing principle that has until then adequately accommodated the known facts inevitably meets resistance. But this reaction, as Waller stresses, must not be taken to imply that the



Unprincipled investigator? Selman Waksman took all the credit for the discovery of streptomycin.

opposition is foolish or bigoted. An example is the power that the germ theory of disease exercised in the late nineteenth century, which made it hard for scientists and doctors to get their minds around the idea that disease could equally be caused by the absence of something (such as trace nutrients).

But with his relentless emphasis on the influence of social and political factors in determining whether a new theory prevailed or sank, Waller erects some speculative structures of his own. He holds, for instance, that in the prolonged debate over the cause of cholera, Koch vanquished Max von Pettenkofer not because he was right and his adversary was wrong, but because the Kaiser and the Chancellor of a newly united Germany were eager to present the fiercely patriotic and gallophobic Koch as their country's rival to Louis Pasteur and the French school.

And how did Ignaz Semmelweis's insight that childbed fever was disseminated by a contagion on the hands of doctors and students coming from the autopsy room to the labour wards fail so signally to find favour with his superior, Johannes Klein? Why, because of Klein's distaste for Semmelweis's republican politics, of course, rather than for his theory. Well, maybe.

In Waller's summing-up we find the following passage: "By the end of the 1800s scientific advance remained closely linked to political and economic developments. As

the efficient harnessing of power became of vital economic importance with the onset of industrialization, physicists turned from the study of matter to that of energy." Leaving aside the implicit conflation of science with technology, is there evidence that the likes of Hermann von Helmholtz, Julius Mayer, Rudolf Clausius and Ludwig Boltzmann concerned themselves greatly with economic imperatives? And did Darwin really draw his inspiration from the struggle for existence in the mill towns of the Industrial Revolution? There must at least be scope for doubt. Waller's conjectures are certainly not without interest, and he seldom fails to make a lucid case. But he threatens, it seems to me, to replace one form of historical distortion (Thomas Carlyle's 'great man' view of human progress) with another.

Waller concludes with two cases of misrepresentation and injustice that are still within living memory. He does a magisterial demolition job on the egregious scientific mandarin Robert Watson-Watt, whose outrageous claims to have invented radar and directed its operation were scarcely questioned by the politicians. R. V. Jones, in his wartime memoirs, recalls his efforts to escape from Watson-Watt's capacious orbit, having found him to be devious, manipulative and, worse, a third-rate physicist. Watson-Watt's boundless self-aggrandisement bore fruit, and his is still the name most often

associated with the invention that, perhaps more than any other, secured victory for the Allies in the Second World War.

Selman Waksman, by contrast, was a well respected researcher who forsook his principles for the irresistible prospect of lasting fame. The antibiotic streptomycin eventually saved the lives of innumerable consumptives, and earned Waksman a Nobel prize in 1952. His claim to have discovered the antibiotic essentially by himself was challenged by his student Albert Schatz, who went so far as to take his supervisor to court, an act that incurred the opprobrium of the scientific establishment for bringing their calling into disrepute. The affair put paid to Schatz's career, even though it was he who had on his own initiative isolated streptomycin and tested it against tubercle bacilli. As so often in such cases, the student was convinced that the credit was entirely his, while the professor believed that he had created the intellectual milieu which opened the way to the discovery. This does not exculpate Waksman, who had, as Waller shows, fallen into the grip of self-delusion. Friedrich Nietzsche explained this psychology most concisely: "I have done this," says my memory. "I could not have done this," says my pride, and remains adamant. At last memory yields."

Let me affirm finally that *Leaps in the Dark* is a good read, and ought to generate much healthy debate. Waller has opened what seems to be an inexhaustible vein — one that will no doubt yield more high-quality ore. ■

Walter Gratzer is at the Randall Division of Cell and Molecular Physics, King's College, New Hunt's House, Guy's Campus, St Thomas' Street, London SE1 1UL, UK.

.....
Poison in the well

Venomous Earth: The World's Worst Mass Poisoning

by Andrew A. Meharg
Macmillan Science: 2005. 256 pp. £16.99, \$29.95

Roger P. Smith

The dust-jacket shows cupped palms in a pose eerily reminiscent of that used by the US insurance company that bills itself: "The Good Hands People". The skin, however, is pigmented by the black raindrop pattern of melanosis characteristic of chronic arsenic poisoning. The victim is one of a predicted 350,000 people in Bangladesh and West Bengal, India, who will develop fatal cancers over the next ten years.

As one of the poorest nations in the world, Bangladesh has long lacked even necessities such as safe drinking water for its burgeoning population. Before the early



Arsenic in the drinking water leaves its mark on the hands.

1970s, a quarter of a million children died each year from water-borne communicable diseases such as cholera and dysentery. In what better hands to place this catastrophe than those of UNICEF, the United Nations children's fund?

Acting under the purest of humanitarian motives, UNICEF proposed a solution that seemed a providential blend of economy and speed. Inexpensive iron tubes were pushed through the marshy ground to tap water stores just beneath the surface. When fitted with hand pumps, an inexhaustible supply of clean water seemed assured. By 1972, nearly a million such devices had been installed, and the health benefits were already evident. The mortality rate for children under five began to drop and was halved by 1996. Efforts to provide the entire area with safe water were redoubled, and now an estimated 95% of rural inhabitants have access to at least one such well.

But in the background an unimagined horror was slowly emerging. The first confirmed report of arsenic contamination of tubewell water came as early as 1983, but it was regarded as an isolated incident. A dermatologist at the Calcutta School of Tropical Medicine recognized the skin lesions, and had some West Bengali wells investigated. They tested positive for arsenic. By 1987, more than 1,000 cases had been identified. But papers published in local and international journals were largely ignored. Organized conferences and pleas for attention fell on the deaf ears of aid officials and government workers, who pointed to the obvious

health benefits. The installation of the tubewells continued to accelerate. Cases of arsenic poisoning began to appear in Bangladesh, where the problem was found to be even more severe than in West Bengal.

How the water came to contain such high levels of arsenic is still a matter for conjecture. Why the distribution of arsenic contamination is so maddeningly random is still not known. The only timely recourse seemed to lie in testing each well and painting the pumps red if they were contaminated and green if they were safe. The water's arsenic content tends to change with the time and season, however. Much deeper tubewells were more likely to be safe but were more expensive, and replacing the hundreds of thousands of contaminated shallow tubewells could take years.

This tragic but important story is told in the first two chapters of this slim volume, with some solutions proposed in the final chapter. In between the book deals with the history of arsenic. There is a unique section on the commercial uses of arsenic pigments, such as Scheele's green and emerald green, which satisfied a void in the colour spectrum for consumer products such as wallpaper. The use of arsenical dyes in the nineteenth century spread to clothing, paper, cardboard, soap, toys, paints, artificial and dried flowers, stuffed animals, Venetian blinds, curtains and ballgowns. They were even used as food colourings. The morbidity and mortality that resulted from this collective insanity will never be fully tabulated.

There is a chapter on the largely ill-advised therapeutic uses of arsenic, and another on the homicidal application of arsenic, including some of the more famous poisoners and their victims. Also discussed is the ugly environmental impact of arsenic production or its release from the commercial smelting of ores for other materials.

There is certainly much here to fascinate a general audience but I found the book to be curiously disjointed. There is little mention of the biological mechanisms by which arsenic produces its effects, for example. Earth scientists may find enough to identify with, but perhaps the author could have been persuaded by his editor to provide a little more for life scientists. ■

Roger P. Smith is emeritus professor of pharmacology and toxicology, Dartmouth Medical School, Hanover, New Hampshire 03755, USA.

J. SHAW/REUTERS/NEWS.COM