

sociologists of science Jerome Ravetz and Silvio Funtowicz, in which specialists (including non-scientists) review policy-relevant scientific claims but a wider variety of stakeholders bring further knowledge to bear in interpreting them. Rather than assuming that disputes are solely scientific, opening up these decision-making processes would render their primary nature more honestly political and economic, while giving proper weight to scientific reason and evidence.

Merchants of Doubt is an impressive

account of science's role in many key public issues of today, especially given the difficulties of accessing archival materials on recent and still-unfolding events. Yet it is incomplete: it does not examine other areas, such as genetically modified organisms, in which grounds for doubt have been downplayed rather than amplified by powerful players to the same deregulatory ends. Oreskes and Conway could have gone further in asking how scientific uncertainty should be interpreted in policy, and how science can be led

to overreach itself in arbitrating public facts, meanings and norms. ■

Brian Wynne is professor of science studies and associate director of the ESRC Centre for Economic and Social Aspects of Genomics (CESAGen), Lancaster University, Lancaster LA1 4YD, UK. He is the author of *Rationality and Ritual: Participation and Exclusion in Nuclear Decision-Making*.

e-mail: b.wynne@lancaster.ac.uk

See also *Nature* 465, 686–687 (2010).

Behind the periodic table

The Disappearing Spoon: And Other True Tales of Madness, Love, and the History of the World from the Periodic Table of the Elements

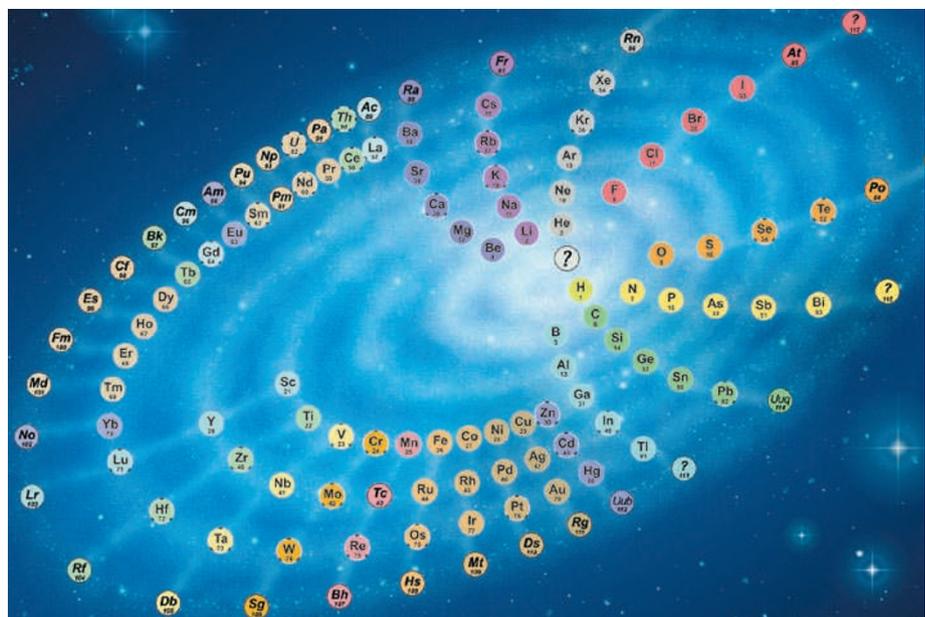
by Sam Kean

Little, Brown and Company: 2010. 400 pp.
\$24.99, £18.99

Aesthetically speaking, there is little to venerate in the periodic table. It is a messy family tree whose charm stems more from its quirks than its orderliness. No one doubts its mnemonic utility, but it is perverse that we regard the table both as an object of beauty and as an intellectual framework of chemistry, rather than simply as the piecemeal way things turned out at this level in the hierarchy of matter.

In *The Disappearing Spoon*, writer Sam Kean accepts the reverential notion of the periodic table. He portrays it using a cast of characters whose stories illustrate our interactions with the physical world. By weaving handfuls of tales into loose themes in each chapter, he leaves no corner of the table untouched. All readers will learn something — in my case, how the tin solder belonging to Robert Scott of the Antarctic was allegedly converted into a brittle form by the extreme cold. But most of Kean's tales have been told before. Despite focusing on the periodic table, the book is not the survey of chemistry one might expect. *The Disappearing Spoon* dwells as much on nuclear physics as on chemistry, and molecules feature only occasionally or implicitly. It is an attractive collection, but lacks a moral.

Kean writes with energy and pace. Yet there is a fine line between the wryness of hindsight and smirks at the conventions of the past. Emilio Segrè did slip up when he failed to spot the first element heavier than uranium — neptunium — and Linus Pauling's inside-out triple-helix model of DNA was worse than a poor guess, ignoring the implausibility of the closely packed



P. J. STEWART (2007)/C. WENCZEK, BORN/DIGITAL

Chemists have tried many ways of portraying the order of the elements.

anionic phosphate groups. But it would be more illuminating to put such routine mistakes into context than to deride them.

The cult of the periodic table has led to many pointless attempts to find a new taxonomy of the elements. The resulting spirals, pretzels, pyramids and hyper-cubes only reveal that we have not yet cracked the geometry of the elements, that there is some hidden understanding to be teased out from these baroque juxtapositions of nature's building blocks. Similar desires to find cryptic order probably motivate the search for grand unified theories and supersymmetry; but in the case of the table, such impulses are inappropriately directed towards contingency.

To call the periodic table contingent will probably elicit howls of protest from many scientists, who would contend that the allowed configurations of electrons around nuclei are surely a predictable consequence of quantum

mechanics. But the logic of these arrangements is tortuous. Electron shells are subdivided and become interleaved as they are filled by electrons, and the delicate balance of electron-electron interactions creates untidy anomalies. Relativistic effects — the distortion of electron energies by their tremendous speeds in heavy atoms — elicit oddities such as mercury's low melting point and gold's yellow lustre. All can be explained, but not elegantly.

In making the periodic table the organizational emblem of his book, Kean ends up with an arrangement of facts about the behaviours and histories of the elements that does not add up to a thesis about our conception of the material world. Consequently it is best taken in small bites, rather than digested at one sitting. ■

Philip Ball is a writer based in London and author of *The Ingredients: A Guided Tour of the Elements*. His latest book is *The Music Instinct*.