

*Quantum* is brief, pacy and lucid (although some titles are perhaps too clever: for example, 'Stalking the Planck'). The breadth and depth of Einstein's contribution in this area becomes overwhelmingly clear. Eleven years after his first great paper on the subject, he delivered a theory of transitions that introduced into quantum theory the idea of probabilities, which he came to despise. Finally, in 1924, he built on the thinking of Indian physicist Satyendra Bose about quantum gases and predicted that, under some conditions, a high proportion of particles could occupy the lowest quantum state, enabling quantum effects to appear in the everyday world. This was later called Bose–Einstein condensation and was first observed experimentally in 1995.

Stone covers all this with clarity and even tackles Einstein's little-known 1917 paper on the quantization of chaotic systems. This chapter will probably leave non-specialists scratching their heads, but it is worth a read because it demonstrates that there is more to Einstein's *oeuvre* than even most quantum physicists know. Stone concludes that Einstein's work was worthy of four Nobel prizes, and it is a measure of the book's achievement that his claim sounds quite reasonable.

It was left to Werner Heisenberg, Erwin Schrödinger and Paul Dirac to set out the full-blown quantum theory of matter in the mid-1920s. Einstein was a formidable critic of the theory, although he was always outwitted in argument by his friend Niels Bohr — a topic treated only briefly in the book, probably because this ground is so well-trodden. Yet all the originators were indebted to Einstein's thinking. As Max Born later said, he was "clearly involved in the foundation of wave mechanics and no alibi can disprove it".

In old age, Einstein seemed indifferent to his reputation as a fuddy-duddy, but the criticisms may have hurt more than he let on. I have often wondered how he felt when he saw the Princeton University Players' production of William Shakespeare's *The Tempest* in July 1953, especially when Prospero contemplates the fleeting nature of existence that leaves "not a rack behind". Einstein died less than two years later. He was proud to have built the great edifice of relativity, but still profoundly dissatisfied with quantum theory, which he was confident would be superseded.

Was he wrong? Some theoretical physicists are now speculating that space and time might in some sense emerge from the more fundamental quantum, so it may be that scientists will one day regard Einstein's greatest achievement as pioneering a theory he believed was terribly flawed. In the meantime, Stone's rewarding book helps us to appreciate the remarkable extent of that feat. ■

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## Books in brief



### **Junkyard Planet: Travels in the Billion-Dollar Trash Trade**

Adam Minter BLOOMSBURY (2013)

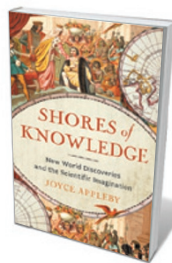
Junk really is filthy lucre — the basis of a global scrap trade worth up to US\$500 billion a year, writes Adam Minter. Scion of a professional recycling family, Minter anatomizes this complicated, half-hidden industry that he argues is, even at its dirtiest, greener than harvesting raw resources. He focuses on scrap metal, a prized commodity now recycled in innovative ways, and the kingpins of the trade. Leonard Fritz, for instance, rose from extreme poverty to run the Michigan-based Huron Valley Steel Corporation, which annually processes almost half a million tonnes of shredded automobile.



### **Cut It Out: The C-Section Epidemic in America**

Theresa Morris NEW YORK UNIVERSITY PRESS (2013)

Birth by Caesarean section is expensive and carries a higher risk of medical complications than vaginal birth. Yet in 2011, 33% of US births were by Caesarean. To investigate why, sociologist Theresa Morris crunched the numbers and interviewed more than 100 medical staff and mothers. The culprit, she concludes in this excellent and detailed study, is a risk-averse US medical culture that favours heavily managed births — such as the overzealous use of fetal heart monitors, which restrict the mother's movement — and that frowns on women having vaginal births after Caesareans.



### **Shores of Knowledge: New World Discoveries and the Scientific Imagination**

Joyce Appleby W. W. NORTON (2013)

A sea change gripped Europe from the late 1400s as word of the thrillingly strange New World spread. Maps were redrawn and the 'book of nature' swelled with new species, from penguins to chillies. In a history stretching from Christopher Columbus to Charles Darwin, Joyce Appleby reveals how a thirst for empiricism grew with the need to sift out tall tales from genuine reportage. She treads the trail of paper and specimens left by the likes of ethnographer Bernardino de Sahagún and "first ecologist" Alexander von Humboldt.



### **To the Letter: A Journey Through a Vanishing World**

Simon Garfield CANONGATE (2013)

The letter — that pillar of the historical record — may itself soon be history. As Simon Garfield reminds us in this elegy to the post, letters uniquely revivify past eras and the psychological complexities of people living through them. The first stirrings and exponential rise of e-mail are touched on, but Garfield's focus is the physical missive and the depth of thought it allows. From wooden tablets dug up at the ancient Roman garrison Vindolanda, UK, to the epistolary gems of novelist Virginia Woolf, this is a billet-doux to two millennia of the impassioned, often life-changing power of private correspondence.



### **Survive! Inside the Human Body, Vol. 1: The Digestive System**

Gomdori co., Suk-young Song and Hyun-dong Han NO STARCH PRESS (2013)

From volcanic burps to colonic bacteria, this comic-book ride through the human digestive system is a delirious joy for pretty much everyone aged eight and over. Hyun-dong Han's lurid images and zippy text by Suk-young Song deliver on facts even as they shamelessly milk the 'yuck' factor. Take the plunge with hero Geo and "self-proclaimed genius" Dr. Brain as they shrink and are sucked into the ever-hungry Phoebe: the ultimate inside story. [Barbara Kiser](#)