

and learning were not shared among operators. Disaster analysis of man-made incidents — in contrast to normal accidents — implied that if the background conditions incubated over time, there was some possibility of prior detection even when systems were complex.

Tensions are evident in the comparison of Turner's and Perrow's accounts — between the possibilities for foresight and fatalism. These resurfaced several years later in debates among US scholars over 'normal accidents' versus 'high-reliability organizations'. Similar discussions were seen in related work in Europe on safety culture and organizational accidents. The fundamental question, posed by influential political scientist Scott Sagan in his book *The Limits of Safety* (Princeton University Press, 1993), was: are normal accidents inevitable or can the combination of interactive complexity and tight coupling be safely managed?

The high-reliability researchers believed that it could. They studied cases such as the flight operations on aircraft carriers, where the conditions for normal accidents exist but the systems operate safely each day. They identified cultural factors, such as collective decision-making and organizational learning, as key reasons why an otherwise toxic combination of complexity and risk can be managed. By contrast, critics such as Sagan pointed out that even these systems had serious near-misses from time to time, and that normal accidents could always occur as a result.

That debate is still unresolved. Nevertheless, the analyses of Perrow and Turner were ahead of their time and their legacy remains profound. Many subsequent accident inquiries drew on their insights — most notably the space shuttle *Columbia* Accident Investigation Board report in 2003. Enquiries into the Fukushima disaster will benefit too, but we need a wider appreciation of how future normal accidents might gestate, and a better understanding of the actions of organizations and people, both intended and unintended, that generate major risks.

The world still faces many systemic risk challenges, including those of runaway climate change, financial-market failure and information security. Although many advances in safety technology, engineering practice and risk management have been made over the past 30 years, organizational and technical complexity remain integral to the many systems that drive such risks. *Normal Accidents* is a testament to the value of rigorous thinking when applied to a critical problem. ■

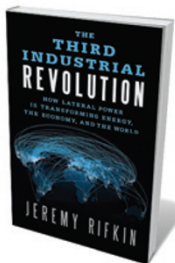
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Books in brief



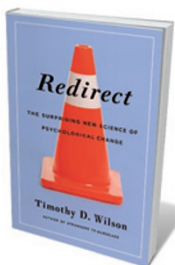
Lifeblood: How To Change The World, One Dead Mosquito at a Time
Alex Perry C. HURST 208 pp. £16.99 (2011)

Journalist Alex Perry chronicles two years of US philanthropist Ray Chambers's crusade against malaria. A mix of science, history and research, this is a fascinating take on a disease that kills a million people a year. Chambers's story is just as intriguing. Pragmatism, business sense and bullheadedness gave him an advantage over the formulaic and often cost-ineffective approaches of many aid agencies. His Wall Street clout helped him to bring world leaders on board. And his focus on solutions such as bed nets and poverty eradication has, says Perry, enabled him to save millions of lives.



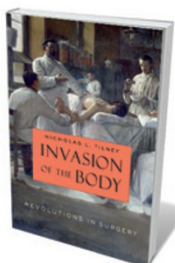
The Third Industrial Revolution: How Lateral Power Is Transforming Energy, the Economy, and the World
Jeremy Rifkin PALGRAVE MACMILLAN 304 pp. £16.99 (2011)

Green energy and the Internet will revolutionize society and environment. So argues economist Jeremy Rifkin in this blueprint for global change. The five pillars of his vision for a post-fossil economy are a shift to renewables; a miniature power plant in every building; hydrogen storage for intermittent energy; an 'intergrid' for sharing energy that harnesses Internet technology; and eco-transport that runs on plug-in electricity and fuel cells. With the European Union already on board, this is a big idea with backbone.



Redirect: The Surprising New Science of Psychological Change
Timothy D. Wilson LITTLE, BROWN 288 pp. \$25.99 (2011)

The stories we tell ourselves shape our lives, says social psychologist Timothy D. Wilson. Editing them can help us to redirect our thoughts and actions. He trawls through multitudinous 'happiness formulae' in popular-psychology books to show what doesn't work — from critical incident stress debriefing for trauma victims to the Healthy Families America initiative to prevent child abuse. What does work, he says, is simpler, subtler and backed by sound research: writing exercises, 'rewind' therapy, helping children to develop healthy narratives of their own and practising tolerance.



Invasion of the Body: Revolutions in Surgery
Nicholas L. Tilney HARVARD UNIVERSITY PRESS 384 pp. \$29.95 (2011)

Tumours removed, joints replaced, organs transplanted: every weekday, 85,000 non-emergency operations take place in the United States alone. Distinguished US surgeon Nicholas L. Tilney intersperses moments from his own career with a rousing history of the evolution of surgery, breakthrough by breakthrough — from near-butchery to today's fine-tuned procedures. Wading through the gore with aplomb, he covers anaesthesia, pharmaceuticals, asepsis, health-care reform, surgery in war and in peace, facial transplants and more.



About Time: Cosmology and Culture at the Twilight of the Big Bang
Adam Frank FREE PRESS 432 pp. \$26 (2011)

In this eloquent book, physicist and astronomer Adam Frank explores the interweaving of social and cosmological time. His trek through the history of humanity takes a parallel look at how we have gained a deeper grasp of the Universe during our time on Earth. Starting at the dawn of consciousness, he brings us through millennia of revolutions — from the development of agriculture, industry and the rise of cities to the emergence of string theory and ideas about eternal inflation and the multiverse.