

are much too complex to engineer and control with top-down thinking. And his book offers revealing examples of how evolution has improved approaches across essentially all fields, from software design and telecommunications to the economics of housing and basic human morality. *The Evolution of Everything* will be enjoyed by anyone interested in the origins of order and organization in human societies, and how we might put evolutionary forces to better use in managing our lives and communities.

One thing that I liked less about the book, however, is how Ridley's political views often intrude on his arguments. His examination frequently gives way to complaints about all manner of things that he — a libertarian — despises. Too much government and meddling in health care; too many taxes and layers of social policy to protect people. Ridley manages to blame the good intentions of left-leaning people for the persistence of global poverty, for the demise of the British health-care system, even for fascism. Most of the intelligent public, Ridley grouches, believes that government is the foundation of all that is good, and is generally infallible.

Does anyone actually believe this? Most people just think that government does some necessary and useful things — helping to ensure the stability of the financial system, for example, and providing basic levels of education. Most economists think the same. This aspect of the book will no doubt appeal to the libertarian element in right-wing organizations, but for many readers, the asides will interfere with the discussion.

If you filter out the political cheerleading, Ridley's argument emerges as edifying. It is almost certainly true that solutions to our most pressing problems — from global poverty to climate change — are not going to spring from the mind of any lone genius or planning committee. We will find them through the collective tinkering and evolutionary exploration of tens of millions of diverse minds working together. ■

**Mark Buchanan** is a science writer based in Abbotsbury, UK. His latest book is *Forecast*. e-mail: [buchanan.mark@gmail.com](mailto:buchanan.mark@gmail.com)

## PHYSICS

# Two shades of physics

**Robert P. Crease** contrasts a physicist's account of awe with a historian's reality check.

**T**hese two concise tours of physics are delightful, each in their own way. In *Seven Brief Lessons on Physics*, physicist Carlo Rovelli appreciates the field's beauties in an expansion of articles he wrote for the Italian newspaper *Sole 24 Ore*. Science historian John Heilbron's *Physics* surveys the discipline from ancient times to today.

Rovelli begins by relaying his excitement at discovering the general theory of relativity for the first time, in the gnawed pages of a textbook he had used to plug mouse holes. Reading it on a beach in Italy, he was inspired by its disclosure of a simpler, deeper order to the Universe — the gravitational field is not diffused through space, but is space. It was “as if a friend was whispering into my ear an extraordinary hidden truth”.

He writes evocatively of the theory's many wonders: exploding universes, space collapsing into bottomless holes, time sagging and slowing and the unbounded extensions of interstellar space rippling and swaying “like the surface of the sea”. We are immersed not in an invisible rigid infrastructure, but in “a gigantic flexible snail-shell”. The metaphors are vivid, the visions dramatic. When this book was first published in November 2014 in Italy, it outsold E. L. James's blockbuster novel *Fifty Shades of Grey* (Vintage, 2011).

Through chapters on quantum principles, cosmology, particles, quantum gravity and thermodynamics, Rovelli maintains the awestruck tone of a practising physicist. Only in a final chapter on the place

## Seven Brief Lessons on Physics

CARLO ROVELLI  
*Allen Lane: 2015.*

## Physics: A Short History from Quintessence to Quarks

JOHN L. HEILBRON  
*Oxford University Press: 2015.*

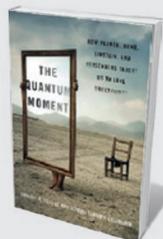
of humans “in this great fresco” does this stance lead him astray. It makes it hard to explain why some people struggle to comprehend science, and even distrust it. It tempts him into scientism — regarding the world that science describes as the real

one. The flow of time, he suggests, is “absent from descriptions of the world”. Yet philosophical ‘lived time’ — the process of anticipating the future out of a past to allow the human experience of the present — is a fundamental condition of being human. It allows us, among other things, to create and marvel at scientific frescos.

Placing himself as observer rather than participant, Rovelli forgets where he stands.

Heilbron's *Physics* is different in topic and tone. He uses the Greek word *physis* to name the ancient field, then traces how it morphed into physics. *Phisica* seamlessly folded in astronomy, psychology and zoology; its idea of cause included form, purpose and the stuff of which things were made, as well as pushes and pulls. From this, Aristotle developed a ‘theory of everything’, which explained almost all phenomena experienced by humans, from the growth and behaviour of plants and animals to the patterns made by heavenly bodies. It included a deity that drew things into motion; ▶

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### The Quantum Moment

Robert P. Crease and Alfred Scharff Goldhaber  
(W. W. Norton, 2015)

Philosopher Robert Crease and physicist Alfred Goldhaber reveal how quantum theory has pervaded popular culture, from quantum poetics to television's *Quantum Leap* (see Jim Baggott's review: *Nature* **513**, 308–309; 2014).



### Adventures in the Anthropocene

Gaia Vince (*Milkweed*, 2015)

The human epoch is in full swing, with a population of 8 billion looming. In search of sustainability, journalist Gaia Vince travelled to six continents and found much to foster hope — such as the Ugandan farmer who feeds livestock on a by-product of her sunflower crop.

▶ and ‘quintessence’, a fifth element (in addition to the familiar earth, air, fire and water), which was needed to keep the theory consistent, explaining, for example, why heavenly bodies move in circles rather than in straight lines.

*Physica* did not become physics simply as a result of observant people adding pieces to a puzzle. It required transformations in the social ecosystem, such as who pays for knowledge and why; its social applications; and how it is communicated. *Physica* got a big boost from the Islamic world, where Aristotle’s concept was highly regarded and translated into Arabic around the ninth century. But physics began to acquire its eventual outline in the West after the sixteenth century, with the generation of Francis Bacon, Galileo and René Descartes.

Fostered by the needs of centralized, bureaucratic states, the discovery of new worlds, the spread of universities and new industrial applications, the emergence of physics as we know it today was a process of “dedefying and deanthropomorphizing nature”. Now, God is marginalized and ‘dark energy’, our new quintessence, is needed to make sense of it all. A theory of everything is an ever more remote goal.

Heilbron does not sneer at *physica*, but carefully examines it and the ecosystem in which it thrived. By the book’s end, physics has split off into so many branches — radar, Earth science, space probes, accelerators, meteorology and so on — permeating so many spheres of human life that we begin to lose sight of the field as something coherent. And that is the point.

Whereas Rovelli’s feel-good book ends with us gazing in wonder at the edge of “the ocean of the unknown”, Heilbron leaves us rooted in lived reality. “Physics has given civilization a somber, disturbing, and challenging world picture, many fertile and some terrifying inventions, and notice of responsibility for the outcome of the human story.” If it, too, outsells *Fifty Shades*, there is hope for humanity yet. ■

**Robert P. Crease** is a professor in the Department of Philosophy at Stony Brook University, New York.  
e-mail: robert.crease@stonybrook.edu

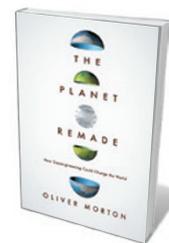
## GEOENGINEERING

# Journey into geopoetry

Jane C. S. Long relishes an erudite exploration of the people and principles of climate intervention.

Several authors have tackled geoengineering — the idea of harnessing science and technology to cool our overheated planet. In the 2010 *How to Cool the Planet* (Houghton Mifflin Harcourt), Jeff Goodell told the personal stories of geoengineers. One, physicist David Keith, described how his interest in climate modification is grounded in a desire to preserve nature in *A Case for Climate Engineering* (MIT Press, 2013). Jack Stilgoe discussed responsible governance of geoengineering in *Experiment Earth* (Routledge, 2015). Eli Kintisch covered the history of potential solutions and their developers in *Hack the Planet* (Wiley, 2010). Stewart Brand described intervention as inevitable in *Whole Earth Discipline* (Atlantic, 2010), stating: “We are as gods and we might as well get good at it.”

But if you are going to read one book on climate engineering, it should be *The Planet Remade*. Oliver Morton, briefings editor at *The Economist*, starts by asking: do you think climate change is a problem, and the energy system easy to change? Using this dialectic, he explores the thesis that the climate crisis cannot be solved, but could be managed. There follows a journey through the people and principles of climate science and intervention, the natural history of carbon dioxide, engineering of the nitrogen cycle and the backstory of weather modification. Morton speculates about the ethical, political and social implications if climate intervention became available. The book finishes with a range of scenarios — including one that could end well for Earth and a frank discussion of what could go wrong. *The Planet Remade* is as much an exploration of science and



**The Planet Remade: How Geoengineering Could Change the World**

OLIVER MORTON  
*Granta*: 2015.

engineering as it is of people and attitudes.

Most climate engineering proposes to change the radiation balance of Earth so that less radiation gets in, or more escapes. Techniques include spraying reflective aerosols into the stratosphere, brightening clouds with salt spray or sequestering greenhouse gases.

Morton traces the idea to the cold war, when scientists including physicist Edward Teller began to fear that a nuclear war would cause a hellish conflagration, darkening the skies and creating a ‘nuclear winter’. Efforts to understand this led to the birth of modern climate science — which in turn supported 1980s warnings about climate change by the likes of atmospheric physicists James Hansen and Stephen Schneider. Given clear evidence that volcanic eruptions can send enough reflecting sulfur particles into the stratosphere to cool Earth noticeably, it was not a great leap for some scientists to contemplate intentionally using sulfur to counteract greenhouse-gas emissions. *The Planet Remade* encourages researching this idea and others to learn more about their effectiveness, feasibility and advisability.

Climate engineering evokes very disparate and strong reactions. As Morton shows, some people, such as Keith, are keen to start intervention, whereas others, such as ethicist Clive



## The Naming of the Shrew: A Curious History of Latin Names

John Wright (Bloomsbury, 2015)

*Ba humbugi* is not a curse but a snail, and bananas are a “taxonomic nightmare”. Fungus fanatic John Wright digs into taxonomy’s origins, including Carl Linnaeus’s overtly sexual plant-ordering system, based on reproductive parts.



## The Body Keeps the Score: Brain, Mind, and Body in the Healing of Trauma

Bessel van der Kolk (Viking, 2015)

Violence, abuse or conflict can burn trauma into memory. Psychiatrist Bessel van der Kolk reveals how severe stress rewires the brain, and suggests therapies from breathing techniques to eye-movement desensitization and reprocessing.