

EVOLUTION

Parsing the cycles of change

Mark Buchanan examines a treatise on evolution as central to processes in a vast, varied range of domains.

Evolution is an almost magical idea. First proposed by Charles Darwin in 1859 as an explanation for the manifold diversity of biology, the concept has turned out to be much more profound than its inventor could have imagined. Evolution is a general strategy, or class of strategies, for finding solutions to very difficult problems through iterative, combinatorial exploration in high-dimensional spaces of possibilities. Organisms evolve, and so do algorithms for image recognition or for financial trading.

Matt Ridley, an accomplished science writer and Conservative member of the UK

House of Lords, has explored the power of evolution in biology in half a dozen books. In his latest, *The Evolution of Everything*, Ridley makes a powerful argument that evolution in a more general sense has created most of the things that we treasure — from modern technology to decent government and reasonably stable economies. He also ponders the mystery of why, despite this overwhelming evidence for the value of evolution in design, so many people still long for the apparent order of top-down planning and control, solutions designed and implemented by policy experts.

Over 16 chapters, Ridley explores



The Evolution of Everything: How New Ideas Emerge
MATT RIDLEY
Fourth Estate: 2015.

processes that involve incremental change through trial and error. He considers the evolution of the Universe, morality, the economy, technology, money and more — even the future. In each, he attempts to solve human problems through logical planning and purposeful intervention so often fail.

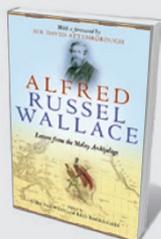
Take overpopulation. In the 1960s and 1970s, a number of writers — most prominently, the ecologist and demographer Paul R. Ehrlich — proclaimed that global famines would soon devastate humanity unless drastic action were taken to stop the population explosion. The problem, one expert suggested, required the creation of a planetary authority with responsibility “for determining the optimum population for the world and for each region”. The idea was a non-starter, and even trying to implement it would probably have caused immense suffering. As Ridley argues, it was the evolutionary inventiveness of science and changing human practices that offered a solution, at least temporarily. We found much more efficient agricultural methods, and people, as they grew more prosperous, started to have fewer children.

In this case, and in many others that Ridley examines, solutions to important human issues were discovered not through conscious planning, but through undirected experimentation. We defeated the dark of night through the slow accumulation of many discoveries — fire, the production of metals, the steam engine, vacuum technology and so on — none of which were expressly aimed at illumination. Similarly, nearly all human societies have created powerful, flexible written languages for communication — not by design, but through slow adaptation, adjustment and modification.

Ridley is generally correct. The world is teeming with systems — anything from the Internet to New York City traffic — that

NEW IN
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Highlights of this
season's releases



Alfred Russel Wallace: Letters from the Malay Archipelago

Edited by John van Whye and Kees Rookmaaker (Oxford Univ. Press, 2015)

Alfred Russel Wallace led an adventurous life in science, from insect spotting in a Borneo swamp to exploring Ternate island, Indonesia, where he independently developed a theory of natural selection. This collection of correspondence from 1854 to 1862 covers his fateful travels. The letters (which took six weeks to arrive), to and from Wallace's family and Charles Darwin, shed light on the controversy over precedence of the theory, as well as the malaria and other hardships that Wallace suffered for his work.

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. ■

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PHYSICS

Two shades of physics

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

These 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.

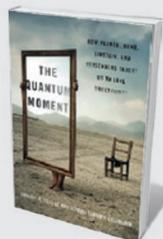
of humans “in this great fresco” does this stance lead him astray. It makes it hard to explain why some people struggle to comprehend science, and even distrust it. It tempts him into scientism — regarding the world that science describes as the real

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. *Physis* 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.