



MEDICAL HISTORY

A surgeon for all seasons

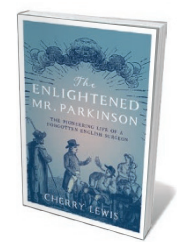
Tilli Tansey extols a biography of the radical who gave his name to Parkinson's disease.

Parkinson's disease is the second most common neurodegenerative condition in the world, with 6 million people affected. But who was Parkinson? In a splendid new book, historian of geology Cherry Lewis introduces us to a fascinating, multifaceted Enlightenment figure: the intellectually curious, politically active and socially concerned London surgeon-apothecary James Parkinson (1755–1824).

The Enlightened Mr. Parkinson reveals a man involved in endeavours as varied as the founding of the Geological Society and the alleged Popgun Plot to assassinate George III. Perhaps his most extraordinary accomplishment was the prescient 1817 monograph *An Essay on the Shaking Palsy* — the first extensive description of the disorder that would be named after him. As Lewis reveals, the path to this historic discovery was long and winding.

Parkinson lived in the same house in Hoxton, east London, for most of his life. He practised medicine there with his father, and then his son, in a business that would span at least four generations. In a seven-year apprenticeship, he learned to make medicines, diagnose ailments and purge, bleed and blister his patients, mostly lower-middle-class but with a smattering of the rich. He then spent six months as a surgical dresser at what is now the Royal London Hospital.

During Parkinson's lifetime, Lewis shows, Hoxton's open fields disappeared beneath



The Enlightened Mr. Parkinson: The Pioneering Life of a Forgotten English Surgeon
CHERRY LEWIS
Icon: 2017.

tenements and factories as the Industrial Revolution gathered pace. London's water and air became grossly contaminated, and overcrowding provided ideal conditions for diseases such as tuberculosis. Open fires, combustible clothing and dangerous manual work meant that fractures, lacerations, burns and hernias were common. The conditions Parkinson saw as he travelled on his rounds, often stricken with gout, might well have stirred his social and political awakening.

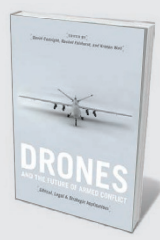
He lived in turbulent times, marked by the Seven Years War, the War of American Independence and the Napoleonic Wars. High taxes to pay for these military adventures coincided with civilian unrest, influenced by the French Revolution of 1789. Parkinson became increasingly radical, advocating votes for all (at a time when approximately 2% of Britons were enfranchised), parliamentary reform, education of the poor and unfettered discussion of politics and religion. In 1792, he joined the London Corresponding Society, which campaigned for parliamentary reform and promoted representation of all men. Parkinson became adroit at the social media of his age — producing periodical articles, broadsheets and pamphlets, often under the pseudonym Old Hubert.

In 1794, the radicalized Parkinson was caught up in the Popgun Plot. The conspiracy seems to have been 'fake news', concocted by the authorities to justify restrictive legislation. Summoned to Whitehall to be examined, with Prime Minister William Pitt (the Younger) leading the questioning, Parkinson admitted to writing inflammatory — even seditious — pamphlets, but was never arrested. How he escaped is not clear.

Next, Parkinson turned his talents to books on geology and general medical advice. As a young apothecary, he had attended anatomical lectures by the celebrated surgeon John Hunter, who, like many medics, collected fossils and encouraged their study. Parkinson started his own collection. In 1807, he was invited to join like-minded individuals such as chemist Humphrey Davy and physician William Babington in founding the Geological Society. Struggling to reconcile biblical authority with the fossil record, which suggested the existence of animal life hundreds of thousands of years before humanity, he embraced the theory of Swiss naturalist

NEW IN PAPERBACK

Highlights of this season's releases.



Drones and the Future of Armed Conflict: Ethical, Legal, and Strategic Implications
Eds David Cortright, Rachel Fairhurst & Kristen Wall (Univ. Chicago Press, 2017)
This cogent and compelling edited volume on the burgeoning use of drones in warfare takes a hard look at issues such as accountability, even as it praises the technology. Contributors highlight the questionable efficacy and ethics surrounding the deployment of drones, particularly in Pakistan, and stress the need for international guidelines on their use.

Jean-André de Luc that geological history was a sequence of seven vast periods, each corresponding to a day of creation.

In his medical work, Parkinson continued to demonstrate a concern for social justice. His 1799 book *Medical Admonitions* was intended to help poor families to recognize disease and understand when to pay for medical advice. In the following years, cheaper, condensed versions found a ready market with an increasingly literate working class. Parkinson became involved with local issues of late-eighteenth-century medicine: child labour, asylums and vaccination. His investigation of the horrific conditions endured by destitute children working in factories brought about local improvements, 30 years before any national legislation.

He was also one of the first people in London to offer smallpox vaccinations (he gave a dissecting microscope to his friend Edward Jenner, who pioneered the procedure). Less successfully, he served as a medical attendant to a private asylum. At a trial in 1810, he was involved in a notorious false commitment of a sane woman, for which he was widely criticized. That experience prompted a book the following year — *Mad-houses: Observations on the Act for Regulating Mad-houses*. Many of its suggestions for the humane treatment and legal protection of the mentally ill were finally incorporated in the 1845 Lunacy Act.

Given Parkinson's broad interests, passions and activities, it is perhaps surprising that his name lives on because of one essay — politely received at the time but not widely known. His description of the signs and symptoms of the disorder are still exemplary, although he had little to suggest in the way of causation or therapy. More than 50 years later, the great French neurologist Jean-Martin Charcot coined the expression *maladie de Parkinson*, and the essay began to gain a wider audience. I hope Lewis's book will do a similar job for the man himself. ■

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ENERGY

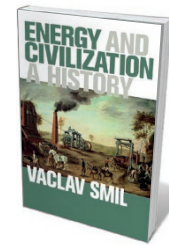
Muscle, steam and combustion

Roger Fouquet applauds Vaclav Smil's vast survey of the technologies powering human progress.

Vaclav Smil's *Energy and Civilization* is a monumental history of how humanity has harnessed muscle, steam and combustion to build palaces and skyscrapers, light the night and land on the Moon. Want to learn about the number of labourers needed to build Egypt's pyramids of Giza, or US inventor Thomas Edison's battles with Nikola Tesla and George Westinghouse to electrify homes and cities, or the upscaling of power stations and blast furnaces in the twentieth century? Look no further.

Admired by Microsoft founder and philanthropist Bill Gates, Smil is a prolific writer on energy and environmental issues, with a penchant for history. This is especially valuable today, when renewables such as wind and solar power are set to disrupt the fossil-fuel-based energy system. Our use of energy has been transformed since the late nineteenth century with the extraction of oil and natural gas, the diffusion of technologies driven by electricity and the expansion of power-distribution networks. History offers guidance on paradigm shifts, and how we adapt.

The book is a significantly revised, updated and more detailed version of Smil's *Energy in World History* (Westview, 1994). It takes us back to prehistory to quantify the energy expended by foragers, hunters and agrarian societies. Smil uses evidence from the !Kung people in Botswana, the Maasai in Kenya and Alaskan whalers, and discusses 500,000-year-old spear tips found in South Africa and the



Energy and Civilization: A History
VACLAV SMIL
MIT Press: 2017.

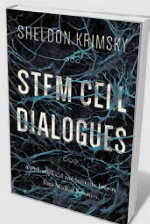
role of hunting in the extinction of the mammoths.

From the fifth millennium BC to the middle of the second millennium AD, civilizations such as those of ancient Egypt, Rome and China through to medieval and Renaissance Europe collectively invented technologies reliant on muscle power, wind and water, along with increasingly refined wheels and pulleys. Smil explains that the shift from human to animal power and the use of irrigation, fertilizer and crop rotation were key to increasing agricultural yields and ultimately population size. He reveals how settlements in warm climates, such as Mesoamerica or India, depended on

an area of agricultural land 60 times greater than that of the average town at the time. It was 100 times greater in colder climates such as northern Europe, where forests providing fuel for heat were also needed. The ability

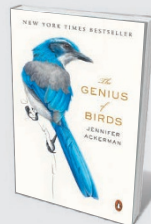
to mine and use energy-dense fossil fuels altered the 'energy footprint' of towns and cities and allowed urban centres to become denser. Smil dwells on genius scientists and heroic engineers of the first and second industrial revolutions between 1760 and 1913, and the high-tech takeover ▶

SOLVING ONE ENVIRONMENTAL PROBLEM OFTEN LEADS TO ANOTHER.



Stem Cell Dialogues

Sheldon Krimsky (Columbia Univ. Press, 2017)
Sociologist Sheldon Krimsky explores the history of stem-cell research through an unusual lens: Socratic dialogues. From the ethics of cloning to the politics of using embryonic stem cells, the scenarios examine the achievements and controversies of regenerative medicine.



The Genius of Birds

Jennifer Ackerman (Penguin, 2017)
In a study scattered through with personal observations, science writer Jennifer Ackerman extols the startling intelligence of birds. New Caledonian crows can fashion tools, magpies recognize their own reflections and western scrub jays may hold "funerals".



► of the twentieth century.

He is not a historian. There is no strong narrative or testing of a central hypothesis. But he does provide economic and geopolitical context. For instance, he touches on the importance of the Organization of the Petroleum Exporting Countries and the oil-price shocks of the 1970s in ushering in a new energy era. Larger petroleum reserves, alternative energy sources and more efficient technologies were frantically sought to minimize the economic damage from the oil-price hike.

Smil concludes with some broader points. He notes that advances in the capacity to harness energy have led to huge improvements in human well-being, including greater mobility and illumination. However, he stresses that many political leaders in the twentieth century, from Vladimir Lenin to Franklin Delano Roosevelt, have been let down by the promise of economic growth boosted by huge energy investments, such as hydroelectric dams and nuclear power stations. These are not panaceas, because abundant energy is a necessary but not sufficient condition for development.

Similarly, energy subsidies — mostly for fossil-fuel production and consumption — may do more harm than good. Running at around 6.5% of global gross domestic product, they lock economies into

energy-intensive and polluting consumption patterns, making them more vulnerable to price shocks, trade-balance deficits, political pressures from energy companies and pollution. Furthermore, Smil warns, humanity's ability to harness greater power could lead it down several very different pathways, including melting the entire Antarctic ice sheet and raising sea levels by 58 metres. Ultimately, he warns that the long-term survival of our high-energy civilization remains uncertain.

Smil's detailed review of military applications of energy is fascinating, and unusual. He notes, for instance, that the atomic bomb dropped on Hiroshima by US forces on 6 August 1945 produced 63,000 gigajoules of energy. On other negative aspects of energy production and consumption, the book is weaker. Coal mining and nuclear accidents — such as the disasters in Chernobyl, Ukraine, and Fukushima, Japan, in 1986 and 2011, respectively — have scarred communities. Yet the most lethal side-effects of energy use have been car accidents and air pollution, each only briefly mentioned. Traffic accidents cause almost 1.3 million deaths per year. Harder to quantify, air pollution has also led to millions of lost lives in the past 200 years.

Although these risks have been tolerated, Smil reminds us that concerns about air

pollution have encouraged transitions away from coal in Europe and China. Chinese investment in wind turbines and solar panels has driven down the price of renewable power so that in many locations it is the cheapest source of electricity. Although it is too early to say, we could be witnessing a dramatic new chapter in energy history. But a lesson from history is that solving one environmental problem often leads to another: increased energy consumption.

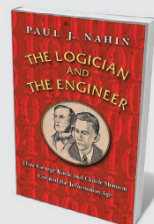
Because of the vast literature on energy written since Smil's 1994 history, this radically revised version is 60% longer. Structurally and in terms of message, the books are similar, however, probably because the new literature has not fundamentally changed our interpretation of the energy landscape. It is also a credit to Smil's original and enlightening way of seeing energy in world history. Read it and be dazzled by the panoply of ways in which humanity has powered progress, with forces, materials and sheer blazing ingenuity. ■

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The Worst of Times

Paul B. Wignall (Princeton Univ. Press, 2017)
Palaeontologist Paul Wignall journeys through the tumultuous end of the Permian period, some 260 million years ago, on supercontinent Pangaea. The era's catastrophic extinctions, he suggests, could be linked to its unprecedented levels of volcanism.



The Logician and the Engineer

Paul J. Nahin (Princeton Univ. Press, 2017)
Proving that two heads are better than one in innovation, Paul Nahin examines how engineer Claude Shannon used mathematics devised by George Boole 90 years before to develop electrical circuits — and traces the advancement of high technology such as the abstract 'Turing machine'.

PHILANTHROPY

The politics of giving

Anne-Emanuelle Birn reviews a survey of the new megaphilanthropy and its impact.

In January, Oxfam released its annual zinger on inequality: the collective net worth of the world's poorest half (3.6 billion people) is equivalent to that of just 8 of the wealthiest men. This figure was released to coincide with the yearly gathering in Davos, Switzerland, of economic and political elites and celebrities, who publicly commit to advancing global well-being even as they safeguard conditions for private profiteering.

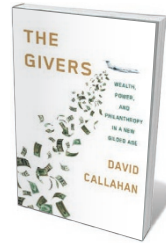
Each of the eight wealthiest men is a megaphilanthropist, underwriting billions of dollars for medical research, public health, humanitarian causes and education. The bulk are familiar US names, including technology gurus Bill Gates, Mark Zuckerberg and Lawrence Ellison, investment oracle Warren Buffett, Amazon founder Jeff Bezos and media magnate (and politician) Michael Bloomberg. Health is much in their sights: Zuckerberg has earmarked US\$3 billion to "cure, prevent or manage" disease; Bloomberg has designated almost \$1 billion to curb smoking and traffic fatalities; and Gates has ploughed some \$20 billion into vaccine development and global health. This group — with many others in the top tier of the \$700-billion US philanthropic sector — is the subject of David Callahan's exposé, *The Givers*.

As Callahan reveals, many philanthropists participate in the Giving Pledge, a brainchild of Gates and Buffett that invites the world's wealthiest to contribute the majority of their assets to addressing "society's most pressing problems", echoing steel tycoon Andrew Carnegie's 1889 homily 'The Gospel of Wealth'. Drawing on insider interviews, Callahan discovers that many pledgers are initially humble about giving. This contrasts with the arrogance enabling their profitmaking journeys, which spills over into a sense of "hyperagency" — sociologist Paul Schervish's term for elites' sense of entitlement.

Callahan goes beyond such sentiments to explore the scientific, social and political implications of largesse in the new gilded age.

His breathless overview of the provenance, giving style and domestic impact of current US philanthropy finds it undemocratic. Most egregiously, this set-up heightens private influence in an era of plunging public spending. Not all philanthropists are anti-government. Buffett calls for increased taxes; Bloomberg wants philanthropy to "embolden", not replace, government. Still, both continue to marshal soaring wealth while their donations mount, making them absurd reformers of the system that empowers them.

Older-style "legacy" philanthropy (exemplified by New York City's Rockefeller Foundation) was based on slow accumulation from mainline industries, with late-in-life or posthumous creation of perpetual, bureaucratized



The Givers: Wealth, Power, and Philanthropy in a New Gilded Age
DAVID CALLAHAN
Alfred A. Knopf: 2017.

**MANY WOULD
ARGUE
THAT IT IS TIME TO
REIN IN
THE BILLIONAIRES.**

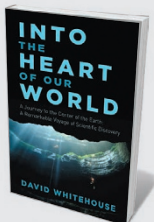
foundations. Callahan is more interested in those with fast and vast fortunes derived from finance and technology. Overnight tycoons prefer to 'give while they live', spending down huge fortunes with huge donations. Their venture philanthropy is characterized by risk-taking, mirroring the donors' own business

trajectories to big bucks — leaving room for both colossal failure and large-scale impact. It often bypasses traditional support for educational and cultural institutions to invest in catalysing issues, including gene editing and artificial intelligence.

Philanthropy remains gendered: men earn fortunes and their wives or daughters give them away, with little focus on gender equity beyond reproductive rights. Still, women's philanthropic networks (such as Women Moving Millions, based in New York City) have emerged, perhaps portending change around women's political representation.

Callahan marvels at the ideological range of philanthropic giving. Firmly for or against issues ranging from the 2010 US Affordable Care Act to climate change, it also spans support of both liberal and conservative think tanks such as, respectively, the Center for American Progress and the libertarian Cato Institute, both in Washington DC. (Think-tank funding is a savvy way of bypassing laxly enforced prohibitions on political lobbying by non-profit institutions.) Yet Callahan is troubled that the donors' agenda-setting priorities do not reflect the public's. He believes that philanthropists are more fiscally conservative and socially liberal than the general population, and are stronger advocates of market solutions and technocratic fixes. Thus they typically favour the latest medical innovation over ensuring decent housing conditions.

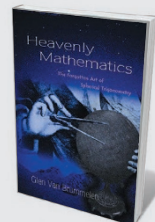
Callahan's discussion of science and medicine is circumscribed. One concern is that therapies for the wealthy, such as precision oncology, garner undue attention. Prospects for accelerating research where government grant-making is bureaucratic and cautious, he fears, are accompanied by spending cuts leading to the privatization of science. Callahan says little about the impact of such changes, but foreseeable problems include ratcheting down peer-review processes and ignoring already underfunded arenas such as occupational health.



Into the Heart of Our World

David Whitehouse (*Pegasus, 2017*)

In this vivid imagined trek into our planet's depths, science journalist David Whitehouse details the technological advances that are making possible astonishing discoveries, from the origins of seismology to the bacteria living deep in Earth's crust.



Heavenly Mathematics

Glen Van Brummelen (*Princeton Univ. Press, 2017*)

Once a mainstay of mathematics, spherical trigonometry no longer appears on school curricula. Here, Glen Van Brummelen reasserts the field's importance, sharing in illuminating detail how it figured in astronomy, cartography and our understanding of Earth's rotation.

One of the most contentious targets of activist philanthropy is education. Among others, the Walton family — heirs to the Walmart fortune — Zuckerberg and hedge-fund maestro Bill Ackman have given enormous sums to charter schools, facilities that are publicly funded, privately administered and sometimes for-profit. Illustrating how fraught this philanthropic involvement is, in Newark, New Jersey, a top-down school-reform strategy disregarded community priorities, generated wide resentment, exacerbated inequity and defunded public schools.

Despite his lament that increasingly powerful philanthropy engenders civic inequality, Callahan pays inadequate attention to philanthrocapitalism. This model, which infuses business principles into philanthropy (proffering handsome investment returns), essentially justifies wealth accumulation on the backs of ordinary people. He mentions various structural enablers of gargantuan fortunes, from tax shelters to weak securities laws and corporate pressure to cut taxes and shrink regulation. Yet he retreats to mild critique, calling for a “balancing act” of middling reforms around philanthropic accountability, transparency, partnerships and political lobbying.

If philanthropy indeed poses a grave threat to egalitarian values, Callahan’s prescription may amount to tinkering at the margins. Why should self-anointed philanthropic elites, who already exercise inordinate power, have carte blanche to steer public policy? As former US labour secretary Robert Reich has noted, governments once collected billions from tycoons, then democratically redistributed these revenues. Many would argue that it is high time to rein in the megabillionaires, whether they are wielding influence from the boardroom, the White House or philanthropic perches. ■

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METEOROLOGY

Weather makers

Jim Fleming assesses a history of US governmental intervention in the atmosphere.

“**M**ake it rain,” commanded choleric US bureaucrats who sought to control the weather in the nineteenth and twentieth centuries. Yet their decrees carried little weight in the aerial realm: the atmosphere does not respond to state control.

In *Make It Rain*, historian Kristine Harper treats weather control as a political agent in the hands of the American state. Politicians at local, state and national levels issued edicts in pursuit of their political ends to bring enhanced ‘sky water’ to their thirsty districts, or to mobilize the clouds for diplomatic or military ends; “entrepreneurial scientists” took their money and produced technical reports. But in the long run, the weather did what the weather does.

In an overextended metaphor belying the complexity of her narrative, Harper asks us to imagine the state as “a shadowy male figure” lurking at the edges of technical and environmental histories: “Do we invite him in, take his money, let him ‘meet the parents’, acknowledge that he is calling the shots, and then continue checking in with him to make sure he hasn’t trotted off with a more attractive partner...?” Her work is informed by political scientist James C. Scott’s *Seeing like a State* (Yale Univ. Press, 1998), which criticizes the administrative ordering of nature and society by the state. It also echoes sociologist Theda Skocpol’s admonishment to “bring the state back in” — in the book of the same name, co-edited with Peter B. Evans and Dietrich Rueschemeyer (Cambridge Univ. Press, 1985) — when describing efforts to control nature.

The strongest sections of *Make It Rain* include an account of GROMET, the code name for a secret agricultural rainmaking project run by the United States in India during the administration of US president Lyndon Johnson, in 1967. GROMET

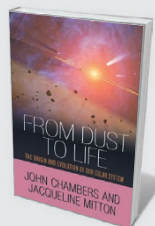


Make It Rain: State Control of the Atmosphere in Twentieth-Century America
KRISTINE C. HARPER
University of Chicago Press: 2017.

provided a diversion and a cover story for the testing of silver iodide cloud seeding, slated to be used in the Vietnam War. Here, an interesting cast of characters from the 1960s appears, made up of big government figures not typically included in histories of science: Bureau of Reclamation director Floyd Dominy, US ambassador to India Chester Bowles, secretary of state Dean Rusk, agriculture secretary Orville Freeman, national-security adviser Walt Rostow and CIA director Allen Dulles.

Yet Harper includes no parallel analysis of earlier bureaucrats and no mention of president Richard Nixon’s continuation of weather-modification programmes over Vietnam. She provides a helpful list of weather-control bills passed by Congress in the period 1947–53, and a list of weather-control research projects conducted in more than a dozen countries in the 1950s — but these lack detailed analysis.

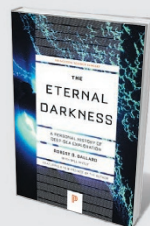
Harper indicates, in several places, that weather control is actually possible. Most meteorologists would disagree. She cites the “earliest success” as occurring in 1921, “when an airplane dispersing [electrically] charged sand into clouds triggered a snow flurry”. This was an Army Air Corps-sponsored project in Dayton, Ohio, that produced no reliable scientific results. Later, she writes that “as a result” of silver iodide seeding in 1961, Hurricane Esther’s barometric pressure “stopped deepening and maintained a relative constant pressure thereafter”. She also cites



From Dust to Life

John Chambers & Jacqueline Mitton (Princeton Univ. Press, 2017)

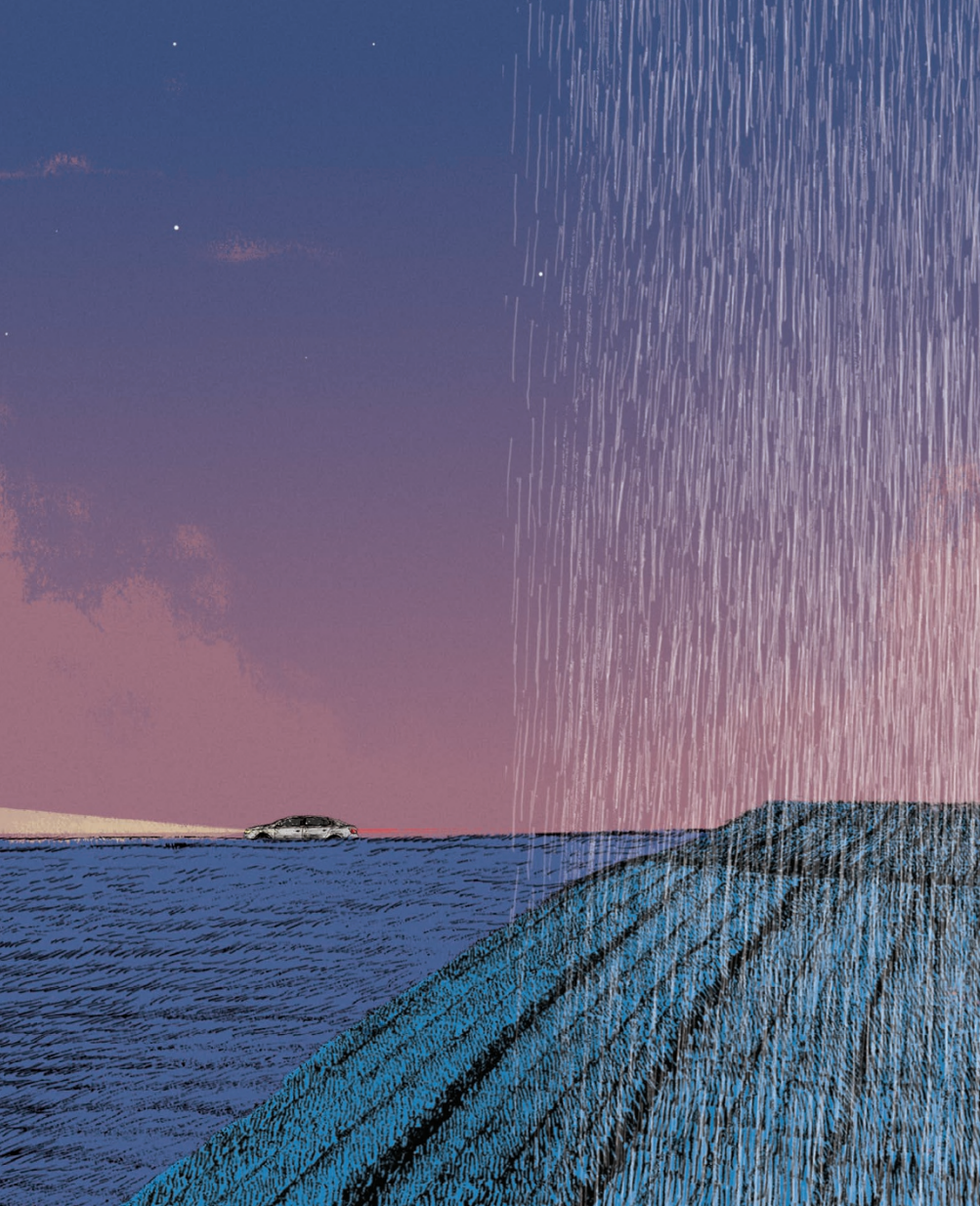
In this grand chronicle of the science behind the origins of our 4.6-billion-year-old Solar System, John Chambers and Jacqueline Mitton peruse everything from the giant collision thought to have formed our Moon to the nature of meteorites.



The Eternal Darkness

Robert D. Ballard & Will Hively (Princeton Univ. Press, 2017)

Globally, just 1% of the sea floor has been explored in detail. Robert Ballard and Will Hively’s exploration of that unforgiving environment reveals how divers reach it, and uncovers amazing beasts, such as blind white crabs and giant clams.



by chemist William Ramsay.) The Bergeron–Findeisen ice-crystal process — a theoretical explanation of the growth of precipitation particles made of both ice and liquid water — is active in clouds in many seasons and latitudes, producing rain in mid-latitude summer and tropical convective systems, not, as Harper indicates, only in mid-latitude winter.

Harper's exclusive focus on state-run projects unfortunately prevents examination of the plethora of private rainmaking efforts in the United States and elsewhere during the twentieth century. And the book's US-centrism means no mention of the successful British fog-clearing project FIDO during the Second World War.

In my book *Fixing the Sky* (Columbia University Press, 2010; cited in Harper's first footnote), I covered rainmaking by concussion, electrified sand, chemical agents, dry ice and silver iodide; weather warfare; and climate engineering. Many of my protagonists (and even some of the cartoons) are the same: Dyrenforth, James Espy, Wilder Bancroft, Tor Bergeron, Henry Houghton, Vladimir Zworykin, John von Neumann, Langmuir, Vincent Schaefer, Bernard Vonnegut and Edward Teller. The two books are best read in parallel.

Near the end of *Make It Rain*, Harper lists the current challenges of climate change, wondering whether rainmaking will make a comeback to alleviate water shortages. But her claims that all weather-control efforts are local and pertaining to water prevent her from any meaningful follow-up on technological fixes for climate warming, such as carbon dioxide removal or albedo modification.

The state can indeed influence, and in many ways control, water resources. The hydrological and hydroelectric regimes controlled by the great Hoover Dam, for example, far exceed in capacity and reliability the puny results produced by any politician who commanded rain to fall from the sky. It is important, however, that historians of science begin to bring the state back into their stories, and this book is a start. ■

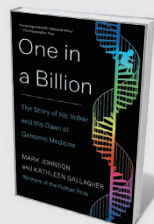
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“qualitative data” reported by military pilots and observers that clouds seeded over Vietnam “grew six to ten times taller and wider within ten minutes of seeding and doubled the precipitation of unseeded clouds”. None of these observations is verifiable, in my view.

Intervention is not control. In 1946, Kathleen Burr Blodgett, a physicist at the General Electric Corporation, advised chemist and weather-modification enthusiast Irving Langmuir that altering a cloud was a far cry from controlling its subsequent motion, growth or characteristics of precipitation. This is still true. The US National Research

Council study *Critical Issues in Weather Modification Research* (National Academies Press, 2003) warned that “weather modification has largely been relegated to the realm of promises unfulfilled”. It noted, too, that further research may reveal that the “intentional modification of a weather system is neither currently possible nor desirable”.

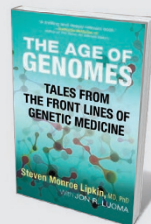
Harper's book contains some errors. For instance, US government agent Robert Dyrenforth, who in 1892 sent explosives and balloons into the air to produce rain, used a hydrogen–oxygen mixture, not helium. (Helium was isolated on Earth only in 1895,



One in a Billion

Mark Johnson & Kathleen Gallagher (Simon & Schuster, 2017)

Journalists Mark Johnson and Kathleen Gallagher tell the story of Nic Volker, a boy with a baffling inflammatory condition. Volker's life was saved when scientists harnessed DNA sequencing to identify the genetic mutation responsible.



The Age of Genomes

Steven Monroe Lipkin & Jon Luoma (Beacon, 2017)

In his insightful tour of clinical genetics, Steven Lipkin shares the stories of his patients — some of whom have rare conditions. With science writer Jon Luoma, he also delves into the field's limitations, including the manipulation of DNA in high-profile murder cases.

PHYSICS

Revelations of fundamental science

Robert P. Crease wonders at a physics history with more than a hint of the biblical.

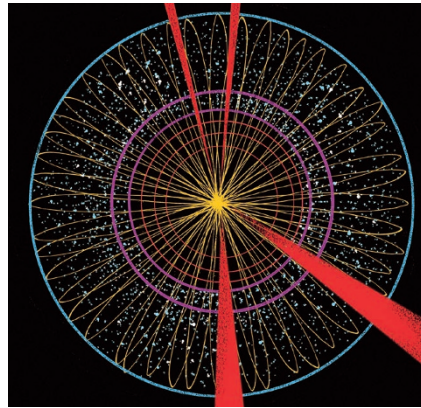
Forget the *Odyssey*, the *Aeneid* and the Bible — the story of modern fundamental physics, Lawrence Krauss argues, is greater than all of these. What could live up to such a billing?

The tale has been told before, in outline and detail. Krauss's retelling is fast (four centuries in 300 pages) and aimed at nonscientists. Its best parts are its explanations of difficult concepts. Its worst are where Krauss, a theoretical physicist, apparently feels competitive with the Bible and the humanities.

With considerable chutzpah, Krauss breaks his book into 'Genesis', 'Exodus' and 'Revelation'. 'Genesis' opens with Isaac Newton, who used geometry and calculus to understand nature. By the end of the nineteenth century, the tribe of scientists — now including Thomas Young, Michael Faraday and James Clerk Maxwell — had gained key tools with the discovery of light interference, fields and electromagnetic waves.

Krauss's accounts of early scientific struggles are certainly easy to follow. "The Church was the National Science Foundation of the fifteenth, sixteenth, and seventeenth centuries," he remarks. Of Faraday's discovery that magnets produce electricity, he writes: "Voilà, Niagara Falls, hydroelectricity, and the modern world!" Twentieth-century developments are more difficult, but Krauss provides catchy anecdotes. He explains relativity by referring to a time when he was struck by his child's projectile vomit in the car, and the different trajectories the vomit took as perceived by himself and someone outside the vehicle.

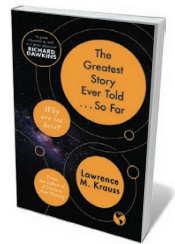
'Genesis' ends in the mid-1930s, with the discovery of the neutrino and short-range weak force. It is silly for Krauss to analogize this period to the part of the Bible in which the Jews are enslaved in Egypt, but that's the flavour of this book. Many physicists see the 1950s to 1970s as a golden age, with soaring budgets and huge machines unearthing hordes of particles. Their prestige was at a peak. New heroes, including



Murray Gell-Mann and Yoichiro Nambu, led further discoveries: Yang–Mills theory, parity violation, Bose–Einstein condensates, quarks and the Higgs particle.

'Revelation' comes with the development in the 1970s of the standard model of particle physics, which describes all known particles and three of the four known forces. Krauss dubs it "perhaps the greatest theoretical edifice yet created by human minds". He calls what came next the attaining of the "Promised Land" (mixing the biblical structure). Krauss also likens the discovery of the model to the allegory of the cave in Plato's *Republic*, in which humans are captivated by shadows and illusions, but philosophers can become aware of the 'forms' underlying existence. For Krauss, it is scientists who go "outside our cave of shadows to glimpse the otherwise hidden reality beneath the surface".

Krauss clearly covets the cachet of the humanities. He likens Albert Einstein's creativity to Vincent van Gogh's, and compares



The Greatest Story Ever Told ... So Far
LAWRENCE M. KRAUSS
Simon & Schuster:
2017.

particle accelerators to Gothic cathedrals. He says his story "contains every bit as much drama, human tragedy, and exaltation" as the *Aeneid*, and is motivated, like that work, to parse humanity's origins and nature. These are sloppy analogies. Although we've achieved 'Revelation', for instance, Krauss says that what we now know may be almost "ephemeral" because future experimental results may change everything. The reader may be reminded less of the *Aeneid* than of the myth of Sisyphus, whose story never ends.

In Krauss's oversimplified take, there are two answers to the question, 'why are we here?'. The biblical one is to say that humans have a special status and that the Universe was made just for us. The other is to realize that the laws of nature are independent of us and that we are "the result of an accident in the history of the universe". He opts for the latter.

And in his invocations of the cave analogy, he omits two key features. One is that, for Plato, the forms outside the cave are unchanging, like laws of logic that cannot be disproved and are at work in all human activity, including science. Science is therefore an inner-cave activity, and those who claim it uncovers ultimate reality are priest-like pretenders. Second, the *Republic* is not about matter, but about justice and the Good. The central cave image helps to show what motivates the person who sees the forms to return to the cave and try to reorganize communal life, despite its difficulties. Krauss's protagonists seek only the structure of matter, and their moral message to the cave-dwellers is: "We're accidents!"

Krauss clearly thinks that his story deserves to displace the classics of the humanities. His book reveals why it can't. ■

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Unravelling Starlight

Barbara J. Becker (Cambridge Univ. Press, 2017)
In this exhaustive biography, Barbara Becker celebrates British astronomers William and Margaret Huggins. William contributed to the origins of astrophysics as the first to use a spectroscope to detect stellar motion in the line of sight; Margaret pioneered astrophotography.



Black Hole Blues

Janna Levin (Alfred Knopf, 2017)
Astrophysicist Janna Levin records the long, arduous journey of the scientists building the nascent field of gravitational waves, from the enthusiasm of its founders to first detection five decades later (see Sheila Rowan's review: *Nature* **532**, 28–29; 2016). [Rosalind Metcalfe](#)