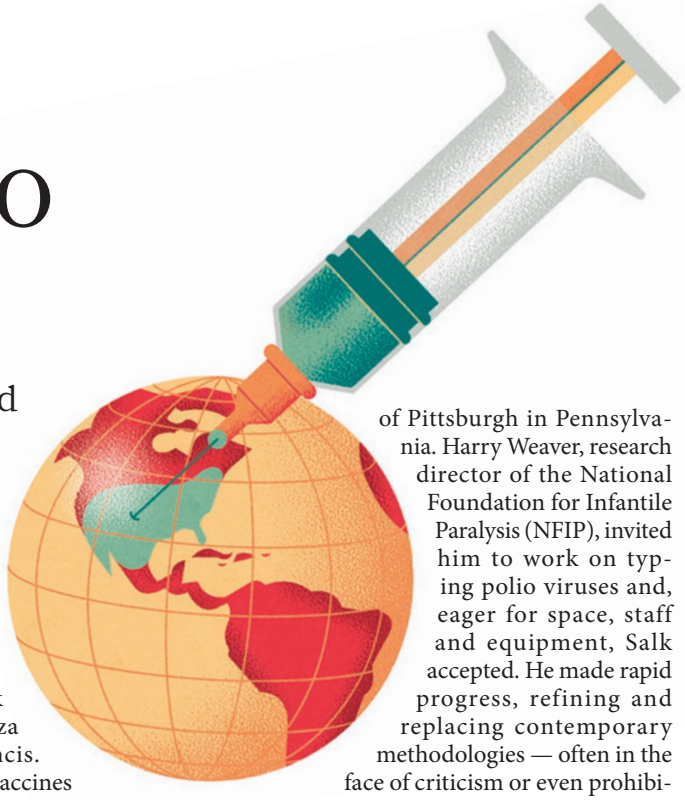
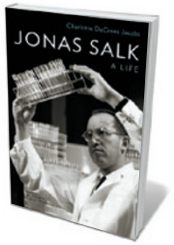
MEDICAL HISTORY

Pioneer of polio eradication

Tilli Tansey extols a biography of determined vaccine trailblazer Jonas Salk.



On 12 April 1955, across the United States, "church bells tolled, horns honked, and sirens rang" in celebration: the largest clinical trial ever undertaken had reported that the first polio vaccine was safe and effective. So writes Charlotte Jacobs in her riveting biography of the vaccine's discoverer, *Jonas Salk*. Two years earlier, poliomyelitis had killed or paralysed almost 36,000 US children. It has been estimated that before the vaccine there were 600,000 cases a year worldwide. Salk's triumph made him a global household name, and the gongs began rolling in.



Jonas Salk: A Life
CHARLOTTE DECROES JACOBS
Oxford Univ. Press: 2015.

As Jacobs shows, the tale of Salk's discovery is one of grind, intrigue, rivalry, politics and dirty tricks. Add commercial interests (pharmaceutical giant Eli Lilly made US$30 million from polio vaccine in 1955 alone) and Salk's extramarital entanglements while wedded to artist (and muse to Pablo Picasso) Françoise Gilot, and the mix becomes even headier. Jacobs contextualizes the polio effort with Salk's work on influenza, multiple sclerosis and HIV/AIDS — and with the Salk Institute for Biological Studies in La Jolla, California, which he created and directed, and from which he was ultimately excluded.

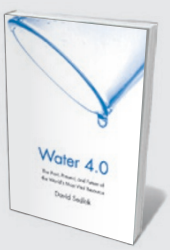
Growing up in the Bronx, New York, in a family of Russian Jewish immigrants, Salk was dominated by his ambitious mother. He came to crave doing things his own way — a tenacity that shaped both his scientific success and his professional difficulties. Early on, at the New York University College of Medicine, Salk worked with influenza expert Thomas Francis. At the time, antiviral vaccines (against smallpox, rabies and yellow fever) used artificially weakened live virus. Salk and Francis developed an experimental technique that used killed virus to stimulate antibody production and confer immunity, suggesting a powerful therapeutic approach.

In 1941, Salk followed Francis to Michigan, pursuing the holy grail — an influenza vaccine. He modified laborious procedures to culture the virus and develop vaccine production, usually with only gloves and a mask as protection. He supervised clinical tests on patients at two psychiatric institutions, deliberately infecting some with influenza — a practice common until the Nuremberg Code of 1947 offered some protection to human research subjects — and in 1945 advised the US surgeon general to vaccinate 8 million soldiers. Without consulting Francis, Salk signed an exclusive contract with pharmaceutical firm Parke, Davis to provide details of production methods that he devised. This departure from academic etiquette did not go unnoticed; nor did his writing for non-professional publications such as *Parents Magazine*. Tensions grew as Francis received honours, while Salk was ignored.

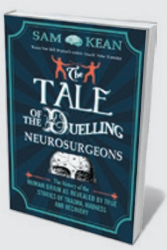
In 1947, Jacobs recounts, Salk left to establish an influenza lab at the University of Pittsburgh in Pennsylvania. Harry Weaver, research director of the National Foundation for Infantile Paralysis (NFIP), invited him to work on typing polio viruses and, eager for space, staff and equipment, Salk accepted. He made rapid progress, refining and replacing contemporary methodologies — often in the face of criticism or even prohibition from the NFIP advisory committee. Weaver supported his protégé, and the foundation came to see Salk as its 'poster scientist', wheeled out for public and media events. Fellow researchers continued to carp.

Undeterred, Salk pioneered a killed-virus vaccine and organized safety testing and field trials. Those leading up to the 1955 announcement involved more than 1.5 million children, tens of thousands of doctors and nurses, and 220,000 volunteers. The clamour attendant on success (a film was mooted, to star Marlon Brando) laid Salk open to charges of self-aggrandisement.

Almost immediately, problems arose. Batches of vaccine became contaminated, and physicians inoculated family and friends while leaving first-grade children, the most vulnerable group, unprotected. Over a few months, 260 individuals contracted polio directly or indirectly from a single substandard preparation. Several states suspended vaccination. Massachusetts halted its programme when children had received only the first of three shots; in July 1955, some 4,000 contracted polio and 1,700 were paralysed. Salk was unfairly associated with these errors and was castigated, especially by scientific colleagues. However, tighter adherence to his



Water 4.0
David Sedlak YALE UNIV. PRESS *2015*
From Roman aqueducts to desalinization plants, David Sedlak's study overflows with facts about water management. Chlorine by-products could be carcinogens, so he argues that water treatment needs another upgrade. (See Margaret Catley-Carlson's review: *Nature* **505,** 288–289; 2014.)



The Tale of the Duelling Neurosurgeons
Sam Kean BLACK SWAN *2015*
Crammed with curious anecdotes from neuroscience's gory past, Sam Kean's book ranges from the crude methods of early brain studies (including the beheading of criminals to use as test subjects) to the prion disease kuru, which spreads through cannibalism.

protocols and resumption of vaccination meant that six years after the vaccine was introduced, polio was almost eradicated in the United States.

Much of the scientific establishment closed ranks against Salk. He was given the prestigious Lasker Award for clinical medical research in 1956, but Swedish virologist Sven Gard dealt his Nobel nomination a fatal blow by sneering that the vaccine was a technical advance, not a discovery. Nor was Salk elected to the US National Academy of Sciences. Virologist Albert Sabin — bombastic, imperious and galled by Salk's success — continued to develop a live, orally delivered poliovirus preparation. By 1961, Sabin's vaccine had performed well in trials and the American Medical Association began to promote it. Salk's vaccine was, for a time, superseded, and his efforts to improve its potency stymied.

Salk moved on, although he remained involved with the polio vaccine. Influenced by chemist C. P. Snow's 1959 book *The Two Cultures and the Scientific Revolution*, he launched a research institute integrating social responsibility and the humanities with the biological sciences. The Salk Institute recruited some of the great biologists of the time, including Jacob Bronowski, Francis Crick and Jacques Monod. But Salk was unable to translate his lofty ideals into practical management. His research from the 1960s onwards, on immune responses in cancer, multiple sclerosis and, later, HIV/AIDS, met with ambivalence. He was increasingly derided by the very scientists whom he had recruited.

In many ways, Salk was ahead of his time, notably in public engagement and in his multidisciplinary agenda. A polio vaccine would have emerged without him, but it was his vision and willpower that produced the first, and a descendant of it is still the basis of many public-health programmes. Yet universal polio eradication remains a dream: cases continue to appear in Pakistan, Afghanistan and Nigeria, and have resurged in recent years in Syria. ■

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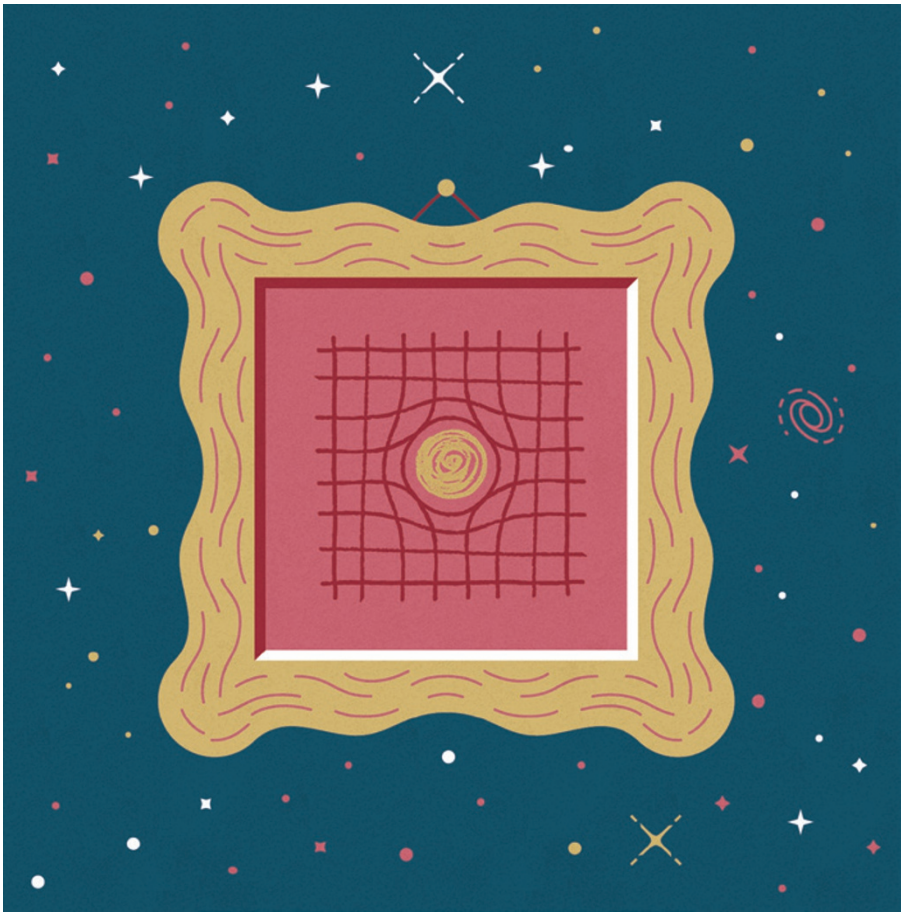


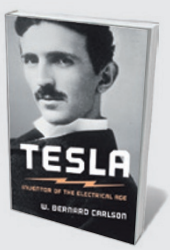
PHYSICS

One hundred years of general relativity

Pedro Ferreira looks back at how Einstein himself and a panoply of other physicists have framed the theory.

Until very recently, relativists were few and often self-taught. General relativity still had the stigma of being esoteric, pointless and, well, hard. In some places you could find specialized graduate courses, but on the whole, if you were at all interested in expanding universes and black holes, you were left to your own devices. That is what happened to me.

I studied engineering and did not enjoy it very much. But during the course on electromagnetism, I discovered Albert Einstein's world of special relativity. ▶



Tesla: Inventor of the Electrical Age
W. Bernard Carlson PRINCETON UNIV. PRESS *2015*
Over-hyped eccentric or electricity wizard? Bernard Carlson's account of Nikola Tesla's life at the turn of the twentieth century recalls the inventor's great creations, such as the alternating-current motor, as well as the unfulfilled promise of wireless power. (See Patrick McCray's review: *Nature* **497,** 562–563; 2013.)

Infinitesimal: How a Dangerous Mathematical Theory Shaped the Modern World
Amir Alexander ONEWORLD *2015*
Through religious and revolutionary figures of the seventeenth century, Amir Alexander tells the history of the struggle for mathematics' place in society. The 'heretical' concept of infinitesimals, the indivisible points of a line, takes centre stage.