Love and Science: from the autoimmune drug Remicade (infliximab) to honour the contribution of immigrant scientists

and artists to US society.

Vilcek begins with how he discovered the drug. He cut his research teeth on interferons — proteins produced in response to infection — at the Bratislava Institute of Virology in the early 1960s. But it was in 1988 at New York University's School of Medicine that the main event occurred: the development of a monoclonal antibody against the inflammation-inducing molecule tumour necrosis factor (TNF). As Vilcek and others revealed, people with rheumatoid arthritis had high levels of TNF. Remicade was the first TNF-blocking agent approved by the US Food and Drug Administration, initially for treating Crohn's disease, in 1998. Today, it is used against multiple autoimmune conditions, including rheumatoid arthritis and psoriasis, and remains one of the world's five top-selling prescription drugs.

Vilcek hymns the importance to medicine of fundamental science, serendipity, collegiality and some risk-taking. He supports funding for translational medicine, but cautions that without continued support for basic research, there might be nothing to translate. However, the book's early detail about science, clinical trials and intellectual-property processes behind Remicade could be intimidating to those who picked up the autobiography for its personal tale. *Love and Science* becomes more engaging in its second section, when it steps back to the memories of a Jewish boy born in the year that Adolf Hitler came to power in Germany.

It is a tale of ingenuity and near misses. Vilcek's mother officially converted to Catholicism in 1939, his father in 1942, allowing both to be exempted from the Czechoslovakian government's punitive measures against Jews. They placed Jan in a Catholic orphanage at the age of eight, in a further attempt to keep him from being deported. Through several moves and periods of separation, the family survived the Second World War, and re-established a comfortable lifestyle in Bratislava in 1945. The democratic republic of Czechoslovakia had been reinstated after years of occupation and division during the war, but upheaval returned in 1948 when the Communist Party gained political power and quickly imposed a totalitarian system.

Vilcek decided early on to pursue research. He joined the Institute of Virology immediately after graduating from medical school in 1957, and soon published a single-author paper in *Nature* (J. Vilcek *Nature* **187**, 73–74; 1960). The young scientist doggedly established contacts with Western researchers, and these efforts paid off when he and Marica defected in 1964. Carrying no ▶

JAN VILCEK'S PERSONAL ARCHIVES

Jan Vilcek at medical school in Bratislava in the 1950s.

DRUG DISCOVERY

A life of tumult and triumph

Marian Turner reviews the memoir of émigré virologist and millionaire philanthropist Jan Vilcek.

Medical students in communist Czechoslovakia in the early 1950s were taught that Mendelian genetics was “bourgeois pseudoscience”. The theory of heredity that toed the party line came from Soviet agronomist Trofim Lysenko: Stalin championed his idea that acquired traits could be inherited. Jan Vilcek was one of several students of the time who saw through this nonsense, but kept quiet. The budding virologist already had two decades of experience of staying under the authoritarian radar — a frustration that would later prompt him

to break free in spectacular fashion.

In *Love and Science*, Vilcek traces that tumultuous, ultimately triumphant journey. He takes us from his birth in 1933, to Jewish parents in Bratislava (in what is now Slovakia), to his current position of president and co-founder, with his art-historian wife

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Marica, of the Vilcek Foundation in New York City. This multi-million-dollar philanthropic enterprise uses Vilcek's royalties

► official documents, they were waved across the border from Austria to West Germany — a scene rendered poignant in light of the current European refugee crisis. The ease with which Vilcek procured job offers from US colleagues is also hard to imagine now. He joined New York University as an assistant professor with no interview, a beneficiary of the US government's competitive research investments during the cold war.

The final section of the book I found the most original. Here, Vilcek reverts to the story of Remicade's success, and his unexpected wealth. His first quarterly royalty payment in 1999 was just less than his annual salary as a professor; by 2005, the portion of his future royalties pledged to New York University was projected to eventually reach more than US\$105 million. At first, Jan and Marica ate at restaurants and caught taxis more often; they helped family and friends, and replaced their second-hand furniture with European art-deco pieces. But they had no interest in luxury living, so as the royalties grew, they established what would become the Vilcek Foundation in 2000.

They began by supporting their workplaces, the New York University School of Medicine and the Metropolitan Museum of Art. They endowed professorships, lab space, scholarships and curatorships, earning a place among the top 15 US philanthropists of 2005. After the terrorist attacks of 11 September 2001, they began to see chinks in the US welcome for foreigners. Accordingly, in 2006 they launched annual Vilcek Prizes to recognize extraordinary achievements by immigrants to the United States in biomedical science and the arts and humanities. Aware that many of their prizewinners, from cancer biologist Joan Massagué to cellist Yo-Yo Ma, were already lauded, the Vilceks established annual prizes "for creative promise" in 2009 to honour up-and-coming talent. Prizewinners so far have included the Iranian-American scientist Pardis Sabeti, for her work on pathogen evolution (see N. L. Yozwiak *Nature* **518**, 477–479; 2015).

This story is told humbly, with honest insight into the deliberations between the Vilceks and generous credit to the many people who have advised them. The couple clearly delights in following the careers of the awardees. Jan Vilcek is now in his early eighties, and he mentions in *Love and Science* how he and Marica have made provision for the foundation to continue when they can no longer administer it. One senses that he is happy with his legacy, both scientific and benevolent. ■

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Density fluctuations in the Universe (shown in a computer simulation) have a sponge-like topology.

ASTRONOMY

Topology quest

Michael Blanton enjoys a history of cosmology focused on large-scale structure in the 'spongy' Universe.

Over the past half-century, astrophysicists and cosmologists have revealed how structure formed in the Universe. This has vast importance: we exist only because tiny initial fluctuations in the density of matter grew through gravity to form galaxies, stars and planets. Key pieces of physics, astronomy and mathematics have only in recent decades been combined into a scientifically coherent and convincing origin story. In *The Cosmic Web*, astrophysicist Richard Gott, a compelling teller of cosmological stories, describes his part in this scientific quest.

He begins with a brisk primer on the early history of cosmology, starting with the discovery of the expansion of the Universe by US astronomer Edwin Hubble and others in the 1920s. The second half of the twentieth century, he shows, brought the detection by Arno Penzias and Robert Wilson of the cosmic microwave background radiation left over from the very early Universe (predicted by George Gamow and others), and the realization that fluctuations in this radiation would reveal the irregularities in density that seeded the growth of large-scale cosmic structure.

This is when Gott's work enters the picture. Beginning with his high-school obsession, topology — how geometric shapes can be connected — the book comes into focus. We start to follow Gott's fascinating path towards a better understanding of large-scale cosmic structure. Remarkably, his early discoveries

led to a paper in *American Mathematical Monthly* when Gott was just 20, on a new class of regular 'pseudopolyhedrons' with sponge-like topology (J. R. Gott *Am. Math. Mon.* **74**, 497–504; 1967). These polyhedrons are infinite, and their surfaces divide space into two identically shaped, interlocked regions. As in a sponge, each region (the 'sponge' and the 'holes' in it) is fully connected. If the Universe is separated into regions greater than and less than the mean density, it shows the same sponge-like topology, although with irregular patterns. Gott's enduring (and endearing) enthusiasm for this connection carries the reader through the more technical parts of the book.

The Cosmic Web is not a complete or representative intellectual history of twentieth- or twenty-first-century cosmology. Gott is rigorous in assigning credit for findings, but tells the history through the lens of his collaborations. This could leave a reader with the impression that a relatively small group of scientists is responsible for the discovery of dark matter, the development

The Cosmic Web: Mysterious Architecture of the Universe
J. RICHARD GOTT
Princeton University Press: 2016.

ILLUSTRATION SIMULATION