BOOKS & ARTS

A life worth writing about

Craig Venter's autobiography recounts the conflict and controversy that have contributed to his celebrity.

A Life Decoded: My Genome: My Life
by Craig Venter
Allen Lane/Viking: 2007. 400 pp.
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Reviewing Jim Watson's *The Double Helix*, Erwin Chargaff dismissed scientific autobiography as "a most awkward literary genre", arguing that most scientists lead monotonous and uneventful lives. This certainly does not apply to Craig Venter, whose autobiography is fittingly well-written, fast-paced and full of interesting data, gossip — and score-settling.

Little introduction is necessary for the man who is possibly the celebrity scientist of the modern era. Venter's name has rarely been out of the headlines for the past 12 years. Most recently, on the publication of his own genome sequence, his portrait occupied one-third of the front page of the *New York Times*'s science section. His fame peaked at the beginning of the millennium at the celebrations for the first release of the human-genome sequence. Inspired by Darwin's *Beagle* voyage, he then set sail in his yacht *Sorcerer II* to catalogue the oceans' bacteria and viruses.

C. VENTER

Craig Venter on his yacht, the venue for a gargantuan project to catalogue the oceans' bacteria and viruses.

Close encounter

A Life Decoded is in three parts, divided by two epiphanies. Venter grew up a bad boy in Millbrae near San Francisco. On his bike he raced planes taking off from the airport, and hung out with other bad boys. Many character traits formed early, notably the competitive — and combative — spirit: his track relay team set a US record and his swimming coach thought him to be potential Olympic material. His love of sailing began when he built a hydroplane to plans in *Popular Mechanics*. That Venter graduated was a close-run thing: his grades were poor and he led a school sit-in to protest against a teacher's dismissal. At 17, he set off to southern California for surfing, girls and drink.

In late 1960s America, the good times couldn't last for a healthy young man. The armed forces beckoned and Venter enlisted in the hospital corps. His talent for spinal taps kept his name off the lists of postings to Vietnam. But he was eventually shipped off to a hospital in Da Nang. Experiences of working with the wounded and dying left a lifelong mark on Venter, of which he writes with candour and passion.

Epiphany number one came after 5 months in Vietnam. He decided to commit suicide by swimming out to sea. Out of sight of land, a nudge from a shark made him race back. He served out his time in Vietnam and returned to California in late 1968, marrying his girlfriend and buying a motorbike en route.

Venter quickly made up for his misspent youth, enrolling first in a community college, then moving to the University of California, San Diego. He studied biochemistry and researched into the action of adrenaline. Publishing his work proved more satisfying than winning swimming or sailing competitions. After graduation, Venter continued with research on hormones and their receptors, completing his doctoral thesis in 1975. Following a productive period at the State University of New York, Buffalo, where his son was born, he divorced his wife and married Claire Fraser, now director of the Institute for Genome Sciences at the University of Maryland School of Medicine in Baltimore. In 1984, he and Fraser moved to the National Institute of Neurological Disorders and Stroke (NINDS) in Bethesda, Maryland, and continued to work on neurotransmitter receptors.

Epiphany number two came in 1987. Venter read a paper from Lee Hood's laboratory at the California Institute of Technology on the automation of DNA sequencing. After months of toil to clone and sequence the human brain β-adrenergic receptor, the idea that a machine could replace postdocs and technicians was thrilling. He phoned Mike Hunkapiller, who developed the automated sequencers at CalTech, and ordered a machine. In a prophetic turn of events, he paid for it with his rainy-day savings when his NINDS boss allegedly refused to fund it. Within a few months, Venter and his colleagues had sequenced two receptors.

It was about this time that I met Venter at a conference on new developments in complex human genetic disorders, where he displayed his characteristic impatience with those who play it safe. One participant remarked that what would most help her research would be the sequence of the 300-kilobase region she was studying. Venter said, in effect, why don't you just get on and do it then? His suggestion was regarded with incredulity.

Genome giant

The larger part of *A Life Decoded* chronicles Venter's controversial move into genomics and his part in sequencing the human genome. He covers a lot of ground, with facts, quotations and accounts of others' intentions. Some assertions lack references, so the reader must take them on trust. Venter pillories a long list of people whom he believes conspired and lied to obstruct him, but offers generous praise for the staff of his institutes who tackled obstacles not of their making.

Clashes began while Venter was at the National Institutes of Health (NIH) in the early nineties, over sequence patenting and strategies for cracking whole genomes. Eventually, Venter left and set up The Institute for Genomic Research in Rockville, Maryland. His team used whole-genome assembly (WGA) to

sequence the *Haemophilus influenzae* genome, which was eight times larger than the previous record. Instead of painstakingly cloning, mapping the clones and sequencing them, they blasted *H. influenzae* DNA into fragments, sequenced these, and used a computer to assemble the complete genome that graced the cover of *Science* on 28 July 1995. WGA became standard procedure for microbes: *Mycoplasma genitalium*, *Methanococcus jannaschii* and many more quickly followed.

By 1998, the Human Genome Project, financed by the NIH and the US Department of Energy (DoE), was making slow and steady progress by mapping clones, sequencing them and using the map to assemble the genome. In May of that year, everything changed. Venter announced that he and Hunkapiller (by now running Applied Biosystems) were forming a private company, Celera, to sequence the human genome more cheaply and faster than the non-commercially funded consortium, later called the International Human Genome Sequencing Consortium. They would use WGA and capillary sequencers not yet built.

The announcement, covered by the world's press, was met with incredulity (WGA would never work with a genome so complex), consternation (the human genome would be in the hands of a private company) and fear (would Congress and the Wellcome Trust cut off funding for the public project?). Days later at the Cold Spring Harbor Laboratory Genome Mapping and Sequencing meeting on Long Island, New York, the tension was palpable — and exciting. With characteristic chutzpah, Venter fanned the sparks when he suggested that the NIH and DoE teams give up on the human genome and do the mouse instead.

Jim Watson was at the meeting, asking the elite how they were to counter-attack. It was not the US cavalry but the British Grenadiers — John Sulston and Michael Morgan of the Wellcome Trust — who restored confidence. The public effort girded its loins and stepped up the pace. Interactions between public and private projects remained poisonous. Occasional attempts at reconciliation foundered on data-release issues.

Only three years later, first drafts of the human genome were published simultaneously by Celera and the public consortium. Venter shared a podium with Francis Collins, head of the US genome project, and President Bill Clinton at the White House, while UK Prime Minister Tony Blair attended via satellite link. Even this moment of triumph held no reconciliation. Venter balked at the standard requirement that all data should be provided in the paper, so Celera published in *Science*, as it had agreed, with restricted access. The public group, making all their sequence available for free, published in *Nature*. Squabbling continued over exactly how the private sequence had been assembled. Many people's worst opinions of Venter were confirmed when he admitted that most of the Celera sequence was his own, rather than that of anonymous DNA donors. One journalist called it a "high point in the annals of egotism".

Called to account

This year, Venter and Watson became the first people to have their entire genomes sequenced and made public. Both believe that deciphering our individual genetic inheritance will lead to better health: if there are no therapies yet for what is found, the risk might be minimized. Venter underlines the point throughout his book by describing what particular genes mean for him. For example, he takes a statin to lower his cholesterol levels, because he has the *E4* allele of the *APOE* gene that increases the risk of Alzheimer's disease.

I have interacted with Venter over the years since our first meeting in 1990, and have heard many strong opinions of his character. *A Life Decoded* is a fair representation of the man. It may even be more revealing than he thinks.

But the differing published accounts of the *Drosophila* and human-genome sequencing projects are reminiscent of the fable about the blind men who described an elephant by touch. Reading the books by John Sulston and Georgina Ferry (*The Common Thread: A Story of Science, Politics, Ethics and the Human Genome*), James Shreeve (*The Genome War: How Craig Venter Tried to Capture the Code of Life and Save the World*), Michael Ashburner (*Won for All: How the* Drosophila *Genome Was Sequenced*) and now Venter's contribution, it is scarcely credible that the protagonists lived through the same events. Robert Cook-Deegan's *The Gene Wars: Science, Politics, and the Human Genome* provided an authoritative, inside-the-Beltway account of the early days of the Human Genome Project, but what we need is a record of the whole project by a team of historians with no axe to grind.

Such an endeavour should begin with a comprehensive collection of material, along the lines of Thomas Kuhn's *Sources for History of Quantum Physics*. Kuhn and his colleagues interviewed the participants in, and found primary documents relating to, the greatest change in our view of the physical world since Isaac Newton. The greatest project in biology so far deserves to be similarly documented. The principals are still with us, as are their e-mails.

Chargaff called the heroes of *The Double Helix* "a new kind of scientist, one that could hardly have been thought of before science became a mass occupation, subject to, and forming part of, all the vulgarities of the communications media". Four decades on, our infinitely more vulgar media has called Venter many things: maverick, publicity hound, risk-taker, brash, controversial, genius, manic, rebellious, visionary, audacious, arrogant, feisty, determined, provocative. His autobiography shows that they are all justified. ■

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A gallery of micrographs

German biologist Ernst Haeckel branded radiolarians — tiny seawater plankton — one of the "art forms of nature", an accolade borne out under the scrutiny of the scanning electron microscope almost a century later. These single-celled animals come in a variety of intricate shapes, as shown in this image of a radiolarian shell. It is one from a striking collection of micrographs assembled by the Science Photo Library for *Microcosmos* by Brandon Broll (Firefly Books, 2007).

The book includes some 200 images, taken at up to 22 million times magnification, of subjects drawn from biology, mineralogy and technology. Readers can marvel at pictures of a hummingbird hawkmoth's tongue and of nanowires just ten atoms wide, of exotic gallstone crystals, butterfly scales and hairy gecko feet. Although kettle scale and a wound dressing in filigree may be a step too far into the microcosmos, there is wonder lurking in these too.

The micrographs are showcased with cunning digital artistry to impart colour. In places this borders on the fanciful (garish crystals of vitamin C and a Siberian microdiamond), but otherwise brings the pictures sharply to life.