literature and science. *Journey to the Centre of the Earth* (1864) is about scientific method and its misuses. Scientists Professor Lidenbrock and Axel enter Earth through an Icelandic crater and, after improbable adventures involving mastodons and underground oceans, are ejected through the Italian volcano Stromboli. Lidenbrock ignores data that disturb his schema. Axel is a romantic who fails to examine observable facts. Yet the book probes scientific wonder: when Axel is lost and terrified in subterranean darkness, the reader experiences awe contemplating the complete absence of light.

The French-language genre advanced significantly with the uncompromising scientific approach of J.-H. Rosny Aîné — the pseudonym of the Belgian Joseph Henri Honoré Boex. In the 1910 *Death of the Earth*, Rosny's vision of global environmental crisis is prescient. An imbalance created partly by humans turns Earth to desert. Targ, the last man, succumbs with Darwinian altruism. Realizing that carbon-based life must perish so that the iron-based Ferromagnetics can inhabit the stricken planet, he invites them to take his blood. Rosny excised the anthropomorphic from science fiction.

The 1950s and 1960s saw an invasion of space-age Anglo-American sci-fi, quickly rejected by French critics. Its main portal was *Fiction*, launched in 1953 as a French edition of the US *Magazine of Fantasy and Science Fiction*. From the outset, its editors used it as the platform for a new French sci-fi school relocating space expansionism to 'inner space' and exploring 'mind travel'. In Gérard Klein's *The Overlords of War* or Kurt Steiner's *The Scratched Record* (both 1970), time travel occurs in a vast mindscape generated by huge computers.

In French neuroscientist Jean-Pierre Changeux's scientific treatise *Neuronal Man* (1983), consciousness is linked to brain biology, breaking Descartes' duality. Yet mapping the mind in the brain is a work in progress. There remains plenty of scope for Gallic sci-fi to explore consciousness: the Cartesian ghost still lurks in the French vision of mind and matter. ■

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REX

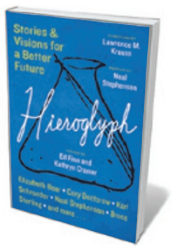
Q&A Neal Stephenson
The sci-fi optimist

Best-selling science-fiction writer Neal Stephenson's works cover everything from cryptography to Sumerian mythology. Ahead of next year's novel Seveneves, *he talks about his influences, the stagnation in material technologies, and* Hieroglyph, *the forthcoming science-fiction anthology that he kick-started to stimulate the next generation of engineers.*

What sparked your interest in science?
There were scientists in several generations of my family. My father was an electrical engineer. I grew up in the university town of Ames, Iowa, which was the best place to grow up in the history of the world, if you were a kid with an interest in science. My friends' parents had PhDs or were studying for them. Respect for science was implicit. I am drawn to 'hard' sciences because I have tools for understanding them, and it is the culture I came from.

How did you become a writer?
As a kid, I read a lot of science fiction and Classics Illustrated comics, and had a series of gifted English teachers — so it wasn't a completely alarming career choice. In college I took a mishmash of physics, geography and computer programming subjects that never added up to a marketable degree. I found myself working as a typist at the University of Iowa libraries, writing my third novel sitting on a milk crate with a fan, beer and a fancy rented typewriter. It was so hot that July that the typewriter's plastic ribbon kept sticking to its internal parts. I figured out that it only got stuck if the ribbon stood still for long enough, so I hammered the thing out. It was accepted and editor Gary Fisketjon spent a year cleaning up my "loose and baggy monster". That became my first published novel, *The Big U* (1984, Harper Perennial), a broad, science-fiction-inflected satire of college life.

How much background research do you do?
I veer back and forth between trying to do the right thing and blind panic. After *The Big U*, I thought I would write about physics. The idea was that the huge explosion in Tunguska, Russia, in 1908, was caused by a primordial singularity — a tiny black hole — popping in and out of Earth. I had a conceit that people following it put the equivalent of a bungee cord around it and got pulled out into space. I spent years writing this thing — and it was terrible. I was so scared that I had blown my chances of being a writer that I wrote another book in 30 days. That turned out to be my second published novel, *Zodiac* (1988, Atlantic Monthly).



Hieroglyph
EDITED BY ED FINN AND KATHRYN CRAMER
HarperCollins: 2014.

How does attending scientific meetings inform your writing?
I go on the spur of the moment. It is good to be in touch, to see what people are working on.

I can also get a sense of personalities and ideas — although I try to avoid focusing on specific living people in my books.

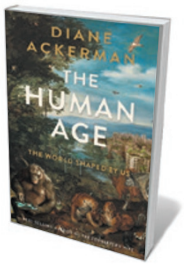
What is *Hieroglyph*?
It was born from a friendly argument with Michael Crow, president of Arizona State University in Tempe. I was complaining that progress in material technology has petered out. We have taken the creativity that went into designing rockets and channelled it into information technology (IT). A lot of bright people are dedicating their lives to inconsequential things: writing apps and so on. There is a lack of grandeur. Crow said, "It's your fault. You sci-fi writers need to give us something to work on." So the university, with my input, founded the Center for Science and the Imagination and launched Project Hieroglyph as an online forum where science-fiction authors could write in an optimistic vein, positing attainable technologies for young engineers. The collection *Hieroglyph*, out this month, showcases work by 20 visionaries, including astrophysicist and award-winning writer Gregory Benford, and science-fiction authors Cory Doctorow, Elizabeth Bear and Bruce Sterling. My contribution is 'Atmosphaera Incognita', about the construction of a 20-kilometre steel tower and the resulting adventures.

What do you think about the trend for apocalyptic science fiction?
In the 1950s we could see that we have a rocket and if we build a bigger rocket, we could go to the Moon. But with advances in nanotechnology and IT, there are many imponderable outcomes. It is easier to predict a gloomy one. But that has led to lazy, derivative, predictable stories, especially on television and in movies.

What do you think about the rise of anti-science feeling in the United States?
It is a surprise to me. Growing up in Ames, I went to a Methodist church filled with professors who never would have questioned the validity of evolution. I think a lot of opposition to global warming and evolution is not about science. The majority of people who identify themselves as global-warming sceptics, for example, do believe it is happening. But they think that admitting that will open the door to excessive regulation by the government. They don't come from the scientific community, where it is important to say what you mean. They come from a political community, where what really matters is the final outcome. I think it's self-destructive in the long run — people who refuse to face reality are infantilizing themselves. ■

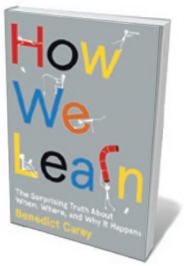
INTERVIEW BY ZEEYA MERALI

Books in brief

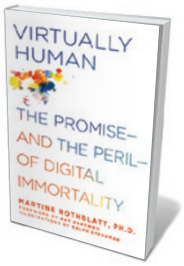


The Human Age: The World Shaped By Us
Diane Ackerman W. W. NORTON *(2014)*
The incisive yet optimistic science writer Diane Ackerman slices into the chaotic age of turbocharged technology and environmental crisis that we call the Anthropocene. She zips from deep history to speculative futures to contextualize snapshots of our vivid, frenetic present. We meet an ocean-column farmer and an orang-utan wielding an iPad; consider cross-border wildlife corridors and invasive species; wonder at the human microbiome and printed drugs. As Ackerman deciphers our grave new world, one message reverberates — that we "still and forever remain a part of nature".

A Buzz in the Meadow
Dave Goulson JONATHAN CAPE *(2014)*
In 2003, leading bee researcher Dave Goulson bought a run-down farm in France. His aim was to provide a haven for the insects he has devoted his life to studying, notably the bumblebee. He writes beautifully of the panoply of creatures — from deathwatch beetles to dragonflies — that often pass unnoticed under our noses. But for all its easy charm, Goulson's account is permeated with awareness that biodiversity is now often confined to managed sanctuaries. What begins as a scientific rural idyll becomes a journey into the imperilled territory of Rachel Carson's *Silent Spring* (Houghton Mifflin, 1962).



How We Learn: The Surprising Truth About When, Where, and Why It Happens
Benedict Carey RANDOM HOUSE *(2014)*
Learn how to learn, enjoins science journalist Benedict Carey in this tour of past and present research on the process. Hard graft is just part of the package; what is key, Carey argues, is exploiting the brain's quirks. He lays bare the biology, cognitive science and "ways to co-opt the subconscious mind" that ensure mental labour becomes ingrained. Carey is an adroit guide to techniques for comprehension and retention, whether exploring the value of forgetting, distraction and interruption, or examining the power of studying in varied venues.



Virtually Human: The Promise — and the Peril — of Digital Immortality
Martine Rothblatt ST MARTIN'S PRESS *(2014)*
In this explication of cutting-edge artificial intelligence, technologist Martine Rothblatt argues that software brains will "express the complexities of the human psyche, sentience, and soul" surprisingly soon. Aeroplanes, she notes, lack the complexity of birds but still fly; similarly, cyber-doppelgängers or "mindclones" will emerge when symbol-association software is combined with personal information gathered on social media ("mindfiles"). Rothblatt lays out a serious analysis of the ethical and scientific implications.

The Big Ratchet: How Humanity Thrives in the Face of Natural Crisis
Ruth DeFries BASIC BOOKS *(2014)*
Vastly boosted agricultural production and cheaper food have driven today's human boom — the "big ratchet", or explosion in population over the past six decades — argues environmental geographer Ruth DeFries. Now, we are embarking on the vast experiment of feeding today's 7-billion-plus people, with no sure outcome. DeFries unpicks the historical patterns to parse the uneasy equation of people and food — our most powerful link with nature. **Barbara Kiser**