

graphics in *Narrative Economics* and those in his bestselling book *Irrational Exuberance* (2000). But the message is effective: the value of your story might go up as well as down.

The empirical core of the book is a detailed exploration of numerous real-life case studies, ranging from bimetallism (an old-fashioned form of money) to bitcoin (a brand-new one), and from the Great Depression of the 1930s to the Great Recession of recent years. Along the way, his anecdotes form a fascinating subplot. A convincing case is made, for instance, that fears of a 'singularity' – a point of no return arising from technological advances – are perennial. He notes numerous viral outbursts of this meme (associated with cotton mills, electricity and computers, for instance) dating back to the nineteenth century. Today's apocalyptic anxieties about a robot takeover are nothing new and should not be heeded, Shiller seems to imply. How that will turn out remains to be seen.

We learn that the mechanism through which a memorable turn of phrase goes viral can be described as a form of contagion, mirroring models from epidemiology. But we are also persuaded that viral success depends inherently on the messenger. Few remember that the phrase "the only thing we have to fear is fear itself", immortalized by US president Franklin D. Roosevelt during the Great Depression, was first uttered years earlier by economist Irving Fisher. It's troubling, of course, to be reminded that the rewards for creativity are often misallocated – particularly in today's plagiaristic world of social media, with its immense powers of narrative acceleration. But for me, this particular example raised a deeper concern.

Fear is a rational response from people whose livelihoods are under existential threat. So why would a president inveigh against it? The answer is that Roosevelt was painfully aware of the implications of fear. He was addressing what the economist John Maynard Keynes (borrowing from another long-forgotten creative) called the "paradox of thrift": the tendency of ordinary people to curtail their consumption in the face of economic uncertainty, and put their money into savings instead.

Such behaviour is sensible, admirable even, at the individual level. Perhaps it is so at the planetary level, too: lower consumption might benefit the environment. But economics has a problem with it. As people spend less, demand is suppressed, prolonging the recession. The same thing happened after the 2007–08 crisis. The paradox of thrift was the foundation for Keynes's most famous proposal: that governments provide stimulus that could return the economy to growth when people would not. This was the rationale for Roosevelt's New Deal package of reforms, and the inspiration for the proposed US legislation called the Green New Deal.

Keynes was a pragmatist; his prescriptions were a response to the diseases of the day. But

he was also a visionary. In his essay 'Economic Possibilities for Our Grandchildren' (1930), he foresaw a time when our society would move beyond growth. It hasn't happened yet – in spite of economist Kenneth Boulding's remark to the US Congress in 1973 that "anyone who believes exponential growth can go on forever in a finite world is either a madman or an economist".

Shiller is clearly not a madman. But in the course of an otherwise fascinating exploration

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of the power of story, he never once acknowledges that eternal growth is itself just a narrative. He notes that the logic of relentless expansion conflicts with the logic of human anxiety. But he assumes that it is people who are at fault. Narratives can have clear, moral and prudential foundations, it seems, but they might still be cast as irrational.

Indeed, for Shiller, that memorable speech on the "fear of fear" shows government

attempting to "lean against false or misleading narratives and establish a moral authority against them". Roosevelt's remark was designed to "create and disseminate counternarratives that establish more rational and more public-spirited economic behavior". What Shiller seems to be saying is this: when ordinary human sentiment runs counter to the prevailing logic of capitalism, the state must override it. It is a deeply suspect, potentially dangerous conclusion. But it, too, demonstrates just how pervasive narrative is.

Ultimately, *Narrative Economics* is an eloquent and accessible exposition of a seductive idea. It's a particularly compelling hypothesis for Britain, a country still reeling from a public referendum whose outcome was determined by viral confabulations of the most pernicious kind. We are all "tellers of stories and makers of poems". But neither economists nor politicians can claim moral authority over narrative truth. We must all choose carefully which stories we live by.

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Testosterone chronicles: truths and tall tales

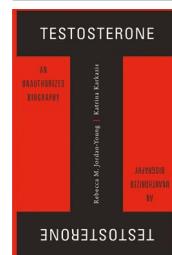
A book on the hormone dissects fact from fake and questions interpretations. By Randi Hutter Epstein

On 1 June 1889, renowned neurologist Charles-Édouard Brown-Séquard shocked his colleagues. Speaking at the Paris Society of Biology, the 72-year-old announced that a slurry made from the ground testicles of guinea pigs and dogs (injected under his skin ten times in three weeks) made him stronger. He also noted that his "jet of urine" lengthened by 25%.

Brown-Séquard was ridiculed by his peers throughout Europe for disseminating results with no scientific basis and promoting quack youth-enhancing 'cures'. Yet the bizarre elixir found favour with members of the public in the United States, United Kingdom and Europe – at least among men eager to recapture youthful sexual prowess. As the engaging book *Testosterone* explains, Brown-Séquard's testimonial helped to shape future studies that linked the hormone to alleged 'manliness'.

Anthropologist Katrina Karkazis and

sociomedical scientist Rebecca Jordan-Young did not write *Testosterone* to rehash familiar tales of wacky hormone experiments of yore, although this is one of a few that they include. Their contention is that many testosterone researchers – then and now, and intentionally or not – interpret data with blinkers on. When the facts do not fit the paradigm, the authors argue, findings are moulded into flawed dogma. Karkazis and Jordan-Young strive to comprehend how scientific practice



Testosterone:
An Unauthorized
Biography
Rebecca M. Jordan-Young, Katrina Karkazis.
Harvard University
Press (2019)



Polarized-light micrograph of crystals of testosterone.

around testosterone unfolds, and explore how the results “circulate and morph in the world”.

Today, the biochemistry of this steroid hormone is well known, from its daily fluctuations to its synthesis from cholesterol and occasional conversion to oestradiol, a form of oestrogen. Testosterone is known to restore sex drive and muscle tone among men with ailments that reduce levels of the hormone, such as pituitary tumours. During puberty, a surge of testosterone in young men typically leads to enlargement of the muscles, penis, testes and prostate gland, and the emergence of secondary sex characteristics. In women, testosterone excreted by the adrenal glands and ovaries is generally important for ovarian function and bone strength.

Like pathologists doing a post mortem, Karkazis and Jordan-Young dissect the remains of a selection of studies. They parse statistics and the cultural context that prompted the research and influenced how the data were analysed. (Full disclosure: I have served on a history of medicine panel with Karkazis and, as medical authors writing about endocrinology, our paths have crossed several times.)

The authors delve first into testosterone’s role in ovulation. The hormone and its

precursor, DHEA, have a role in the maturation of ovarian cells; DHEA might boost fertility directly or as a mediator of oestrogen production. There are chapters focusing on traits often assumed to be associated with testosterone, such as athleticism. The authors also scrutinize the brouhaha surrounding a small psychology study¹ claiming that holding particular poses boosts testosterone production. There is a section on parenting, thanks to studies that created a fleeting media buzz by claiming that new fathers’ testosterone plummets when they change nappies and do other nurturing chores^{2,3}. And the authors discuss athletes who take testosterone to boost their abilities.

They do not dispute that injections, gels or patches that send testosterone levels skyrocketing above the norm build muscles when coupled with intense training. But they are sceptical about whether the hormone makes a large difference for every athlete. Some studies, they write, have found a correlation between high natural testosterone levels and speed and power; others show tenuous or no links. And a few studies link higher testosterone levels to worse performance.

Jordan-Young and Karkazis challenge murky definitions. They show how researchers define

risk-taking through “weirdly narrow and also wildly divergent” behaviours, such as riding a motorcycle without a helmet. They cite a team that surveyed business students about their entrepreneurial experience and used a saliva sample to gauge their testosterone levels⁴. On the basis of these dubious data, the investigators concluded that those who had the highest levels, coupled with family business experience, were the most entrepreneurial.

When it comes to testosterone and aggression, the authors say that some of the most rigorous studies (double-blind, placebo-controlled) show no connection. What’s more, they write that even the investigators of studies that tie testosterone to violence acknowledge that the link is inconsistent and weak. Yet the idea that testosterone drives violence remains widely accepted and “grossly overblown”.

By setting the record straight, the authors build on their past record. Jordan-Young explored the evidence for putative neurological sex differences in the 2011 book *Brain Storm*; Karkazis demolished preconceptions about people who are intersex in her 2008 work *Fixing Sex*, which also explores the often disturbing history of ‘treatments’ for ‘ambiguous’ genitalia.

Although often academic in tone, the book is leavened by a welcome informality. The authors describe the link between testosterone and violence as a zombie: "a fact that seemingly can't be killed with new research". They personify testosterone as "T" and characterize their book as an "unauthorized biography". An authorized biography, they note, "sweeps away all kinds of details and smooths over contradictions". Theirs intends to pull back a veil that has obscured the field.

Still, I sometimes wanted more. In a chapter on ovulation, they quote a woman receiving fertility treatment who thinks that a therapy containing DHEA helped her to produce more eggs of higher quality. The authors note that the idea of testosterone aiding a woman's fertility has been anathema to reproductive endocrinologists, but quote only one clinician. That left me wondering whether other clinicians were still reluctant, or if this were part of standard treatment. I wanted to hear from other fertility clinicians.

In the opening of the chapter on athleticism, the authors refer to a 2012 meeting with an endocrinologist who explains that testosterone rises sharply in response to intense exercise, but that responses vary among athletes. Then, they describe an interview with a second expert who tells them the opposite, and also says that some types of sports training might lower testosterone. I wanted to know who these experts were.

Moreover, although Jordan-Young and Karazis are lively storytellers, every now and then an anecdote doesn't jibe with the chapter's content. For example, they start the discussion on risk-taking with a delightful account of 63-year-old Annie Edson Taylor, who in 1901 went over Niagara Falls on the US–Canadian border in a pickle barrel. That seems a literary stretch: we know nothing of Taylor's hormonal state (except that because she was probably postmenopausal, her testosterone would have been low, and her oestrogen and progesterone certainly lower than before).

These quibbles, however, are minor in a deeply researched and thoughtful book that adds a fresh perspective to a growing body of work aiming to debunk myths about hormones.

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Science by design: *Nature* renewed

From custom typeface to digital-friendly logo, follow the journey to the journal's new look. **By Kelly Krause**

Should science be ugly? This is a serious question asked by serious people at seminars. Some assume that an aesthetically appealing presentation signals at best a lack of priorities, and at worst a lack of rigour.

I disagree. Science sorely needs best practices in visual communication as well as in information design, a mature field with quantitative methods. In my view, the idea that scholarly publishing should be divorced from evidence-based applications of good visual design is perplexing.

"The 'flavour' of the typeface – the feelings it evokes, its personality – evolved over several months."

Looking back over the past 150 years of *Nature*, we see an aesthetic that bends with time and trends, from ornate Victorian embellishments in 1869 to stark minimalism in the late 1960s. But design is not solely about how something looks; it is also concerned with how it works, and that understanding has never been more urgent than in the digital age. Design as a discipline exists to solve problems, and working researchers, readers and contributors have many. As publishers, we've asked how we might assist working scientists. We have heard your pleas, many stemming from information overload and the need to pack ever more data on to small screens.

So we are refreshing *Nature*'s look, and not just in honour of our 150th anniversary. We are in the early stages of our evolution towards designing for readers' digital reality. Here is a tour of what is different, and why and how we have changed it.

Typography

A custom typeface, Harding, has been created for *Nature*'s new logo and much else: you're reading it right now. Harding is named after the late neurologist Anita Harding. Brilliant and generous, she published in *Nature* before she died in 1995 at age 42. According to colleagues, she was known for taking questions from the clinic back into the laboratory, and for her wry

sense of humour. When she learnt that she had a terminal illness, she apparently joked that at least she wouldn't have to buy Windows 95.

Our team designed the typeface specifically for science, in partnership with Commercial Type founders Christian Schwartz in New York and Paul Barnes in London, and with London designer Mark Porter, whom *Nature* engaged for the overall redesign. Care was taken to identify the needs of technical material, because scholarly articles use classic type styles in unique ways. For instance, papers often have mathematical equations and formulae in the sub- and superscript lines, along with Greek letters and special characters. So we have made the sub- and superscript characters larger than standard, and created a Greek alphabet carefully honed to convey scientific meaning rather than typical Greek-language prose – for example, clearly rendering an alpha (α) in a shape that looks like a mathematical symbol, so that it is not easily confused with a Latin italic letter *a*. We have also made the italics more slanted so they are more distinct; single italic characters, such as *h* for Planck's constant, are often used as isolated symbols with scientific meaning.

Harding is designed to cope across the disciplines. It boasts an unusually large range of special characters, from triple prime and nabla to a full set of astronomical symbols and the 'click' phonemes found in some African languages.

A key consideration in Harding's overall design is performance on small digital screens. To boost readability in a limited space, it helps to enlarge the main portion of the lower-case letters, while making the ascenders and descenders (as in 'h' and 'g', respectively) smaller. Ultimately, this renders long, complex strings of words easier to parse, and allows for neat stacking of lengthy technical research-article titles over a number of lines.

The 'flavour' of the typeface – the feelings it evokes, its personality – evolved over several months. We initially looked at six fledgling concepts, each with distinct letterforms such as rounded serifs (the small strokes at the end of letters). After we winnowed these down to two, Harding emerged as the clear