

35–40 licences per decade through the 1960s, and declined steadily to 12 per decade in the 1990s. The numbers reflect all vaccines developed for endemic and exotic pathogens. She convincingly contests similar analyses.

Today's biological revolution cuts both ways, offering great advances in medicine while providing new means of attack for terrorist groups. It is thus short-sighted that US biodefence funding is largely overseen by congressional committees that are oriented towards health rather than national security.

If the 1940–69 model was a worthy paradigm, why did we migrate away from it? Hoyt attributes the change to several factors. Government contracting and licensing became mired in bureaucracy, and concerns over intellectual property curtailed collaborations. Oversight of vaccine development across a number of bodies became inadequate. The political constituency for biodefence issues weakened and funding for products suffered. Arguably, the lack of US government prioritization of vaccines was the most damaging factor. The result is that now, the time it takes to develop a vaccine is increasing. A better balance of basic and applied research could restore a product-oriented focus.

Government-sponsored research of bioweapon countermeasures has generated knowledge and publications, but faltered in delivering practical results. Biodefences cannot be put in place solely by accepting or dismissing research hypotheses; they require safe and effective pharmaceutical products. We need the biological equivalent of the defences that now protect Hawaii's Pearl Harbor.

So what should society and governments do next? At this point, the book's contributions fade. Hoyt dismisses most vaccine stockpiles as unresponsive to today's threats, yet doesn't indicate any need for quick-acting antibody formulations or therapeutics. Instead, she advocates an emphasis on multipurpose technologies and 'platforms', many of which are hypothetical. How can we measure success using a platform approach? How quickly could platforms be transformed into defences against bioweapons?

Perhaps Hoyt's idea is the right interim solution for today's nadir in national will. Perhaps later, if and when it returns, the well-coordinated, product-centric development of vaccines can resume. History offers us lessons in how to do so. ■

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ILLUSTRATION BY ALESSANDRO GOTTARDO

FICTION

Cosmic creation

Pedro Ferreira explores Alan Lightman's latest novel — a magical-reality take on the origins of the Universe.

When a physics heavyweight is mentioned in the same breath as Salman Rushdie and Italo Calvino, it is tough for a reviewer. Few venture into air that rarefied and make it out alive. But when the book is *Mr g*, a creation myth by physicist Alan Lightman, it is worth the risk.

In *Mr g*, Lightman has taken the core of what we know about the origins of the Universe from physics, chemistry and biology and wrapped a few characters around it. The protagonist is the narrator: god, dubbed Mr g. Mr g lives in a timeless Void with his Aunt Penelope and Uncle Deva, playing out skits that could have been lifted from a Woody Allen film — but with the humour on mute. One day, Mr g wakes up from a nap, decides to create a Universe called "Aalam-104729", and from then on marvels at his creation as it evolves and becomes more complex — from the beginning of space and time, to the



Mr g: A Novel About the Creation
ALAN LIGHTMAN
Pantheon/Corsair:
2012. 224 pp.
\$24.95/£9.99

emergence of fundamental laws, particles, forces, stars, galaxies, planets and, ultimately, life itself.

As sentient beings finally emerge out of the cosmic mess, Mr g is torn: should he intervene or let them go their own way? Throughout, he is taunted by the creepy Belhor, a devilish character (a fine role for Al

Pacino if this were ever made into a film) and Belhor's annoying daemons, the Baphomet siblings. Belhor pushes Mr g to allow his creations to do their own thing, and watches with glee as evil and unhappiness begin to emerge — leaving Mr g to observe as, for instance,

an impoverished young woman anguishes over stealing meat to feed her starving siblings. Lightman uses the exchanges between Mr g and Belhor to riff on good and evil, free will and relative morality.

Lightman's grasp of the science, in all its gory detail, is unerring. His ability to interweave the fantastical with the factual is impressive — not surprising, given his background. In the 1970s, Lightman established himself as an astrophysical relativist, writing several important papers and books. I still use them. In 1993, he published a magical collection of short stories, *Einstein's Dreams* (Pantheon), in which he took the strange concepts and consequences of Einstein's principle of relativity and wove them into vignettes. I was shocked at how well it worked — and I was not alone. The book has been translated into 30 languages and has led to several stage productions around the world.

Lightman had done something that I had thought impossible: he had brought in the hard science and softened it up. *Einstein's Dreams* is sensual; it breathes. *Mr g* is different. Much more abstract and almost pedagogical, it is a detailed description of the birth and evolution of the Universe that reads like a Rushdiesque fable about an invented place and time. The facts are faultless. Yet the book can occasionally be unintelligible.

For example, Lightman defines a tick of a clock in terms of a particular frequency of the hydrogen atom. Beautifully precise and clear. But as a result, any other timescales that he mentions must be written in scientific notation. And, of course, other big numbers — such as the number of neurons in a brain or of Universes in what he calls the Void — can also be accurately presented only in scientific notation. You begin to wonder about the readership. Are these nuggets meant to be seen as just icons, like hieroglyphs? Or is the generalist supposed to know what they mean?

It has to be said too that Lightman's work could have worked well as a short story. It loses steam early on and sometimes feels like interspersed vignettes on science and morality with a dose of 'magic' thrown in. Finely crafted it may be, but it can be hard going. Throughout, I had a pretty good idea of what was going to happen and, given the nature of the story, the characters didn't need to be developed. There was nothing to wait for.

Yet ultimately, this is a marvellous counterpoint to all of the other nonsense out there on creation. Lightman writes exquisitely, so this fable on the origin of space, time, matter and life is a wordfest that is securely pinned to the rational — making him a 'magic realist' of a refreshingly different stripe. ■

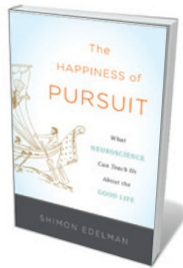
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Books in brief



The Green Paradox: A Supply-Side Approach to Global Warming
Hans-Werner Sinn MIT PRESS 288 pp. \$29.95 (2012)

Frustrated by "counterproductive" climate policies, economist Hans-Werner Sinn proposes a radical alternative. Policy-makers, he notes, have ignored the oil sheikhs and coal barons who supply the fossil-fuel market. Yet it is they who call the shots, as shown by the 'green paradox' — announcements of future reductions in carbon consumption that drive carbon-resource controllers to bump up production. Sinn's antidote to the ideology that plagues policy-making is a "Super-Kyoto" system: unified countries, coordinated caps and trade, and taxation designed to curb the 'extraction habit'.



The Happiness of Pursuit: What Neuroscience Can Teach Us About the Good Life

Shimon Edelman BASIC BOOKS 256 pp. \$25.99 (2012)

The mind, says cognitive psychologist Shimon Edelman, is a literal "meat computer". Our experience of the world is a series of computations carried out by neural wetware. But where does that leave philosophical conundrums such as joy? Taking passages by luminaries including Homer, William Shakespeare and Jorge Luis Borges as touchstones, Edelman powers along on his "quest for an algorithmic understanding of happiness", revealing that it is this computational journey itself that constitutes the good life.



How Not to Be Eaten: The Insects Fight Back

Gilbert Waldbauer UNIVERSITY OF CALIFORNIA PRESS 240 pp. \$27.95 (2012)

Insects and their predators use a vast, often bizarre array of strategies to eat or to avoid being eaten. Entomologist Gilbert Waldbauer tours tactics on both sides, from sticky lures to kamikaze speed. His fascinating cast ranges from goatsuckers (birds in the order Caprimulgiformes) that can catch massive moths in their bristled gapes, to the brilliantly hued lubber grasshopper (*Romalea guttata*), which, when threatened, both vomits a noxious substance and hisses as stinking froth erupts from its thorax.



Knowing Nature: Art and Science in Philadelphia, 1740-1840

Edited by Amy R. W. Meyers and Lisa L. Ford YALE UNIVERSITY PRESS 432 pp. \$65 (2012)

When writer Thomas Paine saw Philadelphia in 1774, he noted that nearly every citizen had "some scientific interest or business" — a state that persisted to the mid-nineteenth century. The city boasted artist-naturalists such as John James Audubon, and the study of nature filtered through all strata of society. These 14 illustrated essays, edited by art historians Amy Meyers and Lisa Ford, trace a century of influential scientific endeavour, from botanic gardens and cabinets of curiosity to pioneering colour-plate techniques.



Vegetables: A Biography

Evelyne Bloch-Dano (translated by Teresa Lavender Fagan) UNIVERSITY OF CHICAGO PRESS 128 pp. \$20 (2012)

Next time you chop a carrot, spare a thought for the centuries of breeding, farming technology and trade that brought it to your kitchen. In brief 'biographies' of 11 vegetables, from pumpkins and artichokes to chard, writer Evelyne Bloch-Dano serves up a feast of associated genetics, agriculture, history and culture. From the role of chillies in world trade to the strange link between peas and the court of Versailles in France, there is much to savour.