nature

www.nature.com/nature

Vol 448 | Issue no. 7149 | 5 July 2007

Parallel worlds galore

The 50th anniversary of an astonishing scientific hypothesis deserves celebration. So too do the truly astounding tales of a literary genre that anticipated it.

From the evidence of our cover, you could be forgiven for thinking that you are holding a copy of *Nature* from an alternate universe. And if that were the way your imagination took off, it would be doing just what our cover seeks to do — celebrating the overlap between the world of science and the fables it inspires and feeds on. In particular, the 'Astounding Tale' of a plethora of alternate universes is at the same time a well-worn theme of science fiction and a valid, if speculative, way of understanding the ultimate implications of Schrödinger's wave equation.

The idea of a 'many-worlds' multiverse, introduced into physics 50 years ago this month by Hugh Everett, neatly highlights the intersection between science and science fiction — which is why our coverage of the anniversary spills from our News Features pages into our Books & Arts pages (see pages 15, 18, 23 and 25). For the most part, though, the two domains are themselves seen as alternates. It is a cliché of science popularization to proclaim that phenomenon X, once science fiction, is now science fact, as though the two were in some way mutually exclusive. This might suggest to some that science fiction is worthless; alternatively, it can tacitly imply that it is the job of science to reify the fancies of science fiction. Neither implication is useful.

The interaction between science and science fiction is more complex and symbiotic. Science fiction feeds on science. It also anticipates it. For good or ill, it articulates possibilities and fears: the notion of the super-weapon was commonplace in science fiction long before the Manhattan Project, and no debate about genetic technology seems complete without an appearance by Victor Frankenstein and his creature. More positively, science fiction provides crucial raw material — the minds of young people who will in time become scientists themselves. Not every science-fiction-reading teenager becomes a scientist, nor do all scientists grow up with shelves of Wells, Asimov and Le Guin by their beds. But the inspirational value is real.

This is not to say that science fiction is a childish thing, to be grown out of. But it does undeniably have a frequently childish character, one that reveals its true nature. Childhood is a time of games; games that allow their players' curiosity free expression while at the same time preparing them for a life in which every year brings novelties both anticipated and unlooked for. Science fiction, too, provides a way of exploring what is to come. Its main aim is not to foretell the future — indeed, the great Ray Bradbury once remarked that he wrote not to predict the future, but to prevent it. Yet even though it can be serious and frightening, it is not at heart a literature of warning, either. It is a literature of playfulness. Within the constraint of telling human stories about more-or-less human beings, it revels in the possibility of expanded physical and intellectual horizons.

"Science fiction does not tell us what the future will bring, but helps us to understand what the future will feel like."

And above all it revels in the possibility of change. Serious science fiction takes science seriously, and its games provide a way of looking at the subjective implications of newly revealed objective truths of the Universe. Science fiction does not tell us what the future will bring, but at its best it helps us to understand what the future will feel like, and how we might feel when one way of looking at the world is overtaken by another.

To be sure, science fiction doesn't always connect in this way. It can be tired and cliché-ridden; the games it plays can be tedious, solipsistic power fantasies. And over recent years many of its finest practitioners have become so besotted by the endless new games that ever-accelerating progress allows them to play that their works can be inaccessible to the general reader. To demand that everything be accessible is to demand mediocrity — there is a role for dialogues that can be appreciated only by *cognoscenti*. But we believe that science fiction written for every scientist can be rewarding, too, which is why this issue sees the return of our popular showcase for short science-fiction stories, Futures (see page 104).

Science takes place in a cultural context. The many forward-looking, ever-changing worlds of science fiction provide one that is both fruitful and enjoyable. ■

Enough talk already

Governments should act on researchers' attempts to engage the public over nanotechnology.

There hasn't been anything quite like it in the history of science. Over the past three years, in Europe, the United States and Australasia, a plethora of groups of scientists and other citizens have discussed nanotechnology in extended exercises in 'public engagement'. These initiatives have arisen partly because of the acute awareness by many that all is not as it should be either in the degree of trust in science and technologies on the part of the public, or in confidence in nanotechnology in particular.

As documented in a report published last week (see www.involve.org.uk/negreport), these initiatives have a number of common features. Definitions of the word 'nanotechnology' have been chewed over, optimism expressed that nanotechnology can benefit mankind, but — most importantly — concerns have been expressed about a lack of knowledge and regulation surrounding the impact of nanoparticles on health and the environment.

Equally notable were common outcomes for participants, where members of the public and scientists reported how much they had unexpectedly gained in understanding each others' perspectives.

Scientists appreciated how non-scientific participants were constructively interested and able to get to grips with key aspects of a complex subject. The latter, meanwhile, usually starting from zero, gained knowledge about what scientists are doing and about their motivation, and a greater awareness of the potential impacts — both real and hyped.

But what's the point of such engagement? One positive example inspired many subsequent activities: the 2004 report on nanoscience and nanotechnology by the British Royal Society and the Royal Academy of Engineering. This was productive not only in its content but also in the way the various processes of engagement enhanced its public credibility and helped ensure that the questions it addressed were of appropriate scope.

A more recent example was a series of 'Nanodialogues', workshops conducted by the UK think-tank Demos unveiled last week (see www.demos.co.uk/publications/nanodialogues). One workshop, involving Unilever, showed how issues of corporate social responsibility arise not only in manufacturing processes and products but also in corporate R&D. Another, conducted in a village near Harare in Zimbabwe, demonstrated how remote from reality are some claims made for nanotechnology's potential impact on water purification in the developing world.

A nanodialogue in Swindon involved engagement between 14 local citizens and scientists funded by two UK research councils based there. Here was an example of true 'upstream engagement', the idea — often suspiciously received by scientists — that both the public and scientists have something to gain from discussing future research prospects as an input to research funding. Most encouraging for researchers was the strong support by public participants for fundamental science.

A taste of true upstream thinking by nanoscientists can be found in blogs at http://ideasfactory.wordpress.com. These feature futuristic nanotechnology concepts, including software-controlled assembly of a variety of building-blocks (small molecules to nanoparticles) linked by covalent bonds, and the development of a flexible machine, computer language and compiler as an assembler of molecules and materials under atomically precise control.

"Most encouraging for researchers was the strong support by public participants for fundamental science."

These are potentially powerful enabling technologies. To take a view on their risks or values, either as a scientist or as a citizen, depends on imagined contexts of application. The benefit of the public engaging with scientists years or even decades ahead of the arrival of such technologies lies in the broadening of the bases of knowledge, mutual trust and — most importantly — critical appraisal. One challenge now is how to allow a much larger proportion of the public to share in those benefits.

Few governments have put solid investment in the one type of research most consistently and urgently demanded by these groups — on the health and environmental risks of technologies already embedded in hundreds of products on store shelves. Commendably, a new Australian initiative in nanotechnology research includes such investment.

Regrettably, the governments of two countries that have taken strong leads in nanotechnology — the United States and Britain — have failed to respond. These governments and others not only need to act on this outcome of public engagement but must also integrate such processes into their departments' and agencies' activities. ■

Discriminating on genes

The United States is belatedly establishing necessary protections in law. Others, take note.

In a rare departure, President George W. Bush, the House of Representatives and most of the US Senate have found a landmark piece of legislation on which they can agree. The Genetic Information Nondiscrimination Act of 2007 was passed overwhelmingly by the House late in April. The bill would bar insurers from using the results from genetic tests to deny coverage to new applicants, or from hiking the price of premiums for existing customers. It would also make it illegal for employers to use genetic information in hiring, firing or promotion decisions. (Shamefully, however, military personnel are excluded from the act's protections.) Such protections are sorely needed in many countries, but certainly in the United States, where employers and private insurers pay a significant proportion of health costs and have every reason to try to minimize the health risks of those they hire or insure.

Despite the endorsement of the White House and strong historical support for such a measure in the Senate, the bill is still awaiting a Senate vote. It has been delayed by a crammed legislative calendar and by behind-the-scenes wrangling of lawmakers over issues ranging from the measure's definition of a genetic test to whether the bill as written would allow violators to be sued twice for the same offence.

These negotiations should be concluded soon. There have seldom been so many good reasons to see a bill speedily enacted. Public concerns about the potential abuse of genetic information have risen steadily in the past decade. Leading voices, from the White House to top geneticists such as Francis Collins, argue that this threatens both the beneficial use of more than 1,100 clinically available genetic tests and the ability to conduct further research. Genetic studies rely, after all, on the good will of thousands of subjects who agree to have their DNA scrutinized. Without solid legal protection in place, people will remain justifiably wary of being tested, whether for research or for their personal health. The wealth of information now pouring out — for instance, in a raft of genome-wide association studies that are targeting suspect genes in complex diseases such as diabetes — will not be fully exploited, and the benefits of personalized medicine will be, at best, only partially realized.

Given the nature of its private-insurance system, it is apt that the United States should be leading the way with the current legislation. The Charter of Fundamental Rights of the European Union includes "genetic features" in its non-discrimination protections, and individual countries are charged with making their domestic laws compatible with it. Yet many countries — France and Austria are notable exceptions — have so far failed to enact an explicitly protective genetic information law. In this, they could take a leaf from the US book — provided that the book finally gets written. ■