





# The biologists strike back

Time machines, spaceships, atomic blasters — the icons of science fiction tend to come from the physical sciences. But science fiction has a biological side too, finding drama and pathos in everything from alien evolution to the paradoxes of consciousness. *Nature* brought together four science-fiction writers with a background in the biological sciences to talk about life-science fiction.

**Nature has given biologists a lot of weird things to study — how easy is it making aliens that are even weirder?**

**Peter Watts:** Every now and then I think I'm taking a shot at it, but it always trips my ass ultimately. In my latest book, *Blindsight*, I thought I had come up with the ultimate alien: they didn't even have genes, and most of their metabolic processes were mediated by external magnetic fields. I thought I was really striking off into new and unexplored territory. But when it comes right down to it, I had described, at least in terms of gross morphology, brittle stars. Something that essentially had a whole series of pinhole cameras across its entire body surface, something like a very large telescope array.

**Joan Slonczewski:** I ended up in microbiology because microbes are the most fantastic creatures, more diverse than any other kind of creature in the natural biosphere. In fact, for much of my career it's been hard to tell which is more bizarre, the kind of research that I'm doing or the kind of science fiction I'm trying to write. In the textbook I'm doing now I've been writing about organisms that live 2 kilometres below the earth in gold-mines and that live off hydrogen atoms produced by uranium decay. I have yet to see nuclear-powered creatures much in science fiction.

**Can science fiction work as a medium to put across important scientific ideas?**

**Joan:** Yes. I actually teach a course on biology and science fiction for students who have trouble with a standard science course. There are certain books that do a wonderful job of teaching science through science fiction — Kurt Vonnegut's *Galapagos* is a great example.

**Peter:** I've got to second that. I think that was Vonnegut's best: it got evolution right. The idea that what is left of our civilization a million years hence is that when one of our seal-like descendants farts on the beach, the others just laugh and laugh — that's a wonderfully ironic and potent summation of human achievement.

**Paul McAuley:** Evolution is a keynote that runs through most of H. G. Wells's science

fiction. The human race was going to slip down into unthinking Morlocks and Eloi or we could continue to rise and become the big-brained, small-limbed creatures that are the kind of epitome of science-fiction cliché of future man. Wells was taught by Huxley, had a zoology degree and so on, so he had a good grounding in it. But in Wells's time, evolution was some blind force. We've now got the opportunity to start directing evolution ourselves.

**Joan:** We can change our genes based on cultural views, what we believe are better genes. That's what the aliens in Octavia Butler's books are doing when they mate with humans. But what happens when it turns out the environment changes and that's not the best gene or we make a mistake? And what happens if we lose the variation that's required in the environment?

**Those are great questions, but is science fiction good at answering them? Take cloning — how helpful has the vast amount of pre-existing science fiction about cloning been in informing the post-Dolly debate?**

**Joan:** My impression is that for the students it was more helpful than not. That is, if Dolly had happened and there was no context at all, where would you begin to discuss what had happened? Whereas because there was a whole science-fiction tradition of questioning the ethics of cloning and the ethics of making people for spare parts, you had at least somewhere to start.

**Ken Macleod:** I think the prior art provided by science fiction was distinctly unhelpful in dealing with Dolly and cloning: ludicrous drek about cloning armies of soulless robots and *The Boys from Brazil* cloning Hitler, and the whole Frankenstein mess. And the actual ethical issues that arose with cloning were essentially none of the above.

**Joan:** I used to agree with your point that bad science fiction was an obstruction to learning, but as a biology professor I learned that sometimes bad science fiction is better than none at all. For example, you could poke Michael Crichton's portrayal of dinosaur cloning full of holes, but those stories encouraged a whole

generation of molecular-biology students. As a result, we have a molecular-biology programme now at Kenyon College.

**And that's really due to *Jurassic Park*?**

**Joan:** Yes, we call it the *Jurassic Park* generation.

**Paul:** The big problem I have with Michael Crichton is he's basically anti-science. That old cliché of things that man wasn't meant to know embodies most of his work. Science is always running out of control, with people coming in to mop up afterwards. I think that the effect that Joan is seeing is from the film more than the novel, the wonderful scene of the dinosaurs up there on the screen. In the novel the hero was a lawyer. That's how anti-science it was.

My stuff gets compared to his stuff occasionally and I just have to say, 'Well, no.' Because I like science, I like scientists. I like what science does and I think that on the whole it's a good thing — and I think Crichton thinks the opposite, mostly. But the good thing about Crichton's work is that he does show, usefully I think, that science is not ethically valueless. Some scientists tend

## Who's who

**Ken Macleod** took a master's in biomechanics and worked as a computer programmer before becoming a full-time writer based in Edinburgh. He is the author of the *Engines of Light* novels, the *Fall Revolution* novels and most recently of *The Execution Channel*.

**Joan Slonczewski** is a microbiologist and a professor of biology at Kenyon College in Gambier, Ohio. She is the author of six science-fiction novels, most recently *Brain Plague*.

**Paul McAuley** has been a full-time writer, almost exclusively of science fiction, since the late 1980s; before that he was a lecturer in botany at the University of St Andrews, Scotland. His latest novel is *Players*.

**Peter Watts** says he has spent much of his adult life trying to decide whether to be a writer or a scientist, ending up as a marginal hybrid of both. Having done research in marine biology, he is the author of the *Rifters* trilogy and most recently of *Blindsight*.

to argue that knowledge is knowledge for knowledge's sake and that we should just find out what we can and damn the consequences. Crichton does actually cast the shadow of what we find back on to society and what's going to happen to it if we take these things to their logical conclusion.

**Peter:** When I start writing, I like to think of it as a sort of thought experiment. I go where the data lead, and I do not explicitly start off with a goal of writing a cautionary tale of saying that the world is turning to shit. That does seem to be where my stories all end up ultimately, but that's just because I'm following the data and there is an inertia to big systems and we can't realistically imagine a situation in which things would be better by 2050 unless we had actually had gotten serious about cleaning things up 20 years ago.

**Ken:** I think there's a distinction between science fiction and techno-thriller. The sort of thing that Michael Crichton writes is different from the sort of thing that Paul McAuley writes. Even when what Paul McAuley writes looks like a techno-thriller, he's actually sneakily writing science fiction in disguise. I attempt now and again to do the same thing. The difference is that in the techno-thriller, the lab eventually gets burned down, the genie gets back in the bottle, the evil scientist is defeated and so on. That's not the spirit of science fiction at all.

**Paul:** Ken's hit the nail on the head there. Science fiction posits that change is good and that change will happen and doesn't necessarily say in which direction change will go. The great power of science fiction is that, first of all, it's able to do that, and second, that it's able to get away without causing so much fuss. We can sneak in under the radar with all these outrageous notions and these manipulations and speculations about human nature.

**Peter:** Just to play devil's advocate for a moment, how would you guys react to the argument that if we can get away with it, we're not really doing the job? That if nobody gets pissed off by what you're doing, you are essen-

tially conceding defeat when it comes to actually trying to provoke action.

**Ken:** I don't see science-fiction writers as agents for change. I think we're here not so much to bring about change but to investigate and imagine change. What happens as a result is the responsibility of the readers, not of the writers.

**Joan:** I think the imagination of change has to come first. If you don't do that, you're not a science-fiction writer. But I think there are some science-fiction writers who attempt to be scandalous. I think Robert

Heinlein's *Stranger in a Strange Land* was considered extremely scandalous when it first came out — it posited a religion where there is cannibalism at the core of it, which was an attempt to imitate the Eucharist, and had all kinds of things that were then considered scandalous.

**Ken:** Yes, but have you ever come across anyone who was genuinely scandalized by *Stranger in a Strange Land*? I mean, I was a little Christian fundamentalist when I first read it as far as I can remember and I wasn't scandalized. I was kind of mildly titillated, but...

**Joan:** In Ohio we're a little more easily scandalized, perhaps.

**"I think we're here to investigate and imagine change."**  
— Ken Macleod

**"As a result of Jurassic Park, we have a molecular-biology programme at Kenyon College."** — Joan Slonczewski

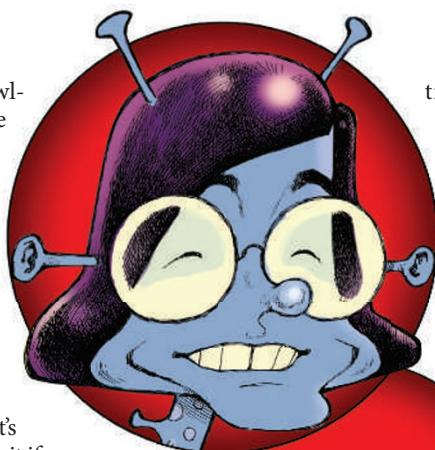
**Science fiction has always been interested in 'the other' — and these days that other is as likely to be a computer program as an eight-legged alien. How does the interaction between biology, technology and artificial intelligence feature in your work?**

**Joan:** One of the things that fascinates me is how people react to ideas of aliens or of artificial intelligence, and it seems to me that the way we treat artificial intelligences has a lot in common with the way we treat immigrant labour and the lower classes, or slaves. We think about these machines as slaves to do our work, but the more like us the machine is, the more effective a servant it is. This is the kind of dynamic we don't like to think about, but that has gone on in the way we treat either immigrant labour or slaves historically. Some studies have shown that even people who are very computer literate will treat their desktop computer as if it were another person. What if their computer were to become so powerful it actually wakes up and demands human rights?

In my book *Brain Plague*, there are technological entities that have sentience, whether they're robots or an entire transit system and it's just assumed that although they're robots, they're also just another ethnic group. My view as a molecular biologist is that our own bodies are machines composed of molecules and the computer on my desk is a machine composed of molecules, and the only difference is which one has woken up.

**Ken:** When I wrote my first novel, *Star Fraction*, I wrote it partly under the impulse of the feeling that Richard Dawkins and his selfish gene and the propagation of memes were something not widely enough known. I had to spread the word about these new and exciting ideas, and you know that whole thing of darwinian evolution going on in electronic systems seemed to me to be an enormously exciting and fruitful line of work and now it's pretty much all-pervasive on the talk shows. I think I was pretty much behind the curve even when I wrote it, though it didn't seem like it.

**Peter:** In my *Rifters* trilogy I wrote about Maelstrom, which was a far-future, massively super-evolved descendent of the Internet; all I did there was apply darwinian principles, assume you get your computer viruses, set them loose to breed in the wild, and end up with a seething electronic ecosystem that reproduces 200 times a second. It didn't strike me as a particularly radical innovation and I don't think any biologist would find that.





But people who were in AI [artificial intelligence] found this a massively innovative idea. I started getting letters from this guy who works in the Lawrence Livermore lab who told me that he had found my portrayal of digital ecosystems inspirational in his own work, which I found a little bit creepy because of the kind of things they do at the Lawrence Livermore labs and the fact that he couldn't tell me exactly what his work was.

The way my ideas about marine biology fall by the wayside and my ideas about AI get taken up makes me think that our imaginations are hamstrung in our own area of expertise. We know too many reasons why this, that or the other wouldn't work. We're perhaps a little too cognizant of our colleagues peering over our shoulders and ranking us as one or two steps above child pornographers because we write that sci-fi stuff in the first place. I wonder if some of the most innovative stuff comes when you retain the respect for logic and the respect for consequence, but you leave behind that infestation of fact and dogma that you used in getting your degree.

**Paul:** Well, that's why I quit science, folks. To get away from that self-censorship thing. I'm partly joking, but only partly. One of the useful things that science fiction does is to get out from under self-checking circuits that scientists must use when they're doing their work and just let rip and dance away with it. Doing science is like slogging through mud. Science fiction straps on mud shoes and dances off over the surface and onto the horizon, gesticulating madly and doing all sorts of silly little dances, but sometimes doing useful stuff.

**Joan:** I actually find science to be inspirational for science fiction. I can still remember

seeing an isolated photopigment that a grad student had got in a test-tube that was purple, and he shone light on it and it bleached white and this idea of the colourful switch enabled me to imagine: 'What if people had symbiotic microbes that would turn a switch depending on the environmental situation.' Later, that same pigment was used in a molecular switching device to make biochemical computers. So I think that science can be inspiring if you're doing it; you just have to be willing to not be inhibited in taking it a little farther.

**Ken:** In the novel I'm working on, one of the assumptions in it is that some AIs become self-aware because they're combat-robots and they're required to have ever more sophisticated theories of mind to work out what the guys they're about to shoot are going to do. But the other AIs, the ones that do our dirty work for us, like the police national artificial intelligence, which is one of the characters in my story, don't necessarily have self-awareness in the human sense at all.

**Peter:** The creepy thing about self-awareness is that 'the other' may in fact have been inside us all along, it may really be the one in control. The conscious decision to move your arm occurs half a second after the motor nerves have started firing, the conscious event is an executive summary received after the fact. This little self-aware homunculus behind the eyes doesn't seem responsible for nearly as much as it gives itself credit for; the heavy lifting seems to be done by something deeper, something we don't have conscious access to. I played with this idea in

*Blindsight*, in which although there are aliens, there is no 'other'; the things our heroes meet are hyperintelligent but utterly nonsentient. And maybe that thing inside us that we can't feel, that makes the real decisions, that lets us think we're in control — maybe that's the same way.

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— Peter Watts



Let's end with your favourite biological moment in science fiction.

**Paul:** In *Blood Music*, by Greg Bear, when the protagonist looks down the microscope and he sees the bacteria have created little circuits that look like cities. A moment of 'Wow' like that is quite rare in science fiction, even though

the 'Gosh, wow' thing is something we all aspire to. And it happened really early on in the novel, as well, which got even weirder after that. So I knew I was in for a good time.

**Peter:** Mine was Alice Sheldon's *The Screwfly Solution*. The idea is a rampant, literally epidemiological spread of homicidal hatred towards women, which society insists on treating as mass hysteria, whereas in fact it's been pheromonally introduced by aliens who want to clean up the real estate without using radioactive devices. So it's essentially a form of biological pest control.

**Joan:** For me, if it's a defining moment, it's the moment in Vonnegut's *Galapagos* in which the narrator of the story has the opportunity to decide whether to stick around for the next million years of evolution or to be taken off to heaven. And he decides that observing the next million years, no matter what, no matter how bad it is, that the next million years of human evolution are more compelling to him than going off to heaven. That to me is an inspiring moment.

**Ken:** I think that my sort of favourite biological science-fiction story is *Sunken Universe* [aka *Surface Tension*] by James Blish. It's an absurd idea that in the far future there are engineered human beings on another planet who are the size of protozoans. They're living in a puddle and they build what they call a spaceship, a little device made of bits of leaf and twig and so on that has wheels propelled by paramecium, and they laboriously drag this device across the dry land to the next puddle and at the end of it wonder if they have actually built this spaceship and crossed space like their ancestors did. And I loved that as an image of where we are and what we can do.

See Editorial, page 1. An expanded version of this conversation is at <http://tinyurl.com/224s24>

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