

EMERALD CITY

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Introduction

Hello, and welcome to the Emerald City nanotechnology special. This issue has been specially impregnated with viral nanoware programmed to spread a highly contagious cultural meme that causes all SF fans to vote for Ian Gunn in this year's Hugos.

Not got a clue what I'm talking about? The explanation comes soon.

In the meantime, the rationale. Really I should dedicate this issue to Alan Stewart. He told me where to find a cheap hardback copy of *Necroville*, encouraged me to read Paul McAuley, and loaned me a copy of Drexler. I could not have produced this issue without him. But equally I had my own reasons for doing it. Partially this was a result of having read, loved and been fascinated by *The Diamond Age*, and partially it stems from that very unsatisfying panel at Swancon. I wanted to know more, so I set about finding out. Here are the results of my delving.

What is nanotechnology?

In one of the more forgettable episodes of *Next Gen* (so forgettable that I can't remember the title), the irrepressible Wesley creates artificial life forms called Nanites which proceed to evolve at an alarming rate, escape, and threaten to take over the Enterprise. Given the rate at which they were evolving, they have probably taken over most of the universe by now, and have created *Voyager* as a means of lulling us to sleep before their final assault on Earth. It was a silly story, but it had its roots in real science. And given that it was a Welsey episode, and therefore early on in the series, it was pretty quick off the mark. Nanotech only became big news in 1986 with the publication of a certain book.

But I'm jumping the gun a little. The story of nanotechnology really begins in 1959 with a famous lecture called "Plenty of Room at the Bottom". It was given by Richard Feynman, one of the best scientific thinkers of this century (albeit one with some rather strange working practices). The essential theme of the lecture was that things could be built small, atom by atom if necessary. This idea was largely confined to the scientific community for many years, but Feynman is still due the credit for inventing nanotech. Then in 1986....

Engines of Creation, by Eric Drexler, is not science fiction, though there are times when you might be forgiven for thinking it so. Drexler is an enthusiast of the possible, a limitless optimist where scientific progress is concerned. As far as he is concerned, it is sufficient to show that something could be done in order to prove that it will be done. And proof he has, in plenty, right under our noses, or rather, under our epidermises.

Can you really do engineering on a molecular scale? The answer, in principle, has to be yes, because we are doing it, every second of our lives. In every cell of our bodies there are busy little structures called Ribosomes which are essentially molecular machines for building proteins. They work. If they didn't, we wouldn't be here. So all we need to do is figure out how to build these things ourselves (Drexler calls them Assemblers), how to design them to build specific molecules, and how to control the build process. Easy, huh?

The point is that once we have mastered this trick, the possibilities are limitless. We can build lots of wonderful things out of really basic, plentiful materials such as carbon, oxygen, nitrogen, hydrogen and silicon. For example, Drexler postulates a light, strong engine built from diamond (carbon) and sapphire (aluminium and oxygen). Hence Neal Stephenson's *Diamond Age*, a time of technological abundance.

We can do other things too. At present we use cell-level machines (moulds and bacteria) for things such as sewage processing and medicine. If we can design molecules that perform the same functions, and then improve upon them, our pollution problems will be over. Medicine will become simply a question of seeding the body with the right sort of molecule to root out and fix whatever is wrong. We do this to a certain extent now with drugs, but it is a crude process. It could be made a lot better.

Of course the computational problems of designing such molecules are enormous, and it is no accident that the hero of Stephenson's book works as a nanotech designer/programmer. Drexler is a big believer in AI as well, not in the naive sense of "computers that think like us", but rather in the concept of expert systems which can process much faster than us and can be taught to solve specific problems. Again we can do this sort of thing now, all we need is another decade or two with the level of progress we've seen since the 1970s.

In fairness I should point out that Drexler is not so optimistic that he thinks there will be no problems. He acknowledges that nanotech will make fearsome weapons, and the dangers of creating harmful molecules are not to be sniffed at. But, unless we find some way to curtail scientific research entirely, he believes that nanotech will happen, and sooner rather than later. So we had better start planning for it.

Is he right? In principle, probably yes, but there may be a few hurdles to overcome first. The obvious one that occurred to me is the energy source. The reason that diamond is so strong is that a lot of energy is required to force carbon atoms into such a compact structure. In nature gemstones are normally only made in the heat and pressure found inside volcanoes. If a molecular machine is to be designed that can build diamonds it will need to be supplied with energy that will allow it to force the carbon together in the same way. Drexler says that his nanomachines will make their own energy from sunlight the same way that plants do. It is a nice idea, but I have a feeling that we will find there are some things that are hard, even with nanotech.

There is one more thing I should mention whilst we are with Drexler, and that is the idea of memes. Memes have nothing to do with nanotech. They are ideas, thought patterns, things like the concept of God, or sportsmanship, or the idea that "it's Mac time". The term was, I think, first coined by Richard Dawkins (whose work should be read by anyone who thinks that the evidence for evolution is flimsy) whilst he was explaining how ideas evolve.

Drexler was quite taken by this idea, and goes on at length about how bad memes are the main thing that stand in the way of progress for his pet projects (such as space colonies

and cryonics). But the fact that memes feature heavily in his book means that they will tend to turn up in nanotech novels by people who have read it. Paul McAuley, for example, uses the idea that a good nanotech weapon would be a virus that affects the brain and induces an attachment to a particular idea. Scary.

New life for old?

“Our spacecraft are still crude, our computers are still stupid, and the molecules in our tissues still slide into disorder, first destroying health, then life itself” - Eric Drexler

“The first thing we get with nanotechnology is immortality” - Ian Watson

By 1989 nanotech was being batted around by SF writers as a possible vehicle for great new stories. Ian Watson and Ian McDonald were supposed, so McDonald says in his afterword, to have been discussing the future of telecommunications. But panels have a habit of drifting from the point, and Watson at least was fascinated by the possibilities of the new technological idea. Drexler felt that nanomachines could be used to seek out and repair damaged cells, starting as a cure for cancer, and eventually overcoming the gradual wearing out of the body that manifests itself as old age. Watson, probably correctly, held that people would want immortality far more than any of the material benefits that nanotech could bring. McDonald did what every good SF writer should: he went away and thought about this, and then said “what if”.

What if it wasn't that easy. Filling a body full of nanomachines might be kind of dangerous. You might need to make radical changes to the physio-chemical structure of the system. Sure you could animate a body with nanomachines, but you might kill it in the process. You might, however, re-animate the recently dead. And then what?

You have rather a lot of zombies. Beings whose memories may or may not be intact, whose physical abilities may well be beyond those of normal humans, but who have been certified dead, and therefore probably have no legal rights at all. An ideal slave population.

Of course, even dead people need somewhere to live: hence the Necroville. And where better to house the dead, whose resurrection process includes the ultimate in cosmetic surgery, than in the very home of artificial life: Hollywood.

Meanwhile, those who have managed to claw their way to the top of the economic pile of the living will exist in bored luxury. Nanotech provides the means, the dead provide the labour, anything is possible. But there comes a time when even anything becomes boring: there is no high, nowhere to go. So it comes that, on the Night of the Dead (Spanish America's version of Halloween), five young friends agree to meet at Terminal Café in the Necroville in search of something new.

Meet Trinidad Malcopuelo, poor little rich girl, running scared of the world. She searches for love in the hope that Mr. Wonderful will shelter and protect her. Once she found him, but Peres is dead, and living in the Necroville. Everyone else pales in comparison.

Then there is Touissant, bored heir to the industrial empire of resurrection. Disaffected and dissident, he is an ideal route to strike at his father. Or Yo Yo Mok, sampan girl made good: a corporate lawyer caught in a web of intrigue of which Gibson could be proud. A cyberpunk novel nestled in a greater whole. And Camaguey Quintana, lover of life,

builder of nanotech coral reefs, struck down by a virus contracted from his dead girlfriend. It is incurable, he has two days to live.

Finally we have Santiago Columbar, the great artist of neuro-chemistry, the man who invented all of the most famous psychotropic substances on the markets (white and black). He is the Vivienne Westwood of recreational reality bending, but he knows that if he does not burn out soon he will rust. And somewhere, deep in the Necroville, his long dead Malcolm McLaren waits for him with a promise of the ultimate trip.

Meanwhile, the dead are on the move. Remember, they have their memories. Many of them know who they were, and what they have become. They are an oppressed majority, and they know it. But in life in death there are endless possibilities. They can rebuild you, they've done it once already. Why stop with just cosmetics? There are whole new environments to conquer. Does a zombie need a space suit?

This is McDonald back to his best. I was rather disappointed with *Out on Blue Six*, his first venture into cyberpunk, but this has the imagination of *Desolation Road* and, whilst it may not match the anguish of *Hearts, Hands and Voices* (few things could), it still tears at the heart strings.

My only complaint about McDonald is that he simply cannot tell where respectful references end and plagiarism begins. The worst example is still the entire chapter of *Desolation Road* stolen from a Jim Steinman song, but it keeps happening. Here it is *Hyperion* that is the object of his affections: his Freedeadead are Ousters in all but life, and they have Templar style tree ships. I wish he wouldn't, because I'm starting to look for it in even the most innocent reference.

All in all, an excellent book (called *Necroville* in some countries and *Terminal Café* in others), and one I would recommend to anyone who says that SF authors can't write. But was it really a nanotech novel? For now, the jury is out.

Or new life forms?

Ah, but what if.....

What if it wasn't that easy with people? What if the best thing was to start with primates and "improve" them? That might just give you your slave labour force without any problems about whether they have human rights. You can use them as pets too, as gladiators, and as exhibits in theme parks. All the things people think of using robots for. Make them all infertile males as well and you have complete control over their population. Nice idea, but....

Well we have all these animal liberationists now, and you can be sure that they'll feel sorry for these things. All it takes is someone clever enough to give them brains and gonads and you have a whole new species on your hands. A species which is quite alien, and may not be all that well disposed towards its makers.

Fairyland is a strange book. It starts off as fairly standard cyberpunk set in London and telling of the origin of "fairies", the name given to the intelligent nanoware dolls. From there it moves ahead twelve years to a rather lame story about a fairy kingdom in the ruins of EuroDisney (carefully called The Magic Kingdom for obvious reasons). Finally it drops

into a weird mix of Robert Graves and a cyberpunk war novel set in Albania where the dastardly plot is finally revealed and stymied.

In reading through it I kept thinking that Paul McAuley would be a really good writer once he had had a bit of practice and had harnessed all that talent properly. Of course coming to him immediately after an Ian MacDonald novel is a mean thing to do to any writer, but I think it fair to say that there is an air of unpolishedness about the book.

Which is not to say that I didn't enjoy it. It is a darn sight better than a lot of stuff being published at the moment. But it has just won the Arthur C. Clarke Award, and I am wondering why.

In the cover blurb, Kim Newman says "*Fairyland* addresses the Big Issues in an astonishingly insightful and absorbing manner". Well, Kim and Paul have written together, and I guess I should forgive him for eulogising a mate, but this is a little over the top. Like *Necroville*, *Fairyland* addresses the issue of what it is to be human and what the future of the human race might be. Unlike *Necroville* it doesn't really offer an answer. The fairies are a viable, sentient species, but they are not human. Their destiny, which may or may not involve taking over the planet for themselves, is their own, not ours. In the end they follow the traditions of their namesakes and vanish from our sight, if not from our world. I guess that should only be expected, as they were programmed with mythological memes when they were created, but it leaves you with a feeling of the story not having got anywhere.

As futurology it is not much more insightful. The world that McAuley paints is possible, and thoroughly dismal, but it has the air of having been designed by someone whose knowledge of economics has come from reading Socialist Worker. Sometimes it read like a rant.

All in all, a strange book. One that I enjoyed reading, and was in a hurry to get to the end of, but then couldn't find anything much good to say about it. Guess you'll just have to read it yourselves and make up your own minds.

Nanotech and SF

At the end of all this, what I have to ask myself is "what has nanotechnology done for SF?". Has it spawned a new sub-genre? Has it re-kindled the flame of scientific promise so long extinguished? Has it given us new plots?

We have three fine books, *The Diamond Age* (reviewed in Emerald City #1), *Necroville*, and *Fairyland*, two of them by favourite authors of mine. And what conclusions can we come to on all the above? Probably that no one has got there yet.

All three books attempt to describe a future world in which nanotechnology is common. The conclusion, in all three cases, is that the rich will get richer and the poor poorer. Well big deal, you don't need Nostradamus for that one. Other than that, their futures are very different. *Diamond Age* has nanotech well under control, at least for the rich; *Necroville* has it changing the world in one fell military swoop; *Fairyland* has the world order all but collapsing under the strain of meme plagues and ecological disasters. None of the predictions are that convincing or, with the possible exception of McAuley's, are they intended to be.

Science-wise they are also a mixture. McAuley shows most signs of having read Drexler and regurgitated what he has learnt. His descriptions of gene splicing sound convincingly knowledgeable, and he is clearly interested in science. MacDonald, on the other hand, has just taken an idea and run with it. He throws things into the plot which are technologically way ahead of the ambience of the rest of his society simply because they help the story along. He is more interested in the theme he is developing, and in his characters, than in science. Neal Stephenson falls somewhere in between. His nanotech is thought out, but not so slavishly copied from Drexler as McAuley's. He doesn't try to explain, and possibly gets a better book as a result.

Above all, however, what nanotech has given SF is the ability to write stories containing stuff that would otherwise have been "science beyond our understanding" or "magic". Want Star Trek style replicators? They are possible with nanotech. Want resurrection of the dead, shape changers and rapid adaptation of humanity to life in space? Nanotech is the answer. Want real, live fairies just like in the old myths? Use nanotech, then it is science, not fantasy.

Of course I have hardly covered the field. There is a whole web site devoted to nanotech in SF (http://www.erinet.com/prass/nanowars/ninsf/n_in_sf.htm) which lists a vast number of books. I would like to read John Brunner's *A Maze of Stars*, as John always had the ability to think about the science and its effect on society in an intelligent and insightful manner. So far what I have found have been good stories (and I'm all in favour of that. SF is littered with the corpses of far too many books which are good science and awful stories) but not great futurology. Maybe the possibilities of nanotech are just too overwhelming, or maybe the temptation to do really weird stuff now you have a good excuse is just too strong. Either way, there is a book waiting to be written here.

And one final point. All three books contain short sequences featuring rhythmic drumming. Is there a meme plague going about, or are all these guys just fans of the Kodo Drummers? I think we should be told.

Nanotechnology today

So is it all true? Are we on the verge of a scientific breakthrough of monumental proportions? Armed with my trusty web browser, I set out to investigate.

An excellent place to start, if you are interested in nanotech, is Ralph Merkle's page on the Xero Parc web site (<http://nano.xerox.com/nano>). This gives a good basic introduction to nanotechnology and has a wealth of links to other sites. You should also check out The Foresight Institute (<http://www.foresight.org>) which seems to exist purely for promoting and encouraging nanotech research.

From what I can see, although there is an awful lot of research going on, most of it is still very much still in the lab. As you might expect, there is a lot of work going on with DNA, RNA and similar molecules. A molecule which is self-replicating has enormous possibilities in nanotech. There is also a lot of excitement about Bucky Balls.

Now that one requires a bit of explanation. For those of you flunked chemistry at school, here is a (hopefully) simple overview. Pure carbon can exist in a number of forms. Soot is a jumbled, amorphous mess. Graphite (pencil lead) is made of overlapping plates: it is

structured, but breakable. Diamond is a tightly packed lattice of interlocking tetrahedrons. But in conditions of near vacuum carbon tends towards an entirely different structure. The plates of graphite wrap round into spheres which bear a startling resemblance to the geodesic domes popularised by Buckminster Fuller (the things that look like oversized soccer balls). Hence Bucky Ball carbon, the nanotech equivalent of the ball bearing. It is a very useful little structure.

If you want any more than this you will have to start delving into scientific papers. There are things going on, but it will be a few years yet before we start seeing the benefits. Once we do, governments will start having a panic that makes the current furore over the Internet seem like a storm in a teacup. Whether we reach Drexler's utopia or McAuley's disaster will depend on what decisions they make.

Footnote

Hmm, next time I do a theme issue, I'll give myself a bit longer to research it. Book reviews and convention reports I can do off the top of my head. Other stuff takes time, and this has been a pretty busy month work-wise. Still, I hope you found it interesting and not too heavy.

Next month back to normal, if anything in this 'zine can be called normal. There should be reports on the Australian Costumers' Guild Annual Ball and the SCA Winter Revel, plus lots more books (at present my library is expanding faster than I can read it). I also must get round to some Aussie fanzine reviews. August's edition will be a Worldcon special and will therefore major in Australian authors.

Music for this issue provided by the utterly wonderful *Cranberries* who are playing in Melbourne on Wednesday night. Bonza! as we say down here.

I'm also trying, with the aid of some CDs loaned by Terry Frost, to understand jazz. Despite being utterly useless at making music, I've always prided myself on my sense of rhythm. I find jazz very confusing. It can have this really great rhythm going, and then branch off in another direction without warning. Still, is someone as talented as Sting can say that jazz needs to be worked at before you can appreciate it I guess I can't complain. Anyone care to help enlighten me?