NewScientist

April 9, 2005

The immortals' club

By Greg Klerkx

My brush with immortality began almost by accident. Late last year, rumours began to drift through my email inbox that some of the entrepreneurs who had backed the Ansari X prize – which I had been writing about for years – were working on a new project. They were helping to develop and fund an institute to solve the "problem" of death, called the Institute of Biomedical Gerontology.

At first I didn't really give it much thought. True, I have recently turned 40, but generally I feel young and fit enough not to care too much about my mortality. And in any case, the fanciful idea you can actually extend a life by more than a few years is surely best confined to science fiction. It must be bunkum.

But then, a few months later, another email arrived. A friend wrote to tell me about a new book by futurologist Ray Kurzweil, a man I had long admired. Back in the 1980s, Kurzweil predicted that the internet, then an obscure government communications network, would rise to global dominance. He went on to invent the flatbed scanner, among many other things, and win the US National Medal of Technology. Impressive credentials indeed. But now it looked as if he had gone too far. In his new book, he was predicting that the next big thing would be nothing less than eternal life. And that's not all: he had a recipe to achieve it.

I couldn't help but be struck by the coincidence, and it wasn't a happy one. OK, recent years have been peppered with discoveries that have slowly begun to illuminate the mechanisms of ageing, but I know that most biologists would laugh at the idea of immortality. "It's not science, it's hype," says S. Jay Olshansky, a bio-demographer at the School of Public Health of the University of Illinois at Chicago. Given current trends, the US Census Bureau estimates that life expectancy will on average grow by about six years by 2050. Not to be sniffed at, but not exactly forever.

Even so, I couldn't help being intrigued. Kurzweil and the X prize guys together... And so I started to dig. And the more I dug, the more interesting it got.

Kurzweil and the X prizers, it turns out, are not alone. In fact, they are part of a movement whose ranks, hitherto populated with fringe groups such as the Betterhumans and the Extropians, are swelling with mainstream researchers prepared to risk their reputations by claiming they could conquer death.

To date, gerontology has largely been a cautious and conservative field dedicated to understanding the biology of ageing. The new immortalist movement takes a wholly different perspective. Kurzweil and others, such as Marvin Minsky,

professor of artificial intelligence at Massachusetts Institute of Technology and founder of the MIT Media Lab, Aubrey de Grey, a self-taught biologist, who works as a computer technician in the genetics department at the University of Cambridge, and Gregory Stock, director of the programme on medicine, technology and society at the University of California, Los Angeles, and author of *Redesigning Humans: Our inevitable genetic future* , think of ageing not as an immutable fact of life, but as an engineering problem that can be solved.

And they don't just sit around talking about it. The immortalists are organising conferences to spread their ideas. They are attracting media coverage, convincing established scientists to endorse their claims, and courting rich businesspeople to fund their research. That doesn't make them right, of course, but it did make me question my scepticism. Could they be onto something? Is it possible to live forever?

So I rang Kurzweil to find out. And it's true: the 56-year-old is staking his reputation on the imminence of immortality, or at least a decent approximation of it. I asked him how long he expected to live – 150 years? 200 years? A thousand years? "Let's just say I'm not planning on dying," he says.

Kurzweil's confidence is based largely on the fact that biotechnology has at last yielded to the kind of exponential progress that created the information technology revolution. For example, the cost of DNA sequencing is halving roughly every year. "It took 15 years to sequence HIV," says Kurzweil. "We sequenced SARS in 31 days," Other areas of biotechnology are racing ahead at a similar pace, he says.

Kurzweil believes that if you take today's knowledge and grow it exponentially, radical life extension becomes not just possible but inevitable. The basic idea is to use whatever is available right now to prolong your life, confident that by the time you've exhausted that avenue, technology will have moved on and you can do it again with the latest new developments in life extension. He calls this strategy "a bridge to a bridge". I see it more like ascending an endless property ladder without ever having to accept the granny flat.

Kurzweil and co-author Terry Grossman, a nutritionist and alternative medicine specialist, have even mapped out the first three bridges to eternal life. Number one is to use knowledge available today to keep you in tip-top condition. Kurzweil proudly announces that he takes 250 different dietary supplements a day, including alpha lipoic acid, grapeseed extract, *N* -acetylcysteine and milk thistle, which are all supposed to boost physical health in a variety of ways, and ginkgo biloba, acetyl--carnitine and vinpocetine to increase "brain health". He also has weekly intravenous infusions of phosphatidylcholine 4, which he says "rejuvenates all of the body's tissues by restoring youthful cell membranes". And he avoids all vices, even coffee. Adherence to this rigorous regime keep his body and mind as healthy as that of a 40-year-old, says Kurzweil, an age he anticipates will be his eternal state as he leaps from one bridge to the next.

Bridge two involves the realisation of medical techniques already under development, such as genetic tests to detect whether you are more likely to

develop cancer, determine its propensity to spread and which therapies it is most likely to respond to.

Bridge three advances are more far-fetched. Kurzweil imagines a personalised army of nanoscale robots that would replace his digestive system, extracting the optimum amount of nutrition from the food he eats and delivering it directly to every organ and tissue in his body.

He points to recent advances in nanotechnology, such as the 3-millimetre-long swimming robot developed by a group headed by Tao Mei of the Chinese Academy of Sciences, Beijing. Mei hopes it will soon be shrunk further and could ultimately be used for drug delivery or artery-clearing. "We're 20 years away from the golden era of nanotechnology," says Kurzweil, adding "I didn't just start making predictions yesterday."

Another man with a plan, not to mention a less-than-catchy catchphrase, is Aubrey de Grey. His strategy to "solve" death is called Strategies for Engineered Negligible Senescence(SENS). De Grey has become the controversial poster child for the new engineers of life extension, while his lanky frame and dramatic, chest-length beard have earned him less-than-flattering comparisons to Rasputin. In person, he is an engaging fast talker who enjoys nothing better than a good chat about the meaning of life extension. And despite his image, he had no problem attracting some of the world's luminaries in reproductive biology, cloning and stem cell research to his inaugural anti-ageing conference at the University of Cambridge in September 2003. The second is scheduled for September this year, again in Cambridge, and the line-up of speakers is similarly impressive.

Maverick plan

De Grey knows he is outside the mainstream but insists he is on the right track. "Most of my colleagues in gerontology do appreciate that ageing in general is not a good idea, but they're completely convinced that nothing can be done about it in the near term," he says. "They're wrong. If I make it to 110, I reckon I'll have at least a 50:50 chance of making it to 1000 and quite possibly much more."

De Grey trained as a computer programmer but became interested in the science of ageing after meeting his wife, Adelaide, a research biologist. De Grey launched himself on a binge of self-teaching, devouring the literature on senescence and ageing. He says he was driven less by a desire for personal immortality than by sheer intellectual curiosity. "Defeating ageing is probably the greatest challenge in biology, and I've always been drawn to the biggest challenges," he says. His studies led him to formulate SENS, which boils down to halting or reversing the damage that leads to ageing. De Grey says these fall into seven rather technical categories, all of which will be conquered in mice inside 10 years, he predicts.

His critics point out that he has never conducted an iota of laboratory research and that his work – SENS in particular – is entirely theoretical. "There's only so much you can know without getting into the lab and doing the work," says Olshansky. This doesn't bother de Grey. "I'm a theoretical gerontologist," he says. "In physics, it's understood that it's necessary to have people who are

narrowly focused on experimental work, and that it's also necessary to have people who are sitting back thinking, reading a bit more widely. Most of what I do is identify connections that other people don't see."

But theorising isn't enough. De Grey wants change and he wants it now, and for that he needs money. Backed by Peter Diamandis, the man who masterminded the Ansari X prize for the first private manned flight into space, de Grey is now pursuing purses to fund a new centre called the Institute of Biomedical Gerontology. It will focus solely on making SENS reality. He says he needs at least $100 million. One confirmed SENS backer is Gary Hudson, another private space travel pioneer.

Most mainstream gerontologists, however, are circumspect. "Research on the biology and genetics of ageing is currently at a similar state to cancer research 20 years ago," says Howard Jacobs, a geneticist at the University of Tampere, Finland. Jacobs works on mutations in mitochondrial DNA, which he believes have a major impact on expanding healthy human lifespans. Last year his team won the prestigious Descartes prize for scientists based in Europe. Nevertheless, Kurzweil's pronouncements rankle with Jacobs. "Knowledge does not necessarily translate into technology on a foreseeable timescale," he says.

Felipe Sierra, a programme director at the US National Institute of Aging, agrees. "The main problem with the recipes for radical life extension is that they have multiple complex components," he says, "and we are still far from fully understanding any of them, let alone their interaction."

Cell senescence is a case in point. Most scientists believe senescence arose as a way to suppress tumours. Remove senescence, and you could remove a key natural barrier to the development of cancer. The trick is to be able to remove only senescent cells, but not senescence itself. "We don't currently know how to do this," says Sierra.

But the immortalists are not entirely without support. One of the few biologists to tacitly endorse de Grey's aims is Michael Rose, a biogerontologist at the University of California, Irvine. "The concept of natural death is bogus," he says. Rose has spent the past 30 years studying ageing in fruit flies and believes his work holds the key to understanding the cause of cell senescence. But he concedes that radical life extension may not happen in his lifetime. Rose declined to comment specifically on either de Grey's SENS or Kurzweil's "bridge" scheme. "I'm very confident that some time in this century, the lives of everyday people will be transformed by the slow, methodical work we're doing now," he says. "But Jules Verne science doesn't work."

Olshansky thinks there are deeper, more fundamental problems with de Grey's thinking. Treating the human body like a machine is just plain wrong, he says. "Let's say you go ahead and make the seven changes Aubrey suggests, and hypothetically you live to 200 or 300. He assumes the effect will be the same on the mind as on the body." Olshansky points out most gerontology experiments are performed on tiny creatures, such as roundworms and fruit flies. The psychological impact of dramatically altering human life expectancy is completely unknown. Most people live

their life in an arc that they expect will last around 70 to 80 years and that splits up into known and manageable phases of life. What would you do if you had 300 years in hand? "You can't ask a fruit fly, 'How do you feel about it?'" says Olshansky.

I can't deny that the possibility my life could be extended by a few decades, let alone centuries, is extremely tempting, if only to realise my life-long dream of travelling into space. But I won't be subjecting myself to intravenous infusions, taking any supplements, or giving up on my morning shot of java just yet. Life's too short.

Greg Klerkx is a science writer based in London