

Fighting the common fate of humans: to better life and beat death

Written by Cathal D. O'Connell, Centre Manager, BioFab3D (St Vincent's Hospital), University of Melbourne



Can technology help us to beat death? Shutterstock/Zwiebackesser

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The oldest surviving great work of literature tells the story of a Sumerian king, [Gilgamesh](#), whose historical equivalent may have ruled the city of Uruk some time between 2800 and 2500 BC.

A hero of superhuman strength, Gilgamesh becomes instilled with existential dread after witnessing the death of his friend, and travels the Earth in search of a cure for mortality.

Twice the cure slips through his fingers and he learns the futility of fighting the common fate of man.

Merging with machines

Transhumanism is the idea that we can transcend our biological limits, by merging with machines. The idea was popularised by the renowned technoprophet [Ray Kurzweil](#) (now a director of engineering at Google), who came to public attention in the 1990s with a string of astute predictions about technology.

In his 1990 book, [The Age of Intelligent Machines](#) (MIT Press), Kurzweil predicted that a computer would beat the world's best chess player by the year 2000. It [happened in 1997](#).

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He also foresaw the explosive growth of the internet, along with the advent of wearable technology, drone warfare and the automated translation of language. Kurzweil's [most famous prediction is what he calls](#)

“the singularity” – the emergence of an artificial super-intelligence, triggering runaway technological growth – which he foresees happening somewhere around 2045.

In some sense, the merger of humans and machines has already begun. Bionic implants, such as the [cochlear implant](#), use electrical impulses orchestrated by computer chips to communicate with the brain, and so restore lost senses.

At [St Vincent's Hospital](#) and the [University of Melbourne](#), my colleagues are developing other ways to tap into neuronal activity, thereby giving people natural control of a robotic hand.

These cases involve sending simple signals between a piece of hardware and the brain. To truly merge minds and machines, however, we need some way to send thoughts and memories.

In 2011, scientists at the University of Southern California in Los Angeles took the first step towards this when they [implanted rats with a computer chip](#) that worked as a kind of external hard drive for the brain.

First the rats learned a particular skill, pulling a sequence of levers to gain a reward. The silicon implant listened in as that new memory was encoded in the brain's hippocampus region, and recorded the pattern of electrical signals it detected.

Next the rats were induced to forget the skill, by giving them a drug that impaired the hippocampus. The silicon implant then took over, firing a bunch of electrical signals to mimic the pattern it had recorded during training.

Amazingly, the rats remembered the skill – the electrical signals from the chip were essentially replaying the memory, in a crude version of that scene in The Matrix where Keanu Reeves learns (downloads) kung-fu.

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The Matrix: I know king fu.

Again, the potential roadblock: the brain may be more different from a computer than people such as Kurzweil appreciate. As [Nicolas Rougier](#), a computer scientist at Inria (the French Institute for Research in Computer Science and Automation),

[argues](#)

, the brain itself needs the complex sensory input of the body in order to function properly.

Separate the brain from that input and things start to go awry pretty quickly. Hence sensory deprivation is used as a form of torture. Even if artificial intelligence is achieved, that does not mean our brains will be able to integrate with it.

Whatever happens at the singularity (if it ever occurs), Kurzweil, now aged 68, wants to be around to see it. His [Fantastic Voyage: Live Long Enough to Live Forever](#) (Rodale Books, 2004) is a guidebook for extending life in the hope of seeing the longevity revolution. In it he details his dietary practices, and outlines some of the 200 supplements he takes daily.

Failing that, he has a plan B.

Freezing death

The central idea of cryonics is to preserve the body after death in the hope that, one day, future civilisations will have the ability (and the desire) to reanimate the dead.

Both Kurzweil and de Grey, along with about 1,500 others (including, apparently, Britney Spears), are [signed up to be cryopreserved](#) by [Alcor Life Extension Foundation](#) in Arizona.

Offhand, the idea seems crackpot. Even in daily experience, you know that freezing changes stuff: you can tell a strawberry that's been frozen. Taste, and especially texture, change unmistakably. The problem is that when the strawberry cells freeze, they fill with ice crystals. The ice rips them apart, essentially turning them to mush.

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That's why Alcor don't freeze you; they turn you to glass.

After you die, your body is drained of blood and replaced with a special cryogenic mixture of antifreeze and preservatives. When cooled, the liquid turns to a glassy state, but without forming dangerous crystals.

You are placed in a giant thermos flask of liquid nitrogen and cooled to -196°C , cold enough to effectively stop biological time. There you can stay without changing, for a year or a century, until science discovers the cure for whatever caused your demise.

"People don't understand cryonics," says Alcor president Max More in a YouTube tour of his facility. "They think it's this strange thing we do to dead people, rather than understanding it really is an extension of emergency medicine."

Alcor president Max More.

The idea may not be as crackpot as it sounds. Similar cryopreservation techniques are already being used to preserve human embryos used in fertility treatments.

"There are people walking around today who have been cryopreserved," More continues. "They were just embryos at the time."

One proof of concept, of sorts, [was reported](#) by cryogenics expert Greg Fahy of [21st Century Medicine](#) (a privately funded cryonics research lab) in 2009.

Fahy's team removed a rabbit kidney, vitrified it, and reimplanted into the rabbit as its only working kidney. Amazingly, the rabbit survived, if only for nine days.

More recently, a new technique developed by Fahy enabled the perfect preservation of a rabbit brain through vitrification and storage at -196°C . After rewarming, advanced 3D imaging revealed that the rabbit's "connectome" – that is, the connections between neurons – was undisturbed.

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Unfortunately, the chemicals used for the new technique are toxic, but the work does raise the hope of some future method that may achieve the same degree of preservation with more friendly substances.

That said, preserving structure does not necessarily preserve function. Our thoughts and memories are not just coded in the physical connections between neurons, but also in the strength of those connections – coded somehow in the folding of proteins.

That's why the most remarkable cryonics work to date may be that performed at Alcor in 2015, when scientists managed to glassify a tiny worm for two weeks, and then [return it to life with its memory intact](#).

Now, while the worm has only 302 neurons, you have more than 100 billion, and while the worm has 5,000 neuron-to-neuron connections you have at least 100 trillion. So there's some way to go, but there's certainly hope.

In Australia, a new not-for-profit, [Southern Cryonics](#), is planning to open the first cryonics facility in the Southern Hemisphere.

"Eventually, medicine will be able to keep people healthy indefinitely," Southern Cryonics spokesperson and secretary Matt Fisher tells me in a phonecall.

"I want to see the other side of that transition. I want to live in a world where everyone can be healthy for as long as they want. And I want everyone I know and care about to have that opportunity as well."

To get Southern Cryonics off the ground, ten founding members have each put in A\$50,000, entitling them to a cryonic preservation for themselves or a person of their choice. Given that the company is not-for-profit, Fisher has no financial incentive to campaign for it. He simply believes in it.

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"I'd really like to see [cryonic preservation] become the most common choice for internment across Australia," he says.

Fisher admits there is no proof yet that cryopreservation works. The question is not about what is possible today, he says. It's about what may be possible in the future.

Cathal D. O'Connell does not work for, consult, own shares in or receive funding from any company or organisation that would benefit from this article, and has disclosed no relevant affiliations beyond the academic appointment above.

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