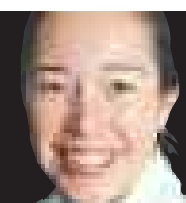




NYSSA SKILTON

BYTE SIZE



**M**uscular trout with "six-pack abs" may help researchers boost the aquaculture industry. The genetically modified rainbow trout, developed at the University of Rhode Island in Kingston in the United States, have 15-20 per cent more muscle mass than standard fish. Researchers at the university spent 500 hours injecting 20,000 rainbow trout eggs with various DNA types designed to inhibit myostatin, a protein that slows muscle growth. Of the eggs that hatched, 300 fish carried the gene that led to increased muscle growth and after two years they exhibited the "the six-pack ab" effect, even though fish lack standard abdominal muscles. The researchers hope their work will enable fisheries to grow larger fish without increasing the amount of food the fish are fed.

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About 20 per cent of Americans believed US President Barack Obama was a Muslim during the 2008 presidential campaign. Now media analysts from the University of Georgia in Athens have conducted a study to find out why. Professor Barry Hollander analysed surveys of more than 2400 people taken at three points during the campaign to find out if exposure to news media affected misperceptions about Obama's faith. He found respondents who were younger, less educated, politically conservative, and believed in a literal interpretation of the Bible were more likely to be among those who shifted to a perception of Obama as Muslim. For these groups of people, he found exposure to news media did nothing to improve their political knowledge. He says, "Ultimately, the message here is that people believe what they want to believe."

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Explore the marvellous skill of animal flight at a public lecture in Canberra tomorrow. A senior lecturer at the University of New South Wales, Australian Defence Force Academy, Dr John Young, will speak about what we can learn from nature about flight, how we can improve on nature's designs and how this is being applied to the design of robotic micro-air vehicles. The talk, presented by the Sydney section of the American Institute of Aeronautics and Astronautics, will take place at 6pm at the Australian National University Engineering Lecture Theatre, Engineering Building No 32, off North Road. RSVP to [aiaa.sydneysection@gmail.com](mailto:aiaa.sydneysection@gmail.com)

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Australian researchers are uncovering new information about genes after an international consortium recently unravelled the genome of the pea aphid. Dr Owain Edwards is leading a CSIRO team in research designed to reveal which genes control certain functions in the aphid. "This sort of 'epigenetic' information – where changes in an organism happen without changes in its DNA – is now known to be important in controlling diseases such as cancer and diabetes," he says.

■ ■ ■

A new form of energy storage device may help mobile phones and laptops run for longer, according to a New Zealand electrical engineer. Waikato University researcher Nihal Kularatna is exploring new uses for supercapacitors, which are beginning to appear in products such as electric vehicles and IT memory back-up equipment. Traditional capacitors store electrical charge on two conducting sheets separated by a thin insulating layer. Supercapacitors, however, are based around activated charcoal, or some other highly porous material, which gives them an enormous internal surface area and vastly greater electrical storage capacity.

# The science of Avatar



CHARLES LINEWEAVER

**A**s a planetary scientist I thought it should be part of my duties to watch the movie, *Avatar*. I went once for fun, and a second time to evaluate the merits of the science. This is my report.

*Avatar* takes place between May and August in the year 2154 on a hypothetical Earth-like moon (Pandora) in orbit around a Saturn-sized planet (Polyphemus) which is in orbit around the real star Alpha Centauri A. Alpha Centauri is a triple-star system. Its three stars (A, B and Proxima Centauri) are the closest stars to our sun – 4.3 light years away.

It takes our hero (Jake Sully), five years, nine months and 22 days in cryogenic hibernation to travel the 4.3 light years to Pandora. Thus the average speed of the space craft was about 75 per cent (= 4.3/5.8) the speed of light. That sounds a bit optimistic for only 144 years from now, but mankind's first interstellar missions will probably be launched during our lifetimes.

Flying in 3-D through a Pandoran rainforest on a mountain banshee (a giant, four-winged pterosaur), and then falling in love with a sexy, sentient 3m-tall, blue-skinned humanoid named Neytiri, was a vicarious thrill. But it was also an interesting anthropological experiment in cross-cultural understanding. Could audiences of humans identify with giant blue-skinned hunters and gatherers with tails? Yes, they could – millions and millions of them. *Avatar* has grossed more than \$2 billion – more than any other movie in the history of the universe. However, the success of this experiment in empathy

produced unanticipated side-effects. According to some blogs, many *Avatar* fans are suffering from depression brought on by their inability to cope with the fact that they live on Earth, not Pandora. Victims are trying unsuccessfully to find ways to cope with Earth not being as pristine and unspoiled as Pandora. And many, through the prolonged exposure of multiple screenings, have become addicted to living with the Na'vi.

Some basic science may be able to help these victims. One reason Pandora looks so pristine is that its surface area is about 60 per cent as large as Earth's surface, while the population of the Na'vi inhabitants is less than the population of Canberra. How can that be? What Malthusian device has kept the Na'vi numbers so low? Disease? Infanticide? Being eaten by Toruks? Spontaneous abortions? Tribal wars?

Director James Cameron has kept this big dirty secret from us. Without running water, sewers, vaccines or any knowledge of microbiology, the level of child mortality must be similar to the high rates among terrestrial hunters and gatherers. There are almost 7 billion humans on Earth. If only a small fraction of *Avatar* fans followed their romantic whims and emigrated to Pandora, the floating boulders of the Hallelujah Mountains would probably be covered with condos.

There is another planetary issue that Pandoraphiles should be aware of. Stars become more luminous over time. Thus, over the next billion years or so as the sun gets more luminous, the Earth will heat up. Even if we reduce carbon dioxide to the minimum needed to feed plants their carbon, the increasing luminosity of the sun will gradually increase the Earth's temperature, putting more water above the tropopause where it photo-dissociates into hydrogen and oxygen. The hydrogen escapes to space and the net

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1. What is the "Goldilocks zone"?
2. How many infectious diseases have been eradicated?
3. Rank the following in terms of their iron content: dung beetle, beef, termite, fish.
4. Which organs produce endorphins?
5. True or False. Baleen whales have only one blowhole.

**Answers:** 1. The Goldilocks Zone is the not too hot and not too cold, but just right, region around a star where a planet can maintain liquid water. 2. One. Smallpox is the only disease to have its prevalence amongst the global population reduced to zero. 3. Termite (35.5 grams per 100 grams), dung beetle, (7.7), beef (3.5), fish (1.0). 4. The pituitary gland and the hypothalamus (a part of the brain). 5. False. Baleen whales such as blue whales and humpback whales have two blowholes (analogous to other mammals having two nostrils). Toothed whales (sperm whales, orcas, dolphins) have only one nostril, the other nostril having evolved into a tool for echolocation. The Australian Government has just submitted a new proposal to the International Whaling Commission to strengthen whale conservation efforts.

effect is that the Earth loses its water and dries out.

This is not good, but Pandora's situation near Alpha Centauri A is worse. Alpha Centauri A is 10 per cent more massive than our sun and it is about a billion years older than our sun. Thus, Pandora will

probably heat up, lose its water and become lifeless before the Earth does. Even an unobtainium flux vortex couldn't stop that.

Alpha Centauri A and B are the same distance from each other as Neptune is from the sun. So there should have been two suns in the Pandoran sky for much of the time. Cameron included the faint and much more distant Proxima Centauri in only one brief scene but seems to have forgotten the bright and close Alpha Centauri B. Still, Cameron did a lot of scientific homework. For example, the Alpha Centauri system has been and is being intensively scrutinised for any signs of planets. So far none has been detected. Cameron created his Saturn-sized Polyphemus just below the current threshold of our best planet-sniffing instruments.

So there really could be a planet like Polyphemus in orbit around Alpha Centauri A.

The idea of a moon as big as Pandora is harder to accept. Pandora would be 10 times larger than the largest moon in our solar system, Ganymede, which orbits Jupiter. Moons just don't come as big as Pandora.

Pandora is a rainforest, with huge beautiful trees, vines and bioluminescent insects. With all that water, it would be an ideal place for a leech. But there don't seem to be any leeches, ticks or even mosquitoes. No ice cream, no electricity and the possible emigration show-stopper, no movies. Growing to adulthood in vitro, like the Avatars did, is also not a recommended procedure for humans or Na'vi. Cameron's Pandora is probably as ephemeral a paradise as Bougainville's Tahiti. Don't be fooled by the brochure.

■ Dr Charles Lineweaver is from the Research School of Astronomy and Astrophysics and the Research School of Earth Sciences at the Australian National University. He is also a senior fellow at the Planetary Science Institute.