

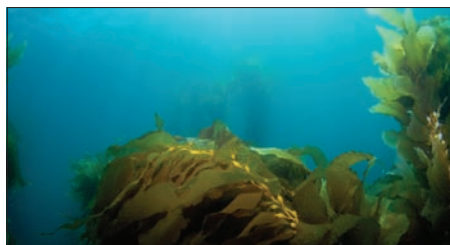
Sciencewatch

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Brown algae give a boost to batteries

Lithium-ion batteries are typically made with conductive carbon electrodes, but with the use of silicon instead of carbon their capacity could be dramatically increased. The stumbling block has been that silicon-based electrodes tend to degrade quickly. But that has now been overcome thanks to an unlikely source – brown algae, which include giant kelp.

Igor Kovalenko of the Georgia Institute of Technology and colleagues have shown that electrodes made from silicon nanopowder and alginate – a natural polysaccharide



Giant kelp (Macrocystis pyrifera) could help to power your laptop for up to eight times longer than with current battery technology. (Image credit: Naluphoto/Dreamstime.com)

obtained from brown algae – makes for a stable battery that has eight times the capacity of state-of-the-art graphitic electrodes. Alginate also has the advantage of being cheaper and more environmentally friendly than the plastics used instead in current technologies. The increased lifetime is a really remarkable improvement that would will undoubtedly be welcomed by anyone with a laptop computer.

● Further reading

I Kovalenko *et al.* 2011 *Science* **334** 75.

Gravity on large scales

In cosmology, general relativity is often assumed to be valid out to arbitrarily large scales, but whether this is true or not has been difficult to test directly. Now, Radosław Wojtak and colleagues of the Niels Bohr Institute in Copenhagen have managed to use archived data from galaxies in clusters to make a direct test of general relativity out to scales of 1–10 megaparsecs. Working from a new galaxy cluster catalogue from the Sloan Digital Sky Survey they used data on 7800 galaxy clusters and 120 000 galaxy redshifts.

The new technique may be extended in the future, but for now it means that the standard gravitational redshift has been tested over scales spanning 22 orders of magnitude. Still viable are models such as $f(R)$ gravity, which can be used to explain dark energy. However, the tensor–vector–scalar (TeVeS) theory, a relativistic version of modified Newtonian dynamics (MOND) that eliminates the need for dark matter, seems to be excluded.

● Further reading

R Wojtak 2011 *Nature* **477** 567.

The biggest virus

Viruses are often thought of as being tiny, but some are relatively huge and may have actually descended from cells. The giant mimivirus *Acanthamoeba polyphaga mimivirus*, for example, is some 400 nm across. Discovered in 2003, it has many genes previously thought to be unique to cellular life, but it was an open question as to whether it might have stolen them from some sort of cell. Jean Michel Claverie of the Structural and Genomic Information

Word order

Little is known about the hypothetical protolanguage from which all modern ones descended, which could date back 50 000 years. However, Merritt Ruhlen of Stanford University and Murray Gell-Mann of the Santa Fe Institute in New Mexico argue that the word order must have been subject-object-verb. In a family tree of 2200 languages, living and dead, based on how similar sounds were used to convey similar meanings, they found that subject-verb-object (*I drink beer*) languages always descended from subject-object-verb (*I beer drink*) ones – never the other way round.

● Further reading

M Ruhlen and M Gell-Mann 2011 *PNAS*.

Laboratory in Marseille and colleagues have now found a huge new virus in sea water off the coast of Chile. The discovery of *Megavirus chilensis* – which seems to be a distant relative of the mimivirus and shares its cell-like genes – bolsters the case that at least some viruses had cells as ancestors.

● Further reading

D Arslan *et al.* 2011 *PNAS*, doi:10.1073/pnas.1110889108.

Underground ice

In winter it is easy to see how much damage ice causes when it forms underground, but there may be more to the process than meets the eye. Robert Style of the University of Oxford and colleagues have created a physically intuitive model that goes a long

way towards explaining what goes on, and in particular how “ice lenses” form, pushing up large regions of ground. Naively it might seem that this is a result of ice taking up more space than water, but similar behaviour is found with liquids that do not shrink on freezing.

A key insight is a new concept called “geometrical supercooling”. The idea is that ice crystals can be prevented from growing through more water freezing if they are confined and under pressure. More and more water can be drawn up into a supercooled region via thermomolecular pressure gradients or “cryosuction”, until the soil gives way and an ice lens forms. In this case, it is not just that water expands on freezing, but crystal growth that does the pushing.

● Further reading

R W Style *et al.* 2011 *Phys. Rev.* **E84** 0414202.

Lizards with placentas

Recent work with lizards has shaken the long-standing assumption in biology that only mammals have placentas. Daniel G Blackburn of Trinity College in Hartford, Connecticut, and Alexander F Flemming of Stellenbosch University have found that a lizard – the skink *Trachylepsis ivenzii* – is an exception. While many reptiles give birth to live young, they do not have embryos that implant themselves into the mother and connect to her circulatory system via a true placenta. The discovery of placentas in two distinct groups of animals may help biologists to figure out how they evolved.

● Further reading

D J Blackburn and A F Flemming 2011 *Journal of Morphology*, doi: 10.1002/jmor.11011.