

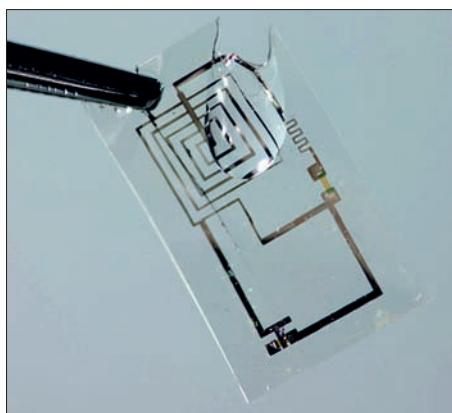
Sciencewatch

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Silicon electronics that can disappear

Researchers in the US have found a way to produce silicon devices that degrade, opening the door to biodegradable electronics and medical implants that can be absorbed safely in the body. John Rogers and colleagues at the University of Illinois at Urbana-Champaign, Tufts University and Northwestern University, have developed a new type of technology that they call “transient electronics”. Based on earlier work with ultrathin sheets, the new devices dissolve in a few days – for example, in biological fluids.

Silicon hydrolyses in the body at a rate of about 1 nm a day. So, working from this understanding, Rogers and his co-workers



have built devices out of 100-nm-thick silicon, using magnesium for conductors, magnesium or silicon oxide for insulators and silk as a substrate. Three weeks after implanting these in mice, the team’s devices leave only residues of silk – with the silk taking a little longer to break down.

● Further reading

S-W Hwang *et al.* 2012 *Science* **337** 1640.

A biodegradable integrated circuit during dissolution in water. (Image credit: Beckman Institute, University of Illinois and Tufts University/Courtesy J Rogers.)

Evolution caught in the act

Opponents of evolution often complain that it is not seen in real time – but now that objection is gone. Zachary Blount of Michigan State University and colleagues grew *E. coli* bacteria for almost 25 years and followed them for more than 56,000 generations starting in 1988. The idea was to see if some of them would evolve to consume citrate as a nutrient. While *E. coli* may have been able to do this long ago, the ability to consume citrate in the presence of oxygen was lost at least 13 million years ago.

Around 33,000 generations into the experiment, one strain learnt the trick. It took three steps, taking place over more than 13,000 generations, to develop this ability. This experiment demonstrates that evolution really does take place and it even reveals how pre-existing genetic information is reshuffled to give rise to new characteristics. Darwin would have been thrilled.

● Further reading

ZD Blount *et al.* 2012 *Nature* **489** 513.

The smallest ice crystal

How many water molecules does it take to make a crystal? About 275 ± 25 , according to Christoph Pradzynski of the University of Göttingen and colleagues. The researchers developed a technique that allowed them to measure for the first time the infrared spectra of precisely selected molecular clusters in a size range that was previously inaccessible. Studying size-selected clusters with the

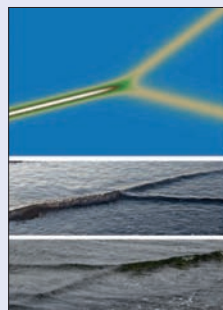
Nonlinear-waves at the beach

Most people think of low-amplitude ocean waves as being linear to a good approximation but it turns out that this is far from the case. Mark Ablowitz and Douglas Baldwin of the University of Colorado in Boulder report on nonlinear interactions that occur every day at low tide on two flat beaches at Nuevo Vallarta, Mexico, and Venice beach, California. Waves that intersect in X and Y shapes are closely related to interacting “line soliton” solutions of the nonlinear Kadomtsev–Petviashvili equation.

Their observations follow a tradition of soliton-spotting that began in 1834, when a naval architect, J S Russel, first recorded a solitary wave on the Union Canal in Edinburgh. They show that these nonlinear interactions are not rare events, as had been previously thought. Apart from being something to look out for while on holiday, such interactions play an important role in the formation of tsunamis – though, of course, with much larger waves.

● Further reading

M J Ablowitz and D E Baldwin 2012 *Phys. Rev.* **E86** 036305.



Plot of a Y-like interaction, top, and photos at the beaches in Mexico, centre, and California.

number of water molecules ranging from 85 to 475, they found that the absorption band at around 3200 cm^{-1} , which is indicative of crystalline ice, first appears in clusters of about 275 molecules.

The results should help to refine the interaction potentials of water that are used in predicting water’s macroscopic properties and the techniques could also be applied to other substances.

● Further reading

C C Pradzynski *et al.* 2012 *Science* **337** 1529.

Reaching the Planck scale at accelerators

The Planck scale – around 10^{-35} m – is far below scales that can be reached with current accelerators; even the LHC gets down to only about 10^{-19} m . However, there may yet be hope. Vahagn Ghaharibyan of DESY, Hamburg, has looked at laser Compton-scattering from leptons at current and future accelerators for effects of a modified dispersion relation that is expected in many quantum-gravity models. Despite the deviations from the usual relation being suppressed by the Planck scale, it turns out that the effective change in refractive index of space could be detectable. For 6 GeV electrons at PETRA-III, a scale of 10^{-31} m could be reached, while at a future 250 GeV lepton collider, the real Planck scale could come into view.

● Further reading

V Ghaharibyan 2012 *Phys. Rev. Lett.* **109** 141103.