

CHEMISTRY

Hydrogen can be stored as acid

Hydrogen gas holds promise as a carbon-free fuel, but is difficult to store and transport because it is highly flammable, diffuse and has a low energy density. Jonathan Hull at Brookhaven National Laboratory in New York and his colleagues have found a possible way to store hydrogen as an aqueous solution of formic acid (HCOOH), which has a higher energy density.

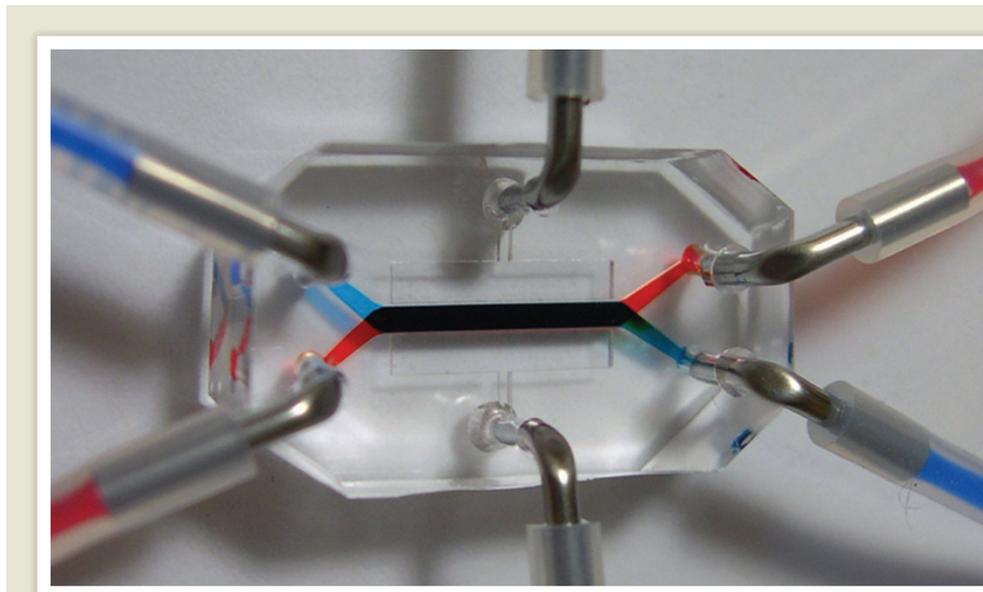
At ambient temperature and pressure, an iridium catalyst dissolved in water causes H₂ to react with carbon dioxide to form the acid under mildly basic conditions. Acidifying the solution triggers the release of pure pressurized H₂ gas. Because of the mild conditions needed for the reactions, the work could eventually lead to a mechanism for H₂ storage.

Nature Chem. <http://dx.doi.org/10.1038/nchem.1295> (2012)

MATERIALS

Slicing silicon with less waste

Cutting silicon blocks into thin wafers for solar cells and other applications generates a lot of wasted metal because



BIOENGINEERING

A pulsating gut on a chip

A coin-sized device created by a team at Harvard University mimics the structure and physiology of the human intestine by supporting gut microbes and imitating the organ's rhythmic motion.

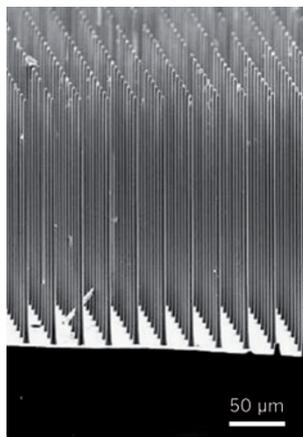
Donald Ingber and his colleagues at the Wyss Institute in Boston, Massachusetts, built the chip (**pictured**) out of a clear polymer. It contains two microscopic fluid channels separated by a porous, flexible membrane. Human gut epithelial cells, which line the gut's surface, cover the membrane and supported the growth of a common gut bacterium, *Lactobacillus rhamnosus*. The researchers

simulated gut contractions, or peristalsis, by applying suction through two side chambers. In response, the epithelial cells formed folds similar to the finger-like protrusions, or villi, that line the inner intestinal wall.

The gut tissue layer blocked the flow of small molecules between the channels, and this barrier function improved with the presence of the bacteria. The authors say that their device is a better intestinal mimic than cells in static culture and suggest that it could be used for drug screening and toxicity tests.

Lab Chip <http://dx.doi.org/10.1039/C2LC40074J> (2012)

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of the width and vibration of the mechanical sawing wire typically used. Sungho Jin at the University of California, San Diego, and his colleagues report a way to etch silicon into various intricate shapes that produces an order of magnitude less waste than conventional approaches.

The authors adapted a common etching technique, depositing a catalytic gold and iron layer on top of certain sections of a silicon wafer and using other

chemicals to dissolve those parts of the silicon away. Strong neodymium magnets guide the chemical etching, allowing the researchers to slice silicon in any desired direction, forming sheets, microneedles, nanowires (**pictured**) and tunnels. Magnetically guided chemical etching makes thinner cuts than mechanical sawing, thus reducing waste.

Nano Lett. <http://dx.doi.org/10.1021/nl300141k> (2012)

ZOOLOGY

All the better to see whales with

The giant eyes of the world's largest squid seem to be specially adapted to spot approaching predatory sperm whales.

Dan-Eric Nilsson at Lund University in Sweden and his colleagues examined a photograph of an adult giant squid (*Architeuthis* sp.) and a full-size colossal squid

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(*Mesonychoteuthis hamiltoni*) specimen, and found both animals' eyes to measure about 27 centimetres in diameter — the largest eyes of any species. The researchers created a mathematical model relating eye size to vision. They found that the only advantage of such large eyes over smaller ones is an enhanced ability to detect large, luminous objects below ocean depths of about 500 metres.

The authors suggest that these squid evolved such eyes to detect the bioluminescence that can be created by the movement of hunting whales. *Curr. Biol.* <http://dx.doi.org/10.1016/j.cub.2012.02.031> (2012)

MICROBIOLOGY

Bacteria signal to survive

Bacterial cells that are genetically identical to members of their population that succumb to antibiotics can survive in a dormant state, thanks to chemical communication between bacteria.

Surviving 'persister' cells have been implicated in chronic infections such as tuberculosis. James Collins and his team at Boston

University in Massachusetts gave *Escherichia coli* the chemical indole, which the bacteria produce as a signalling molecule. Indole-treated *E. coli* were able to withstand higher levels of several antibiotics than untreated bacteria. Moreover, the individual bacterial cells in a culture that were most responsive to indole were also those most resistant to antibiotics.

Indole activates genes involved in responding to stress, and *E. coli* strains lacking stress-response genes produce fewer persisters. *Nature Chem. Biol.* <http://dx.doi.org/10.1038/nchembio.915> (2012)

CLIMATE MODELLING

Predicting realistic rains

A high-resolution climate model has produced the most accurate representation yet of rainfall in the southern United Kingdom, bolstering confidence in the potential of detailed regional modelling.

A team led by Elizabeth Kendon at the Met Office Hadley Centre in Exeter, UK, used a regional model with a 1.5-kilometre grid to conduct detailed simulations from 1989 to 2008. The authors analysed the duration, extent and intensity of rainfall and compared the results of their model with those produced by a less-detailed 12-kilometre regional climate model.

The results suggest that the 1.5-kilometre model significantly improves the representation of heavy rains and reduces long-standing inaccuracies that produced too much light rain. *J. Clim.* <http://dx.doi.org/10.1175/JCLI-d-11-00562.1> (2012)

EVOLUTION

No sweetness for meat-eaters

Many meat-eating animals have lost their ability to taste sugars, having lost a working copy of a gene that encodes a taste receptor for sugar.

Peihua Jiang and Gary Beauchamp at the Monell Chemical Senses Center in Philadelphia, Pennsylvania, and their co-workers sequenced DNA from 12 members of the order Carnivora, including spotted hyenas and several sea mammals. Seven of the species carried a malfunctioning copy of the *Tas1r2* gene that encodes a sweet taste receptor. However, the exact mutations differed from one species

to another, suggesting that carnivores have independently lost their ability to detect sugars during the course of evolution.

Furthermore, bottlenose dolphins (pictured) and sea lions lack working copies of the gene encoding receptors for tasting savoury flavours, or umami. Dolphins also seem to have lost a receptor that senses bitter compounds. The authors say taste may not affect what these creatures eat as sea lions and dolphins tend to swallow their food whole. *Proc. Natl Acad. Sci. USA* <http://dx.doi.org/10.1073/pnas.1118360109> (2012) For a longer story on this research, see go.nature.com/y4tzk7

CLIMATE CHANGE

Coming surge in storm surges

As the climate warms and sea levels rise, the frequency of local extremes in storm surges will increase along much of the US coastline.

To assess changes in local

flood risk, Claudia Tebaldi at Climate Central in Princeton, New Jersey, and her colleagues combined projections from a model of global sea-level rise with long-term records from 55 tidal gauges around the United States. The team estimates that by 2050, one-third of gauge locations will see an increase in the frequency of extreme high-water levels that are currently expected to occur only about once a century. Some locations can expect to see these extremes, on average, every ten years, others even annually.

In a separate study, Benjamin Strauss, also at Climate Central, and his colleagues assessed US communities' topographic vulnerability to sea-level rise. Given that sea level could increase by one metre or more during this century, the team estimates that 3.7 million people live within one vertical metre of local mean high tide. *Environ. Res. Lett.* **7**, 014032; 014033 (2012)

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BEHAVIOURAL SCIENCE

Testosterone hinders collaboration

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Women taking testosterone pills collaborate less effectively than those given a placebo.

Nicholas Wright and his colleagues at University College London asked 17 pairs of women to decide individually if a set of striped circles on one screen was brighter than those on a second screen. If the women within a pair disagreed, they had to collaborate to come up with a joint decision.

The team found that the women were generally more accurate when they collaborated than when working alone. However, testosterone decreased this boost in the women's performance compared with placebo, even though the hormone did not affect the accuracy of the decisions made individually. The authors suggest that the hormone causes individuals to place much more weight on their own judgment than on that of others.

Proc. R. Soc. B <http://dx.doi.org/10.1098/rspb.2011.2523> (2012)

