RESEARCH HIGHLIGHTS

Selections from the scientific literature

CLIMATE MODELLING

Wetter, drier with warming

Trends in tropical rainfall over land could provide a signal of global warming, with very wet and very dry months both projected to become more frequent as temperatures rise.

Benjamin Lintner at Rutgers University in New Brunswick, New Jersey, and his colleagues compared the results from climate models simulating rainfall for 1975–99 and 2075–99. The researchers found that dry areas will tend to become drier by the end of this century as Earth warms, whereas rainfall will increase in wet areas.

The team also compared rainfall simulations with measurements obtained between 1979 and 2008. However, there was no clear link between changes in tropical precipitation and recent temperature increases. This suggests that natural climate variability, in addition to global warming, is important in influencing tropical rainfall trends.

J. Geophys. Res. **http://dx.doi.org/10.1029/2012JD017499 (2012)**

JOHN WILEY AND SONS

MATERIALS

Butterfly-inspired reflectors

A synthetic material mimics the complex microscopic structure of brilliant butterfly wings to achieve a bright blue colour.

Butterflies of the genus *Morpho* are known for their dazzling blue wings (pictured right). The colour arises from densely packed layers of ridges that cover the scales on the wing surface. The ridges are structured such that light waves reflecting off the ridges interfere with each other, creating the blue colour. The tight, semi-random packing of the ridges makes the wings appear bright across a wide range of viewing angles.

To recreate these features in a reflective material, Jung Shin at the Korea Advanced Institute of Science and Technology in Daejeon, South Korea, and his colleagues deposited silica microspheres onto a surface and then sprayed layers of titanium dioxide and silicon dioxide over them. The resulting film (pictured left) had just the right mix of regularity and disorder to create the even blue colouring.

Adv. Mater. **http://dx.doi.org/10.1002/adma.201200521 (2012)**

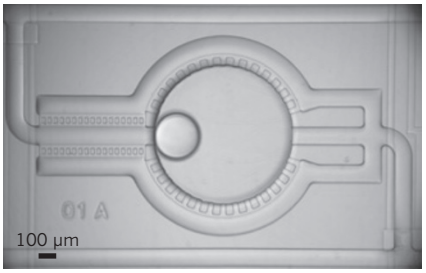
BIOENGINEERING

Shunting bacteria on a chip

A device that moves chemical reagents through a network of tiny chambers and channels on a chip has been used to analyse the genomes of individual bacterial cells.

Carl Hansen at the University of British Columbia in Vancouver, Canada, and his team developed the microfluidic device, which uses computer-controlled valves to pump reagents and cells as discrete droplets suspended in a stream of oil. By programming the valves, the authors directed single droplets to 95 different 30-nanolitre reaction wells (**pictured, with droplet**), in which the droplets can be isolated or mixed with others. The authors used their device to sort, culture and sequence the genomes of individual bacterial cells sampled from the human mouth and from marine sediment.

Proc. Natl Acad. Sci. USA **http://dx.doi.org/10.1073/pnas.1106752109 (2012)**



KASTON LEUNG

CANCER

A tumour's Kras behaviour

Growing cancer cells divert glucose and other nutrients away from energy-producing pathways towards those that make complex molecules that can be used as building blocks. The cancer gene *Kras* promotes this diversion in pancreatic cancer.

Using a mouse model of the most common type of pancreatic cancer, Alec Kimmelman at the Dana-Farber Cancer Institute in Boston, Massachusetts, Ronald DePinho, now at the MD Anderson Cancer Center in Houston, Texas, and their colleagues show that the pancreatic tumours need mutant Kras to survive. The mutant protein shunts

glucose metabolism towards two pathways — one that adds sugars to proteins and another that makes precursors for DNA and RNA synthesis — by downregulating a glucose transporter and other key enzymes.

The enzymes altered by mutant Kras represent potential new drug targets, the authors conclude.

Cell 149, **656–670 (2012)**

MATERIALS

Graphene's silicon cousin

Silicon can form two-dimensional honeycomb sheets one atom thick. This material — known as silicene — is the silicon equivalent of carbon-based graphene, and could fit more easily into industrial silicon-based circuits than graphene.

Patrick Vogt at the Technical University of Berlin, Paola De Padova at the Institute of Structure of Matter in Rome and their colleagues deposited a single layer of silicon onto a silver surface heated to more than 200 °C. The resulting silicene is corrugated and seems to have similar electronic properties to graphene.

Other researchers have reported making silicene before, but Vogt and colleagues say that they have provided more conclusive evidence, including microscopy images and measurements of the material's electrical and chemical properties.

Phys. Rev. Lett. 108, **155501 (2012)**

NEUROSCIENCE

Small RNAs boost memory process

A class of small RNA molecules discovered just six years ago has now been detected in the brain, where it seems to regulate the expression of a gene involved in memory. This could help to explain how long-lasting memories are maintained.

Researchers in New York led by Thomas Tuschl at the Rockefeller University and Eric Kandel at Columbia University analysed a collection of small RNAs that do not encode proteins, from the central nervous system of the sea-slug *Aplysia*. The researchers identified a group of RNAs called Piwi-associated RNAs (piRNAs) that bind to a protein called Piwi. Complexes of piRNAs and Piwi protein silence a memory-inhibiting gene called CREB2 by promoting the addition of methyl groups to the gene in the presence of serotonin, a neurotransmitter important in learning and memory. Silencing CREB2 boosts the ability of neurons to change the strength of their connections in a sustained way — a key process in long-term memory.

These small RNAs had previously been found only in reproductive organs, so this study suggests a broader role for the molecules than expected.

Cell 149, **693–707 (2012)**

ZOOLOGY

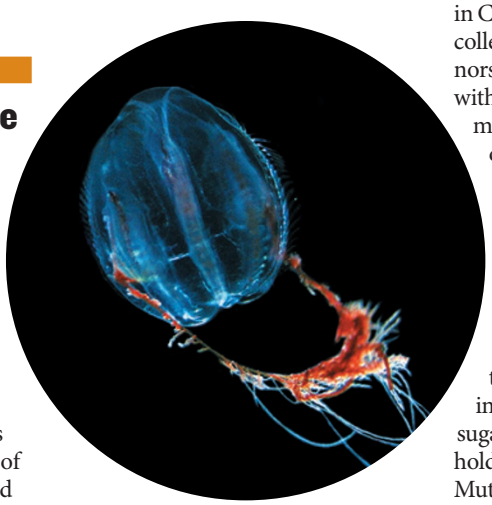
Jellies reproduce as little larvae

A population of comb jellies in the central Baltic Sea is the first of its kind to be discovered living and reproducing entirely in the larval stage.

Mertensia ovum (**pictured**) is common in the Arctic. Cornelia Jaspers at the Technical University of Denmark in Charlottenlund and her colleagues discovered thousands of *M. ovum* jelly larvae and hundreds of eggs during sampling cruises in the central Baltic Sea in 2009–10. They found no adults and the larvae measured at most 1.6 millimetres. However, the larvae reproduced at a rate that would sustain the observed population.

The authors suggest that this comb jelly population may have been driven to reproduce at a young age in an attempt to avoid the abundant predators in the region.

Biol. Lett. **http://dx.doi.org/10.1098/rsbl.2012.0163 (2012)**



C. JASPERS

MICROBIOLOGY

Bacterial biofilm breakdown

A compound produced by certain bacteria can break down biofilms — the tight-knit communities that some bacteria form on surfaces to protect themselves from antimicrobial attack.

Researchers in Massachusetts identified the compound, norspermidine, in *Bacillus subtilis*. Jon Clardy at Harvard Medical School in Boston, Richard Losick at Harvard University in Cambridge and their colleagues found that norspermidine acts in concert with a previously identified mix of amino acids to break down established biofilms of *B. subtilis* and to prevent biofilm formation in *B. subtilis, Escherichia coli* and *Staphylococcus aureus*. Using high-resolution microscopy, the researchers showed that norspermidine interacts directly with the sugar-based molecules that hold the biofilm together. Mutant bacterial strains unable to make both norspermidine and the amino acids form long-lived biofilms.

Synthetic chemicals modelled on norspermidine could be used to combat biofilms in industrial and medical settings, the authors say.

Cell 149, **684–692 (2012)**

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CARDIOVASCULAR BIOLOGY

Watching risky blood clots form

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Dangerous blood clots form in veins as a result of cross-talk between white blood cells and platelets. This mechanism underpins deep vein thrombosis (DVT) — a condition that can be life-threatening if the clots move to the lungs.

Steffen Massberg at the Technical University of Munich in Germany and his colleagues created a mouse model that displays many of the hallmarks of human DVT. *In vivo* imaging revealed that as blood flow is reduced — as can occur in humans during extended bouts of inactivity, such as on long-haul flights — DVT begins when monocytes and neutrophils, two types of white blood cell, stick to blood vessel walls. These cells then release molecules that trigger coagulation. Clot formation is enhanced when platelets adhere to either the vessel wall or to the attached white blood cells.

J. Exp. Med. 209, **819–835 (2012)**