# RESEARCH HIGHLIGHTS

## Sea change

*Biol. Lett.* doi:10.1098/rsbl.2005.0351 (2005)
Humpback whales (*Megaptera novaeangliae*, pictured) are known for their yearly migrations between the poles and tropics. Calves learn a route from their mothers and follow it every year. And adherence to these routes maintains lineages with distinct genetics and song type. But speculation that a few very bold, or badly lost, whales switch routes has been reinforced by Cristina Pomilla and Howard Rosenbaum, both of the American Museum of Natural History and the Wildlife Conservation Society in New York. One male whale whose DNA was sampled when it was found wintering in the Indian Ocean by Madagascar in 2000 was sampled again in 2002 in the South Atlantic, near Gabon. Microsatellite analysis made the match, and snapshots of the whale's dorsal fin confirmed it.


A. NACHOUM/CORBIS

CELL BIOLOGY

## Calorie burner

*Cell Metab.* **2,** 105–117 (2005)
A role in glucose metabolism in mammals has been revealed for a class of proteins associated with longevity in worms, flies and yeast.

Shin-ichiro Imai and his colleagues of the Washington University School of Medicine, Missouri, engineered mice to overexpress Sirt1 proteins in their pancreatic beta cells. Compared with control mice, the engineered animals produced more insulin, the protein that regulates carbohydrate metabolism, in response to doses of glucose.

Although Sirt1 may be involved in prolonging the life of mammals on calorie-restricted diets, a link has not been proven. The more immediate implication of this study is the possibility that Sirt1 could be used to treat type 2 diabetes, which strikes when the body becomes resistant to insulin, or when the pancreatic cells produce too little of it.

D. H. WELLS/CORBIS


CANCER

## Timing is everything

*Cancer Cell* **8,** 99–110 (2005)
Timing could be the key to successful combination cancer treatments, reports Mark Dewhirst's lab at Duke University Medical Center in North Carolina.

Last year, Dewhirst and his team showed that radiation increases the activity of the hypoxia-inducible factor-1 (HIF-1) protein in tumours, which in turn affects the responsiveness of the tumours to the treatment. Now they have teased apart the pathways through which HIF-1 works — identifying three that make a tumour more radiosensitive, and one that makes it more resistant to radiation.

They conclude that radiation followed by HIF-1 inhibition would be the most effective cancer treatment, but the strength of the effect varies from tumour to tumour — and probably from patient to patient.

NANOTECHNOLOGY

## Mini might

*Phys. Rev. B* **72,** 085416 (2005)
The concept of chains and chain-mail constructed from ring-shaped carbon nanotubes has been explored through molecular dynamics, using a new computational method to study the materials' response to loading.

The calculated tensile strength of such structures is very impressive, given their low mass density. Chains of interlinking nano-rings could lengthen by more than a third without snapping, whereas the mail could withstand a strain of 25%. And unlike the response of structures made from metal, the deformation would also be totally reversible. Although nano-mail has yet to be fabricated, interlinked carbon nano-rings, where each ring measures a few hundred nanometres in diameter, have been observed in experiments.

STEM CELLS

## Easy does it

*PLoS Biol.* doi:10.1371/journal.pbio.0030283 (2005)
Neural stem cells used to be difficult to grow because they had to be cultured alongside more differentiated cells within floating clusters called neurospheres. But a study now suggests that none of this is necessary. Austin Smith of the University of Edinburgh, UK, and his colleagues show that a combination of fibroblast growth factor 2 and epidermal growth factor encourages isolated neural stem cells to propagate. Using this trick, they derived a pure culture of self-renewing neural stem cells from embryonic stem cells obtained from mice. The neural stem cells were able to differentiate into both neurons and their companion glial cells, astrocytes.

NEUROSCIENCE

## Underlying Alzheimer's

*Nature Med.* doi: 10.1038/nm1287 (2005)
The vascular lesions in the brain that are a distinctive, but little understood, feature of

Alzheimer's disease have been linked to low expression of the transcription factor GAX.

A team led by Berislav Zlokovic at the University of Rochester Medical Center in New York made this discovery by studying gene expression in endothelial cells from the brains of Alzheimer's patients. GAX is known to regulate the development of the vascular system, and restoring GAX levels in these endothelial cells *in vitro* stimulated the growth of blood vessels. It also enhanced expression of a factor that helps clear the protein plaques typically found in the brains of Alzheimer's patients. Changes in the brains of mice lacking one copy of the gene that encodes GAX, *Meox2*, provide supporting evidence of GAX's role.

MICROBIOLOGY

## Close encounters

*Science* **309,** 1245–1248 (2005)

Cell-to-cell contact seems to allow certain bacteria to stymie their rivals. David Low's group at the University of California, Santa Barbara, report that the EC93 strain of *Escherichia coli* transfers growth-inhibiting signals when it comes into contact with neighbouring cells of a different strain.

The EC93 strain was isolated from the guts of rats, where it had eliminated all other bacteria. The team identified two proteins that the bacterium releases to inhibit its neighbours' growth, and also found a DNA sequence in the EC93 strain that provides it with immunity against its own secretions. The researchers speculate that the contact-dependent inhibition may involve interactions between tiny tentacles called pili found on the surface of the cells.

OPTICS

## Caught behind bars

*Opt. Express* **13,** 5961–5975 (2005)

What is the best way to cage light? This is a useful feat in building all kinds of optical devices including lasers. But in the past, researchers have had to use trial-and-error to design photonic-crystal cavities that trap light in very small volumes. Now a team at Stanford University in California has devised an equation that does the job in a single computational step.

The inputs to the equation are the desired pattern of the trapped light field, the volume within which the light must be confined and the quality factor, or leakiness, of the cavity. The outputs are instructions for how to arrange the different layers of material that form the photonic crystal.

NEUROBIOLOGY

## A taste sensation

*Neuron* **47,** 593–605 (2005).

To get the most from your meal, you should savour the scent before tucking in. Dana Small of the John B. Pierce Laboratory in New Haven, Connecticut, and her colleagues show that a smell arriving through the nose can stimulate different regions of the brain





compared with the same odour delivered through the mouth.

The team used functional magnetic resonance imaging to probe the brain's response to scents delivered into the nostrils or — to simulate odours arriving through the mouth — to the back of the nasal passage. A difference in response was seen for chocolate, but not for three non-food smells. The team suggests that the mechanism distinguishes between the availability and receipt of food.

BACTERIOLOGY

## Tactical defence

*Cell* **122,** 461–472 (2005)

The bacterial pathogen *Salmonella typhimurium* senses when it has become the target of its host's immune system, and takes steps to avoid destruction. Samuel Miller at the University of Washington Medical School in Seattle and his colleagues have elucidated the mechanism.

They deciphered how the PhoQ enzyme bound to the bacterial cell membrane is activated by the positively charged peptides released by the host cell to kill the bacteria. This triggers a cascade of events that affects the expression of more than 200 genes, including some that strengthen the bacterial outer membrane, and so protect the bacteria from attack.

## JOURNAL CLUB

**Elizabeth Brainerd**
**Brown University, Providence**

**A specialist in functional anatomy hopes that advances in stickleback genetics will help solve a mystery about her favourite group of vertebrates.**

I have long been fascinated, for no sensible reason at all, by pufferfish and their various spiny, prickly and armoured relatives. Some unknown trait of this group Tetraodontiformes predisposes its members to repeated evolution of mechanical defences against predation, such as body inflation in pufferfish, stout spines in triggerfish and whole-body armour in boxfish.

Impressive body armour and spines are also found in Gasterosteiformes, a group that includes seahorses, pipefish and sticklebacks. Recently, progress has been made in revealing the genetics of armour in the threespined stickleback (*Gasterosteus aculeatus*).

The question tackled by the new research is how freshwater sticklebacks evolved to have fewer armoured plates along their sides than marine sticklebacks. The populations separated after the end of the last glaciation, some 20,000 years ago.

Unexpectedly, Cresko *et al.* showed that the loss of lateral armour plates has the same genetic basis in geographically isolated freshwater populations (*Proc. Natl Acad. Sci. USA* **101,** 6050–6055; 2004). Variation in *Ectodysplasin*, a gene known to affect skin and scale development, was then implicated as the causal factor by Colosimo *et al.* (*Science* **307,** 1928–1933; 2005).

An interesting twist is that the alleles found in low-plated fish also turn up in marine sticklebacks, indicating that evolution in the different freshwater populations was driven by selection on pre-existing alleles, rather than on parallel mutations.

Understanding the evolution of tetraodontiform defences will be a harder problem, in part because they diverged over 50 million years ago. But work such as this gives me hope.