# RESEARCH HIGHLIGHTS

## Wee beasties

*J. Exp. Biol.* **208,** 2865–2872 (2005)
When male lobsters clash, the loser remembers who beat him and retreats from the winning male during future encounters.

Researchers at the Boston University Marine Program in Woods Hole, Massachusetts, have discovered how this recognition works. It depends on chemoreceptors on the odour-sensitive hairs along the lobsters' antennae detecting urine pheromones.

When Jelle Atema and Meg Johnson shaved off these hairs, the weaker lobsters (*Homarus americanus*) continued to pick fights with champions who had defeated them before.

J. ATEMA

NEUROBIOLOGY

## Spindle cycle

*Cell* **122,** 119–131 (2005)
When neural stem cells in the embryonic mammalian brain divide, they yield either two new stem cells or a stem cell plus a nerve cell.

Before any cell divides, its scaffolding, or cytoskeleton, forms a shape like an American football called the mitotic spindle. Kamon Sanada and Li-Huei Tsai of Harvard Medical School in Boston, Massachusetts, show in mice that the orientation of this spindle in neural stem cells determines whether one daughter cell will become a nerve cell. They also identify intracellular signalling molecules that control the spindle orientation — these are the βγ subunits of G proteins and their activator, AGS3.

COSMOLOGY

## Parting of the waves

*Phys. Rev. Lett.* **95,** 031301 (2005)
A weak light is thought to leak from black holes. It originates when the black hole captures one of a pair of virtual particles — the other seems to be emitted from the same spot.

The process, known as Hawking radiation, could be mimicked in the laboratory by studying microwaves moving in an electronic structure known as a waveguide, propose Ralf Schützhold of Germany's Dresden University of Technology and William Unruh of the University of British Columbia, Vancouver.

The velocity of the microwaves can be reduced by sweeping a laser beam along the waveguide. An observer moving with the beam would see slower-moving microwaves 'trapped' to their left and faster-moving ones escaping to their right — a simulation of what happens to virtual particles at the edge of a black hole (see artist's impression, below).

MATERIALS

## All white now

*J. Am. Chem. Soc.* **127,** 9986–9987 (2005)
Making white light generally requires the combination of sources of red and green (making yellow) and blue light. Phosphor-based light sources come in all these individual colours and can be mixed appropriately — to mimic natural light, for example.

Now, Sue-Lein Wang and her colleagues at the National Tsing Hua University in Taiwan have found the first single-material white phosphor. It is a zinc gallophosphate laced with nanoscale pores, made by mildly heating the raw inorganic ingredients in water and ethylene glycol. The white light seems to stem from blue fluorescence in highly ordered regions of the material, combined with yellow emission where it is more disordered.

IMAGE UNAVAILABLE FOR COPYRIGHT REASONS

C. DARKIN/SPL

OPTICS

## Speed writing

*App. Phys. Lett.* **87,** 031101 (2005)
Laser pulses can be used to write patterns into transparent objects by burning tiny holes, but the repetition needed to build a whole picture can be time consuming.

Yoshio Hayasaki and his colleagues from the University of Tokushima, Japan, have devised a method whereby a complete pattern is created with a single laser pulse.

The laser light passes through a computer-controlled liquid-crystal cell. And the different diffraction patterns that result allow the laser to etch entire characters. The technique could be used to carve tiny serial numbers into products.

DEVELOPMENTAL BIOLOGY

## Keeping mum

*J. Exp. Med.* **202,** 231–237 (2005)
For a fetus to survive, the mother's immune system must be appropriately suppressed — otherwise her body could react against proteins expressed by fetal genes inherited from the father.

Levels of a regulatory molecule called programmed death ligand 1 (PDL1) are known to be elevated in the human placenta. Indira Guleria of Harvard Medical School, Boston, and her colleagues show that this molecule may play an important role in the development of immune tolerance during pregnancy.

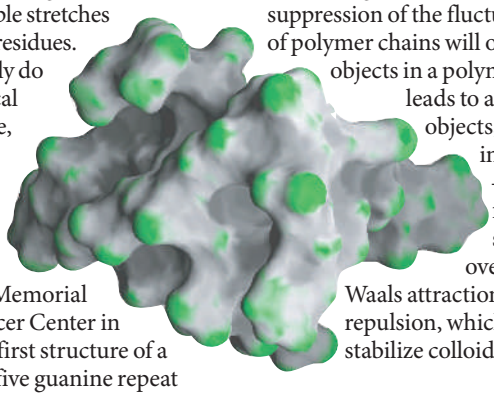
They show that decreased levels of PDL1 in mice raises the number of immune cells that tackle infectious diseases, and heightens the risk of fetal rejection.

STRUCTURAL BIOLOGY

## In the loop

*Nature Chem. Biol.* doi:10.1038/nchembio723 (2005)

The human *MYC* gene regulates cell growth, but is overexpressed in many cancers. Lengths of its promoter region, the gene's activation switch, contain multiple stretches of repeating guanine residues. Such stretches typically do not assume the classical double-helix structure, but a quadruplex structure where four DNA strands fold back on themselves.



Dinshaw Patel and his colleagues at the Memorial Sloan-Kettering Cancer Center in New York report the first structure of a DNA fragment with five guanine repeat stretches within the *MYC* gene promoter (pictured). They show that it forms a quadruplex with a unique combination of strand directions and propeller-like loops that may provide a target for anticancer drugs.

IMMUNOLOGY

## Nosy parkers

*PLoS Pathog.* doi:10.1371/journal.ppat.0010001 (2005)

Some of the many species of bacteria that colonize mammalian noses can activate the innate immune systems of their hosts to destroy a competing species.

Elena Lysenko and her colleagues from the University of Pennsylvania School of Medicine, Philadelphia, studied the competition between two potentially pathogenic bacteria, *Haemophilus influenzae* and *Streptococcus pneumoniae*. When one strain was presented to mice in the absence of the other, each colonized a similar microenvironment in the nose and pharynx. But when both were present, *H. influenzae* stimulated immune cells called neutrophils to destroy its competitor.

The study indicates that the immune system can mediate competitive conflicts between species, influencing the composition of colonizing flora.

POLYMER PHYSICS

## Suspended animation

*Phys. Rev. Lett.* **95,** 038305 (2005)

The mysterious Casimir force is an attraction found between two conducting plates when they are separated by only a few atomic diameters. The nearness of the plates suppresses a proportion of the electromagnetic fluctuations that naturally occur in space. With fewer such fluctuations there is 'less than nothing' between the plates, and this forces them together.

Sergei Obukhov and Alexander Semenov of France's Charles Sadron Institute in Strasbourg calculate that a similar suppression of the fluctuations in density of polymer chains will occur between two objects in a polymer solution. This leads to a force between the objects, but in this case the interaction is repulsive — an anti-Casimir force. The researchers say this force could overwhelm van der Waals attraction and lead to a net repulsion, which could be used to stabilize colloidal suspensions.

CANCER

## Jagged path

*Cancer Cell* **8,** 13–23 (2005)

Tumour cells frequently release 'pro-angiogenic' proteins, which stimulate the growth of blood vessels needed to feed them.

But Cun-Yu Wang and his colleagues from the University of Michigan have found a molecular mechanism for such blood vessel stimulation that involves direct physical contact between tumour cells and the endothelial cells that line the vessel walls.

They found that a chemical called hepatocyte growth factor turns on a gene in tumour cells called *jagged1*. Blood-vessel growth is triggered when the Jagged1 protein, displayed in the tumour cells' outer membrane, binds to a protein called notch in the membrane of endothelial cells.

CELL BIOLOGY

## Born again

*Cell* **122,** 85–95 (2005)

Peroxisomes are small, abundant organelles in cells that assist oxidative reactions. One theory holds that they evolved independently of eukaryotic cells, as mitochondria may have done. But, unlike mitochondria, their number in a living cell is constantly refreshed.

Henk Tabak from the University of Utrecht in the Netherlands and his colleagues have deciphered a key step in this regeneration process. By following the path of two proteins vital for the formation of peroxisome membranes, they show that the membranes are derived from another, highly complex organelle — the endoplasmic reticulum. This supports the notion that peroxisomes evolved in primitive eukaryotes, not independently.

## JOURNAL CLUB

**Jan Zaanen**
**Stanford University, California**

**A theoretical physicist hopes to see obese traits in skinny neutrinos, given cosmic patience.**

The distinguished mathematical physicist Roger Penrose recently stirred up a debate that has been running for more than 75 years. The question is: why do the rules of quantum mechanics play no role in the macroscopic world?

In *The Road to Reality,* published in March, Penrose argues that the limit of quantum rules is rooted in a physicist's nightmare: the deep conflict between quantum mechanics and Einstein's general theory of relativity. He predicts that gravitational effects thoroughly destroy the quantum nature of anything heavier than an obese bacterium so quickly that we cannot detect the process.

But might we see the transition in objects that are just a little bit smaller? I got excited about Penrose's ideas because I follow the field of quantum computing. In the past, no one even came close to carrying out quantum experiments on objects as big as bacteria. Now experimentalists are perfecting fat quantum things in order to get quantum computers running, although messy environmental influences deteriorate their signals.

Neutrinos are isolated from such influences, but you probably wouldn't expect these particles to be much help because of their tiny mass — at $10^{-36}$ kg they are the skinniest things in the Universe. This should mean their quantum states remain unperturbed by gravity for longer than the lifetime of the Universe.

Yet Joy Christian from the University of Oxford, UK, argues that patience may pay off (http://arxiv.org/quant-ph/0503001; 2005). He shows that neutrino oscillations speed up Penrose collapse. Neutrinos created soon after the Big Bang may now have lost their quantum nature... and might be detected by telescopes that are currently being constructed.