RESEARCH HIGHLIGHTS

Light as a feather

Phys. Rev. E (in the press)
The drab brown of male peacocks' tail feathers has been shown to arise from the same kind of structures that produce the vibrant colours of the 'eye'.

Photonic crystals give colour to many insects, butterflies and birds. The crystals have a periodic structure, often created by repeating patterns of tiny holes, that usually only reflects a narrow range of wavelengths of light.

Researchers from Fudan University in Shanghai, headed by Xiaohan Liu and Jian Zi, have now proved that a subtle arrangement of melanin rods and air spaces can also reflect the mix of colours needed to produce brown. The structure may inspire designs for artificial photonic crystals.

D. A MURAWSKI/GETTY IMAGES

DRUG DISCOVERY

Screen for promiscuity

Nature Chem. Biol. doi: 10.1038/nchembio718 (2005)
Two new drug-screening techniques could reduce the amount of time that pharmaceutical companies waste exploring the biological properties of 'promiscuous inhibitors'.

Such molecules seem promising as potential drugs when tested in a high-throughput fashion, as they inhibit the activity of a target enzyme. But they often have this effect by forming aggregrates that sequester the enzymes, rather than binding to the enzyme's active site. So promiscuous inhibitors can rarely be developed into drugs.

Researchers led by Brian Shoichet and Kip Guy, both from the University of California, San Francisco, have developed high-throughput screens that use detergents (to disrupt aggregates) and dynamic light scattering (to detect aggregates). When applied to 1,030 drug-like molecules, both techniques identified promiscuous inhibitors.

QUANTUM PHYSICS

Time's up

Phys. Rev. Lett. **94,** 230401 (2005)
There is a fundamental limit to how long quantum coherence can last, say Jan Zaanen and his colleagues at the University of Leiden, the Netherlands.

Coherence, which allows many particles to share the same quantum state, underpins phenomena ranging from superfluidity to quantum teleportation. It is also key to proposals for quantum computers. But Zaanen's team shows that spontaneous fluctuations destroy quantum coherence in a time period that depends on the size and temperature of the system. For macroscopic bodies this can take centuries, but at the 'mesoscale' of hundreds of nanometres, it can happen in seconds. Fortunately, proposals for quantum computers don't tend to invoke mesoscale bits, so they are not undermined.

MOLECULAR BIOLOGY

Enlightened proteins

Chem. Biol. **12,** 685–693 (2005)
Light can act as a powerful switch to set off chemical reactions. Harnessing this effect, researchers led by Timothy Dore of the University of Georgia in Athens, and Erin Schuman of the California Institute of Technology, Pasadena, have developed a system that could be used to inhibit protein synthesis in cells in a controlled way.

They bound an antibiotic compound that hampers protein formation to a light-sensitive molecule called a chromophore. The antibiotic is released, and thereby activated, when the compound is exposed to ultraviolet light.

STRUCTURAL BIOLOGY

All in the ions

Cell **121,** 1005–1016 (2005)
The enzyme RNaseH is a member of the nuclease family of enzymes that cut strands of DNA and RNA. In work that may help to explain how the various nucleases target different substrates, researchers led by Wei Yang at the National Institutes of Health, Bethesda, have described the structure of RNaseH bound to a DNA–RNA hybrid.

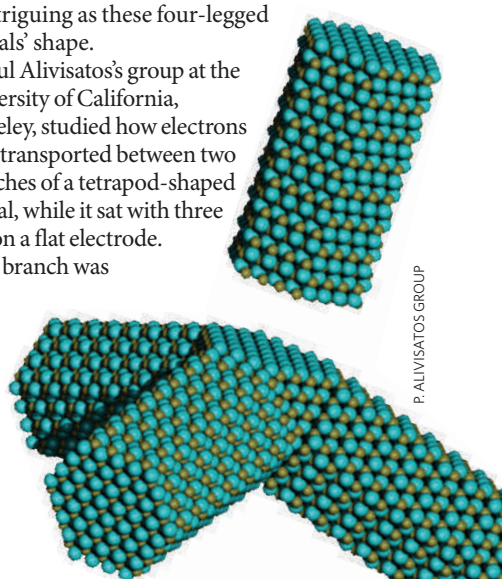
RNaseH acts on molecules that contain both DNA and RNA, but cuts only the RNA chain. The structure shows that two metal ions are involved in catalysing cleavage of the RNA strand. Nucleases related to RNaseH also use two metal ions to make cuts, but the geometric arrangement of the ions in these nucleases is different.

SOLID-STATE PHYSICS

Bendy legs

Nano Lett. doi:10.1021/nl051064g (2005)
The first investigation of the electrical properties of semiconductor tetrapods (pictured), has revealed a behaviour that is as intriguing as these four-legged crystals' shape.

Paul Alivisatos's group at the University of California, Berkeley, studied how electrons were transported between two branches of a tetrapod-shaped crystal, while it sat with three legs on a flat electrode. Each branch was



P. ALIVISATOS GROUP

150 nanometres long. Depending on how bent the branches had become when the tetrapod stuck to the electrode surface, electrons either behaved in a quantum way and hopped across the central junction, or a simple current flowed. This unexpected complexity could be put to use in nanoscale circuits, where the tetrapod's branches act as interconnects.

IMMUNOLOGY

On the defensive

J. Clin. Invest. **115,** 1806–1815 (2005)

Tissues attacked by bacteria can defend themselves by increasing levels of certain molecules, such as nitric oxide, that kill microbes. A protein called hypoxia-inducible factor 1 is already known to control this response in tissues that lack oxygen — a typical sign that they are under attack. Now, increased production of this protein by white blood cells has been directly linked to the presence of bacteria by Randall Johnson and and Victor Nizet of the University of California, San Diego, and their colleagues.

Johnson's team also showed that mice were more susceptible to infection if they lacked the protein. But the researchers' suggestion that therapies that enhance production of the protein could boost a patient's immune system, although shown *in vitro,* remains to be tested *in vivo*.

DEVELOPMENTAL BIOLOGY

Uncertain destiny

J. Exp. Med. doi: 10.1084/jem.20050146 (2005)

A single type of precursor cell found in the thymus can develop into a T cell, B cell or dendritic cell, a study finds.

The precursor cells migrate from the bone marrow to the thymus before maturing into these immune cells. To pinpoint the moment when the cells' fates are sealed, Claudia Benz and Conrad Bleul from Freiburg's Max-Planck Institute for Immunology monitored the expression of a receptor protein that marks an early stage of T-cell development. The researchers identified a threshold of expression in the most immature precursors that marks an important branching point in the cell hierarchy. Beyond this threshold, the cells were incapable of turning into B cells.

CANCER

Liver trouble

Cell **121,** 977–990 (2005)

One link between inflammation and cancer is known to involve the NF-kB pathway, which regulates gene expression. Now Michael Karin and his colleagues at the University of California, have implicated the pathway's activator, IKKβ, in chemically induced liver cancer.

Mice injected with a chemical carcinogen were more prone to cancer when IKKβ was deleted from their hepatocyte liver cells. But if the enzyme was deleted from both hepatocytes and Kupffer cells — a type of immune cell in the liver — the animals were less likely to develop cancer. Karin's lab conclude that carcinogenesis depends on 'crosstalk' between damaged hepatocytes and Kupffer cells, mediated by IKKβ.

BLICKWINKEL / ALAMY

IMAGE UNAVAILABLE FOR COPYRIGHT REASONS

ANIMAL BEHAVIOUR

Smart settlers

Proc. R. Soc. Lond. B doi:10.1098/rspb.2005.3099 (2005)

Birds with bigger brains are less likely to fly south for the winter, a survey of the habits of 134 species has shown. This supports the theory that migration evolved in birds that weren't smart enough to survive cold weather.

Daniel Sol from the Autonomous University of Barcelona and his colleagues analysed existing data on birds living in temperate regions of Europe, Scandinavia and western Russia. In addition to finding that non-migratory birds have larger brains relative to their body size than species that migrate, they also discovered that non-migratory birds, such as the blackbird (*Turdus merula*, pictured), are more flexible in their feeding habits.

JOURNAL CLUB

Tony Pawson
Samuel Lunenfeld Research Institute, Mount Sinai Hospital, Toronto, Canada

Signalling proteins have taught this week's writer that cells can add one and one to get three.

The thought that one might understand mechanistically how cells work has always struck me as heady stuff. Yet, although we know a great deal about the pathways that orchestrate cells' responses to internal and external signals, and about regulatory systems such as the cell cycle, more complex cellular functions largely await explanation.

One exciting possibility is that cells are displaying emergent properties. My own research is focused on signalling proteins, which govern the dynamic behaviour of cells, and I am enthusiastic about the notion that signalling proteins might interact to yield an activity that is more than the sum of its parts.

Recently, Kevan Shokat and colleagues demonstrated such emergent behaviour for two protein kinase enzymes in the yeast *Saccharomyces cerevisiae* (C. Kung *et al. Proc. Natl Acad. Sci. USA* **102,** 3587–3592; 2005). By analysing gene expression, they examined the effects of inhibiting either kinase alone, or both together.

They found that one set of genes was affected by inhibition of the Cdk1 enzyme, which controls aspects of the cell cycle, and another was regulated by Pho85, which is involved in phosphate metabolism. The key experiments showed that simultaneously inhibiting both kinases also regulated a third set of genes, which participate in cell budding.

These findings are clinically important because the inhibitors used to treat diseases such as cancer tend to affect multiple kinases. Such non-specificity was initially viewed as a failing, but Shokat's data suggest that inactivating more than one kinase may be advantageous, or even critical, for a therapeutic effect.