RESEARCH HIGHLIGHTS

A fish cooperative

Biol. Lett. doi:10.1098/rsbl.2005.0344 (2005)

A study of small 'cleaner' fish, which groom larger reef fish in return for protection, has shown the sacrifice they make to maintain this precarious cooperation.

The cleaner wrasse *Labroides dimidiatus* helps its host by gobbling parasites, but can also do damage by tucking into its host's tastier mucus. Observations have suggested that reef fish punish their cleaners for eating mucus either by chasing them or by finding a new cleaner.

Redouan Bshary from the University of Neuchâtel, Switzerland, and Alexandra Grutter from the University of Queensland, Australia, show that *L. dimidiatus* learns to avoid punishment by changing its feeding habits.

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G. DOUWMA / NATUREPL.COM

CHEMICAL PHYSICS

Born into nobility

Europhys. Lett. **71,** 276–282 (2005)

Palladium has been endowed with noble status by Erwin Hüger of the Technical University of Clausthal and Krzysztof Osuch of the University of South Africa.

The noble behaviour, or relative lack of reactivity, of metals such as copper, silver and gold results from the complete filling of an energy level in the metal called the *d* band. Lone atoms of palladium have filled *d* shells, but in the bulk metal the band partly empties.

Hüger and Osuch deposited a layer of palladium on niobium, which pushes the atoms further apart, reasoning that this might restore electrons to the *d* band. The resulting monolayer was as unreactive as silver — partly because the *d* band became more nearly filled, but also because the band's energy was lowered, which made the electrons less available for reactions.

DEVELOPMENTAL BIOLOGY

Scent detectors

Science **309,** 787–790 (2005)

Caenorhabditis elegans, everyone's favourite model worm, has been shown to have a long-lasting memory for a smell associated with food, providing it is exposed to the cue during its first larval stage. Adult worms primed in their youth to respond to benzaldehyde, which smells a bit like marzipan, reacted to the odour by laying more eggs and by moving quickly towards its source.

Jean-Jacques Remy of the Developmental Biology Institute of Marseille, France, and Oliver Hobert of the Columbia University Medical Center in New York, also identified the protein required for this olfactory imprinting. Called SRA-11, it belongs to a class of olfactory receptors, but shows up on connecting interneurons rather than on sensory neurons. Its precise role is a mystery.

FERTILITY

Egg boxes

Cell **122,** 303–315 (2005)

Cells from the blood and bone marrow can restock female mammals' ovaries with eggs. This is the controversial claim of Jonathan Tilly of the Massachusetts General Hospital in Boston and his colleagues.

IMAGE UNAVAILABLE FOR COPYRIGHT REASONS

Last year Tilly's group suggested that mouse ovaries contain stem cells that produce new eggs in adulthood, challenging the dogma that female mammals are born with a fixed number of eggs. Now they have identified cells in bone marrow and blood that make proteins characteristic of germ cells. They have also shown that bone-marrow transplants or blood transfusions result in donor-derived eggs appearing in the ovaries of chemically sterilized female mice. However, the team has not demonstrated fertilization of these eggs or embryo development.

VIRAL GENETICS

Catching the flu

PLoS Biol. **3,** 300 (2005)

Influenza viruses (pictured) are known to swap genes. This process, called reassortment, may produce more virulent strains. To quantify the rate at which reassortment happens, Edward Holmes of Pennsylvania State University in College Park and his colleagues studied the genomes of 156 H3N2 influenza A strains collected in New York state between 1999 and 2004. They found more gene swapping than expected, and showed that a flu epidemic during winter 2003–04 was caused when a dominant strain from the previous year picked up a gene for a key surface protein from a less common strain.

SCIENCE SOURCE / SPL

BIOTECHNOLOGY

Safe delivery

Nature Biotechnol. doi: 10.1038/nbt1122 (2005)

Scientists hope to exploit the recently discovered class of molecules called small interfering RNAs, which target and shut down specific genes, as novel therapies. But a stumbling block is that introduced

RNAs are rapidly degraded in the body.

Now, researchers led by David Morrissey at Sirna Therapeutics in Boulder, Colorado, and at Protiva Therapeutics in Burnaby, British Columbia, have found a way to protect the RNA from destruction using a lipid bilayer.

They enclosed siRNAs directed against the hepatitis B virus within bilayer particles, and injected the particles into mice infected with hepatitis B. The siRNA inhibited viral replication for up to seven days at doses low enough to avoid toxicity.

MATERIALS

Supermarket sweep

Nature Mater. doi:10.1038/nmat1434 (2005)

There is a potentially vast market for cheap radio frequency identification tags — which store information like barcodes, but can be read by radio scanners. This is driving efforts to make tag components from organic materials that could be printed directly on to packaging. A team from the University of Leuven, Belgium, has conquered one hurdle, manufacturing a diode from the organic compound pentacene that operates quickly enough to process current in tags read by high-frequency radio signals.

GENETICS

Generation X

Science **309,** 768–771 (2005)

In female mammals, each cell shuts off one of its two X chromosomes. But how cells know that they have multiple copies of the X is little understood. Now, Jeannie Lee of Harvard Medical School in Boston, Massachusetts, reports that the *Tsix* and *Xite* genes seem to house the 'counting' mechanism.

IMAGE UNAVAILABLE FOR COPYRIGHT REASONS

S. CAMAZINE / SPL

Female mouse cells with *Tsix* deletions randomly inactivate one or both of their X chromosomes or neither of them, whereas female cells with extra copies of *Tsix* and *Xite* fail to initiate inactivation.

DRUG DISCOVERY

Poor resistance

Proc. Natl Acad. Sci. USA
doi:10.1073/pnas.0504952102 (2005)

Compounds that inhibit the activity of kinase enzymes have been used to treat some kinds of cancer with dramatic success. But a drawback of their clinical introduction has been the rapid emergence of mutant drug-resistant kinases in treated patients.

A research team led by Patrick Zarrinkar and David Lockhart from Ambit in San Diego demonstrate a strategy that could help tackle this trend, which takes advantage of the tendency of kinase inhibitors to hit multiple targets. The team screened various kinase inhibitors for their effects on three drug-resistant kinases. Although not designed to act on these targets, some were effective against the mutant kinases. Therapeutic deployment could be quick because these compounds are already in clinical development.

OPTICS

A clearer view

Appl. Phys. Lett. **87,** 034102 (2005)

In principle, flat lenses that focus light to a point of infinite precision can be made using materials with a negative refractive index. Such materials, which can be made from arrays of loops of wire, bend light in the opposite direction to classical materials. But these 'metamaterials' also absorb much of the light's energy, thereby clouding the view through the lens. To counter this problem, Steven Anlage and his colleagues from the University of Maryland, College Park, built a metamaterial from superconducting niobium metals. Using this material led to significantly reduced absorption in the lens, and to better imaging properties.

CHEMISTRY

Step by step

J. Am. Chem. Soc. **127,** 10462–10463 (2005)

The stepwise growth of a single polymer chain has been observed inside a 'nanoreactor'.

Hagan Bayley and Seong-Ho Shin of the University of Oxford, UK, studied how monomers link through the formation of bonds between sulphur atoms. The growing polymer chain was anchored to α-haemolysin, a bacterial protein that acts as a nanoreactor by shepherding the units into place. As the polymer grew, the conductance of the protein decreased, allowing the researchers to measure the lifetime of each intermediate over ten extension steps.

The authors suggest that the same technique could be used to study the kinetics of other polymerization reactions.

JOURNAL CLUB

Nicholas Spitzer
University of California, San Diego

The co-director of the Kavli Institute for Brain and Mind likes novel work on neural wiring.

Like many scientists, I'm drawn to big questions. And in neuroscience, one of the biggest is known as the wiring problem. This asks how the nervous system is wired up during embryonic development. With 100 billion neurons each making 10,000 synapses, the complexity of the process is immense.

A consensus on what drives nerves to their targets had slowly emerged from decades of work. Then research by Gartz Hanson and Lynn Landmesser at Case Western Reserve University (*Neuron* **43,** 687–701; 2004) upset the apple cart. Previous studies suggested that electrical signalling played no part in the wiring process, but these researchers find that spontaneous electrical activity in chick embryos is necessary to guide the projections of motor neurons (axons) to muscles.

Everybody believed that axon pathfinding was driven by signals intrinsic to the cell, defined by regulatory proteins known as transcription factors, in concert with certain external guidance molecules. The evidence is strong — altering the expression of either component leads to altered wiring.

Some of my own research had hinted at a role for electrical signalling in pathfinding, but Hanson and Landmesser discover a link that makes their result really powerful. They show that the pattern of electrical activity affects the expression of guidance molecules, although they have yet to demonstrate a connection with transcription factors. This work relies on an intimate knowledge of the patterns of activity in the embryo, which the researchers went to some pains to collect.

It is interesting that it's the pattern of activity rather than the total amount that's important, and I am delighted to reorient my thinking on the topic. Now, what drives the spontaneous activity?