RESEARCH HIGHLIGHTS

P. WERFS-AMBRATOM

Sharp-eyed observation

J. Exp. Biol. **209,** 18–25 (2005)

The slit-shaped pupils of animals from cats to geckos (pictured) evolved to complement the optical properties of their lenses, say researchers.

Ronald Kröger and his student Tim Malmström, of Lund University in Sweden, examined the eyes of 20 vertebrates with an infrared camera. They found slit pupils only in animals with multifocal lenses. These focus light of different wavelengths through different concentric zones, producing a sharper image than a lens with a single focal point at the centre, such as those of humans.

In a multifocal lens, a circular pupil would contract to obscure entire concentric regions needed to focus some wavelengths, whereas with a slit-shaped pupil, light always passes through a portion of each concentric ring.

CELL BIOLOGY

Bound to change

Science **310,** 1966–1970 (2005)

Vioxx, the painkiller recently withdrawn amid concerns about its side effects, works by inhibiting the enzyme cyclooxygenase-2, or COX-2, to limit inflammation. Now researchers in the United States have identified an enzyme in a separate inflammatory pathway that activates COX-2.

Solomon Snyder of the Johns Hopkins University School of Medicine in Baltimore, Maryland, and his colleagues found in immune cells from mice that inducible nitric oxide synthase specifically binds to and activates COX-2. Next, they showed that small peptides can disrupt this interaction. The group suggests that drugs designed to interfere with this pathway in humans could offer a new anti-inflammatory treatment.

CHEMISTRY

Bright prospects

Nature Meth. **3,** 35–40 (2005)

A design for a molecular cage that can be unlatched by light offers promise for *in vivo* experiments, say its inventors.

Light-sensitive molecules called chromophores have been used for decades to cage small compounds, because the release of their contents can be precisely controlled. The cages disgorge their cargo when pulsed with light at critical moments in a synthesis reaction, for example, or inside living cells.

Graham Ellis-Davies of Drexel University College of Medicine in Philadelphia, Pennsylvania, and his colleagues have come up with nitrodibenzofuran, which opens in response to light up to 160 times more efficiently than existing chromophores. This offers advantages for experiments in cells, as these can be damaged by strong doses of light. The researchers used the chromophore to release calcium ions in heart cells.

STEM CELLS

Plant matters

Cell **123,** 1337–1349 (2005)

All multicellular organisms require a supply of stem cells that can differentiate into any type of cell that needs to be replaced or supplemented in a lifetime.

Three different retinoblastoma genes have been implicated in the maintenance of mammalian stem cells, but it has not yet been possible to determine whether they influence stem cells directly, or their daughter cells.

So Ben Scheres from Utrecht University in the Netherlands and his colleagues turned to plants, in which stem cells are easier to see. In the root pictured below left, the stem cells are located just below the green dots. The team shows that the retinoblastoma pathway plays a similar role in maintaining 'stem cellness' in plants, and that its influence is directly on stem cells, and not their progeny.

M. WILDWATER ET AL. *CELL*

CELL BIOLOGY

Quick fix

Mol. Cell **20,** 783–792 and 793–799 (2005)

DNA is easily damaged, so the cell has evolved numerous DNA-repair mechanisms to avert disaster. Some types of damage block normal DNA replication, but can be fixed by a process called homologous recombination repair. The question is: which of the 20 or so different polymerase enzymes in the cell is involved in this process?

Using different approaches, two groups have independently solved the mystery. Stephen West of Cancer Research UK in London and his colleagues used biochemical approaches to identify the enzyme as DNA polymerase η, whereas Shunichi Takeda of Kyoto University in Japan and his team used genetics to reach the same conclusion.

ORGANIC CHEMISTRY

In good shape

J. Am. Chem. Soc. **127,** 17160–17161 (2005)

Widely used for knitting organic molecules together, the metathesis reaction netted its developers the 2005 Nobel Prize in Chemistry. But the carbon–carbon double bond in the reaction's product can sometimes end up in the wrong position.

Robert Grubbs, who shared the prize, and his team at the California Institute of Technology in Pasadena find that adding traces of benzoquinone derivatives can almost entirely block the unwanted bond move.

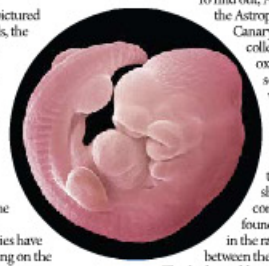
They use the technique to make α-olefins. These have a double bond at the end of the molecule, where it is at risk of adopting the wrong position. The team is now investigating industrial applications of the mild, cheap benzoquinone additives.

DEVELOPMENT

Boy or girl?

Nature Neurosci. doi:10.1038/nn1624 (2006)

The advent of a mouse mutant lacking an oestrogen-binding protein has settled a long-standing debate over the role oestrogens play in the developing brains of the different sexes.



S. GOLD PHOTOGRAPHY/SPL

In the mouse fetus (pictured right) as in all mammals, the brain develops as male in the presence of oestrogens, which are synthesized within the brain from testosterone produced in fetal testes. But it was not known whether normal development of the female brain requires the absence of oestrogens.

Two opposing theories have been developed, centring on the role of the fetal blood protein, α-fetoprotein, which binds tightly to oestrogens. One holds that the protein blocks uptake of oestrogens, the other that it actively transports the hormone into the brain.

By analysing the brains and behaviour of mice lacking the α-fetoprotein gene, Julie Bakker from the University of Liège and her colleagues clearly show that prenatal oestrogens masculinize and defeminize the brain, and that α-fetoprotein protects the female brain from the effects of oestrogens.

SENSORS

As thick as blood

J. Am. Chem. Soc. doi:10.1021/ja056370a (2005)

Changes in the viscosity of body fluids can signify disease. But mechanical devices do not monitor such changes closely enough to provide a reliable diagnosis. That has led researchers from the University of Missouri–Columbia and the University of California, San Diego, to develop molecular viscosity sensors whose fluorescent emission depends on how free the structure is to rotate.

Now work has built on this to overcome the problem of calibrating the sensor for emission intensity, which is influenced by sensor concentration and body-fluid properties. It presents a molecule that contains a built-in 'reference' emitter. Changes in viscosity alter the brightness of the sensor relative to the reference point, irrespective of other factors.

ASTRONOMY

Planetary ingredients

Astron. Astrophys. **445,** 633–645 (2005)

Many studies suggest that stars with planets are richer in heavy metals, such as iron, than their solitary neighbours. But it is unclear whether this is a cause or a consequence of their planetary systems.

To find out, Alexandra Ecuvillon of the Astrophysics Institute of the Canary Islands and her colleagues measured the oxygen content of 155 solar-type stars, 96 of which have planetary-mass companions. If stars with planets got their extra iron from planetary matter, their oxygen content should seem low by comparison. But the team found no clear difference in the ratio of oxygen to iron between the two groups of stars.

The finding adds to growing evidence that planetary systems are more likely to condense from iron-rich clouds.

GENOMICS

Variety is the dice of life

PLoS Genet. **1,** e78 (2005)

One of the things that helps make us all different is the way non-coding areas of our genome control the activity of our genes. Variations in these areas can influence our susceptibility to disease.

Seeking such differences, a group led by Panagiotis Deloukas and Emmanouil Dermitzakis at the Wellcome Trust Sanger Institute in Hinxton, UK, looked at bits of the genomes of 60 unrelated people. These genomes had already been studied as part of the International HapMap Project, which looks for differences in single genetic letters known as single nucleotide polymorphisms (SNPs).

The team found a surprisingly large amount of variation in gene activity between the people, and linked 40 examples to particular SNPs.

JOURNAL CLUB

Seong-Seng Tan
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A neuroscientist sets the brain's cells to music.

If the neurons in the brain were the world's great tenors, I'd argue that, like Luciano Pavarotti, projection neurons hog the limelight, whereas interneurons are the Placido Domingos of the cortical stage.

Projection neurons are seen as more glamorous because of their greater number. They are also well connected inside and outside the brain, carrying messages through powerful axonal cords to distant parts of the body.

By contrast, interneurons have short, locally connecting axons whose main function seems to be suppressing excessive neuronal activity. This puts interneurons in their counterpart's shadow.

But many researchers think the synchronized humming of interneurons is essential to the richness of cortical processing. What makes their music under-appreciated is the problems we have comprehending their repertoire.

Interneurons are hard to study, as they exist in a bewildering diversity. After accounting for different morphological, electrophysiological and chemical characteristics, there is a cast of thousands.

Recently, there has been some progress in understanding how different types of interneurons are made. Two groups have established correlations between the birthplace and birth date of a neuron, and its anatomy, physiology and molecular expression (S. J. Butt *et al. Neuron* **48,** 591–604; 2005 and Q. Xu *et al. J. Neurosci.* **24,** 2612–2622; 2004).

These results show that interneuron identity is specified early. It seems likely that interneurons have to read a libretto of transcription factors in their germinal zones before singing out their type. If we identify these factors, we can study the notes that define the interneurons' opera and maybe that will bring their music the recognition it deserves.