RESEARCH HIGHLIGHTS

Hard wired

Cell **123,** 477–491 (2005)
US neuroscientists have cracked part of the molecular code that controls the development of nerve cells in the spine.

The researchers, led by Thomas Jessell at the Howard Hughes Medical Institute, New York, studied how motor neurons in chick embryos connect to muscles in the developing wing. They found that the expression of different combinations of the chick's 39 *Hox* genes — which determine where limbs and other body parts grow, among other things — told developing cells what kind of neuron to become and which wing muscles to connect to.

The team suggests that other kinds of spinal nerves may also use the *Hox* code, and that deciphering it completely might help them to understand the complex wiring that the spinal cord uses to control movement.

IMAGE UNAVAILABLE FOR COPYRIGHT REASONS

CHEMICAL BIOLOGY

Seeing the light

Science **310,** 1006–1009 (2005)
The molecular event that initiates sight happens on a timescale that makes the blink of an eye seem an eternity. But a technique that uses laser pulses that last in the order of 10^{-15} seconds has revealed how the visual pigment rhodopsin captures the energy of incoming light.

Richard Mathies of the University of California, Berkeley, and his colleagues used femtosecond-stimulated Raman spectroscopy to observe how retinal — the light-absorbing component of rhodopsin — transforms into its structural isomer. This is the only light-sensitive step in vision.

They find that the 'wagging' of hydrogen atoms that are attached to retinal's backbone rapidly converts the system into a new electronic ground state. The changes in the charge distribution then drive the slower structural rearrangement.

L COOLEN

ANIMAL BEHAVIOUR

Undercover learning

Curr. Biol. **15,** 1931–1935 (2005)
Wood crickets (*Nemobius sylvestris*; pictured left) have surprised biologists by appearing to learn from each other.

Crickets that are made to share a cage with predatory spiders will hide under leaves to avoid attack. In experiments led by Isabelle Coolen of the National Centre for Scientific Research in Tours, France, crickets that had not been exposed to spiders were found to adopt this hiding behaviour when mixed with trained crickets. This suggests that the insects are capable of social learning — a phenomenon that, in insects, researchers have only previously observed in species that live in colonies, such as bees, ants and termites.

NEUROSCIENCE

Total recall

Nature Neurosci. doi:10.1038/nn1595 (2005)
The brain regions that help to store images and those that monitor the formation of memories have been teased apart by Yun-Ching Kao of Stanford University, California, and her colleagues.

The team used functional magnetic resonance imaging to scan the brains of 16 people as they were shown pictures of indoor and outdoor scenes. While looking at the pictures, the subjects were also asked whether they thought they would remember the image.

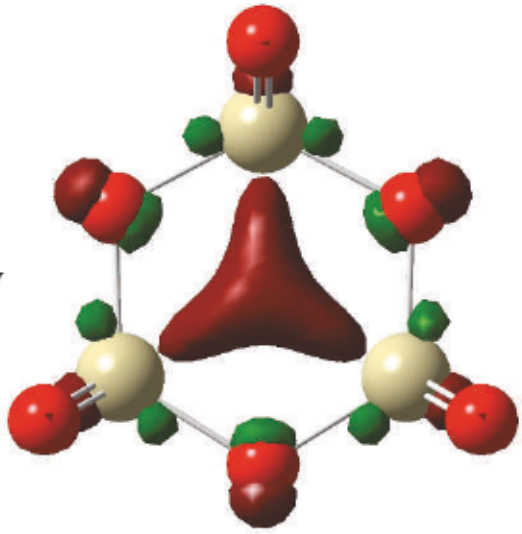
Activity in some regions of the brain, such as the medial temporal lobe, correlated with recall of the scene. But another area — the ventromedial prefrontal cortex (VMPFC) — showed activity when the subject predicted that they would remember the image. This, say the authors, supports the idea that the VMPFC is involved in judging the success of learning processes elsewhere in the brain.

CHEMISTRY

Born slippy

J. Phys. Chem. B doi:10.1021/jp053930j (2005)
Room temperature ionic liquids have the potential to replace more volatile organic solvents in chemical processes. But they tend to be quite viscous, making lab operations such as filtration difficult.

Now Hideaki Shirota and Edward Castner, of the State University of New Jersey in Piscataway, have found that replacing a carbon atom in the cation of an ionic liquid with silicon can make the liquid a much slippier customer, reducing its shear viscosity by up to 7.4 -fold, depending on the partner anion. Charge-density calculations suggest that this happens because polarization of the silicon–carbon bonds spreads the cation's positive charge throughout the molecule, weakening the electrostatic attraction between the ions.



X HUANG *ET AL.*

INORGANIC CHEMISTRY

Full circle

Angew. Chem. Int. Edn **44,** 7251–7254 (2005)

Aromatic organic compounds, originally noted for their smell, are also distinguished by their relative inertness. This arises because in the rings of atoms that they contain, overlap of the atoms' dumbbell-shaped *p* orbitals creates a perfectly filled — and therefore stable — electron shell in the molecular orbital.

But such aromaticity turns out not to be the sole preserve of molecules that can link up their *p* orbitals. Xin Huang and co-workers at Washington State University in Richland show that two anionic metal oxide clusters containing hexagonal rings are aromatic thanks to the overlap of the transition metal atoms' *d* orbitals (pictured right). The formulae of these metal oxide clusters are $[M_3O_9]^-$ and $[M_3O_9]^{2-}$, where M is tungsten or molybdenum

VIROLOGY

On the hook

Science **310,** 1025–1028 (2005)

A molecular hook that juts out from an HIV envelope protein may help this virus to gain entry to its target cells, new experiments have suggested.

HIV latches on to T cells by binding to one of their CD4 receptors and then to a co-receptor to initiate fusion with the cell. The hook, which is formed by the third variable region (V3) of the envelope glycoprotein gp120, was identified using X-ray analysis.

The team that carried out the work, led by Richard Wyatt and Peter Kwong of the National Institute of Allergy and Infectious Diseases in Bethesda, Maryland, suggests that V3 helps the virus to snare the co-receptor. The protruding nature of V3 also makes it accessible to antibodies — perhaps explaining why the immune response often targets this structure.

NEUROBIOLOGY

A charged finding

Cell **123,** 463–475 (2005)

The movements that open voltage-dependent ion channels — which are essential to signalling in neurons — may be more dramatic than some previous studies have suggested.

Measuring these movements is notoriously tricky. But a new technique has revealed that the channel protein's voltage-sensing portion, known as S4, moves 1.5–2 nanometres in response to changes in cell-membrane voltage.

The result comes from Roderick MacKinnon of the Rockefeller University in New York and his colleagues. They stuck molecules of known length to various parts of a potassium channel, then used these tethers as molecular rulers to measure changes in the channel's conformation.

CANCER

Fusion products

J. Cell Biol. **171,** 493–503 (2005)

Some types of virus might promote tumour growth by fusing cells together, hints an *in vitro* study.

Yuri Lazebnik and his colleagues at Cold Spring Harbor Laboratory, New York, examined what happens when a monkey virus fuses two cells together. As expected, in most cases the cells died. But the researchers found that the product cell proliferated if one of the fusing cells had a genetic predisposition to cancer, such as a mutation in the *p53* gene. It seems that the fusion pushes the cell into becoming cancer-like.

The findings should spark studies of the phenomenon *in vivo*. At the same time, the results sound a note of caution for experimental stem-cell therapies that are based on cell fusion.

MATERIALS

Pore show

J. Am. Chem. Soc. doi:10.1021/ja0552601 (2005)

The large surface area of porous materials can make them useful catalysts. But such activity is impaired when manufacturing techniques leave the pore walls in an amorphous, disordered state.

Hideki Sakai and colleagues from the Tokyo University of Science, Japan, report progress. They have synthesized porous titanium dioxide with crystalline walls. Titanium dioxide is widely used in solar cells and as a photocatalyst for the destruction of toxic organic materials, because of its strong oxidizing ability under ultraviolet light. The team manufactured the material from a sol–gel mixture of the precursors at 60 °C.

JOURNAL CLUB

Ariel Darvasi
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A geneticist marvels at the wealth of genetic markers that are now available.

More than a decade ago, I dreamed of mapping genes in a future when the availability of genetic markers was not a limiting factor.

Assuming this time would come, I worked out theoretically how I might trace the complex traits of an organism to their genetic causes. But this approach was deemed ambitious by some, at a time when we had little sequence information.

Since then, the number of markers we have for many genomes, including that of humans, has soared from a few hundred to millions. Most of the new markers are single-nucleotide polymorphisms (SNPs), in which the DNA sequence of some fraction of the population differs by a single base.

We now have enough information for the most demanding, and most promising, kind of genetic study: association-based whole-genome scans.

A pioneering example of such a study comes from Josephine Hoh, of Yale University in New Haven, Connecticut, and her colleagues (R. J. Klein *et al. Science* **308,** 385–389; 2005). They took advantage of chip-based technologies to study 100,000 SNPs in 96 people with age-related macular degeneration (AMD) — a disease causing poor eyesight — and in 50 healthy controls.

The scan associated the gene that encodes complement factor H with the disease. This protein regulates parts of the immune system, consistent with the idea that AMD is linked to inflammation in the retina.

As far as I know, this is the first association study to be done on such a grand scale, and many others are under way. This approach may not allow us to identify all the genes responsible for a trait — for example, some genes may have too modest an effect — but it's a promising place to start.