

RESEARCH HIGHLIGHTS

Bird's-nose view

Proc. R. Soc. B doi:10.1098/rspb.2008.0607 (2008)

Smell may be much more important to the way birds perceive their surroundings than biologists have thought. A study of nine species of bird from seven orders found, in all cases, that the majority of olfactory-receptor genes were probably functional, report Silke Steiger of the Max Planck Institute for Ornithology in Starnberg, Germany, and her co-workers. The only previous estimate — from a draft genomic sequence of the red jungle fowl (*Gallus gallus*) — put that proportion at just 15%.

The total number of working olfactory-receptor genes that an animal has probably indicates how many different scents it can distinguish. Of the species in this sample, the kakapo (*Strigops habroptilus*, pictured), which forages at night, had the most 'smell' genes, 82% of which probably contribute to this bird's sense of smell.



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PHYSICS**Parting a cloud**

Appl. Phys. Lett. **92**, 254102 (2008)

A team of researchers has made three-dimensional 'atom chips' that give unprecedented control over Bose–Einstein condensates (BECs) — clouds of extremely cold atoms that all share the same quantum state.

Thorsten Schumm at Vienna University of Technology and his colleagues used ultraviolet light and electron beams to pattern multiple wiring layers, separated by insulators, onto a semiconductor. By running currents through the wires, the team created magnetic potentials able to hold and manipulate BECs.

For instance, they can split a BEC in two and perform experiments on its halves. They believe that the work might lead to highly sensitive magnetometers and applications in quantum information technology.

ACOUSTICS**Chuckle vision**

J. Acoust. Soc. Am. **124**, 472–483 (2008)

Laughter is considered to be a reflex action, an adaptive tension-reliever with analogues in many non-human species. That congenitally deaf people laugh out loud supports this theory. But do they produce the same sounds as those who hear normally?

Maja Makagon of Cornell University in Ithaca, New York, and her colleagues showed congenitally deaf volunteers clips of films such as *Mr Bean* and *The Naked Gun*, and compared the acoustic properties of their

laughter with that of unimpaired controls. The quality of the sound was remarkably similar; the differences in the sound-waves' shapes were more consistent with deaf people having less vocal-muscle control than with hearers having learned how laughing 'should sound'.

The deaf volunteers laughed more quietly, perhaps owing to social conditioning that led them to lower vocal volume overall.

PLANT SCIENCES**Poisonous grains**

Proc. Natl Acad. Sci. USA doi:10.1073/pnas.0802361105 (2008)

Rice is efficient, indeed disconcertingly so, at assimilating arsenic from the soils of paddy fields. But how it does this has been unclear. Now Fang-Jie Zhao at Rothamsted Research

in Harpenden, UK, Jian Feng Ma at Okayama University in Japan and their colleagues have discovered that it is taken into the plant as though it were silicon.

They found that two transporter proteins belonging to the family known as aquaporins enable arsenite to move from rice's soggy surroundings into its vascular system. Mutations in the genes encoding either of these proteins reduced arsenic uptake by the roots and the amount of arsenic that accumulated in shoots and grains.

The authors hope that different versions of these genes exist that favour silicon transport over that of arsenite. If so, rice carrying such versions could be planted in regions of the world where arsenic poisoning is a problem.

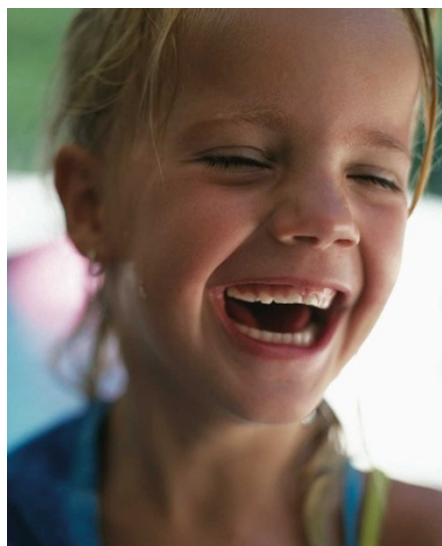
PHYSICS**Gravity up close**

Phys. Rev. D **78**, 022002 (2008)

Gravity is the weakest and least well understood of the four fundamental forces. It behaves well over large distances. But many theorists suspect that undiscovered particles or extra dimensions might cause its observed behaviour to break down over very short distances — which might help to reconcile gravity with the three other forces.

Current approaches will hold a little while longer, however, thanks to Andrew Geraci and his colleagues at Stanford University in California, who have made the most precise measurements yet of gravity over 10 micrometres. They found no anomalies.

The researchers placed a 1.5-microgram gold cuboid on a silicon cantilever a quarter of a millimetre long, rather like a diver on a



B. FASANI/CORBIS

diving-board. They then measured the extra bend, due to gravity, when a second mass was temporarily brought directly beneath the gold.

NEUROSCIENCE

Location, location, location

Neuron **59**, 125–137 (2008)

Researchers studying anaesthetized adult gerbils fitted with earphones report that the neurotransmitter GABA calibrates the processing system that locates a sound's origin.

Ursula Koch and Anna Magnusson of LMU Munich in Germany and their co-workers considered the lateral superior olive (LSO), a nucleus in the gerbil brainstem where information from both ears converges. They played different sound volumes through the right and left earphones and administered chemicals that stimulate or block GABA receptors. This revealed that GABA released by neurons in the LSO adjusts the balance of excitation and inhibition experienced by the same neurons as a result of signals from each ear.

Excitatory nerve terminals seemed to be more strongly affected by GABA, which suggests that neurons in the LSO tend to 'turn down' excitatory input. This would increase auditory sensitivity on the side of the animal that a sound is coming from.

ASTRONOMY

Bright origins

Astrophys. J. **681**, 1035–1045 (2008)

Astronomers have found that vast stores of hot gas in the areas between clusters of gravitationally bound galaxies do form stars, though not many. The gas falls into one of the cluster's bright central galaxies, where it cools and condenses enough for star formation. This process was thought to be negligible in the present-day Universe.

Christopher O'Dea from the Rochester Institute of Technology in New York and his colleagues considered data from 62 of these central galaxies, from which they estimate that 1–10% of the gas contributes to star birth. X-ray emissions served as a proxy for the amount of hot gas falling in, and infrared emissions as a proxy for new stars being formed. Some mechanism, the authors suggest, keeps the gas from cooling completely — perhaps a supermassive black hole in the galactic core, or the new stars themselves.

INFECTIOUS DISEASE

DARC matters

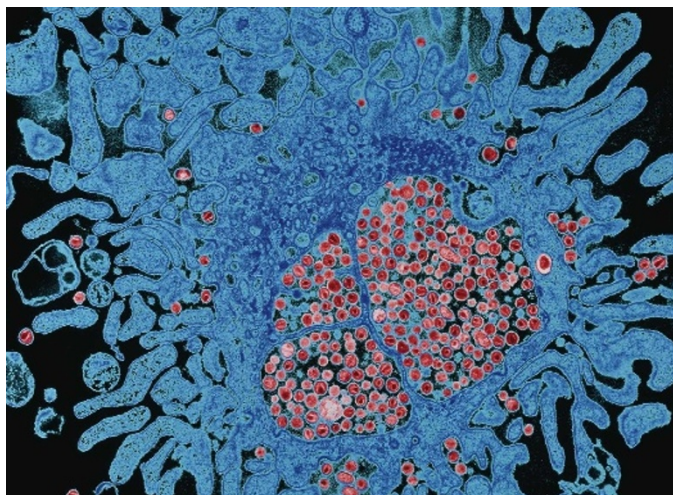
Cell Host Microbe **4**, 52–62 (2008)

A mutation that makes Africans resistant to a form of malaria renders them more vulnerable to HIV infection, researchers have found.

The mutation halts the expression of the protein DARC in red blood cells, where it normally occurs on the surface. Almost all black Africans carry this mutation, which confers resistance to the benign, recurring malaria caused by the parasite *Plasmodium vivax*.

Sunil Ahuja of the University of Texas Health Science Center in San Antonio and his colleagues analysed blood samples from more than 3,400 African Americans and discovered that the DARC mutation is associated with a 40% increase in the risk of acquiring HIV. However, HIV-infected participants with the DARC mutation also survived an average of two years longer than those without it.

The image (below) shows an immune cell known as a T lymphocyte full of newly manufactured HIV particles (red).



CHEMISTRY

Easy bonding

Angew. Chem. Int. Edn doi:10.1002/anie.200802164 (2008)

Many drugs contain compounds with fluorine–carbon bonds, as do tracers used in positron-emission tomography (PET), a medical imaging technique. Producing these compounds is tricky and involves harsh conditions. Now, Tobias Ritter and his colleagues at Harvard University in Cambridge, Massachusetts, have worked out how to perform the fluorination reaction at room temperature.

They developed a palladium catalyst

that can replace a boronic acid group on an aromatic ring with fluorine. The catalyst has nitrogen-containing ligands that make it resistant to attack from aggressive fluorination reagents. Other chemical groups on the ring do not interfere with the reaction, and the carbon–fluorine bond forms in the final step. That is important for making PET tracers because the fluorine isotopes used for PET have short half-lives.

MOLECULAR BIOLOGY

WHAMM!

Cell **134**, 148–161 (2008)

A protein called WHAMM helps shuttle other proteins between compartments in mammalian cells by interacting with two components of the cell skeleton, researchers have found.

Matthew Welch, Kenneth Campellone and their colleagues at the University of California, Berkeley, found that WHAMM mediates the transport of proteins between the endoplasmic reticulum and the Golgi apparatus. The researchers mapped distinct regions of the protein that interact with the membranes of the Golgi, and with two constituents of the cell's internal skeleton: actin and microtubules.

Both raising and lowering the amount of WHAMM in human cells disrupted the Golgi's structure and interfered with the transport of a viral protein from the endoplasmic reticulum to the Golgi.

GENETICS

DNA potholes

Proc. Natl Acad. Sci. USA **105**, 9936–9941 (2008)

In living cells, palindromes in a DNA sequence often stall the

DNA replication machinery when their two halves bind, making the strand loop outwards.

Such arrangements, in which similar or identical sequences sit close to each other but run in opposite directions, are hotspots for chromosome breaks that can cause disease. Using gel electrophoresis to analyse DNA at various stages of its copying, Sergei Mirkin of Tufts University in Medford, Massachusetts, and his colleagues showed that hairpin structures are made this way in living bacterial, yeast and primate cells.

The researchers think that when a hairpin forms, the lagging strand is left uncopied. This makes it more prone to breakage, and thus at greater risk of elimination from the genome.