

THIS YEAR IN NATURE

Nature's manuscript editors made a selection of 'favourites' from the papers we published in 2007.

STEM CELLS

Now in primates

Producing primate embryonic stem cells by somatic cell nuclear transfer, J A Byrne *et al.* *Nature* **450**, 497–502 (22 November).

This important Article brought somatic cell nuclear transfer to primates for the first time. A group led by Shoukhrat Mitalipov generated two embryonic stem cell lines from 314 oocytes taken from 14 rhesus monkeys. The hope is that this approach could work in humans for generating patient-derived embryonic stem cells. [doi: 10.1038/nature06357]



GENOMICS

Disease risks

Genome-wide association study of 14,000 cases of seven common diseases and 3,000 shared controls, The Wellcome Trust Case Control Consortium *Nature* **447**, 661–678 (7 June).

An extensive genome-wide association study in the British population for bipolar disorder, coronary artery disease, Crohn's disease, hypertension, rheumatoid arthritis, and type I and type II diabetes. The analysis confirms previously identified loci and provides strong evidence for many novel disease susceptibility loci. [doi: 10.1038/nature05911]

QUANTUM PHYSICS

Travelling light

Coherent control of optical information with matter wave dynamics, N S Ginsberg, SR Garner & L V Hau *Nature* **445**, 623–626 (8 February).

This development in quantum control may find application in quantum information processing. The cover illustration represents a unique experiment: a light pulse stopped and extinguished in one 'box' is revived from a completely different box in a separate location and sent back on its way. The 'boxes' in the actual experiment were Bose–Einstein condensates, 160 μm apart. Information was transferred by converting



the optical pulse into a travelling matter wave more amenable to manipulation than light. [doi: 10.1038/nature05493]

EXTRASOLAR PLANETS

Caught in transit

A spectrum of an extrasolar planet, L J Richardson, D Deming, K Horning, S Seager & J Harrington *Nature* **445**, 892–895 (22 February).

Fourteen of the 200 plus known extrasolar planets exhibit transits in front of their parent stars as seen from Earth. In theory, subtracting the spectrum seen with the planet 'behind' its star from that seen when it is 'in front', should leave the actual spectrum of an extrasolar planet. This year practice caught up with theory, and an infrared spectrum was obtained for the transiting 'hot Jupiter' HD 209458b. [doi: 10.1038/nature05636]

LINGUISTICS

Lost words

Quantifying the evolutionary dynamics of language, E Lieberman, J-B Michel, J Jackson, T Tang & M A Nowak *Nature* **449**, 713–716 (11 October).

An unusual paper for *Nature* perhaps. A calculation of the rate at which a language grows more regular, based on 1,200 years of English usage. The trend follows a simple rule: a verb's half-life scales as the square root of its frequency. Irregular verbs that are 100 times as rare regularize 10 times faster. Exceptional forms are gradually lost. Next to go, and next to tumble in the cover 'hour-glass', is the word 'wed'. [doi: 10.1038/nature06137]



MATERIALS

Good on the flat

The structure of suspended graphene sheets, J C Meyer *et al.* *Nature* **446**, 60–63 (1 March 2007). Graphene — a one-atom-thick layered form of graphite — is a hot topic in materials science and also in condensed matter physics, where it is a popular model system for investigation. This experiment suspended individual graphene sheets over a microscale scaffold so that transmission electron microscopy and diffraction could be used in structure determination. The 'wavy' structure that emerged is a

step towards an answer to the question of why such a 'two-dimensional' structure can exist at all. [doi: 10.1038/nature05545]

CANCER GENOMICS

A feat of sequencing

Patterns of somatic mutation in human cancer genomes, C Greenman *et al.* *Nature* **446**, 153–158 (8 March 2007)

A series of outstanding papers on large-scale cancer genomics have appeared this year. In this example a sample of 518 kinases associated with more than 200 different cancers were chosen for a major sequencing effort. More than 1,000 previously unknown mutations linked to tumour formation — some as 'passengers' that don't contribute to cancer formation, but over 100 of them as 'driver' mutations that do contribute to disease development. [doi: 10.1038/nature05610]

MECHANOCHEMISTRY

At a push

Biasing reaction pathways with mechanical force, C R Hickenboth *et al.* *Nature* **446**, 423–427 (22 March).

Mechanical force joins heat, light, pressure and electrical potential as a means of kick-starting a chemical reaction by pushing reactants over an energy barrier. In specially designed polymers exposed to ultrasound, rearrangement reactions are accelerated and reaction pathways biased to yield products not obtainable from heat- or light-induced reactions. This work offers new ways of controlling chemical reactions and may lead to mechanically adaptable polymers that can signal impending damage, undergo structure modification to slow the rate of damage, or even self-repair. [doi: 10.1038/nature05681]



NEUROSCIENCE

Leading light

Multimodal fast optical interrogation of neural circuitry, F Zhang *et al.* *Nature* **446**, 633–639 (5 April). A powerful new technique for controlling neural circuits that is likely to have an impact in all fields of neurobiology. It uses a light-activated chloride pump derived from *Archea* to label neurons, which can then be inhibited by exposure to light. This complements an existing tool

for activating neurons via a photoactivatable algal channel. As the channels are sensitive to different wavelengths of light, fast bidirectional control over neural activity can be achieved in a single neural circuit. [doi: 10.1038/nature05744]

ATTOPHYSICS

Solid progress

Attosecond spectroscopy in condensed matter, A L Cavalieri *et al. Nature* **449**, 1029–1032 (25 October). Electron dynamics on the attosecond timescale (an attosecond is a billionth of a billionth of a second) used to be directly measured only in atomic gases. This paper reported the first attosecond spectroscopic measurements in a solid. The ability to time electrons moving in solids over merely a few interatomic distances makes it possible to probe the solid-state electronic processes occurring at the theoretical ultimate speed limit for electronics. [doi: 10.1038/nature06229]



APPLIED PHYSICS

Weighing in

Weighing of biomolecules, single cells and single nanoparticles in fluid, T P Burg *et al. Nature* **446**, 1066–1069 (26 April). Tiny particles — molecules included — can be weighed with remarkably high resolution using nanoscale mechanical resonators. But not in the presence of fluids, which dampen the vibrations that make the system work. This rules out practical applications such as medical diagnostics or environmental monitoring. But here is an ingenious way around the problem: 'hide' the fluid inside the resonator. A vacuum-packaged resonator holds the solution with particles of interest in microfluidic channels, and weighs single nanoparticles and bacteria at subfemtogram resolution. [doi: 10.1038/nature05741]

MOLECULAR BIOLOGY

Polymerase structures

Structural basis for transcription elongation by bacterial RNA polymerase, D G Vassylyev *et al. Nature* **448**, 157–162; Structural basis for substrate loading in bacterial RNA polymerase, D G Vassylyev *et al. Nature* **448**, 163–168 (12 July). Two papers in the classic mould of structural biology. The first establishes the crystal structure of bacterial RNA polymerase bound to the DNA template and RNA product, revealing a

detailed view of the transcription elongation complex. And the second determines the structures of bacterial RNA polymerase elongation complexes bound to NTP substrate analogues with an antibiotic, revealing the mechanism of substrate loading and antibiotic inhibition. [doi: 10.1038/nature05932; doi: 10.1038/nature05931]

MOLECULAR BIOLOGY

A no-nonsense drug

PTC124 targets genetic disorders caused by nonsense mutations, E M Welch *et al. Nature* **447**, 87–91 (3 May). Many inherited diseases result from premature termination during translation of an mRNA into protein. Muscular dystrophy is one such disease. This work shows that a small molecule, PTC124, enables the translation machinery to bypass sites that cause premature termination, but still terminate normally at the end of the mRNA. PTC124 can restore normal translation of the gene that is mutated in muscular dystrophy, and it also restores muscle function in a mouse model of the disease. This drug offers hope that a wide variety of diseases with similar translation defects might be amenable to treatment that will restore protein function. [doi: 10.1038/nature05756]

CELL BIOLOGY

Architectural prize

Determining the architectures of macromolecular assemblies, F Alber *et al. Nature* **450**, 683–694; The molecular architecture of the nuclear pore complex, F Alber *et al. Nature* **450**, 695–701 (29 November). The proteomics based technology described in the first of these two papers will allow cell biologists to look at the detailed structure of all manner of macrocellular machines. The second paper shows the power of the technique by tackling the architecture of nuclear pore complexes, the macromolecular assemblies that selectively transport cargo across the nuclear envelope. [doi: 10.1038/nature06404; doi: 10.1038/nature06405]



THE SOLAR SYSTEM

A touch of Venus

Venus Express package, *Nature* **450**, 629–662 (29 November). The 29 November issue included eight research papers presenting results from ESA's Venus Express mission — which has been in orbit

since April 2006. Subjects covered included the atmosphere, polar features, interactions with the solar wind and the controversial matter of venusian lightning. [doi: 10.1038/nature06432]

STRUCTURAL BIOLOGY

Structural work

Crystal structure of the sodium-potassium pump, J P Morth *et al. Nature* **450**, 1043–1049 (13 December). One of a package of three papers on the structure of P-type ATPases, this Article reports the long-awaited crystal structure of the Na⁺,K⁺-pump at a resolution of 3.5 Å. P-type ATPases are cation pumps of fundamental importance for all eukaryotes and many prokaryotes. [doi: 10.1038/nature06419]



BIOFUELS

Steady on the alcohol

Production of dimethylfuran for liquid fuels from biomass-derived carbohydrates, Y Román-Leshkov, C J Barrett, Z Y Liu & J A Dumesic *Nature* **447**, 982–985 (21 June). Ethanol has its limitations as a biofuel: it is highly volatile, absorbs water and has a low energy density. A potentially better liquid biofuel on those three counts is 2,5-dimethylfuran (DMF). This two-step catalytic process, still in the development stage, can produce DMF from fructose, which can be made either directly from biomass or from glucose. [doi: 10.1038/nature05923]

CLIMATE

The human factor

Detection of human influence on twentieth-century precipitation trends, X Zhang *et al. Nature* **448**, 461–465 (26 July). Climate models suggested that human activity has caused changes in precipitation on a global scale, but no evidence had been found to support the prediction. This paper produced that evidence. A comparison of observed changes in precipitation over land during the twentieth century with climate simulations points to a detectable influence on the latitudinal patterns of precipitation. Anthropogenic factors contributed to moistening in Northern Hemisphere mid-latitudes, but elsewhere, for instance in the Northern Hemisphere tropics, the effect was drying. [doi: 10.1038/nature06025]