

# RESEARCH HIGHLIGHTS

## GENETICS

### Pace of change

*Science* 317, 813–815 (2007)

The rate at which the bacterium *Escherichia coli* accumulates beneficial mutations may be 1,000 times higher than previously thought, according to research by a team in Portugal.

Isabel Gordo at the Gulbenkian Science Institute in Oeiras and her colleagues tracked mutation rates in small and large populations of *E. coli*. In large populations, the team found, many mutations that would make the bacteria more fit are in effect 'swept away' by a few, more strongly adaptive mutations. The effect, known as clonal interference, is less pronounced in smaller populations. Failing to account for this effect properly may have led to underestimates of the mutation rate in previous studies. The findings may help to explain how pathogenicity and antibiotic resistance evolve quickly in bacteria.

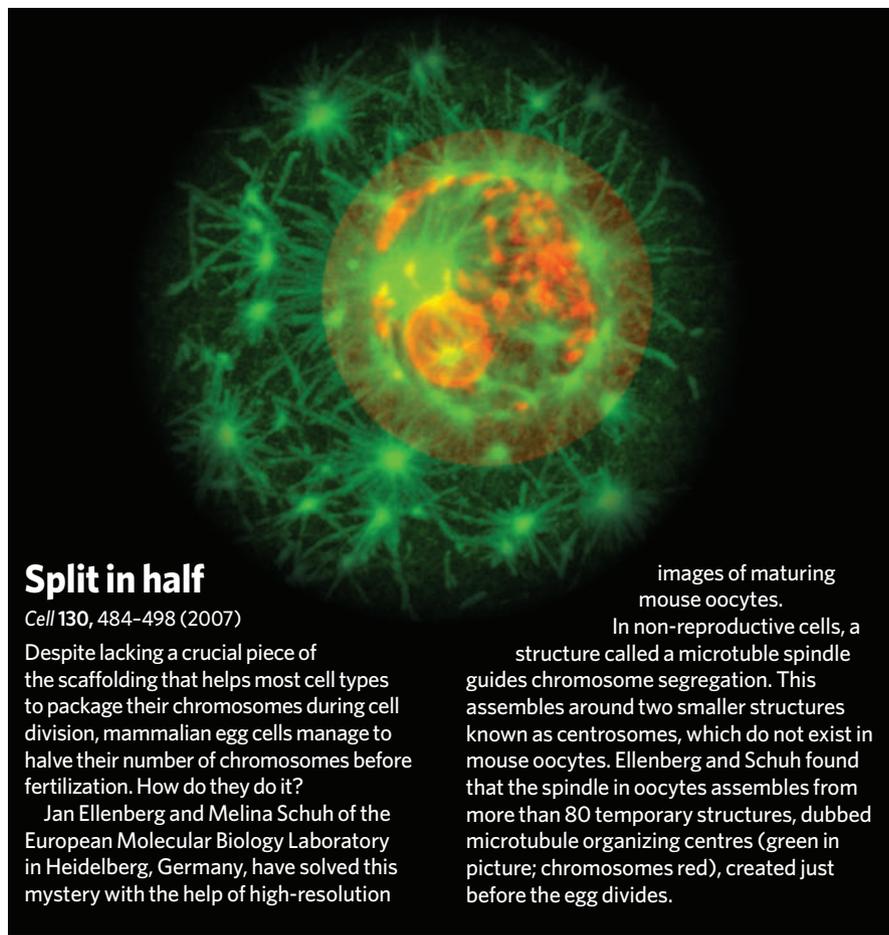
## ANIMAL BEHAVIOUR

### High turnover

*Funct. Ecol.* doi: 10.1111/j.1365-2435.2007.01321.x (2007)

The nectar-eating bat *Glossophaga soricina* (pictured below) has the fastest metabolism of any mammal studied so far, say Christian Voigt of the Leibniz Institute for Zoo and Wildlife Research in Berlin, Germany, and John Speakman of the University of Aberdeen, UK.

The researchers gave bats of this species food with different levels of carbon isotopes, then measured how quickly the isotopes appeared in the bats' breath. They estimate that the bats get more than three-quarters of their energy directly from food yet still turn



### Split in half

*Cell* 130, 484–498 (2007)

Despite lacking a crucial piece of the scaffolding that helps most cell types to package their chromosomes during cell division, mammalian egg cells manage to halve their number of chromosomes before fertilization. How do they do it?

Jan Ellenberg and Melina Schuh of the European Molecular Biology Laboratory in Heidelberg, Germany, have solved this mystery with the help of high-resolution

images of maturing mouse oocytes.

In non-reproductive cells, a structure called a microtubule spindle guides chromosome segregation. This assembles around two smaller structures known as centrosomes, which do not exist in mouse oocytes. Ellenberg and Schuh found that the spindle in oocytes assembles from more than 80 temporary structures, dubbed microtubule organizing centres (green in picture; chromosomes red), created just before the egg divides.

over half of their body fat in 24 hours.

Humans fuel about three-quarters of their metabolism from stores of fat and glycogen, but it would be impractical for bats to carry large fat stores in flight.

## PHYSIOLOGY

### Not just a bunch of bones

*Cell* 130, 456–469 (2007)

The skeleton is more than just scaffolding for the body. New work has revealed that, in mice at least, it regulates aspects of metabolism.

Key to the skeleton's role is a protein called osteocalcin, produced by bone cells known as osteoblasts. Researchers led by Gerard Karsenty at Columbia University in New York found that osteocalcin influences blood sugar levels and fat deposition. Mice lacking this protein showed traits of diabetes, such as insulin resistance. Conversely, mice engineered to be in some senses anti-diabetic, suffering effects including low blood sugar and increased insulin sensitivity, showed reduced symptoms if one allele of the osteocalcin gene was deleted.

The results suggest that osteocalcin

functions as a hormone, making the skeleton an endocrine organ, and hint that it might have a use in the treatment of diabetes.

## CHEMISTRY

### Frenetic kinetics

*Angew. Chem. Int. Edn* doi: 10.1002/anie.200701326 (2007)

Researchers have developed an apparatus that can rapidly determine reaction parameters, such as the rate constant and activation energy, for catalytic reactions. This should aid the design of more effective catalysts for industrial applications.

Oliver Trapp at the Max Planck Institute for Coal Research in Mülheim, Germany, and his colleagues built a microreactor in which polymer-bound catalysts are deposited on the walls of capillaries that serve as reaction vessels. The polymer doubles as a chromatographic separation material, so that catalysis and product separation are efficiently combined.

In a study of palladium-catalysed hydrogenation reactions, 5,880 reactions were performed in 40 hours. If such an

analysis were carried out by one person using traditional methods it could take weeks.

#### EARTH SCIENCES

### Leaks and flows

*Geophys. Res. Lett.* **34**, L13612 (2007)

Ocean circulation in the southern hemisphere is characterized by swirling basin-wide currents, known as gyres, contained within the Indian, Pacific and Atlantic Oceans. Now scientists have discovered a 'supergyre' that connects the three basins.

Ken Ridgway and Jeff Dunn of CSIRO Marine and Atmospheric Research in Hobart, Australia, determined flow patterns from temperature and salinity profiles collected since 1950. They found that, in a region south of Tasmania, Pacific waters 'leak' into the Indian Ocean. There is a similar but weaker connection south of Africa between the Indian and Atlantic Oceans.

Models have suggested that the ocean basins are linked, but until now the connecting element had escaped observation. The supergyre seems to be an essential component of the global ocean circulation system.

#### CELL BIOLOGY

### Age: nothing but a pathway

*Science* **317**, 803–806 and 807–810 (2007)

A molecular pathway that regulates stem cells leads a double life as an usher of old age, two teams have found.

Toren Finkel at the National Heart Lung and Blood Institute in Bethesda, Maryland, and his co-workers examined a strain of mice, known as Klotho, that ages prematurely. The team found that the klotho protein these mice lack keeps the Wnt pathway in check. Wnts are a family of proteins known to stop stem cells from differentiating.

Thomas Rando, at Stanford University School of Medicine in California, and his team noticed the same counterintuitive role for Wnt when they connected the veins and arteries of young and aged mice, so that blood flowed freely between the two. Under these conditions, muscle stem cells in young mice showed signs of fibrosis — a hallmark of old age. Activating Wnt signalling in young mice had the same effect.

#### ASTRONOMY

### Blasts from the past

*Astrophys. J.* **664**, 1000–1010 (2007)

Short gamma-ray bursts have been a feature of the Universe for longer than some observations have suggested, say Edo Berger of the Observatories of the Carnegie

Institution of Washington in Pasadena, California, and his colleagues.

In seconds, these bursts release energy comparable to the Sun's output over its entire lifetime. Berger's team detected nine such events and estimate that up to two-thirds of this type of burst happened more than six billion years ago. They also estimate higher energies for these ancient bursts than have been reported for more recent bursts.

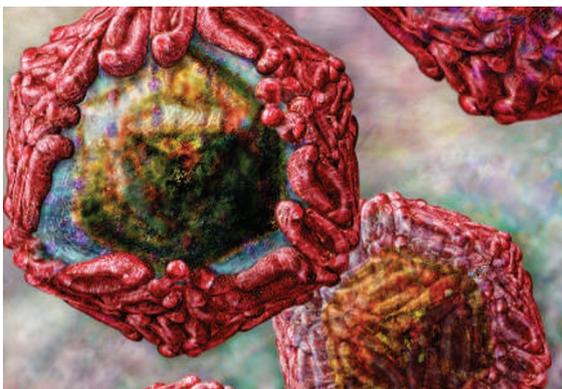
Such observations should help astronomers to work out what causes the explosions: today's best guess is that they result from the merger of two neutron stars, or a neutron star and a black hole.

#### VIROLOGY

### Killer mutation

*Nature Genet.* doi:10.1038/ng2097 (2007)

A single mutation may be responsible for the recent increased virulence of the West Nile virus (pictured below). Since 1996, the virus has caused regular outbreaks of severe and even lethal encephalitis in humans. Previously the mosquito-borne, bird-infecting virus had caused only mild infections in humans.



Aaron Brault of the University of California, Davis, and his colleagues analysed the genomes of 21 strains of West Nile virus from around the world. They identified a single base alteration in a gene encoding a helicase enzyme that had arisen independently in at least three strains associated with human outbreaks. Engineering this mutation into a less virulent strain made the virus more lethal to birds, but whether the mutation is associated with increased virulence in humans remains to be determined.

#### Correction

The Research Highlight 'When dinos hit puberty' (*Nature* **448**, 391; 2007) wrongly implied that modern crocodylians are descended from dinosaurs. Both groups derived from archosaurs.

R. KIGHTLEY/SPL

## JOURNAL CLUB

**Martyn Poliakoff,**  
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**A champion of environmentally friendly chemistry encourages attempts to identify reactions ripe to be turned 'green'.**

The aim of 'green chemistry' is to make the design, production and use of chemicals more sustainable. This means that, unusually for an academic discipline, industrial implementation is an inherent goal.

Research groups in this field, including mine, strive to reduce waste by identifying selective catalysts, alternative solvents or renewable feedstocks that could lead to new industrial processes.

But how do we choose which reactions to try to green? Some targets are obvious; the reactions are notoriously inefficient. However, many chemical manufacturers are understandably reticent about the shortcomings of their processes.

It was therefore particularly refreshing to find a paper that results from the collaboration of seven pharmaceutical companies and highlights key research areas for green chemists (D. J. C. Constable *et al. Green Chem.* **9**, 411–420; 2007). The paper describes several classes of reaction that, if 'greened', would significantly lessen the pharmaceutical industry's effect on the environment.

For example, the paper asks that researchers develop methods to carry out oxidations safely in non-chlorinated solvents (chlorinated solvents are non-flammable but toxic); or to find ways to tame the fearsome reactivity of fluorine so that fluorination occurs selectively.

Another clear message is that new strategies for using solvents could lead to substantial reductions in waste. Could reaction vessels be cleaned out at the end of a process without using organic solvents?

This paper is a great start, but I think the authors have been too conservative. They could have asked for more, such as catalysts that can trigger two or more reactions in sequence. We need really tough challenges to intrigue academic chemists and bring new blood to the task of greening chemistry.

Discuss this paper at <http://blogs.nature.com/nature/journalclub>