RESEARCH HIGHLIGHTS

Trick of the light

Preprint astro-ph/0505484 at http://arxiv.org (2005)

When instruments intended to detect light from planets outside our Solar System succeed in spotting distant pinpricks of light, the data should be interpreted with care.

Michael Jura of the University of California, Los Angeles, warns that some sources may be comets, not planets. He calculates that a comet like Hale–Bopp (pictured) passing through the planetary system of another star can reflect as much light as the planet Earth does, because of the vast amount of dust it sheds.

Tracking the course of possible extrasolar planets would allow true planets to be distinguished from comets, he says. Such observations might also illuminate the poorly understood nature of comet populations around other stars. Both NASA and the European Space Agency have plans to use space-based observatories to study extrasolar planets.

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GENETICS

Barely there

Science doi:10.1126/science.1113485 (2005)

The genome of an ancient cave bear has been partially reconstructed by a team headed by Edward Rubin of the Lawrence Berkeley National Laboratory. The study shows that degraded DNA can be pieced together from fossils, raising hopes of recovering the genomes of early hominids.

The team analysed all the genetic material in samples from a 40,000-year-old bear tooth and bone. Some 90% of the DNA analysed in this metagenomic approach was from bacteria or unidentified sources. But similarities between the bear genome and that of the modern dog meant the team could identify 26,861 base pairs of cave bear sequence.

ANIMAL BEHAVIOUR

Fruitless frolics

Cell 121, 785–794 (2005)
Cell 121, 795–807 (2005)

A single gene found in the neurons of fruitflies, called *fruitless*, controls sexual behaviour so strongly that female flies engineered to manufacture male *fruitless* proteins behave like male flies.

Normally, female flies do not initiate reproduction. But the engineered females target other female flies with a complex mating ritual. Equally, male *Drosophila melanogaster* engineered to lack these proteins become passive in courtship. The researchers who conducted these experiments, led by Barry Dickson of the Austrian Academy of Sciences in Vienna, also discovered *fruitless* to be expressed in olfactory–sensory neurons in males.

NEUROBIOLOGY

Within sight

Neuron doi: 10.1016/j.neuron.2005.04.023 (2005)

What we notice in the corner of our eyes can be determined by unnoticed features of objects in our focus, say Zoltán Vidnyánszky of Semmelweis University in Budapest and his colleagues. They got subjects to focus on coloured dots on a screen that moved too subtly for their motion to be detected. Dots were then introduced in the subjects' peripheral view, and people were best at picking these up when they moved in the same direction as the dots in plain focus. This suggests that objects on the edge of the visual field catch our eye when they share a common trait with those in our direct gaze.

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CHEMISTRY

Maximum mass

Anal. Chem. doi:10.1021/ac048205+ (2005)

Biological molecules weighing a million times more than a hydrogen atom can now be detected using mass spectrometry, report Renato Zenobi and colleagues from the Swiss Federal Institute of Technology in Zurich. The technique — using a modified version of a MALDI-TOF spectrometer — could be applied to clinical analyses of viral and bacterial particles.

EVOLUTION

Love bug

Biol. Lett. doi:10.1098/rsbl.2005.0296 (2005)

It has been suggested that parasites are a key driver in the evolution of sexual reproduction. Support for this idea now comes from experiments in flour beetles (*Tribolium castaneum*) led by Paul Schmid–Hempel of the Swiss Federal Institute of Technology in Zurich. The beetles are locked in an evolutionary battle with the parasite *Nosema whitei*.

The researchers looked at two sequences in the beetle's genome, and they report that infection with co-evolving parasites increased shuffling of genes at these sites during meiotic cell division (by which eggs and sperm are produced). Such genetic recombination can break up favourable genetic sequences, but it may also give the beetle an advantage over the ever-changing parasite.

RNA INTERFERENCE

Meeting places

Nature Cell Biol. doi:10.1038/ncb1265 (2005)
Nature Cell Biol. doi:10.1038/ncb1274 (2005)
Genes are transcribed into messenger RNAs that are then translated into proteins. This central dogma of molecular biology has recently been shaken by the discovery of new classes of small RNAs. Micro RNAs and small interfering RNAs, for example, suppress gene expression without coding for proteins.

Two independent teams, George Sen and Helen Blau of Stanford University, and a group led by Gregory Hannon of Cold Spring Harbor Laboratory, have shed more light on how, or at least where, this happens. Both groups show that components of the cellular machinery needed to help these small RNAs repress the translation of mRNAs, concentrate in the P-bodies of mammalian cells — tiny organelles in the cytoplasm where superfluous mRNAs are processed. Whether this co-localization is a cause or a consequence of mRNA suppression has yet to be determined.

COMPUTATIONAL BIOLOGY

Patterns pending

J. Biol. doi:10.1186/jbiol23 (2005)
To help them build computer models of networks, such as the interactions between molecules inside cells, biologists developed the idea of 'network motifs'. Motifs are simple patterns of interconnection that occur more often than would be expected by chance.

Researchers led by Frederick Roth at Harvard Medical School in Boston investigated five networks that connect genes and proteins in cells of the yeast *Saccharomyces cerevisiae*. As well as finding motifs, they put motifs into higher-order groupings called 'network themes', which seem to represent the elemental design principles of the network. Maps based on such themes could predict the function of unknown genes.

PHYSICS

Speed trap

Phys. Rev. A **71**, 050101 (2005)
Is the speed of light the same in different directions? Yes, according to the most definitive answer yet given to this long-studied question.

Stephan Schiller's group at the Heinrich Heine University in Düsseldorf, Germany, searched for changes in the speed of light by studying laser beams that were reflected back and forth in sapphire crystals held close to absolute zero. As the crystals were rotated, their resonance frequencies remained constant, suggesting that the speed of light is unchanged. The experiment's accuracy of around 6 parts in 10^{16} is an order of magnitude better than the most stringent previous test.

PALAEONTOLOGY

Tyrannosaurus sex

Science **308**, 1456–1459 (2005)
Examination of a *Tyrannosaurus rex* unearthed in 2003 in Montana has revealed a bone tissue similar to that of today's female birds, say researchers led by Mary Schweitzer from North Carolina State University, Raleigh.

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Medullary tissue is found on the inside of hollow bones and is pitted with channels through which blood vessels run. This makes it an excellent source of the calcium that female birds need to produce eggshells. Evidence that *T. rex* used a similar system emphasizes how closely birds are related to these dinosaurs, and suggests that this specimen was an egg-laying mother.

MATERIALS

Going soft

Phys. Rev. Lett. **94**, 205502 (2005)
You can squeeze and mould it like putty. But the material developed by Wei Hua Wang, of the Institute of Physics in Beijing, and his team is not a plastic made from polymers — it is a metallic glass that goes soft in boiling water.

Wang's blend of cerium, aluminium and copper, with a dash of niobium, is completely amorphous. At room temperature, it has the hardness, toughness and electrical conductivity of a typical metal. When heated, it displays plastic properties, becoming malleable at just 68 °C. This unusually low glass transition temperature, combined with resistance to crystallization, means the material should appeal to manufacturers.

JOURNAL CLUB

Luigi Piro
National Institute for Astrophysics, Rome

The mission scientist for a space telescope that probed the origin of gamma-ray bursts explains why these dramatic pulses of energy have cosmic importance.

I was the lead scientist for BeppoSAX, a satellite that could pinpoint gamma-ray (γ-ray) bursts. We discovered that these energy bursts are produced when massive stars in the distant Universe undergo powerful explosions. Intriguing questions remain about the nature of such events, but the bursts also provide thrilling data for cosmologists.

My team and other astronomers are considering how to use γ-ray bursts to learn about the early history of the Universe. One idea is to analyse the accompanying X-rays to get information about the composition of the regions through which the radiation has travelled. Another idea is to use γ-ray bursts as 'cosmic rulers': if astronomers know a burst's total energy, then its brightness, as viewed from Earth, can be used to infer its distance.

Cosmology was revolutionized when type Ia supernovae — exploding stars — were used as cosmic rulers. They revealed that the current expansion of the Universe is accelerating. Gamma-ray bursts should tell us more because they are brighter, and so reach us from farther away.

Indeed, a report in *The Astrophysical Journal* (G. Ghirlanda, G. Ghisellini, D. Lazzati and C. Firmani **613**, L13–L16; 2004) shows that using even a limited number of γ-ray bursts as rulers reduces the margin of error in current cosmological models. The researchers calculated the bursts' total energies from their peak frequencies and directions.

Observations of γ-ray bursts from Swift, a new space telescope, will further test this method and, I hope, shed light on dark energy. Dark energy is thought to drive the expansion of the Universe, but its physical nature is a mystery.