RESEARCH HIGHLIGHTS

ASTRONOMY

Galactic striptease

Astrophys. J. **692,** 298–308 (2009)

Most astronomers agree that spiral galaxies, which were dominant billions of years ago, morphed into the lens-shaped galaxies that are so prevalent today. One idea describing how this happened assumes the existence of regions of hot gas in the intergalactic space of massive galaxy clusters. The hot gas strips away gas in spiral galaxies as they whip through the intergalactic space, turning them into lenticulars.

But David Wilman of the Max Planck Institute for Extraterrestrial Physics in Garching, Germany, and his colleagues have observed lenticular galaxies forming as easily in sparse groups of galaxies, in which the stripping effect of hot gas is negligible. This suggests that, as some astronomers had suspected, galactic mergers are instead an important mechanism.

PLANT SCIENCE

Pigment puzzle

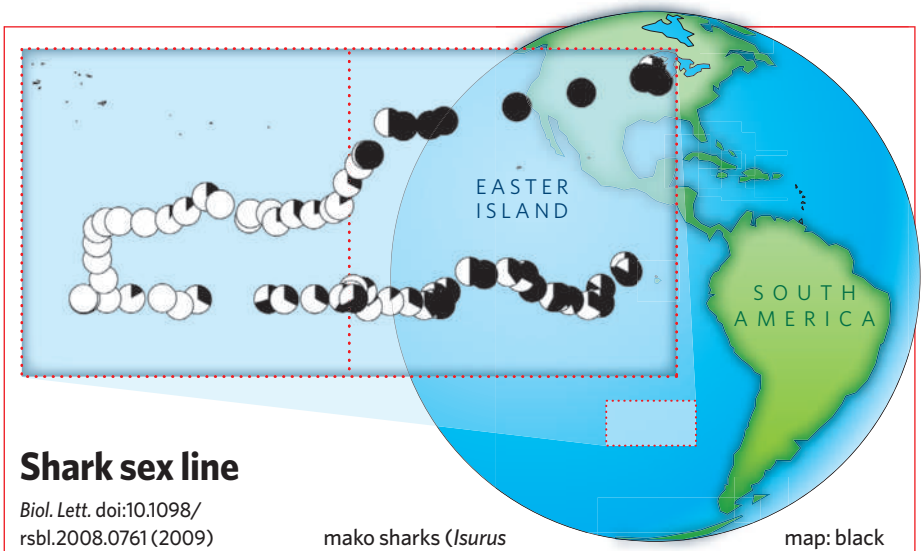
J. Am. Chem. Soc. doi:10.1021/ja809065g (2009)

Researchers at Florida International University in Miami have discovered the 'animal' pigment bilirubin in the seeds of the white bird of paradise tree, *Strelitzia nicolai*. This is the first example of bilirubin occurring naturally in plants.

Cary Pirone and her colleagues cannot yet account for the presence of the bright orange substance, which is a product of the breakdown of the haem chemical group that, in animals, is found in haemoglobin. In plants, haem's normal metabolic product is the light-sensing pigment of the important protein phytochrome.

Although the plant the team studied has white flowers (pictured), the seed part, called the aril, has the hue of oxygenated blood.

P. CLEMENT/NATUREPL.COM



ROYAL SOCIETY

Shark sex line

Biol. Lett. doi:10.1098/rsbl.2008.0761 (2009)

Males and females of many species voluntarily segregate themselves into different habitats. A team led by David Sims of the Marine Biological Association of the United Kingdom in Plymouth has discovered an apparent 'sex line' dividing the South Pacific population of shortfin mako sharks (*Isurus oxyrinchus*) rather as the dance floor at a school disco segregates teenagers.

Of 396 mako caught by commercial fishing boats in this region, those pulled up east of 120°W were nearly all female, whereas those west of this longitude were almost all male (pictured on map: black shows capture locations of female sharks; white indicates males). The western area has traditionally been much more heavily fished, so it is possible that a disproportionately large number of males have been removed from the population.

ZOOLOGY

Nightingale serenade

Proc. R. Soc. B doi:10.1098/rspb.2008.1726 (2009)

Male nightingales that sing during the night are serenading females, whereas those that sing at dawn are letting other males know that the territory is occupied, report Tobias Roth of the University of Basel in Switzerland and his co-workers.

The researchers caught ten female nightingales (*Luscinia megarhynchos*) and moved them 70 km to a site in the Rhine Valley in France where the team has studied nightingales since 1994. Radio transmitters glued on the backs of the incomers revealed that unpaired females fly around at night visiting several males, at a time when bachelor males are singing more frequently than paired males. All males sing vociferously during the dawn chorus, however.

GENETICS

Hopping hope

Science doi:10.1126/science.1163040 (2009); *Nature Biotechnol.* doi:10.1038/nbt.1526 (2009)

Recent studies of human tumours have suggested that solid cancers carry a host of different genetic mutations. Working out which of these set off the disease is tricky, but a team led by David Largaespada of the University of Minnesota in Minneapolis has found a way.

The group engineered mice that contain a jumping gene, or transposon, that can be switched on or off in specific tissues. When it is turned on, it hops around the genome, disabling other genes by inserting copies of itself into them.

Largaespada and his colleagues have used this approach to identify 77 genes potentially involved in human colorectal cancer and 19 that are strongly implicated in liver cancer, some of which were not previously known to be mutated in human tumours.

NEUROSCIENCES

Child abuse 'scars' DNA

Nature Neurosci. **12,** 342–348 (2009)

Childhood abuse may leave its mark on DNA in ways that have an effect on stress responses decades later.

Previous research has shown that rat pups reared by inattentive mothers accumulate more methyl groups on a region of DNA that regulates the expression of a receptor for glucocorticoid hormones. As a result, fewer receptors are made, potentially enhancing the animal's response to stress.

Now Michael Meaney of McGill University in Montreal, Canada, and his colleagues have tested brain samples from people who committed suicide, and found that those with a history of childhood abuse had a similar methylation pattern to the neglected rat pups. They also had fewer than average glucocorticoid receptors. These measures did not differ between people with no history of abuse who killed themselves and unabused people who died by other means.

MECHANICS

Good vibrations

Phys. Rev. Lett. **102,** 080601 (2009)

Harvesting energy from ambient vibrations, such as those created by walking or the shaking of moving vehicles, is one way to obtain low-cost and renewable power for small electronic devices. Most examples so far convert vibrations into electrical energy using 'linear' oscillators, which miss out much of the typically broad frequency spectrum of vibrations.

Nonlinear oscillators — for example, bistable ones with two stable oscillating states — can do a better job, according to Francesco Cottone at the University of Limerick in Ireland and his colleagues. Their proof of principle is an inverted pendulum comprising a piezoelectric beam, which produces electricity when it bends. This generates four to six times more power from ambient vibrations when it oscillates in a bistable rather than a linear manner.

PALAEOCLIMATOLOGY

Global cooling

Science **323,** 1187–1190 (2009)

Large parts of Antarctica became suddenly and substantially icy about 34 million years ago. Oxygen-isotope records suggest that a simultaneous accumulation in ice cover happened in the Northern Hemisphere, which is now challenged by Zhonghui Liu of Yale University and his colleagues.

They calculate sea-surface temperatures for the period using a pair of chemical proxies (tetraether and unsaturated alkenone) found in sediment cores retrieved from 11 locations around the world. According to their calculations, high-latitude cooling averaged 5 °C.

After plugging their numbers into an ocean-circulation model, the team calculated that ocean cooling could explain the discrepancy in oxygen-isotope records: a Northern Hemisphere glaciation would not have been required.

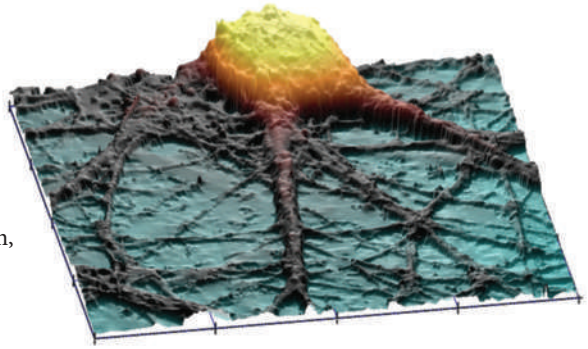
MICROSCOPY

Pogo-stick pictures

Nature Methods doi:10.1038/nmeth.1306 (2009)

There is as yet no way to produce images that capture the three-dimensional convolutions of a living cell's surface without running the risk of deforming the cell. But a team led by Yuri Korchev of Imperial College London, UK, thinks it has cracked the problem by modifying a technique used on relatively flat surfaces called scanning ion conductance microscopy.

The team's method builds up pictures by measuring changes in the ion flow through a fluid-filled nanopipette when its tip comes close to a cell. The team's innovation involves having the pipette 'hop'— that is, approach the sample from above any of its surface features — rather than scanning across the surface. Their image of a mouse cochlear hair cell is shown below.



P. NOVAK *ET AL.*

METAMATERIALS

Taming terahertz

Nature Photon. doi:10.1038/nphoton.2009.003 (2009)

Unlike X-rays, terahertz or 'submillimetre' radiation can penetrate organic samples without damaging them, and so holds promise for medical diagnostics. But there is a stumbling block on the path to such technologies: terahertz waves have proved difficult to manipulate.

Hou-Tong Chen at the Los Alamos National Laboratory in New Mexico and his colleagues have now developed a device that controls the phase of terahertz waves. This makes it possible for researchers to store and transmit information with terahertz radiation by varying the voltage across a 'metamaterial' — one made from tiny components that are similar in size to the wavelength of the terahertz waves.

The metamaterial modulator works as well as analogous devices for manipulating optical waves, but at much higher speeds.

JOURNAL CLUB

Paolo Tammaro
University of Manchester, UK

A physiologist notes the similarities between animal and plant electricity.

Almost all organisms run on electricity. As an undergraduate, I was intrigued by the fact that the long, single cells of the freshwater plant *Nitella* are nearly identical to those of single nerve fibres. These plant cells generate slow action potentials that are similar to those of human or animal nerves. But the electrical components that span plant and animal membranes — the ion channels and transporter proteins — are usually quite different, as are some of the ions they transport.

Earlier this year, however, two researchers in Italy found that a single mutation can turn an important transport protein from a component that is compatible with animal electrical systems into one that is appropriate for plants. They studied the protein CLC-5, which is abundant in the intracellular vesicles of kidney cells. There, it exchanges chloride ions for protons, and in so doing regulates the vesicles' acid content (G. Zifarelli and M. Pusch *EMBO J.* **28,** 175–182; 2009).

The researchers knew that CLC-5 resembled the plant transporter atCLCa, but they had no idea how closely. In plant vacuoles, which are formed by the fusion of several vesicles, atCLCa exchanges not chloride but nitrate ions for protons. The difference is vital: nitrate is necessary for plants to grow and is stored in the vacuoles of root and shoot cells, whereas chloride has a very different role. It is needed for photosynthesis and for the opening and closing of stomata, which matters mostly in the leaves.

Merely substituting one serine amino acid in CLC-5 with a proline changed the protein from a chloride transporter into a nitrate transporter. I find this fascinating because it provides an even more striking example of the similarities that animals and plants can share, even though their biologies are generally very different.

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