

RESEARCH HIGHLIGHTS

GEOPHYSICS

Synthetic sky light

Geophys. Res. Lett. doi:10.1029/2009GL041895 (2010)
Artificial auroras can be created using an array of high-frequency transmitters. Researchers have previously done this by pumping a 3.6-megawatt beam of radio waves into the ionosphere, a region of the atmosphere a few hundred kilometres above Earth's surface. The beam was powerful enough to break electrons free of their parent atoms, creating an artificial aurora similar to that of the Northern Lights.

Now Todd Pedersen of the US Air Force Research Laboratory at Hanscom Air Force Base in Massachusetts and his co-workers have used the same transmitters in Alaska to create a glowing artificial ionospheric layer that was dense enough to move down to about 150 kilometres above Earth's surface. At this altitude, the layer could potentially be useful for long-range communications or new kinds of radar.

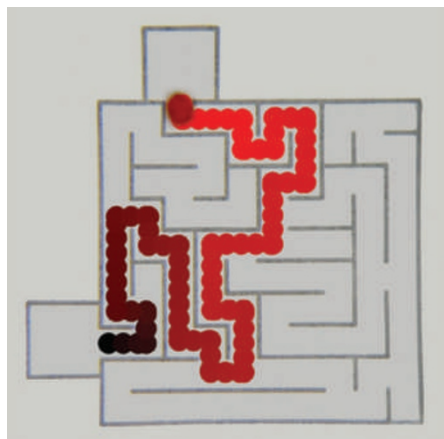
CHEMISTRY

Chase acid, solve maze

J. Am. Chem. Soc. doi:10.1021/ja9076793 (2010)
An acid-seeking chemical blob can propel itself through a maze, always choosing the shortest way out.

Bartosz Grzybowski and his team at Northwestern University in Evanston, Illinois, created this system by lacing a droplet of organic solvent with a surfactant, 2-hexyldecanoic acid, that diffuses to the liquid's surface. The surfactant reacts with base, and in a pH gradient this results in unequal surface tensions at the droplet's edge, which drive it acid-wards.

The authors diffused acid through a maze of silicone channels already filled with basic solution. They then set their droplet loose; it darted down the channel with the steepest pH gradient (pictured below), which was also the shortest route to the acid-soaked exit.



Life in the Lost City

Proc. Natl Acad. Sci. USA doi:10.1073/pnas.0905369107 (2010)

On the sea floor 15 kilometres west of the Mid-Atlantic Ridge lies the Lost City Hydrothermal Field, a collection of deep-water hydrothermal vents that has been active for at least 30,000 years.

William Brazelton of the University of Washington in Seattle and his colleagues analysed the bacteria and archaea that live in the vents' chimneys (pictured). They obtained more than 200,000 DNA sequences for a specific region and correlated these with the age of the organisms' habitats over a 1,200-year period. They found that sequences that occur rarely in young chimneys are more abundant in older chimneys.

The researchers suggest that over the many chimney life cycles that create recurring environmental conditions, selection has resulted in many closely related species that are pre-adapted to specific conditions.



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ASTROPHYSICS

Dusty galaxy

Astrophys. J. **709**, 210–217 (2010)

Astronomers have discovered the glow of a dusty galaxy about 7.3 billion parsecs away that existed when the Universe was just 1.5 billion years old. Kirsten Knudsen of the Argelander Institute for Astronomy in Bonn, Germany, and her colleagues say that it is the earliest-known faint galaxy of its type — a type thought to incubate violent episodes of star birth.

An array of antennas in Hawaii detected the galaxy's diffuse, glowing dust in the microwave part of the spectrum. Follow-up observations with optical telescopes determined its age. The discovery suggests that small and faint dusty galaxies might be as important for star formation in the early Universe as their bigger and brighter counterparts.

EVOLUTIONARY BIOLOGY

How girls go solo

Proc. R. Soc. B doi:10.1098/rspb.2009.2113 (2010)

Sexual reproduction evolved 2 billion to 3.5 billion years ago, but hundreds of species have ditched sex in favour of parthenogenesis, in which female embryos develop from unfertilized eggs. New work suggests that a positive feedback loop may have helped to drive some species from sexual reproduction to female-only lineages.

Tanja Schwander at Simon Fraser University

in Burnaby, Canada, and her colleagues report this finding from an analytical model, which they verified with data from sexually reproducing *Timema* stick insects. A few stick-insect species reproduce by parthenogenesis, but most reproduce sexually, although some unfertilized eggs do hatch spontaneously.

The authors showed that this spontaneous hatching increases when females are less able to find mates. This biases the population towards females, causing even more spontaneous hatching, and so on, providing a potential stepping stone towards full parthenogenesis.

BIOCHEMISTRY

Designer label

Proc. Natl Acad. Sci. USA doi:10.1073/pnas.091116107 (2010)

Chemical labelling of molecules in living animals can provide insight into metabolic and disease processes, but attaching molecular tags rapidly without poisoning the subject can be tricky.

Carolyn Bertozzi at the University of California, Berkeley, and her colleagues have now shown that a method previously used to fluorescently label molecules in developing zebrafish also works in live mice.

They injected mice with a compound bearing a nitrogen-based chemical group called an azide, which bound to sialic acids found on cell surfaces. The animals were then injected with another compound,