

Sciencewatch

COMPILED BY JOHN SWAIN, NORTHEASTERN UNIVERSITY

The frog that hears through its mouth

Gardiner's frogs live in the Seychelles islands and are among the smallest in the world at just 1 cm long. Now they have another claim to fame because they hear in what seems to be a completely distinct way – through their mouths. Other frogs have a tympanic middle ear with a membrane that vibrates on the surface of their heads, while Gardiner's frogs have none and so might seem to be deaf. However, they do croak to communicate and now Renaud Boistel of the Centre de Neurosciences Paris-Sud and colleagues have found that they can hear using their mouths as resonators coupled to an inner ear.

Using X-ray imaging techniques at the European Synchrotron Radiation Facility



A male Gardiner's frog in its natural habitat in the Seychelles. (Image credit: R Boistel/ CNRS.)

in Grenoble, the researchers established that the pulmonary system of these frogs could not contribute significantly to the

transmission of sound to the inner ears, so they focused instead on the head. With the aid of numerical simulations the researchers were able to confirm that the mouth acts as a resonator. Hearing via a middle ear is common to all other four-legged animals and seems to have evolved independently in different lineages. The home islands of these unusual frogs have been isolated from other land masses for 47–65 million years, so their hearing mechanism may be a unique survivor of ancestors from the ancient continent of Gondwana.

● Further reading

R Boistel *et al.* 2013 *PNAS* **110** 15360.

Nature's pain medicine

While a large fraction of modern medicines are extracted or derived from natural plant sources, medical chemistry has managed to synthesize quite a few that would seem to be human creations. Now Ahcène Boumendjel of Université Joseph Fourier in Grenoble and colleagues have found a synthetic painkiller in a plant used in traditional African medicine to treat pain. They found that the roots – the part used in traditional pain remedies of Cameroon – of the pincushion tree (*Nauclea latifolia*) contain large amounts of tramadol, a synthetic painkiller used since the 1970s. This seems to be the first time a widely used synthetic drug has been found at medically useful levels in a plant. It seems that nature got there first for this one.

● Further reading

A Boumendjel *et al.* 2013 *Angewandte Chemie* DOI: 10.1002/anie.201305697.

Cheap and quiet MRI

A new approach to magnetic resonance imaging (MRI) could lead to cheaper devices without the clanging noises and possible nerve stimulation in patients that arise from switching the directions of large magnetic-field gradients in present day devices. Jonathan Sharp at Alberta Innovates Technology Futures in Calgary and colleagues have used a static magnetic field and two resonant RF fields twisting in opposite directions to manipulate nuclear

spins and produce high-resolution images even with a low field of 0.2 T provided by a permanent magnet. In addition to making MRI cheaper and quieter, it opens up new possibilities for MRI imaging and experiments in general because it allows independent simultaneous multi-nuclear or spectrally selective imaging to be done.

● Further reading

J C Sharp *et al.* 2013 *NMR in Biomedicine* DOI: 10.1002/nbm.3023.

Perovskites for solar power

A new, inexpensive approach to making solar cells could beat silicon in price and efficiency. Mingzhen Liu and colleagues at the University of Oxford have shown that vapour-deposited perovskites can provide 15% efficiency at about \$0.15 per watt – a factor of four cheaper than silicon. This efficiency is already close to what has been achieved with silicon and is expected to improve. The fact that the flat layers work has come as something of a surprise, as expectations were that complicated nanostructuring would be needed. An advantage is that the devices produce more than 1 V, which is higher than the 0.7 V from silicon. Moreover, they absorb in a different spectral region, so they could even be printed on top of conventional silicon solar cells, boosting efficiency by 25% with only minor modifications to fabrication.

● Further reading

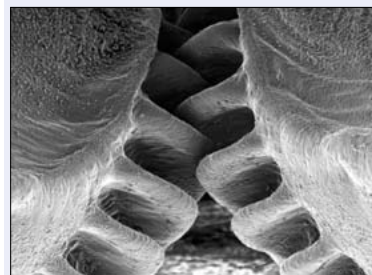
M Liu *et al.* 2013 *Nature* **501** 395.

Insect gears

For the first time, intermeshing gears that function like familiar mechanical gears have been found in an animal. Malcolm Burrows of the University of Cambridge and Gregory Sutton, now at the University of Bristol, have shown that the flightless planthopper insect *Issus* has, in its nymph stage, gears as part of its jumping mechanism. It uses the gears to synchronize motion of the two hind legs, rotating at an amazing 50,000 teeth per second. When the nymph molts to its adult form it seems to no longer need this mechanism and loses it. Once again, nature seems to have got a basic technology first.

● Further reading

M Burrows and G Sutton 2013 *Science* **341** 1254.



A scanning electron micrograph shows the gears in the *Issus* nymph. (Image credit: Malcolm Burrows.)

a clear edge

think vacuum, think edwards



nEXT Turbopumps



RV & EM
Rotary Vane Pumps



T-Station 75
Turbopumping System



Measurement and control



nXDS Dry Scroll Pumps



STP Maglev Turbopumps

Edwards offers an extensive range of pumping technologies for R&D and laboratory applications

- A comprehensive range of primary pumps including oil-sealed, scroll, claw, multi-stage roots and screw mechanisms
- A full line of turbo pumps from 40 to 4500l/s including magnetically levitated and conventional ceramic bearings
- Turbocarts including a turbopump, backing pump and controller, supplied fully assembled and ready to run.
- A broad range of measurement and control equipment

Whatever your requirement, Edwards has the solution and application expertise to meet your needs.

Discover more:
www.edwardsvacuum.com
info@edwardsvacuum.com



Vacuum science... product solution.