

Sciencewatch

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Lasers take inspiration from the birds

Traditional lasers use mirrors to trap light in an amplifying medium, but the brightly coloured feathers of birds like parrots and kingfishers suggest another approach. Such birds owe their colours not to pigments, but to light bouncing off tiny air pockets inside the otherwise transparent material of the feathers. Their arrangement is ordered at short distances like a photonic crystal, with the spacing setting the colour, but disordered on larger scales.

Motivated by this, Heeso Noh of Yale University and colleagues mimicked this structure in gallium arsenide by creating a regular array of embedded quantum dots

containing an amorphous array of air holes. The team etched an array of holes roughly 150 nm wide into a gallium arsenide film. When illuminated, this strange structure lased – the first time that laser action has been seen in such a material.

Random lasers have been made before, but this new material is much more efficient and, remarkably, despite having no photonic bandgap, exhibits wavelength peaks that can be tuned by varying the details of how the material is made.

● Further reading

Heeso Noh *et al.* 2011 *Phys. Rev. Letts.* **106** 183901.



Bouncing light: kingfishers do it without mirrors. (Image credit: Juan Pablo Fuentes Serrano/dreamstime.com.)

A saltwater–freshwater battery

A new type of battery based on the entropy difference between fresh and salty water could be the basis for a vast new source of renewable energy. Yi Cui of Stanford University and colleagues built their battery with one electrode made of sodium manganese oxide nanorods that selectively take up and release sodium ions, and a silver electrode that does the same for chloride ions. The electrodes can be put in fresh water and the battery charged, then moved to sea water where electrical energy can be extracted.

The cyclical process can be repeated indefinitely with a net gain in energy each cycle from the mixing of saltwater and freshwater, with efficiencies as high as 74%. Such batteries could produce as much as 13% of the current world energy consumption from places where fresh and salt water mix naturally.

● Further reading

Fabio La Mantia *et al.* 2011 *Nano Letters* doi:10.1021/nl200500s.

Swimming in sand

Some lizards swim through sand much as fish swim through water. Now it seems that they do it about as well as possible and that their behaviour can be copied. Ryan Maladen of the Georgia Institute of Technology in Atlanta and colleagues used a model that they had developed earlier for motion in granular media (resistive-force theory, which takes into account the fact that sand

Alcohol helps to induce a state of... superconductivity

Alcohol often plays a role in physics, typically in the context of discussions over drinks, but now it seems that it may have a much more direct mode of action in some superconductors. Keita Deguchi of the National Institute for Materials Science in Tsukuba, Japan, and colleagues have shown that hot alcoholic beverages can induce superconductivity in an iron tellurium sulphide material.

Beer, sake, shochu, whisky and white wine all work, but the best results are obtained by heating with red wine for 24 hours. The mechanism involved is still not known. It may have to do with alcohol supplying oxygen to the material, but pure mixtures of ethanol and water do not work as well as any of the actual beverages. Exposure to air alone will also do the trick, but that takes months, so the alcohol treatment makes quite a difference. Because this year marks the 100th anniversary of the discovery of superconductivity, some further research with champagne may be appropriate.

● Further reading

K Deguchi *et al.* 2011 *Superconductor Science and Technology* **24** 055008.

can both be like a solid and a liquid) together with X-ray videographs of sandfish lizards (*Scincus scincus*) to study in detail how the creatures move.

The researchers found that the lizard's sinusoidal body writhings that propel it are more or less optimal. The team also managed

to make segmented robots that, when stuffed into a sock and wrapped in a spandex "swimsuit", could swim through sand just like the lizards. Apart from its intrinsic interest, this work could lead to new robots that might help to burrow through dirt or mud after earthquakes or landslides.

● Further reading

RD Maladen *et al.* 2011 *Proc. Roy. Soc.* doi:10.1098/rsif.2010.0678.

Language out of Africa

Human genetic and phenotypic diversity falls off with distance from Africa – a fact that can be understood if people originally came from Africa, migrating outwards with intermediate bottlenecks each of which would give reductions in diversity. Quentin Atkinson of the University of Auckland has found a similar falloff in the diversity of phonemes – units of sound that make up words – in modern spoken languages.

Using data from 504 languages in the database of the *World Atlas of Language Structures* he finds strong support for the idea that spoken language originated in Africa. With the origin of language earlier than the African exodus some 50 000 to 70 000 years ago, it may well have arisen around the same time indicated by the earliest archaeological evidence for symbolic culture in Africa (some 80 000 to 160 000 years ago). So, the two developments could be related.

● Further reading

Quentin D Atkinson 2011 *Science* **332** 346.