Photonics

A new source of terahertz radiation?

Appl. Phys. Lett. **84,** 4810–4812 (2004)

Imaging using terahertz radiation, which has wavelengths intermediate between those of infrared and microwaves, could provide an alternative to the conventional techniques that use X-rays or ultrasound. Terahertz (THz) imaging could be cheap, non-hazardous and chemically specific. But it requires strong sources of THz radiation. Although semiconductor materials that emit at visible and near-infrared wavelengths are well known, it is harder to find semiconductors with bandgaps small enough to produce THz radiation. (The larger the bandgap, the shorter the emission wavelength.)

Now Ricardo Ascázubi and colleagues report that indium nitride (InN) is a promising THz source. This material is still rather patchily characterized, and previous measurements of the bandgap have given conflicting results. Ascázubi *et al.* show that thin films of InN grown on sapphire and excited with infrared laser pulses emit radiation with a peak at around 1 THz, consistent with the idea that InN has a very small bandgap. Already the researchers can achieve emission intensities comparable to that of indium arsenide, one of the strongest-known THz emitters. They anticipate that InN should perform even better if the crystallinity of the thin films can be improved. **Philip Ball**

Medicine

Diabetic genetics

Science **304,** 1325–1328 (2004)

Most forms of diabetes are caused by a suite of different mutations rather than a single identifiable one. But some rare forms are the result of a single gene defect, allowing researchers a glimpse into the mechanisms that might be involved in the more common versions.

Stella George and colleagues screened DNA from patients with severe insulin resistance, in which the body is impervious to the sugar-regulating effects of insulin. One person, who suffered from hereditary late-onset diabetes, had a mutation in a gene, *AKT2*, which encodes a so-called protein kinase involved in mediating insulin action. The patient's mother, grandmother and maternal uncle all had the mutation, and diabetes, whereas some 1,500 control subjects did not.

The discovery implicates *AKT2* in regulating blood sugar, and more generally shows the potential importance of individual components of that pathway. Its broader relevance to more common forms of diabetes, however, would require identification of more diabetics with the same mutation. **Michael Hopkin**

Chemistry

Solid prospects

Angew. Chem. Int. Edn **43,** 2955–2958 (2004)

Many large-scale chemical processes are catalysed by sulphuric acid. But about 14 million tonnes of acid are wasted each year because the recycling process is inefficient. A solid acid would be easier to separate from a mixture of liquids and, if it could be produced cost-effectively for industrial use, would be cheaper and 'greener'.

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With this in mind, Michikazu Hara *et al.* set to work, and they have synthesized a carbon-based solid acid that is twice as effective as sulphuric acid in catalysing a standard hydrolysis reaction. In other common reactions the solid acid was slightly less effective, but still had comparable activity. The catalyst's activity and composition remained unchanged after four reaction cycles.

The solid acid is formed in an inexpensive process in which naphthalene is heated in sulphuric acid at 300 °C. The resulting black powder is insoluble in common reaction solvents, and contains about five times more proton-delivering groups — and so potential catalytic power — than an existing commercial solid acid used in laboratory work. The authors speculate that their acid may also be useful as a proton carrier in certain types of fuel cell. **Mark Peplow**

Gene therapy

RNA versus brain cancer

Clin. Cancer Res. **10,** 3667–3677 (2004)

Small RNAs are important modulators of gene expression. These molecules bind to complementary regions of protein-encoding messenger RNAs, and either promote their degradation or inhibit their translation into protein. Thus, small RNAs offer the promise of being highly specific drugs. Yun Zhang and colleagues have now demonstrated the potential of these molecules for treating brain cancer.

Some 90% of primary and metastatic brain cancers rely for their growth on the epidermal growth factor receptor (EGFR), so molecules that block this protein are attractive anticancer drugs. Generally, such drugs would be administered intravenously, but the blood–brain barrier poses an obstacle to this; blood vessels surrounding brain tumours have restricted permeability to cells and molecules.

Zhang and colleagues overcame this impediment by placing two antibodies on the surface of a drug-delivery vehicle. One antibody allowed it to pass through the walls of the cancer vasculature, and the other promoted its entry into cancer cells. Once inside the cells, DNA containing the gene for a small RNA that inhibits EGFR was released, and the small RNA was made. This suppressed 95% of EGFR activity and significantly increased the survival time of mice with implanted human brain tumours. **Angela K. Eggleston**

Optical tweezers

A light twist

Phys. Rev. Lett. **92,** 190801 (2004)

Light can be used like a wrench to twist tiny objects. In an optical trap, an intense light field exerts linear forces on an object to fix it in space. If the light is polarized, the force can be given a twist. Arthur La Porta and Michelle D. Wang have used this principle to apply a precisely defined torque to a speck of quartz.

The trapping force in an optical trap is created by electrical polarization of the object in an electromagnetic field. Because quartz is doubly refracting, this polarization is not the same in all directions, and in a polarized trapping beam the material will tend to align its optical axis with the polarization of the beam, creating a torque. Alexis I. Bishop *et al.* used this idea previously to rotate microscopic glass cylinders optically (*Phys. Rev. A* **68,** 033802; 2003).

La Porta and Wang show that they can rotate a 1-μm quartz particle in this way, and that, by measuring the angular momentum of the transmitted beam, they can calculate the torque transmitted to the particle. By adding a feedback mechanism, they adjust the polarization angle of the beam driving the twist to maintain a constant torque on the particle. Such a scheme could be used to measure and to modulate the torque exerted by biological rotary motors such as ATP synthase, which are known to generate torques within the dynamic range of this apparatus. **Philip Ball**