forms of diabetes, however, would require identification of more diabetics with the same mutation.

Michael Hopkin

Chemistry

Solid prospects


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’. 

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 expensive 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 Popow

Gene therapy

RNA versus brain cancer


Small RNAs are important modulators of gene expression. These molecules bind to complementary regions of protein-encoding messenger RNA, 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. Eglinson

Optical tweezers

A light twist


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 J. 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