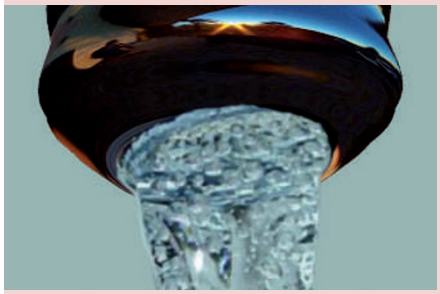
Just pour water over it



Opt. Expr. **14,** 11660–11667 (2006)
Although quantum cascade lasers (QCL) are rather complex structures, they represent the most successful approach for fabricating compact lasers in the mid-infrared wavelength region, which is important for molecular sensing applications. However, once the laser has been grown, its emission wavelength is fixed and can only be modified by cumbersome processes such as heating the device. Laurent Diehl and colleagues have now come up with an ingenious solution to control the QCL emission wavelength in a microfluidic environment. Their approach is based on the indirect control over the emission wavelength exercised by a regular grating, the distributed Bragg reflector, which is grown on top of the laser active region. The regular structure of the grating interacts with the optical laser mode and thus determines the precise emission wavelength. As Diehl and co-workers have shown, guiding a fluid directly to the grating modifies its refractive index contrast and thereby changes the laser wavelength. Using fluids of different refractive indices, the authors show this to be a convenient and flexible approach to tune the laser emission wavelength. The first realization of this integrated device is a promising step towards more sophisticated lab-on-a-chip applications.

Out of the dark

J. Am. Chem. Soc. doi:10.1021/ja065645z (2006)
Cyanogen halides (XCN) are highly toxic compounds that have an effect on the human body similar to that of hydrogen cyanide — indeed, ClCN is used as a military chemical weapon. The ability to detect trace amounts is therefore of the utmost importance. Researchers in the USA have now synthesized previously unreported bis-cyclometalated Pt(II) complexes for use as highly sensitive sensors for XCN. These Pt(II) complexes are strongly orange–red phosphorescent at room temperature in solution, and react with XCN to form Pt(IV) products giving blue-shifted emission. Thin polymer films of these complexes also react in a similar way with XCN vapours. The strong blue-shifted emission gives a signal with almost no background (dark field), which allows for maximum sensitivity to trace quantities. This is an improvement on the more usual chemosensors that are based on energy-transfer schemes, which have a limited signal-to-noise ratio.

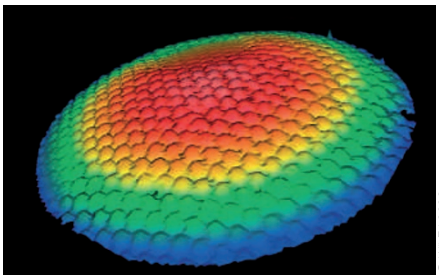
Roll up and relax

Appl. Phys. Lett. **89,** 223109 (2006)
Rudeesun Songmuang and colleagues at the Max Planck Institute in Stuttgart have demonstrated a simple way to obtain rolled-up semiconductor tubes having submicrometre diameter. The starting point is a film of either silicon or InGaAs, grown epitaxially on a substrate made of a different lattice. The authors chose to insert a thin buffer layer of germanium or AlAs between the substrate surface and the Si or InGaAs, respectively, knowing that they could selectively etch them away later. Inevitably, the first layers of the Si and InGaAs films are strained, and the strain decreases with the height of the film. Removing the buffer layer relaxes the films. However, instead of floating free, the films roll up away from the surface (in the case of Si) or down towards the surface (in the case of InGaAs). The diameter of the tubes can be controlled by varying the thickness of the Si or InGaAs films, and therefore the initial strain distribution along the growth direction. Semiconductor tubes have potential applications in electronics and optics, and rolling them up with this method is much simpler than using previously demonstrated techniques that used more complicated multimaterial structures.

Sugar lumps

Angew. Chem. Int. Edn **45,** 8138–8141 (2006)
Photoluminescence (PL) from single-walled carbon nanotubes is an attractive tool for sensing, owing to its photostability and convenient wavelength for detection in the near-infrared. However, nanotube electronic structure, and therefore PL, is highly sensitive to functionalization, and only non-covalent attachment methods can be used so as to prevent their disruption. This makes designing a sensing scheme that retains the nanotubes' optical properties challenging. Barone and Strano report a solution-based sensor for glucose that exploits the effects of aggregation on nanotube optical properties, and avoids covalent bonding problems. Single-walled carbon nanotubes are complexed to a phenoxy-derivatized dextran — a glucose analogue — using a non-covalent interaction between the phenoxy group and the nanotube wall. Introducing a lectin molecule having four dextran binding sites to the solution causes the nanotubes to form aggregates around the lectin, and the PL of the nanotubes is quenched. The PL is restored when glucose is added to the suspension: the glucose preferentially binds to the lectin, displacing the dextran and releasing the nanotubes. The authors predict that the method could be extended to a variety of other analytes.

Wrinkles are good



Adv. Mater. doi:10.1002/adma.200601595 (2006)
As most beauticians will tell you, wrinkles are to be avoided. A group from the University of Massachusetts has, however, embraced them to develop an alternative approach for fabricating microlens arrays. Chan and Crosby go out of their way to induce buckling in their poly(dimethylsiloxane) films by selectively oxidizing them in parts to produce patterns of silicate with different elastic modulus from the unoxidized polymer. The film is then coated with a photocurable acrylate and covered with another piece of glass. The acrylate swells the film, causing wrinkles in regions of elastic modulus mismatch, and the wrinkles are frozen in place by photopolymerizing the acrylate. Removing the glass superstrate causes the film to fracture along the path of the wrinkles, thereby generating the microlens array. The approach offers several advantages over traditional methods of fabrication such as lithography and surface-tension-driven techniques: it is rapid; the dimensions of the lenses and array can be easily tuned by changing the initial oxidation pattern; and it can be applied to a wide variety of substrates, including non-planar ones to make compound lenses.