Cover story

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Although photonic crystals are often considered to be static objects, they can actually be fabricated with optical properties that are sensitive to their environment — ideal for applications such as sensors. Edwin Thomas and colleagues report an extreme in this art: a photonic crystal with a stop band that is tunable from the ultraviolet–visible to the near-infrared region — from 350 to 1,600 nm. The material is formed from a hydrophobic block–hydrophilic polyelectrolyte block polymer, which forms a one-dimensional periodic lamellar structure. Swelling the hydrophilic layers from a fluid reservoir, or changing the salt concentration in the solvent, changes the periodicity of the photonic crystal, which in turn can cause up to a 575% change in the position of the material's stop band. **[Letter p957]**

BEYOND DISPLAYS

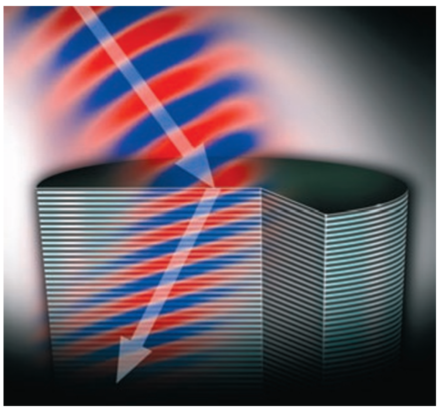
Liquid crystals (LCs) have become a household name through their use in display applications, but with this research area reaching maturity, new directions are being sought. The field of biomedical research has recently provided a number of interesting new opportunities for the use of LCs. In the review by Crawford and colleagues, three primary applications for biology and medicine are presented: optical devices using LCs for integration into spectroscopy, microscopy and imaging systems; biosensor devices directly interfacing with LCs for improved optical imaging and diagnostics; and LCs for the mimicking of biological materials and systems. **[Review Article p929]**

BOUNDARIES CONDITIONED

A novel class of soft solid, consisting of two fluid domains that share a large mutual interface separated and are stabilized by a layer of colloidal particles, has been predicted. Such 'bicontinuous interfacially jammed emulsion gels' are known as 'bijels', and could bring two immiscible solvents into contact through the semipermeable colloidal layer while they flow independently, enabling potential applications such as micro-reaction media. Clegg and colleagues demonstrate the experimental realization and tuning of a bijel, using lutidine–water mixtures and silica particles. A slow change in temperature at critical composition enables the formation of the material, which is demonstrated to behave as a soft solid. **[Letter p966; News & Views p921]**

SEMICONDUCTORS TAKE A RIGHT TURN

Negative refraction is an effect where light that propagates from one material to another bends the opposite way to normal. It has previously only been observed in artificial metallic constructs such as small wires or loops formed by complex lithographic processes. Now Anthony Hoffman and colleagues present a semiconductor material that requires no additional nanofabrication beyond the initial growth process, and that shows negative refraction for a broad range of infrared wavelengths. Furthermore, it is straightforward to integrate these materials into other semiconductor structures for integrated photonic applications such as imaging or the guidance of light. **[Letter p946; News & Views p922]**



Negative refraction in a layered semiconductor metamaterial.

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STRUCTURE PREDICTIONS

A general approach for predicting crystal structures from just molecular formulae has eluded scientists for more than 50 years — a situation controversially described in 1988 by John Maddox (former editor of *Nature*) as 'scandalous'. Gus Hart now suggests that the existence of structures can be inferred on the basis of geometric simplicity and combinatorics. Compared with heuristic methods that predict new compounds, the current method identifies 'least random' binary structures of a face-centred-cubic lattice for which the energy is an extremum. Not only can the extrema be found in a chemistry-independent way, but this energy-minimization approach can be applied to other important polynary systems of larger unit cells. **[Letter p941]**

VIBRATIONS IN DETAIL

Studying the physical properties of quasicrystals was until recently very difficult, owing to the absence of precise information about the atomic spatial distributions. Starting from the recently proposed first atomic solution of a quasicrystal, Marc De Boissieu and co-authors have now investigated the lattice dynamics in a quasicrystal and in a closely related periodic crystal. For both systems, the experimental observations can be compared with model calculations made possible by the precise knowledge of the atomic structure. Aside from revealing the specific differences between the two systems, the study highlights how careful examination of the physical properties of quasicrystals is now achievable. **[Article p977; News & Views p925]**

TOPOGRAPHY CONTROLS STEM CELLS

Mesenchymal stem cells (MSCs) in bone marrow typically produce soft tissue rather than bone in response to implants. This outcome could be altered if the materials used were able to influence cell behaviour. Dalby and colleagues now show that nanoscale symmetry and disorder influences the differentiation of these cells. Highly ordered topographies produce low cellular adhesion and poor differentiation into osteoblasts, a random arrangement shows more osteoblastic morphology, however, topographies with nanoscale disorder significantly stimulate MSCs to differentiate into osteoblasts and subsequently produce bone mineral *in vitro*. This shows that topography is an important consideration in regenerative medicine and tissue engineering. **[Article p997]**