news and views in brief

Optics

Fibres tune in with fluid plug

Appl. Phys. Lett. **82,** 1338–1340 (2003)

A tunable filter has been introduced into an optical fibre by filling hollow channels in the fibre with moveable plugs of liquid. The filter acts as a barrier to infrared radiation within a narrow wavelength band as it passes down the fibre.

Filtering is vital for controlling and routing signals in optical telecommunications. Filters typically consist of an optical grating — a periodic structure that scatters and blocks light at a wavelength determined by the repeat spacing. Such structures have been introduced into optical fibres previously, but the advantage of the filter reported by C. Kerbage and B. J. Eggleton is that it is tunable.

Their grating is made from plugs of organic fluid inserted into six hollow channels surrounding the fibre's core, in which the light travels. These plugs are lined up in a constriction in the fibre, where the light within the core spreads into the channels and interacts with the grating. By warming and expanding the air on either side of the series of fluid plugs, the grating can be compressed so that its periodicity, and thus the wavelength of blocked light, decreases.

Philip Ball

Immunology

Lone rangers

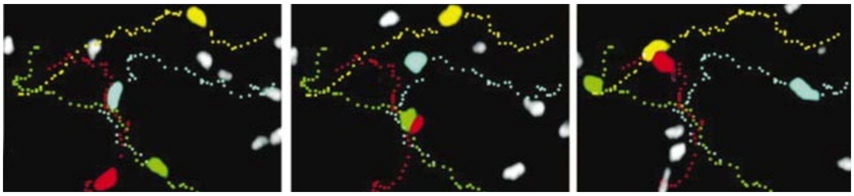
Proc. Natl Acad. Sci. USA **100,** 2604–2609 (2003)

The immune system's T cells circulate between the blood and secondary lymphoid organs such as lymph nodes, continuously surveying the body for foreign molecules. Mark J. Miller *et al.* now reveal the first *in vivo* images of T-cell dynamics within lymph nodes. They find that, contrary to expectation, individual T cells 'go it alone', migrating along independent and seemingly random paths.

Accumulating evidence has suggested that the migration of T cells is directed by attractant molecules called chemokines; from this it was supposed that T cells would stick together, moving in groups towards chemokine signals. Miller *et al.* have used two-photon imaging — a technique until now used largely by neuroscientists and developmental biologists — to ask exactly how T cells move in live mice.

They find that the cells migrate rapidly, but can also change gear, cycling between periods of low speed when the cells momentarily pause, and high speed (more than 25 μm per minute). The real surprise, however, is that T cells travel alone along random routes, as in the images below. This calls into question the role of chemokines in guiding these cells, and reopens the debate over what, if anything, directs their movement.

Alison Schuldt



Far from the crowd: four T cells (false-coloured in different shades) follow independent paths (dotted lines) over periods of minutes.

Neuroscience

Going to town

Neuron **37,** 877–888 (2003)

People use distinct brain regions to find their way along new routes and along familiar routes. This is the conclusion drawn by Tom Hartley and colleagues, who used magnetic resonance imaging to study brain activity as male subjects navigated their way around two virtual, computer-generated towns. In each town they had to find their way between landmark locations. In one town these were chosen in fixed sequence to form a well-rehearsed route that never changed. In the other town the sequence of landmarks defined new routes that the subjects had not followed before.

Rat studies have shown that the hippocampus is involved in using new routes: animals are thought to form 'cognitive maps' that help them use landmarks to find their way from A to B. But when the same journey is taken again and again, a different brain region, the caudate nucleus, kicks in. Hartley *et al.* found a similar pattern in their subjects: more accurate navigators showed activation of the hippocampus when taking the less-familiar path, whereas the 'head' of the caudate nucleus was active when they followed the well-worn routes. This suggests that accurate navigation depends on selecting the best mental representation for the task in hand. This choice also affects the pattern of brain activity, and may help to explain some of the differences seen between men and women in previous studies of navigation.

Helen R. Pilcher

Biomimetics

Gels got rhythm

Macromolecules doi:10.1021/ma0259618 (2003)

Ryo Yoshida and colleagues report slow, mechanical pulsing of a polymer gel. This unusual behaviour is caused by the Belousov–Zhabotinsky reaction, a chemical process that is analogous to the Krebs cycle for producing energy in biological cells. The gel — poly(*N*-isopropylacrylamide) — is covalently bound to a metal catalyst and immersed in a solution of malonic acid and an oxidizing agent. Periodic changes in the redox properties of the catalyst regularly switch the temperature at which the gel swells or de-swells as a result of changes in the hydrophilicity of the polymer chains.

The oscillatory period of the reaction was controlled by the concentration of the organic acid, the fastest being 75 seconds and the slowest about 830 seconds. The rate of the Belousov–Zhabotinsky reaction limited the amplitude of the mechanical oscillations. Beating could last for two to three hours, depending on the volume of solution. The authors are developing their process further for micro-scale transporter and actuator applications.

Rosamund Daw

Atmospheric science

Quick, quick, slow

Geophys. Res. Lett. doi:10.1029/2002GL015674 (2003)

In July and August 2000, remote-sensing instruments tracked the consequences of two typhoons, Kai-Tak and Bilis, during their passage over oceans in Southeast Asia. Analyses of the data have produced a refined picture of the relationship between sea-surface temperature and wind speed.

Typhoons are driven by the energy from a warm sea-surface, and in turn drag up water from depth as they pass, leaving surface patches that can be up to 6 °C cooler than the surrounding ocean. As I.-I. Lin and co-workers point out, this situation provides a natural experiment. Taking advantage of this, they find that the speed of surface winds drops dramatically over such patches compared with wind speed over neighbouring ocean. This agrees with a previously proposed mechanism of wind-speed modulation at the sea surface. In Lin and colleagues' data, every 1 °C drop in sea temperature typically corresponds to a decrease of about 1 $m\ s^{-1}$ in wind speed. The cold patches don't take long to warm up again, however, and — most notably — the authors find that events can be played out on comparatively small scales (100–400 km), and quite fast (within a day).

Tim Lincoln