Chemical biology

Antibacterial sugar-tipped trees

J. Am. Chem. Soc. **126,** 4750–4751 (2004)

Enzymes equipped with grappling hooks can disable pathogenic bacteria, according to Phillip M. Rendle and colleagues. They have found a way to tether a protease (protein-degrading enzyme) to the cell walls of *Actinomyces naeslundii* bacteria so that the enzyme can break down proteins that the bacteria use to invade their host.

Actinomyces naeslundii stick to human oral cavities and surgical prostheses through adhesin proteins in the bacterial cell walls, which bind to sugar (galactose) molecules. Rendle *et al.* figured that galactose groups attached to proteases would enable the enzymes to latch on to *A. naeslundii*, which would not only suppress the bacterium's stickiness by plugging their adhesin sites but would also wreak havoc when the enzyme got to work on the bacterial cell-wall proteins.

A single galactose tether is not enough, however. So Rendle *et al.* fixed branched tethers (dendrons) at selected positions on the proteases. Dendrons with two, three or four sugar tips give the enzyme a secure hold, with two tips being optimal for this bacterium. In preliminary tests, these modified proteases appear to inhibit *A. naeslundii* at concentrations of just 20 nanomolar. **Philip Ball**

Cell biology

Shape dictates fate

Dev. Cell **6,** 483–495 (2004)

The proteins RhoA and ROCK are part of a cellular signalling pathway that controls the development of stem cells into osteoblasts or adipocytes — bone or fat cells. But what causes the activation of this pathway and the subsequent transformation of a stem cell into another cell type?

Rowena McBeath *et al.* suspected that cell shape might play a part, and they tested this hypothesis by manipulating the shape of human mesenchymal stem cells, which can give rise to either osteoblasts or adipocytes. They found, indeed, that controlling the shape of these stem cells, by varying their density or using a specialized micropatterned substrate, affected the type of cell they became.

If the stem cells were loosely packed, they could adhere to their substrate, flatten and spread, and they then developed into bone cells. If they were tightly packed, they remained unspread and round, and became fat cells. The authors also found that cell shape affected cell fate via RhoA and ROCK: these proteins were more active in spread than unspread cells. Quite how the proteins alter cell fate remains uncertain, but their mechanical effects on the cell's cytoskeleton seem to be involved. **Laura Nelson**

Neuroscience

Touched by empathy

Neuron **42,** 335–346 (2004)

Some people physically shiver when they see a spider crawl across someone else's hand. But whereas many take for granted this effortless ability to understand what others are feeling, Christian Keysers *et al.* are attempting to unravel the neural mechanisms involved.

The researchers used functional magnetic resonance imaging to measure the brain activity of subjects as they had their legs brushed with a washing-up glove. They

then showed the subjects movies of other people being touched. In both cases, a particular brain region — the secondary somatosensory cortex — lit up. Previously, the area was thought only to respond to the personal sensation of touch.

"It's as if you're slipping into the shoes of someone that you're watching," says Keysers. The brain implicitly transforms the sight of touch into a neural representation of touch. The authors suggest that this automatic system probably functions as part of a more complex cognitive system, helping us to integrate neural activity with higher thought processes. **Helen R. Pilcher**

Physics

Lithium flows free

Phys. Rev. Lett. **92,** 150402 (2004)
Preprint at http://arXiv.org/abs/cond-mat/0403716 (2004)

Research groups in the United States and Austria have independently found evidence of superfluid behaviour in a gas of lithium-6 atoms.

Atoms cooled close to absolute zero can sometimes behave as superfluids, which flow without resistance. Their exact behaviour depends on whether they are bosons or fermions: bosons form a condensate in which all the atoms share exactly the same quantum state; fermions cannot condense in this way unless they pair up and exhibit boson-like behaviour.

J. Kinast *et al.* show that lithium gas, trapped and cooled with a laser, can occupy a middle ground between the theories that describe these two situations. Turning the laser off and on starts the gas vibrating, and the vibrations persist for longer when the temperature of the system is reduced — typical superfluid behaviour. But the transition to apparent superfluidity is smooth, not abrupt as would be expected.

In similar experiments, M. Bartenstein *et al.* do find an abrupt shift in the vibration frequency of cooled lithium gas. But they say that a better understanding of how this transition depends on the temperature of the system is necessary to confirm that this is a true superfluid. **Mark Peplow**

Aquatic biology

Acid test for freshwater fish

Oecologia **139,** 318–324 (2004)

When injured, several species of freshwater fish release chemical alarm cues that alert others to nearby danger. Research on young rainbow trout and brook charr shows that these warning signals fail in slightly acidic water, hinting that even low levels of acid rain may influence fish behaviour.

In lab work, Antoine O. H. C. Leduc and colleagues presented this danger signal to juvenile rainbow trout (*Oncorhynchus mykiss*) by adding a solution of homogenized trout skin to their tank. Fish in neutral water made themselves scarce, seeking shelter elsewhere rather than staying in the area where the stimulus was delivered. But skin solution prepared at pH 6 failed to elicit a similar effect, suggesting that the chemical message had been destroyed.

The authors next investigated whether the same happens in Ontario's natural streams, where pH can easily dip below 6. Brook charr (*Salvelinus fontinalis*) in neutral water (pH 6.88) responded to the presence of skin solution by ditching foraging and aggression in favour of more cautious behaviour. But, once again, fish in a nearby stream at pH 6.11 remained unmoved by the stimulus.

Failure of these chemical cues would be bad news: increased reliance on vision could play into the hands of camouflaged predators, and naive fish released from hatcheries would be denied a valuable threat-learning mechanism. **Michael Hopkin**