Cell biology

Prion protein, too, shall pass

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Part of the job of a cell's endoplasmic reticulum is to act as a transport system for proteins, which are recognized by their so-called signal sequence and enter the system through a dynamic portal, the translocon. Many proteins are processed perfectly well through a translocon that has just a few, well-recognized components. But what about those, such as prion proteins, that are not?

Ryen D. Fons and colleagues have looked into the case. They find that the prion protein has an especially unusual signal sequence, and that effective initiation of prion translocation requires the translocon to have an extra component, the 'translocon-associated protein' (TRAP) complex. It turns out that TRAP also stimulates the translocation of other proteins in a signal-sequence-dependent manner.

One explanation proposed by Fons *et al.* is that TRAP is required on the inside of the endoplasmic reticulum to stabilize the signal sequence and the translocon when they have failed to form their usual intimate association. Given the involvement of prion protein in neurodegenerative disorders, they also point out that the special requirements for translocation could influence the course of prion disease. **Mirella Bucci**

Planetary science

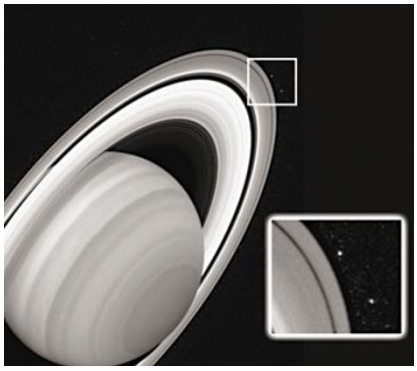
Moons on the wander

Icarus doi:10.1016/S0019-1035(02)00050-7 (2003)

Prometheus and Pandora, two tiny moons of Saturn, have been straying: chaotic interaction between them could be responsible for the perturbation in their orbits. The moons flank the F ring, which lies beyond Saturn's main ring system and is itself dynamically complex.

The two moons are among the smaller of Saturn's 18 satellites (see picture). They were discovered by the Voyager space probe in 1980 and Voyager observations were used to calculate their orbits. Between 1994 and 2000, Richard G. French and colleagues detected gradual changes in the pair's orbits using the Hubble Space Telescope. The variation was in keeping with those of Saturn's other moons, but from images taken in 2001 and 2002 French *et al.* found that Prometheus's orbit had suddenly become 330 metres wider, whereas Pandora's had shrunk by 420 metres.

The authors conclude that these changes have a common origin. They believe that the moons are probably exchanging orbital energy as they hurtle around Saturn, and that a state of resonance results in chaotic behaviour. Such behaviour is theoretically possible, but has not previously been observed in the Solar System over such short timescales. **Tom Clarke**



RICHARD G. FRENCH/SPACE TELESCOPE INSTITUTE

Dynamic dancers: Saturn and (inset) its quickstepping satellites Prometheus and Pandora at the outer edge of the planet's rings.

Soft matter

Paste inside

Phys. Rev. Lett. **90,** 068303 (2003)

Between solid and liquid there exists a host of alluring materials: toothpaste, oil paint, wet cement, peanut butter. Yet these ubiquitous substances are poorly understood. Michel Cloitre and colleagues have now forged a link between the large-scale flow behaviour — the 'spreadability' — of pastes and the motions of their constituent particles.

Cloitre *et al.* made pastes from crosslinked polymer gels and added tiny polystyrene spheres that scatter light, to trace the microscopic structure and motions in the material. In a liquid, the particles gradually diffuse through space. In a glass, this diffusive motion has been slowed to a standstill: the particles become trapped in some random configuration. It seems that pastes are rather like glasses in which the particles are stuck in rubbery traps — elastic cages formed from their neighbouring particles, in which they can rattle around but not escape.

If the paste is stressed, the particles can spring their cages and find a new arrangement. Cloitre *et al.* find that these rearrangements have a characteristic duration, and that this 'microscopic' timescale controls the bulk flow behaviour. **Philip Ball**

Immunology

Vaccinia on the Toll road

J. Exp. Med. **197,** 343–351 (2003)

Toll-like receptors are proteins that recognize bacterial and viral products, and are essential for kick-starting our immune response to microbial invaders. Mary T. Harte *et al.* now propose that vaccinia virus — used to vaccinate against smallpox — can obstruct the path from receptor activation to immune fortification.

In the event of a microbial infection, the Toll-like receptors — ten of which have been identified to date — can activate the transcription factor NF-κB, which turns on genes involved in immune defence. The main track from Toll-like receptor to NF-κB involves a lengthy sequence of adaptor proteins and enzymes. En route one finds the proteins MyD88 and TOLLIP (Toll-interacting protein), both of which attach to Toll-like receptors. This complex recruits the enzymes IRAK or IRAK2, which phosphorylate themselves and then bind the adaptor protein TRAF6. By way of at least two more stepping-stones, TRAF6 finally activates NF-κB.

Harte *et al.* find that the vaccinia virus protein A52R may disrupt this pathway by binding the enzyme IRAK2 and the adaptor TRAF6. Moreover, mice infected with a virus that lacks the A52R gene seem less ill than mice suffering from a normal vaccinia virus infection, indicating that A52R may indeed contribute to viral virulence. **Marie-Thérèse Heemels**

Imaging

Nanoprobes on the blink

Appl. Phys. Lett. **82,** 1102–1104 (2003)

Figuring that a light bulb is easier to see in daylight if it is flashing, Jeffrey N. Anker and Raoul Kopelman have made nanometre-scale fluorescent probes that blink on and off. This modulation helps to separate the probe signal from the background fluorescence.

Particles ranging from many nanometres to a few micrometres in size are becoming widely used as tags and probes in biology and chemistry: for example, to label particular molecules, cells or tissue types, for detecting pathogens and for tracking combinatorial libraries of molecules. Typically these nanoprobes signal their location and identity by emitting fluorescent light.

But other objects in the sample or instrument may also fluoresce, masking the signal. To create a distinctive optical fingerprint in dye-labelled polystyrene microspheres, Anker and Kopelman use spheres embedded with ferromagnetic material. They coat one hemisphere with gold or aluminium, making it dark. When a magnetic field makes the spheres rotate, they blink on and off as the 'dark side' revolves in and out of view. This modulation makes the signal detectable even against a fluorescent background that is ten times brighter. **Philip Ball**