Materials science

Nanoparticles target tumours

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Photodynamic therapy is an increasingly common treatment for tumours. Light-sensitive drugs are delivered to a tumour, which is then irradiated to excite the drug molecules. Molecular oxygen inside the tumour picks up the excess energy, forming reactive species such as singlet oxygen that cause irreversible damage to the tumour cells.

Indrajit Roy *et al.* have tested ceramic-based nanoparticles as drug carriers. Unlike the molecular aggregates currently in use, they do not release the drugs, but have a porous matrix that is permeable to both molecular and singlet oxygen. The nanoparticle carriers are highly stable, and are therefore more likely to reach the tumour without release or denaturization of the drug en route — a major problem with aggregate particles.

The authors found that, *in vitro*, the ceramic particles were actively taken up by tumour cells, and the survival rate of these cells was much lower than that of similar cells that were irradiated but untreated. So more efficient photodynamic treatment, using ceramic nanoparticles as drug carriers, could be in sight: research is now under way *in vivo*. **Jane Morris**

Neurobiology

Wiring the brain

Neuron **38,** 887–898 (2003)

Mutations in the fragile X mental retardation protein (FMRP) or in proteins similar to Rac1 both cause mental retardation in humans. Now Annette Schenck and colleagues have found that another protein implicated in the condition, called CYFIP, may represent a hitherto missing link between FMRP and Rac1, and so affect brain wiring.

Schenck *et al.* found that when fruitfly embryos are genetically engineered to lack a working copy of CYFIP, their neurons are shortened and grow in the wrong direction. Using genetic and biochemical techniques, the authors discovered that CYFIP usually interacts with both FMRP and Rac1. They suggest that, under normal circumstances, the three proteins form a pathway that controls the growth of the cytoskeleton inside nerve axons. This fits with the finding that in people with fragile X syndrome — one of the commonest forms of mental retardation — the number and shape of the delicate fingers linking nerve cells appear abnormal.

One possibility is that Rac1, when activated by unknown signals outside the neuron, links up with CYFIP and that this releases active FMRP. Both are then thought to influence neuronal structure: Rac1 affects the assembly of a cytoskeletal building-block called actin, and FMRP controls the production of other structural proteins. **Helen Pearson**

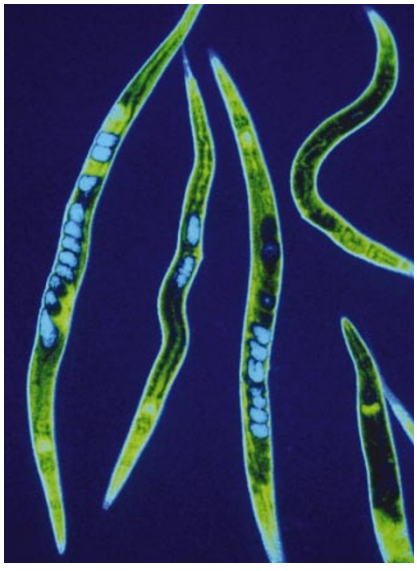
Evolutionary biology

Compensation claim

Evolution **57,** 1022–1030 (2003)

Small populations that are not subject to natural selection will accumulate deleterious mutations. But put them back in a competitive environment and they may regain fitness surprisingly rapidly, find Suzanne Estes and Michael Lynch.

The authors studied laboratory lines of the nematode *Caenorhabditis elegans* (pictured). These lines had been maintained



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by allowing only one individual from each generation to reproduce, and in the absence of competition they became less fit than their counterparts in the wild. Competition was reinstated by allowing groups of 10,000 (or more) worms from each line to breed in each generation. After just a few dozen generations, their rates of survival and progeny production — both measures of fitness — had increased.

Estes and Lynch attribute this recovery to compensatory mutations that ameliorate the influence of the deleterious mutations. Control populations did not increase in fitness under the same conditions, showing that the effect is not due to generally beneficial mutations.

There could be a happy message here for captive breeding of threatened species, given the worries about loss of genetic vigour in such programmes — although, of course, most endangered species breed much more slowly than nematodes. **Michael Hopkin**

Astrophysics

Star spins flat out

Astron. Astrophys. (in the press); preprint astro-ph/0306277 at <http://arXiv.org> (2003)

A team of astronomers has found a flattened star. Achernar (or α Eridani), in the constellation of Eridanus, is rotating so rapidly that it appears squashed, resembling a child's spinning-top. The diameter at its equator is 8.4 million kilometres (12 times the width of the Sun), but the pole-to-pole distance is, at most, 5.4 million kilometres. If we are not seeing Achernar perfectly 'edge-on', its flatness is even more pronounced.

The squished star was spotted by A. Domiciano de Souza and co-workers, using the Very Large Telescope Interferometer in northern Chile. Six times as massive as the Sun, Achernar is 145 light years away. Measuring its shape from Earth is equivalent to measuring the dimensions of a motor car on the surface of the Moon.

As they are essentially balls of hot gas, stars are relatively easily deformed by rotation. But seeing a star this 'flat' is quite a surprise. Either it is rotating close to the break-up speed of 300 km s^{-1}, or it is not rotating as a 'rigid' body. **Philip Ball**

Cell biology

Flies get rhythm

Cell **113,** 755–766 (2003)

Whole organisms, tissues and cells can all have rhythm — patterns of behaviour, physiology and gene expression that occur in a roughly 24-hour cycle. These patterns are generated by intracellular clocks, which are regulated by key genes. In many fruitfly tissues, for instance, the *Clock* gene triggers the expression of so-called circadian genes, which in turn regulate their own production in a negative-feedback loop. This generates a clock-like cycle of gene activity and inactivity.

In the adult fly brain, neurons that express *Clock* are the exception rather than the rule. But Jie Zhao *et al.* now find that forcing the expression of just this gene can bring rhythm to neurons that have none. Misexpressing *Clock* in brain regions where it is not normally active prompted the expression of circadian genes such as *timeless*, as well as *cryptochrome*, which encodes a photoreceptor for blue light.

The flies also behaved differently. Normally, they show two bursts of activity as lights go on and off. Some of the mutant female flies, however, were active all 'day' and moved little at 'night'. This suggests that the new clocks make functional connections with behavioural pathways, lending weight to the idea that *Clock* is a master regulator of circadian rhythms. **Helen R. Pilcher**