Cancer

Cell invasions and oestrogen receptors

Cell **113,** 207–219 (2003)

The cells of many breast cancers contain receptors for oestrogen and are strongly dependent on oestrogen for growth. But low levels of oestrogen receptors may be dangerous too. Naoyuki Fujita and colleagues suggest that a shortage of these receptor proteins could increase the likelihood that breast cancer will spread.

The ability of cancer cells to spread depends in part on their synthesis of cell-adhesion molecules. Such molecules help to anchor healthy cells in place; but in some breast cancers with poor prognoses, the levels of adhesion molecules are reduced. Fujita *et al.* now find that one such molecule, E-cadherin, is indirectly regulated by a protein called MTA3, and that synthesis of this protein is in turn linked to oestrogen. MTA3 is found only in cell lines that contain oestrogen receptors, and if receptor levels are artificially increased, MTA3 levels rise.

More worryingly, if oestrogen-receptor levels are lowered, MTA3 and E-cadherin levels drop — a condition associated with the invasive growth of breast cancers. This has implications for women with breast cancer who are taking selective oestrogen-receptor modulators. Any compound that interferes with the receptor's ability to activate MTA3 would be predicted to lower E-cadherin levels, and might predispose women to invasive tumours. **Helen R. Pilcher**

Biomechanics

With a swing

J. Exp. Biol. **206,** 1631–1642 (2003)

The gibbon's swing has a built-in safety margin, according to James R. Usherwood and John E. A. Bertram. By putting more energy into each swoop than is needed to reach the next branch, they reduce the chances of a potentially fatal fall.

The most efficient way for a gibbon to travel would be like a smooth pendulum, swinging in arcs from branch to branch with little loss of energy in between. But Usherwood and Bertram found that this is not the case. In studies of gibbon movement around an artificial environment, they show that the animal has a built-in overshoot, in effect colliding with a branch and then accelerating into the next swing.

Gibbons (*Hylobates lar*) move their bodies and limbs to minimize the energy loss, it seems, and the apes' long arms also ease the jolt of deceleration. Gibbons have two 'gaits': one where they always keep one hand on the branch, and another used for long distances between branches or high speeds, where they become airborne between handholds. Both involve overshooting. But the technique evidently isn't foolproof, because one-third of all gibbon skeletons show fractures. **John Whitfield**

Astrobiology

A salty life on Europa?

J. Geophys. Res. doi:10.1029/2002JE001966 (2003)

The ice-covered ocean of Jupiter's moon Europa is perhaps the best candidate habitat for extraterrestrial life in the Solar System. Mikhail Y. Zolotov and Everett L. Shock say that, at least early on in the moon's history, the ocean probably contained enough of the right ingredients to provide an energy source for living organisms.

Satellite observations show that Europa's hidden ocean is salty, thanks largely to dissolved sulphates. On Earth, some micro-organisms obtain metabolic energy by reducing sulphate to sulphide — might microbes on Europa do the same thing? If so, they would need a source of electrons, which on Earth is typically provided by organic compounds or dissolved hydrogen.

Zolotov and Shock estimate that hydrothermal reactions between hot rocks and water on the young, warm moon could have generated appreciable amounts of hydrogen, coexisting with dissolved sulphate. This could have supplied the 'fuel' for early life, but it would not have lasted long: although there is plenty of sulphate, the amount of hydrogen is limited. To sustain life for much of Europa's history, other sources of electron donors would have been needed: for example, organic molecules brought by meteorites, recycled 'dead' organic matter in sediments, or recurrent hydrothermal activity that replenished hydrogen or released other reduced volcanic gases. **Philip Ball**

VOYAGER 2/NASA

Apoptosis

Dead cell talking

Dev. Cell **4,** 587–598 (2003)

Programmed cell death (apoptosis) is a necessity for most living organisms. So too is the rapid removal of the resulting cell corpses by specialized engulfing cells or helpful bystanders, to prevent harmful spillage of cellular constituents. But how are dead cells distinguished from living ones? Swathi Arur *et al.* report that the exposure of annexin I protein on the surface of cell corpses is their way of saying, "Eat me".

Like apoptosis itself, the removal of cell corpses is well coordinated. The engulfing cell binds a dying cell. Its membranes protrude, as if it were wrapping its arms around its target. The tips of the arms fuse and the apoptotic cell is digested.

Arur *et al.* now show that, in dying human cells, annexin I is recruited from the cytosol to discrete patches of the cell membrane. Stuck in the membrane's outer leaflet, it co-localizes with an infamous marker of dying cells, the lipid phosphatidylserine. There it seems to be essential for phosphatidylserine receptors on an engulfing cell to cluster around the dying cell and neatly zip the two cells together. **Marie-Thérèse Heemels**

Metallurgy

Bend it, shape it

Science **300,** 464–467 (2003)

A new class of metal alloys developed by Takashi Saito *et al.* combines a remarkable array of unusual and potentially useful properties. The alloys are highly stretchy — both elastically and plastically — and can be made very strong. They also show 'Invar' behaviour, meaning that they expand very little with increasing temperature, and 'Elinvar' behaviour, maintaining constant stiffness over a wide temperature range. These latter properties are important for making delicate engineering components — hairsprings in wrist-watches, for instance.

The new alloys are made of elements from groups IVa and Va of the periodic table — titanium, zirconium, vanadium, niobium and tantalum — along with small amounts of oxygen. They all share three 'magic numbers': an average metal valency of 4.24, a bond order of 2.87, and an electronic *d*-orbital energy of about 2.45 eV. Saito and colleagues say that, unlike most metals, these alloys deform plastically not by local movements of dislocation defects in the crystal structure but by large-scale sliding of defects akin to geological faults. This means that the alloys can undergo large plastic deformation without experiencing 'work hardening', making it possible to shape the cold metals rather like clay. **Philip Ball**