Plant biology

Blooming extension at the roadside

J. Evol. Biol. **16,** 551–557 (2003)

Two plant species that do not normally interbreed do so in habitats that are subject to human disturbance. So conclude B. B. Lamont and colleagues from their study of the shrub *Banksia hookeriana* and the closely related tree *B. prionotes*, two sand-dune-hugging members of the scrub-heath flora of Western Australia.

These species share a common pollinator and hybridize readily when artificially pollinated. But natural hybrids are rare because their flowering seasons do not overlap. Lamont *et al.* found, however, that the plants' biology in disturbed environments beside roads and railway lines differs from that of plants in undisturbed areas, and that hybrids do arise there. In such environments, individuals of both species grow taller and produce more flowers, apparently because of more water and soil nutrients. Crucially, the flowering seasons extend at both ends so that they overlap, breaking the barrier to interbreeding.

The genetic integrity of parent plant species may be compromised if the hybrid offspring have a competitive advantage over them. So the route to hybridization described by Lamont and colleagues is one for conservation biologists to keep an eye on. **Paul Fletcher**

Atmospheric chemistry

Water molecules pair in air

Science **300,** 2078–2080 (2003)

Water molecules may pair up in the atmosphere, say K. Pfeilsticker and colleagues. They have detected hitherto elusive water dimers in ambient air.

In liquid water, the molecules stick to one another via hydrogen bonds. They may be bound into small clusters in the same way in the gas phase, but the concentration of such clusters was thought to be very small in the atmosphere. Previous attempts to find water dimers in air have failed.

The (near-infrared) spectral signature of water dimers is well known from laboratory studies, and Pfeilsticker and colleagues were able to detect it by measuring absorption by the dimers along an 18.34-km path through the lowest region of the atmosphere (troposphere). They estimate that one in every 1,000 water molecules in vapour-saturated air at 20 °C is bound in a dimer.

Larger clusters are also predicted to be stable in the atmosphere, but the researchers conclude that the concentration of such clusters decreases by a factor of around 1,000 for every extra molecule added to a cluster. All the same, this implies that clusters with up to six molecules exist in the troposphere in numbers comparable to the ambient concentration of aerosol particles. Here they can facilitate photochemical reactions such as the formation of sulphuric acid, 'seed' the formation of water droplets, hydrate other atmospheric gases, and alter the atmosphere's radiative balance. **Philip Ball**

Cancer

The alcohol factor

Cancer Res. **63,** 3092–3100 (2003)

As cells break down the ethanol in alcoholic drinks, the by-products can contribute to DNA damage and so to cells becoming cancerous. Elise A. Triano *et al.* have now found that normal human breast epithelial cells contain the enzyme class I alcohol dehydrogenase (ADH), which can metabolize alcohol. They propose that this might help to protect breast-feeding infants from alcohol's toxic effects — but it might also be responsible, in part, for the observation that drinking alcohol increases the risk of breast cancer.

The authors also found, however, that levels of ADH were greatly decreased or absent in cells taken from invasive breast cancers, leading them to suggest that the protein might also have some tumour-suppressor function. Class I ADH can affect a wide range of molecules besides ethanol. Most importantly, it helps to convert vitamin A to retinal — the first step in the production of retinoic acid, which has a restraining influence on cell division. So, in invasive cancer cells, this effect of retinoic acid might be compromised because of decreased expression of the enzymes needed to generate it from vitamin A. **Helen R. Pilcher**

Biophysics

Symmetry by design

Phys. Rev. Lett. **90,** 248101 (2003)

Sphere-like viruses have icosahedral symmetry not by default but by design, say Robijn F. Bruinsma and colleagues. This undermines the common assumption that the shapes of viruses are dictated by simple geometric packing constraints on their protein building-blocks.

The protein coats (capsids) of viruses are made from individual, compact proteins grouped into geometric units such as hexagons, and known as capsomers. In 1956, Crick and Watson proposed that spherical viruses should have the symmetry of regular polyhedra because of the way small numbers of identical protein units pack together. Most such viruses are indeed icosahedral, suggesting that this shape is simply the one that minimizes the packing energy.

Not so, say Bruinsma and colleagues. Their model, which considers the adhesion and bending energies of closed shells of disk-like capsomers, reveals that the most stable structures need not be icosahedral.

Instead, icosahedral shells can be explained by assuming that (as is often found in reality) 12 of the capsomers are smaller than the others. This can be engineered by a 'conformational switch' of the constituent proteins, which has an energy cost. In real viruses, this modification to the building-blocks seems to be an adaptation — although its function isn't clear. **Philip Ball**

Immunology

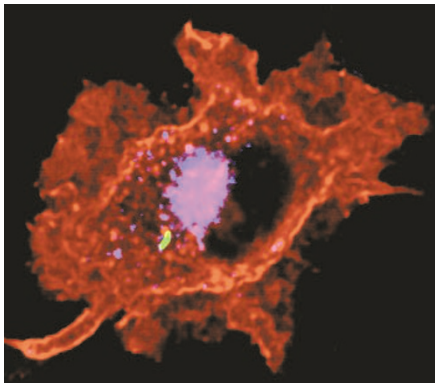
Hide and seek

Immunity **18,** 813–823 (2003)

Legionella pneumophila, the bacterium that causes a severe type of pneumonia known as Legionnaire's disease, hides in a clandestine compartment within our cells. Annie L. Neild and Craig R. Roy have found that dendritic cells — experts in turning on the immune response — can nevertheless seek out the intruder.

Legionella multiplies vigorously within macrophage cells in the lungs. Normally, macrophages can present bits of bacterial proteins to cells of the immune system to elicit an immune attack. But *Legionella* lives in an atypical intracellular compartment, a vacuole, which never seems to mix with the compartment in which proteins are processed for presentation. Moreover, rapid replication of *Legionella* can kill a macrophage within 24 hours. These considerations make macrophages unlikely candidates for setting off an immune response to the bacterium — in theory.

Neild and Roy now show that *Legionella* resides in a vacuole in dendritic cells as well. And, surprisingly, *Legionella*-derived protein products are somehow presented to the immune system by both dendritic cells and macrophages *in vitro*. Unlike macrophages, however, dendritic cells manage to firmly restrict the growth of their unwelcome guest. How they do that is not known, but it may allow dendritic cells *in vivo* sufficient time to live and tell the tale — to the immune system at least. **Marie-Thérèse Heemels**



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Unwelcome guest: *Legionella* (green) inside a macrophage (red). Lysosomes are blue.