

Quantum physics

**Seven atoms make a superfluid**

*Phys. Rev. Lett.* **91**, 163401 (2003)

How many atoms does it take to make a superfluid? About seven, according to Yunjie Xu and colleagues. They have watched single molecules of nitrous oxide (N<sub>2</sub>O) spinning inside clusters of helium atoms, and find that a cluster's total inertia to rotation begins to drop once it contains more than seven helium atoms.

With fewer atoms than this, the inertia increases as more atoms are added, because they stick to the N<sub>2</sub>O molecule and make it more ponderous. But just seven atoms are enough to produce the characteristic signature of superfluidity: a drop in viscosity owing to collective motion of the quantum particles. In the clusters, this is manifested as a decoupling of the spinning molecule from its surrounding solvent of helium atoms.

'Molecular superfluidity' of nanoscale droplets has been reported previously, not just in helium but also in hydrogen. But it was not clear just how small a superfluid cluster could be. The new results, based on spectroscopic studies of clusters with countable numbers of atoms, show that for quantum many-particle systems, seven is a crowd.

Philip Ball

Cell biology

**Stretch and split**

*J. Cell Biol.* **163**, 143–154 (2003)

**In order to split in two, a cell needs extra membrane to accommodate its expansion — plus the proteins actin and myosin to squeeze the two daughter cells apart. Blake Riggs *et al.* suggest that a cellular compartment called the recycling endosome may supply both membrane and actin for the job.**

The team studied cell division by looking at a comparable process that occurs in early fly embryos, where dividing nuclei are surrounded by actin- and myosin-rich membranes called furrows. The authors had previously identified a protein called Nuclear fallout (Nuf) as being required for these furrows to form. Nuf is related to the

mammalian protein Arfophilin, a key component of the recycling endosome — a fact that hinted at how Nuf might aid furrow formation.

Riggs *et al.* now find that Nuf seems to control the formation of furrows (or cell division proper) by helping the recycling endosome to deliver membrane and actin to the site where furrows form. It does this by pairing up with another essential recycling-endosome protein, Rab11 (see picture). The authors speculate that vesicles from the recycling endosome may either ferry actin to the furrow directly, or carry other proteins that organize actin once they are added to the cell membrane.

Helen Pearson

Human evolution

**Robust ideas**

*J. Hum. Evol.* **45**, 99–111 (2003)

The largest-known sample of human skeletons from the Late Pleistocene comes from a place called Kow Swamp, in what is now Victoria, Australia. The Kow Swamp people had an extraordinarily robust body form compared with that of their neighbours at Lake Mungo to the north, in New South Wales.

Researchers have long wondered whether the two populations reflected widely divergent ancestries. Tim Stone and Matthew L. Cupper suggest, however, that the robustness may have been more a response to worsening climate than a reflection of widely sundered heritage.

Recent re-dating of the Lake Mungo specimens placed them at around 40,000 years old, just before a sharp climatic trend towards aridity and glaciation in southeastern Australia. The Kow people were once thought to have lived 9,000–15,000 years ago, on the basis of radiocarbon dates. Stone and Cupper believe that those dates were due to contaminants, and, after dating sediment from the site using optically stimulated luminescence, put the age of the Kow people at around 20,000 years. This time was the coldest, driest part of the Last Glacial Maximum, and the ruggedness of the specimens' body form could have been an evolutionary response of Mungo-like people to these challenging conditions.

Henry Gee

Psychoacoustics

**Hearing ghosts**

*Chaos* **13**, 1226–1230 (2003)

When we hear two tones simultaneously, the brain often 'invents' a third one at a lower pitch. Dante R. Chialvo argues that the illusory note — which is generally the missing 'fundamental' of the two real tones, making them sound like harmonics — depends on omnipresent random noise in the signal reaching the auditory neurons.

Chialvo assumes that the missing fundamental is produced by constructive interference between the two real tones, which generates acoustic peaks at a frequency equal to the greatest common divisor of these two frequencies. But it is not quite that simple, because the amplitude of this linear combination of frequencies is too low in itself to cause auditory neurons to fire. Background noise, however, nudges the peaks above the firing threshold, in much the same way that noise can enhance detection of a signal in the phenomenon of stochastic resonance. This introduces a nonlinearity into the effect, which can account for the shift in the pitch of the missing fundamental when, for example, three equidistant stimulating tones are shifted in pitch. If the illusory frequency were set simply by the difference in frequency between these tones, such a pitch shift would have no discernible effect.

Philip Ball

Conservation

**Model distributions**

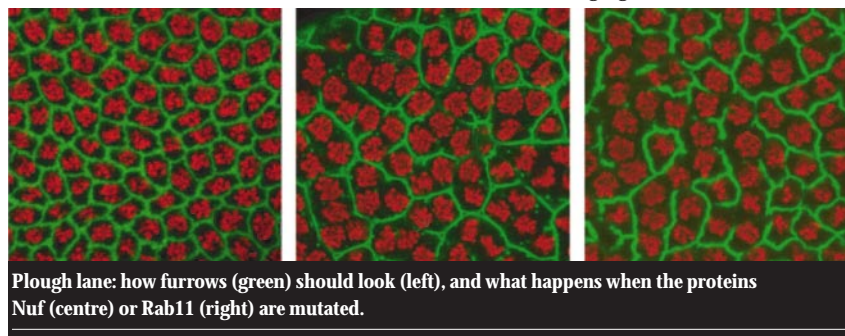
*Glob. Change Biol.* **9**, 1353–1362 (2003)

Understanding how climate and land-use changes will affect species distributions is a crucial task for conservation biologists. Computer models can help to predict shifts in distributions, says Wilfried Thuiller — but the opinion of human experts is still needed to validate the results.

Thuiller has developed a computational framework called BIOMOD (for biodiversity modelling) that combines four different modelling techniques. He tested it by trying to 'predict' the current distributions of 61 European tree species from climate data, and comparing the results with the observed distributions. He then projected the distributions into the future using a simulation of climate change in Europe.

The BIOMOD ensemble performed well at predicting current distributions. But taken individually, the best-performing model varied from species to species, and the differences in accuracy grew as the predictions became more ambitious. Thuiller argues that researchers could develop forecasts using the most accurate model for their preferred species, or a composite of models, backed up with expert knowledge of 'ground truth'.

John Whitfield



Plough lane: how furrows (green) should look (left), and what happens when the proteins Nuf (centre) or Rab11 (right) are mutated.