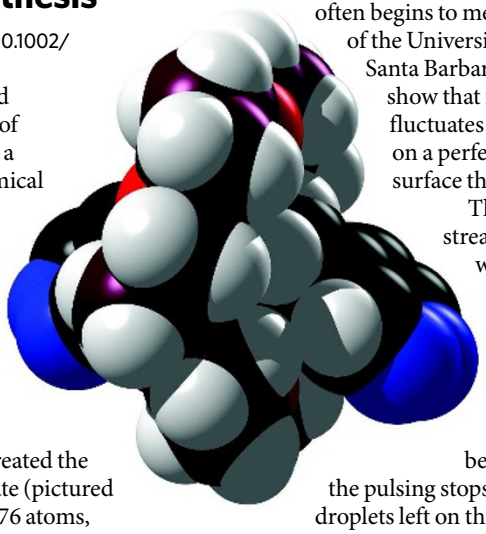
neurons responded sluggishly to stimulation of a dopamine receptor known as D1. The mice had an altered distribution pattern of the G protein-coupled receptor kinase 2 protein, GRK2, which decreases D1's activity. FMRP and GRK2 were also found to bind to one another, and blocking GRK2 with a drug corrected the mice's D1 signalling deficiency. Drugs that boosted D1 signalling also restored some behaviour deficits in the mice. Zhuo and his colleagues conclude that FMRP is a player in the dopamine signalling architecture of the forebrain and that this may explain some of the problems caused by its deficit in fragile X syndrome.

CHEMISTRY

Ro-taxing synthesis

Angew. Chem. Int. Edn doi: 10.1002/anie.200803056 (2008)



Chemists are fascinated by rotaxanes — a class of compound made from a dumbbell-shaped chemical inside a molecular ring — because such structures could be useful in making microscale machines. Sheng-Hsien Chiu and his colleagues at the National Taiwan University have now created the smallest rotaxane to date (pictured right), made from just 76 atoms, with a molecular mass of 510 daltons.

Their ring is a crown ether — a circle of alternating oxygen atoms and ethylene groups — and their dumbell's axle is a dialkylammonium ion. After threading the axle through the ring, grinding the mixture up with a tetrazine caps the axle with pyridazine groups to make the rotaxane.

The scientists hope that they can shave a few atoms off the rotaxane to beat their own record.

EVOLUTIONARY BIOLOGY

Eggs in many baskets

Proc. R. Soc. Lond. B doi: 10.1098/rspb.2008.0794 (2008)

In Bibron's toadlet (*Pseudophryne bibronii*) males are the nestmakers and females shop around. Females of this Australian amphibian lay their eggs in the nests of up to eight males. This makes it the first frog or toad in which such 'sequential polyandry' has been genetically proven, and the most extreme example of this mating tactic seen in any vertebrate.

Using DNA analysis and observations, Phillip Byrne, of Monash University in Melbourne, and his colleague showed that females that laid eggs in more nests had more surviving tadpoles. They suggest that polyandry is an insurance policy against nests flooding or drying out, and that other egg-layers in which dad tends the brood in a risky environment may do the same.

FLUID DYNAMICS

Making water wander

Phys. Rev. Lett. **101,** 114501 (2008)

As a stream of liquid flows down a slope, it often begins to meander. Björn Birnir of the University of California, Santa Barbara, and his colleagues show that if the liquid flow fluctuates this can happen even on a perfectly smooth, clean surface that does not erode.

The researchers ran a stream of a water mixed with glycerine down a plastic sheet. As the flow changed from smooth to pulsed, the rivulet began meandering. The wavy path can be sustained once the pulsing stops, as the stream hits droplets left on the surface during its earlier wanderings.

ATMOSPHERIC CHEMISTRY

Glasses in the sky

Atmos. Chem. Phys. **8,** 5221–5244 (2008)

Some solutions of water-soluble organic compounds form glasses below −43 °C. The upper troposphere, where cirrus clouds form, is this cold; glass formation here could impede the water uptake of aerosol particles, ice nucleation and crystal growth, with implications for cloud formation.

Thomas Koop of Bielefeld University in Germany and his colleagues investigated glass formation in various solutions under realistic atmospheric conditions in the lab. They found that aerosol particles enriched with large organic molecules are most likely to form glasses at low temperatures and high relative humidity. Modelling studies should be used to assess the regional and global impact of atmospheric glass formation, say the authors.

JOURNAL CLUB

Nicola Hamilton and David Attwell
University College London

Two neuroscientists are surprised by the link between a brain-chemical transporter and sexual orientation.

Many nerve cells in the brain release the chemical neurotransmitter glutamate to signal to other neurons via receptors. Dedicated transporters then remove glutamate from the extracellular space to end signalling.

Cystine–glutamate exchangers are unusual glutamate transporters because they do the reverse, adding glutamate to the extracellular space while removing cystine. David Featherstone of the University of Illinois, Chicago, and his colleagues have found that in the fruitfly *Drosophila melanogaster*, knocking down expression of a cystine–glutamate exchanger in non-neuronal glial cells leads to a dramatic change in the sexual behaviour of male flies: they mate with both males and females owing to altered processing of sex-specific chemosensory cues (Y. Grosjean *et al. Nature Neurosci.* **11,** 54–61; 2008).

This behaviour may be caused by an increase in the number of glutamate signalling receptors, which is induced by the fall in extracellular glutamate concentration that follows transporter knockdown. Indeed, the effect of the knockdown could be reversed by feeding the flies a drug that reduces glutamate signalling, and could be mimicked by feeding normal flies a drug that enhances glutamate signalling.

These studies raise questions about whether human sexual orientation, long assumed to be due to a mix of genes and environment, could also be altered by perturbations of neurotransmitter signalling. Could differences in such signalling contribute to different sexual preferences?

The possibility of altering sexual preference pharmacologically is worrying. We cannot rule out a future regression to the twentieth-century idea that sexual behaviour should be regulated by society.

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