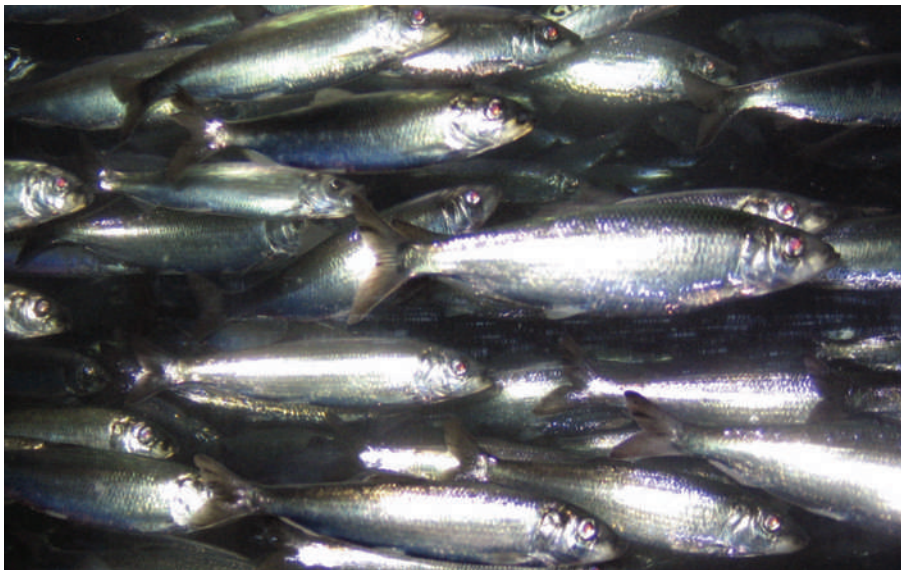
RESEARCH HIGHLIGHTS

School soundings

Science **323,** 1734–1737 (2009)

It is difficult to study what triggers shoaling in sea fish as the conglomerations can be tens of kilometres across and yet are still hard to find in the vast oceans. Nicholas Makris of the Massachusetts Institute of Technology and his colleagues have observed the genesis of an entire giant shoal for the first time, using a low-frequency acoustic technique that can take snapshots of areas up to 100 kilometres across every 75 seconds.

They found that spawning Atlantic herring (*Clupea harengus*) around the Georges Bank in the Gulf of Maine had to reach a critical density of 0.2 fish per square metre to trigger a rapid transition from anarchy to synchronization. After this transition the fish then proceed to migrate in their millions under the influence of a small number of leader fish.



H.BAESEMANN/DPA/CORBIS

MITOCHONDRIAL GENOMICS

Bloody anomaly

Genome Res. doi:10.1101/gr.083188.108 (2009)

Blood-sucking lice are common. Genetically, they are also unusual, say Renfu Shao at the University of Queensland, Australia, and his colleagues. Using information from the Human Body Louse Genome Project, the team found that the mitochondrial genome of the human body louse (*Pediculus humanus*) is splintered into 18 mini-chromosomes.

Chromosome fragmentation seems to have evolved along with blood sucking: the authors found it in human head and pubic lice, as well as in blood-sucking lice of other primates, but not in related lice that feed on other material. The chromosomal break-up may have been advantageous by increasing recombination between mini-chromosomes and introducing genetic variation that helped lice adapt to a bloody mammalian diet.

MECHANOCHEMISTRY

Tug of war

Nature Nanotechnol. doi:10.1038/nnano.2009.55 (2009)

Even the strongest molecular bonds break if yanked hard enough. But studying this effect requires a delicate tugging mechanism that can focus force controllably on individual bonds.

Roman Boulatov and his colleagues at the University of Illinois in Urbana-Champaign have found such a device: a rigid U-shaped molecule, stiff stilbene (pictured right), the ends of which are attached to the molecule under interrogation. Stilbene twists into a strained shape on exposure to light, pulling on its attached molecule. The force generated can be calculated from quantum mechanical principles, and altered incrementally depending on the length of an adjustable linker.

The researchers confirm a direct relationship between the force their probe exerts on a cyclobutene molecule and the rate at which a central bond falls apart.

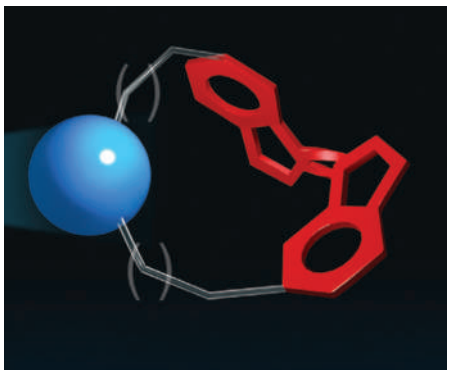
TRIBOLOGY

Brushing problems aside

Science **323,** 1698–1701 (2009)

The joints in human elbows, knees and the like exhibit very little friction even at moderately high pressure — man-made materials can offer nothing as good. Zwitterions might put that right.

Zwitterions are molecules with discrete positive and negative charges in different places. Jacob Klein of the University of Oxford, UK, and his colleagues have created polymer 'brushes' made of zwitterionic phosphorylcholine, in which the multiple positive and negative charges strongly attract water molecules, and attached them firmly to mica surfaces. The result is a system with very low friction when the surfaces move against each other, probably because the water molecules clinging to the phosphorylcholines prevent the brushes becoming entangled. The bound water can exchange freely with other water molecules, which also reduces friction.



This work might have application in biomedical devices where friction is often a problem.

ASTRONOMY

Slow revolution

Astrophys. J. **694,** 130–143 (2009)

Galactic archaeologists have identified a component of the Milky Way's halo that had been predicted but not seen before. The team, led by Heather Morrison at Case Western Reserve University in Cleveland, sifted through stellar velocity data from surveys going back to 1994, and found a group of stars marching to a different beat from the halo's original inhabitants. These stars were probably part of the outer halo and seem to have arrived at their positions more recently.

Some astronomers had theorized that the halo of stars centred on the Milky Way should contain two components. One, roughly spherical, would not rotate. The other, observed now for the first time, flattened into a thick, slowly rotating disk after the Galaxy's formation when stars from the outer halo drifted inwards.

This new component contains stars with eccentric orbits not found in the rapidly rotating main disk.