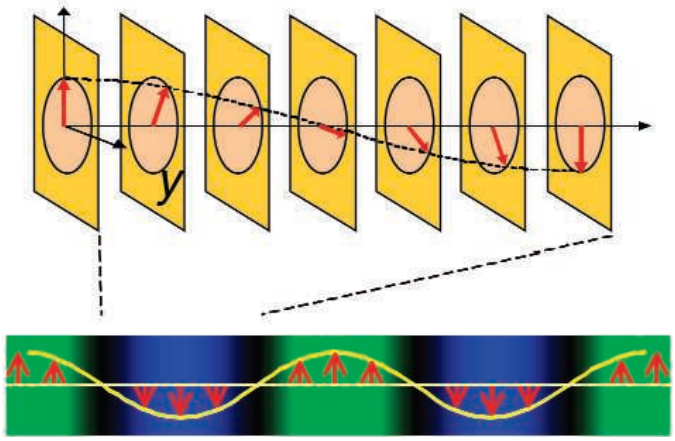
Magnetism with a Twist >>

In helical spin order, the spins in a crystallographic plane of a material tend to align, and this direction rotates by a constant angle between adjacent planes. Knowledge of, and the ability to control, the relative orientation of the magnetic moment between the planes could have important consequences for the flow of spin-controlled current through such a structure. Reciprocal-space imaging probes such as neutron scattering only provide an average view of the overall spin structure. **Uchida *et al.*** (p. 359; see the Perspective by **Nori and Tonomura**), using Lorentz microscopy, found that the real-space structure of helical spin ordering is much richer than that expected from the averaged techniques. They also visualized the real-time dynamics of magnetic defects in response to changes in temperature and magnetic field, which may yield important information for spintronic devices that would rely on this effect.



Spotlight on Structural Genomics Centers

Projects in structural genomics aim to expand our structural knowledge of biological macromolecules, while lowering the average costs of structure determination. **Chandonia and Brenner** (p. 347) quantitatively review the novelty, cost, and impact of structures solved by structural genomics centers, and contrast these results with traditional structural biology.

Spinning Membranes from Phospholipids

Electrospinning is a simple but powerful method for making very thin polymer fibers that can then be collected to create porous films. **McKee *et al.*** (p. 353) expand the range of this technique by making fibers from small molecules, namely phospholipids. The phospholipids form wormlike micelles in specific concentration ranges of mixed solvent systems, and under these conditions they behave like polymers for electrospinning. The membranes formed from phospholipids should exhibit high biocompatibility.

Bridging Nanotube Contacts

In molecular electronics, the contacts between metal electrode and molecule are often the weakest link, and it can be difficult at times to exclude changes in this electrode contact as the cause of switching behavior. **Guo *et al.*** (p. 356) show how small gaps (less than 10 nanometers) in single-walled carbon nanotubes (SWNTs) can be bridged covalently with short oligomeric molecules whose conjugation makes them conductive. After metal contacts were made on a SWNT, patterning allowed a gap to be cut between two contacts. This oxidative cutting left terminal carboxylic acid groups that were bridged by making amide linkages to molecules bearing amine groups at each end. The devices formed are robust, and molecules that bear basic nitrogen atoms in the chain changed conductance with pH.

Restricted Motion

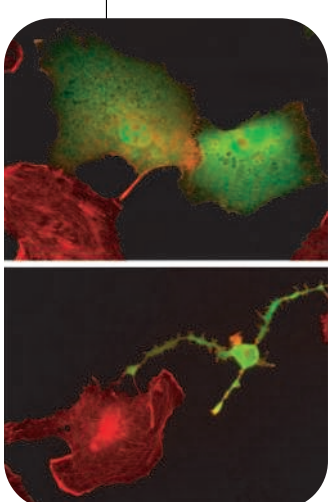
The assignment of gas-phase spectra to specific atomic motions for molecules with even as few as five or six atoms can prove challenging. Such assignments are of particular interest in piecing together the interactions of molecules in deep space, for which spectroscopic signatures are the sole source of data. **Lee *et al.*** (p. 365) take advantage of the unusual properties of solid para-hydrogen (p-H_2) to simplify, and thus interpret, the vibrational spectrum of methanol. By embedding methanol in a matrix of the quantum solid, they prevent overall rotational motion but still observe internal torsion of the methyl group about the C–O bond.

Mist-Made Martian Glaciers

Water ice glaciers flank mountains and volcanoes in the tropics and midlatitudes of Mars. Current conditions on Mars are cold and dry and restrict water ice to regions near the poles, so the origin of these young glaciers at lower latitudes is a puzzle. **Forget *et al.*** (p. 368) used climate simulations of the planet at high obliquity to explain the locations of the glaciers. A few million years ago, the rotation axis of Mars was tilted by up to 45°, which caused more water vapor to evaporate from the poles into the atmosphere. Circulating across the planet, this watery mist then precipitated to build up glaciers on the leeward side of volcanoes and in mountainous regions.

Rho, Rho, Rho Your Vaccinia

Viruses subvert a variety of host cell mechanisms during infection, replication, and dissemination. **Valderrama *et al.*** (p. 377) now describe how vaccinia virus promotes cellular motility by interfering with the activity of RhoA, a small guanosine triphosphase–binding protein involved in intracellular signaling, which particularly affects the actin cytoskeleton. A conserved vaccinia protein, F11L, directly interacts with RhoA, mimicking one of its endogenous substrates, ROCK, and inducing cellular motility. The induced motility is likely to facilitate the spread of the virus within tissues.



Continued on page 301

CREDITS (TOP TO BOTTOM): UCHIDA *ET AL.*; VALDERRAMA *ET AL.*

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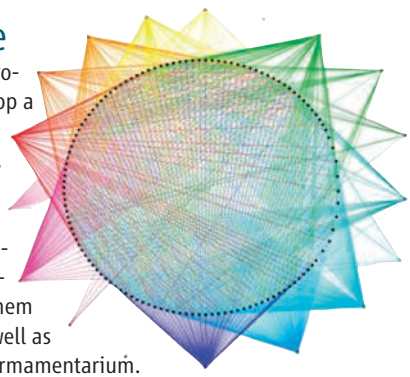
Squares in the Sand

Language is so intimately linked with our thoughts that it is hard to imagine thinking without it, but how language influences thought remains a lively topic of discussion. **Dehaene *et al.*** (p. 381; see the news story by **Holden**) bring new evidence to light from their studies with an Amazonian group, the Mundurukú. Both Mundurukú children and adults proved competent at grasping and using geometric concepts, such as parallel lines and right-angled triangles, even though they lack the words for such terms and concepts. Furthermore, the Mundurukú used relations diagrammed on paper to locate hidden objects, and again performed as well as American children, but not as well as adults. Thus, the Mundurukú possess a basic sense of geometry, in addition to their previously discovered sense of arithmetic.

Ubiquitous Antibiotic Resistance



A major source of antibiotic resistance genes is soil microorganisms that produce antimicrobial agents and develop a variety of resistance mechanisms as a way of self-defense against their own toxic products. **D'Costa *et al.*** (p. 374; see the Perspective by **Tomasz**) show that soil microbiota also represent an enormous reservoir of antibiotic-resistant organisms, most of which do not produce antimicrobial agents themselves. The authors characterized strains of spore-forming bacteria and tested them against 21 antimicrobial agents—some in long use as well as compounds recently introduced into the antimicrobial armamentarium. Every strain was multidrug resistant and exhibited resistance to at least 7 to 8 antibiotics, and sometimes to as many as 20.

Turning Cuttings Back into Whole Plants

Plants regenerate much better than do animals—an entire plant can regenerate from a small snip of tissue, whereas the best that animals can do is the occasional amphibian regeneration of a limb or tail. **Xu *et al.*** (p. 385) now analyze subcellular dynamics in the root tip of *Arabidopsis* to understand how regeneration is directed in response to localized cell ablation. Surprisingly, as new tissues are built, establishment of unidirectional flow of the hormone auxin follows, rather than precedes, cell fate specification. A suite of transcription factors that respond early to changes in auxin distribution directs cell fate respecification.

Got to Hitch a Ride

During cell division, chromosomes must establish connections to the opposing spindle poles and become positioned at the spindle equator. Uncorrected errors in this biorientation inevitably lead to aneuploidy and are associated with cell transformation and cancers. How chromosomes attach properly to the mitotic apparatus is not understood. **Kapoor *et al.*** (p. 388; see the cover and the Perspective by **Heald**) used live-cell two-color fluorescence, correlative light and electron microscopy, as well as chemical biology, to demonstrate surprisingly that chromosomes can congress to the spindle equator before they become bioriented. During congression, the leading kinetochore glides alongside kinetochore fibers of other already bioriented chromosomes toward microtubule plus ends. The gliding is mediated by the kinetochore-associated motor protein. Thus, cells possess a mechanism for repositioning monooriented chromosomes from the periphery to central areas of the spindle where they can establish connections to the other spindle pole.

Mammoth DNA Sequences

The sequencing of ancient DNA is hoped to lend insight into evolutionary studies of a variety of species, including mammals. **Poinar *et al.*** (p. 392, published online 12 December 2005) used a roughly 28,000-year-old bone from a woolly mammoth that had been preserved in the Siberian permafrost to directly sequence ancient DNA without prior repair or amplification bias. A total of 137,000 reads (13 megabases) of mammoth DNA were generated, with only traces of human DNA contamination. Genomic comparisons were used to establish the rate of sequence divergence between extinct species and modern elephants. Examination of microbial and plant sequences isolated from the same source may also give clues about the mammoth's environment.

CREDIT: D'COSTA *ET AL.*