**CHEMISTRY**

**Building Photoswitches**

Some compounds exhibit significant changes in inherent acidity upon electronic excitation. However, the excited states in these photoacids tend to be too short-lived for practical use in tuning bimolecular reactivity. Two research teams have extended the scope of phototunable reactivity by building molecules in which light absorption at different wavelengths switches the structure reversibly between two stable isomers of differing acidities. Lemieux *et al.* prepared a boronate derivative in which the boron is initially conjugated in a planar ring with six π electrons from oxygen and olefin groups, and so has comparatively low Lewis acidity. Ultraviolet (UV) irradiation links two thiophene rings pendant to the olefin, disrupting the conjugation geometry and thereby raising the Lewis acidity to increase the pyridine binding constant from undetectable to ~7000. Blue light cleaves the thiophene linkage and restores the inert geometry. At the opposite end of the pH scale, Peters *et al.* relied on sterics rather than electronics to tune the basicity of a piperidine derivative. A pendant azobenzene group blocks the basic piperidine nitrogen with a bulky aryl or tert-butyl substituent in the trans geometry, but rotates this blocking group out of the way upon UV-induced isomerization to the cis geometry. — JSY


**CLIMATE SCIENCE**

**Dry and Getting Drier**

Global warming is expected to have a substantial impact on the amount and pattern of rainfall worldwide. Although projections indicate that already arid and particularly vulnerable to further drying. One of these regions is northwestern Africa, which recently suffered a severe drought from 1999 to 2002. In order to establish a context for understanding drought frequency and severity in the region, Touchan *et al.* constructed a 547-year summer drought record by measuring and analyzing ring widths of cedar and pine trees across Algeria and Tunisia. They found that the multiyear drought of 1999 to 2002 was the longest in their entire record and that 2002 was the single driest year, a troubling set of statistics if the data do indeed reflect ongoing anthropogenic climate change. Climate models are unable to identify the physical causes of drought in this region, however, so a mechanistic understanding of rainfall dynamics there remains elusive. — HJS


**PSYCHOLOGY**

**A Numbers Game**

Low-tech inexpensive means for enhancing childhood proficiency in mathematics would be of broad utility, and if applied early on and as unobtrusively as possible, might well yield long-lasting benefits. Siegler and Mu find that Chinese kindergartners (5 to 6 years old) score higher than U.S. children of the same age on two tests: the addition of single-digit numbers and the placement of numbers on a number line. The former result is not unexpected as it fits with previous reports of extensive parental involvement in explicit numerical instruction (such as counting) in China. The latter outcome, however, reveals a precocious and implicitly acquired transition from a logarithmic to a linear representation of magnitude, which occurs at elementary school age in the United States and does not appear to occur at all in the absence of formal education (see Dehaene *et al.*, Reports, 30 May, p. 1217). Ramani and Siegler show that the number-line skills of preschoolers from low-income households can be improved by playing simple board games designed to instill multimodal instantiation of numerical concepts. A follow-up analysis revealed that mathematical proficiency in this cohort correlated with commercial board games played outside of preschool, but not with video gaming. — GJC


**MATERIALS SCIENCE**

**Naturally Sticky**

A key property of good composites is a strong adhesion of the reinforcing material to the matrix. Pommet *et al.* sought to optimize this feature while advancing the environmentally friendly goal of deriving plastics from renewable sources. They took beds of sisal or hemp fibers and used them as substrates for the bacterium *Acetobacter xylinum*. During fermentation, a thin film of bacterial cellulose was deposited onto the fibers; to improve coverage, fibers were treated with acetone to remove any waxy coatings. Pullout tests showed greater interfacial shear strength, a measure of adhesion, for both fiber types when they were embedded in a matrix of polymeric cellulose acetate butyrate. For a composite of sisal fibers and poly(lactic...
acid), Juntaro et al. showed that the tensile strength and Young’s modulus improved by about 50% in the direction of the fiber orientation. In the transverse direction, the Young’s modulus was greater than that of the pure matrix polymer, but the strength decreased significantly, possibly because of adhesive failure or internal failure of the fibers themselves.

Because the cellulose coating technique should work with any natural fiber that has a sufficiently hydrophobic surface, it may be possible to improve further the properties of a biologically sourced and potentially biodegradable polymer composite. — MSL


**ANIMAL BEHAVIOR**

**Turning Turtles**

The peregrinations of the remaining leatherback turtles in the eastern Pacific are governed by an urge to go south regardless of currents and temperature. Concerned by the plummeting populations afflicted by human predation of eggs and by fisheries-mediated mortalities, Shillinger et al. attached satellite tracking tags to 46 female leatherbacks that nested on Costa Rican beaches between 2004 and 2007. After laying their eggs, the turtles headed south, parallel to the Cocos Ridge. By swimming at speeds sometimes exceeding 60 km per day, they were able to win through the strong oceanic currents that ply the waters between Central America and the Galápagos. Once released from this web, the turtles slowed down and dispersed in the South Pacific Gyre. During February and April when the females set out to sea, their route is highly predictable and hence makes a multinational conservation strategy practical. — CA


**DEVELOPMENT**

**Pore Differentiation**

Developmental signals are relayed inside cells via nucleocytoplasmic transport in which information and macromolecules are exchanged between the cytoplasm and nucleus via the nuclear pore complex (NPC), which in mice is composed of about 30 different proteins. Thus far, mutational analyses of several nucleoporins have produced embryonic lethality. Lupu et al. find that mouse embryos express the conserved nucleoporin Nup133 in a cell-type– and stage-specific pattern, suggesting that it may not function as a general structural component of the NPC but could instead be a modulator of NPC activity. When Nup133 was disrupted, nuclear pore complexes assembled normally, but mouse gastrulation was defective. Specifically, neural progenitors formed, but cells maintained the features of an earlier pluripotent state and differentiated inefficiently. — BAP


![Differentiated cells (green) within a tube of neural progenitors (red).](http://science.sciencemag.org/content/321/5887/6657/F1.large.jpg)
Turning Turtles
Caroline Ash

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