

## 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  $\pi$  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  $\sim 7000$ . 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

*Angew. Chem. Int. Ed.* **47**, 5034; 10.1002/anie.200802050 (2008).

## 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



the overall effect should be an increase in precipitation, at a regional scale there will be areas that receive less rainfall; many such areas are



## 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

*Psychol. Sci.* **19**, 633 (2008); *Child Dev.* **79**, 375 (2008).

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

*Geophys. Res. Lett.* **35**, L13705 (2008).

## MATERIALS SCIENCE

### Naturally Sticky

A key property of good composites is a strong adhesion of the reinforcing material to the matrix. Pomet *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