



The hawksbill turtle.

## ECOLOGY/EVOLUTION

### Sex on the Beach

For many reptiles, the temperature at which their eggs are incubated determines the sex of the hatchling. In a world affected by global climate change and localized anthropogenic pressures, temperature-dependent sex determination can have all-or-none consequences for sex ratios and hence population viability. Kamel and Mrosovsky document a graphic example of this peril, in the case of the hawksbill turtle in the Caribbean. Like other marine turtles, hawksbills lay their eggs above the high tide mark on beaches. Where the beach is shaded by its natural forest cover, cooler incubation temperatures lead to a more male-biased sex ratio. However, such male-producing sites are increasingly scarce as more of the coastlines of Caribbean islands are deforested and developed for tourism, and there is evidence that the hawksbill population is becoming more female-biased. — AMS

*Ecol. Appl.* **16**, 923 (2006).

## CHEMISTRY

### A Convenient Couple

Biaryls are a common structural motif in pharmaceutically important compounds and have traditionally been prepared using strategies that couple a halogenated substrate to a second compound pre-adorned with a reactive group such as a boronic ester or alkyl stannane. Recent research has focused on improving the efficiency of these syntheses by linking aryl halides directly to the aromatic C-H bond of a partner ring. Yanagisawa *et al.* extend this trend with a rhodium catalyst that couples iodobenzene and its derivatives efficiently to heterocyclic aromatics, including substituted thiophenes, furans, and pyrroles. At 3 mole % loading, the catalyst induces regioselective bond formation at the carbon adjacent to an oxygen or sulfur atom, though somewhat surprisingly selects for the 3 position in N-substituted 1-phenylpyrrole. Pi-accepting bulky phosphite ligands played a crucial role in achieving catalytic efficiency and also conferred air stability on the Rh complex. The catalyst proved capable of coupling aryl halides to methoxy-substituted benzenes as well, albeit with diminished regioselectivities relative to those obtained with the heterocyclic substrates. — JSY

*J. Am. Chem. Soc.* **128**, 10.1021/ja064500p (2006).

## ASTROPHYSICS

### Polarized Snaps

Buried in the patterns of the cosmic microwave background radiation that bathes the sky are clues to the structure of the universe. Ripples in

temperature have been mapped in fine detail for several years, but further insight requires the mapping of polarized signatures that place extra constraints on early-universe physics. One pioneering experiment that has measured temperature anisotropies is BOOMERanG—Balloon Observations Of Millimetric Extragalactic Radiation and Geophysics—a balloon-borne array of bolometer detectors floated from Antarctica. In a 200-hour flight in January 2003, BOOMERanG succeeded in mapping detailed structures in polarized light at 145 GHz over a few percent of the full sky. In a series of papers, MacTavish *et al.*, Montroy *et al.*, Jones *et al.*, and Piacentini *et al.* report the latest power spectra determinations of temperature, polarization, and temperature polarization cross-correlations. These results are consistent with recent measurements on degree scales by the Wilkinson Microwave Anisotropy Probe (WMAP) satellite but also extend to much higher resolution and offer finer sampling than has been achieved to date by other low-frequency experiments. The BOOMERanG data are consistent with the con-



BOOMERanG launch.

sensus cosmological model, a universe dominated by dark energy and cold dark matter. Some models of early structure formation are ruled out, notably defects, and adiabatic seed fluctuations are favored. — JB

*Astrophys. J.* **647**, 799; 813; 823; 833 (2006).

## BEHAVIOR

### Learning to Lift or Slide

Evidence for the cultural transmission of behaviors in nonhuman primates comes primarily from long-term observational histories of wild populations. To counter the criticism that theories derived from these data sets are inference-based, Horner *et al.* describe an experimental study demonstrating that a naïve chimpanzee can figure out how to forage for food by watching a skilled practitioner and can then serve as a tutor for a third individual, creating a chain of learning. They designed a “Dorian fruit” box from which food could be retrieved by either lifting or sliding a door. When untutored chimpanzees (or 3-year-old children in a parallel series of trials) were presented with the apparatus, about half discovered how to open the door, some by lifting it and others by sliding it (which required equally effortful actions). On the other hand, when socially compatible chimpanzees were allowed to play the roles of teacher and student in strictly binary interactions, the initial mode of foraging (lift versus slide) was faithfully passed along a chain of individuals (six and five, respectively); a similarly exclusive transmission of the original foraging technique (for acquiring a toy) was found in chains of eight children. — GJC

*Proc. Natl. Acad. Sci. U.S.A.* **103**, 13878 (2006).

CREDITS (TOP TO BOTTOM): N. MROSOVSKY; BOOMERANG COLLABORATIONS

## CLIMATE SCIENCE

## The Times Temps Were a'Changin'

The occurrence of several large and abrupt climate changes dated to the last deglaciation, first clearly evidenced in Greenland ice cores, has also been confirmed by a variety of other proxies in lower-latitude Northern and Southern Hemispheric marine and terrestrial records. Despite much knowledge of the environmental changes that accompanied these events, an understanding of their causal mechanisms is hampered by the difficulty of determining the absolute ages of the different records. In order to better determine the phase relationships of these events at different locations, Genty *et al.* analyzed stalagmite records of  $\delta^{13}\text{C}$  isotopic distributions from several Northern Hemispheric locations, in France and Tunisia, and compared them with corresponding records from speleothems in China, New Zealand, and South Africa.



Dated stalagmite.

The advantage of this approach is that stalagmites can be precisely dated, thereby establishing an accurate common chronology.

The data suggest that the Bølling-Allerød warm interval began synchronously in France, Tunisia, and China; that the Younger Dryas cold period also began concurrently at all of these sites; and that although the onset times were the same at widely separated sites in both hemispheres, the duration and intensity of transitions differed among sites. The authors also suggest a simple explanation for

these changes, involving the gradual increase of insulation at high northern latitudes, due to orbital changes, and the resulting northward movement of the limits of sea ice there. — HJS

*Quat. Sci. Rev.* **25**, 2118 (2006).

## CHEMISTRY

## A Different Sort of CP

To organometallic chemists, a "Cp" notation in molecular formulas is well understood to signify the widely used cyclopentadienyl ligand  $\text{C}_5\text{H}_5$ . The absence of confusion engendered by this abbreviation highlights the elusiveness of the cyaphide ligand CP: an analog of cyanide in which phosphorus replaces nitrogen. Cordaro *et al.* have succeeded in coaxing a precursor toward this long-sought diatomic and report isolation of a stable ruthenium complex coordinated to cyaphide through the carbon. Their synthetic route proceeds from a triphenylsilyl ( $\text{Ph}_3\text{Si}$ )-coordinated  $\text{CH}_2\text{PCL}_2$  fragment to the  $\text{Ph}_3\text{Si-C}\equiv\text{P}$  phosphalkyne through dehydrohalogenation. This molecule coordinates to a cationic Ru center to yield a stable complex that was characterized by x-ray crystallography. Addition of fluoride to a solution of this compound surprisingly led to attack at P rather than at the traditionally fluorophilic Si center. However, phenoxide proved a more cooperative nucleophile, liberating CP from the silyl cap. The resulting complex was characterized crystallographically and by nuclear magnetic resonance spectroscopy in solution; the vibrational spectrum revealed a  $\text{C}\equiv\text{P}$  stretching band at  $1229\text{ cm}^{-1}$ . — JSY

*Angew. Chem. Int. Ed.* **45**, 10.1002/anie.200602499 (2006).



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## &lt;&lt; A Flexible Fate?

Specific factors in the local microenvironment govern the differentiation of bone marrow-derived mesenchymal stem cells (MSCs) into disparate cell types such as neurons, myoblasts, and osteoblasts, yet remain incompletely understood. Noting that brain tissue is much softer than muscle, which in turn is softer than collagenous bone,

Engler *et al.* cultured naïve human MSCs on collagen-coated polyacrylamide gels in which elasticity was varied via the extent of bis-acrylamide crosslinking in order to investigate the role of matrix elasticity in lineage specification. The morphology, transcriptional profile, and expression of marker proteins of MSCs grown for a week on soft gels (mimicking brain tissue) resembled those of cultured neurons; MSCs grown on gels that mimicked the elasticity of striated muscle resembled myoblasts; and MSCs grown on gels that mimicked young uncalcified bone resembled osteoblasts. During the first week in culture, exposure to soluble factors known to promote myogenic or osteoblastic differentiation influenced lineage, leading to a mixed MSC phenotype. After 3 weeks in culture, however, MSCs remained committed to the matrix-derived lineage. Pharmacological analysis indicated that nonmuscle myosin II was required for lineage specification in response to matrix elasticity but not in response to soluble factors. Thus, the data suggest that matrix elasticity plays an important role in specifying MSC lineages. — EMA

*Cell* **126**, 677 (2006).

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