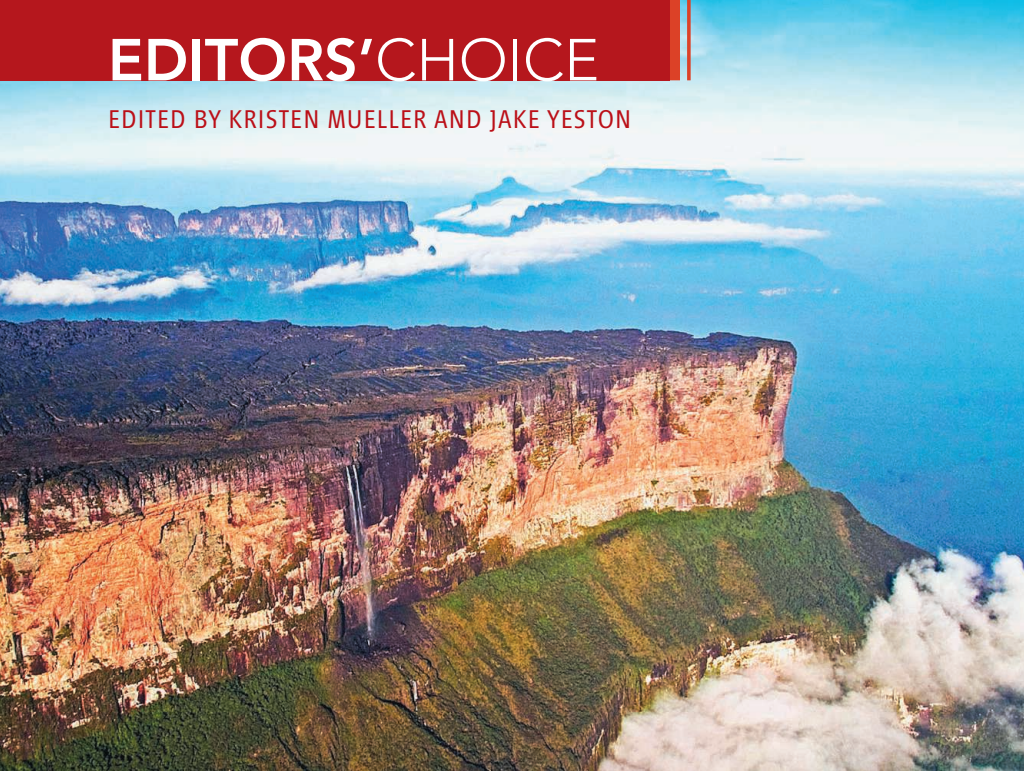
EDITORS' CHOICE

EDITED BY KRISTEN MUELLER AND JAKE YESTON



ECOLOGY

Unlocking the Secrets of a Lost World

The ancient sandstone table mountains, or tepuis, of the tropical South American Guayana Shield are legendary "lost worlds" renowned for their inaccessibility, mystery, and isolation. Rising hundreds of meters vertically from the surrounding savannas and forests, the summits of individual tepuis are known to harbor high percentages of endemic species of plants and animals that have evolved in isolation over millions of years. Or do they? Kok *et al*. helicoptered onto the summits of 17 tepuis to take tissue samples from amphibian species for genetic analysis. Phylogenetic analysis of mitochondrial gene fragments indicated surprisingly close affinities between many of the taxa on separate peaks, indicating that the barriers to gene flow may have been less complete than hitherto thought. The genetic data suggest that dispersal between summits may have been taking place through the Pleistocene and into the Holocene, so that substantial elements of the fauna may be less than 1 million years old—far less than the forbidding nature of the tepuis would seem to predict. — AMS

Curr. Biol. **22**, R589 (2012).

CHEMISTRY

Sugar Placement

Chemical bonds vibrate at frequencies that depend on the masses of the linked atoms. Because bond scission and formation are essentially extreme sorts of vibration, their rates also vary when the atom masses change, giving rise to kinetic isotope effects that offer insight into the order and extent of bond rearrangements underlying a reaction. The easiest, and thus most common, effects to study involve deuterium/hydrogen substitutions, given the factor of 2 mass difference. The 13/12 mass ratio of stable carbon isotopes induces a smaller rate distinction that is nonetheless discernible—even at the low natural abundance of ^{13}C—using current nuclear magnetic resonance (NMR) technology. Huang *et al*. applied this technique to elucidate the precise mechanistic details of substitution reactions at the anomeric carbon of simple sugars, which bear on the selectivity attainable in the generating particular oligosaccharides for targeted biological studies. Specifically, they examined rate distinctions for ^{12}C versus ^{13}C centers in the displacement of trifluoromethanesulfonate by isopropanol to form the and anomers of mannopyranoside and glucopyranoside. For three of the four reactions, comparison of the NMR data to theoretical simulations supported a loosely associative mechanism, with the bond-cleaving and -forming events perhaps just shy of simultaneous. The -mannopyranoside was unusual in appearing to form through initial bond scission before isopropanol binding. — JSY

Nat. Chem. **4**, 663 (2012).

EDUCATION

Making Use of Misconceptions

Ironically, educators themselves hold misconceptions on how best to deal with their students' preexisting ideas. Instead of categorizing misconceptions as mistakes needing to be managed, is it possible to use them as a resource for learning? Larkin surveyed 14 preservice science teachers in different teacher preparation programs and found that their views on student misconceptions fell into five general categories: evidence of content coverage, obstacles to understanding, tools to encourage thinking, elements of a positive classroom environment, and the raw material of learning. Over the course of learning to teach, preservice teachers adjusted their view of student misconceptions, and most grew to recognize the teaching potential of misconceptions. These results suggest that teacher educators should encourage preservice teachers to incorporate misconceptions into their teaching as learning platforms to build on, instead of obstacles to learning. — MM

Sci. Educ. **96**, 927 (2012).

PLANT SCIENCES

How Bananas Weather a Drought

Agriculture is a thirsty business. Despite being grown in the humid tropics, bananas (genus *Musa*) are susceptible to even mild drought and

can require irrigation. A few strains dominate commercial banana production, but much greater banana biodiversity is represented in the Musa International Germplasm collection. Analyzing the genetics driving drought resistance in bananas is challenging, however, because of their growth requirements. To overcome this, Vanhove *et al*. analyzed in vitro banana plantlet growth rates in response to mild osmotic stress. The results

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pointed toward variants known to be more tolerant of irregular water availability in field settings. Analysis of leaf proteomes showed differences between stressed and nonstressed plantlets, with most of the proteome variation attributable to a handful of proteins. Annotations of these proteins suggested that pathways involving photodynamic damage and oxidative stress were activated in the osmotic stress response. Placing their work in context, the authors distinguish between drought survival mechanisms and water use efficiency. Plants that use survival mechanisms—such as closing stomata—to withstand drought are likely to show reduced yield. The variants identified here, however, can tolerate temporary and mild water deficiencies without sacrificing plant growth and yield. — PJH

Front. Plant. Sci. **3**,176 (2012).

APPLIED PHYSICS

Single Entry

Optical fibers provide the backbone of modern communication networks, with information encoded in the wavelength and polarization states of light pulses that each contain billions of photons. Higher data transmission rates, as well as more secure communication afforded by fundamental laws of quantum mechanics, will require the use of single photons as the information carriers. However, because the emission of single photons from quantum emitters such as quantum dots is generally directionally random, getting the single photons into the fiber remains an engineering challenge. Yalla *et al*. present a relatively simple solution in the form of a tapered optic fiber—a standard optic fiber that has been heated locally and stretched so that it is thinner along one part. They place several quantum dots along the tapered section of the fiber, excite them with an external laser source to emit single photons, and then show that the coupling of the single photons into the fiber can be as high as 20%. Configuring the structure of the tapered fiber provides a flexible route to optimizing the efficient channeling of single photons for communication applications. — ISO

Phys. Rev. Lett. **109**, 63602 (2012).

GEOPHYSICS

Slide Hazards

Quantifying the number of fatalities after natural disasters is a challenging yet critically important task. In the wake of an individual event, response teams use this information to focus immediate rescue efforts. In the longer term, human loss statistics are useful in calculating risks associated with a particular hazard. Fatalities from landslides, however, have been poorly quantified as compared to those from other hazards, in part because of their concurrence with other events such as earthquakes and tropical cyclones. To reassess the loss of life from landslides, Petley compiled an exhaustive global data set of fatal landslides from 2004 to 2010, excluding landslides triggered by earthquakes. These 2620 landslides resulted in 32,322 deaths—most occurring in the Himalaya mountains and China—an estimate an order of magnitude larger than those previously drawn from other databases. Because landslides are triggered by increased rainfall and human activities such as environmental degradation, fatalities from landslides may increase with climate change and increased urbanization. — NW

CREDIT: USGS

Geology **40**, 10.1130/G33217.1 (2012).

CELL BIOLOGY

A Close-Up View of Endocytosis

Clathrin-coated pits mediate the uptake of extracellular ligands into cells. Although this process is relatively well understood, questions still remain about how individual clathrin coated pits are initiated and precisely how the budding and scission process to form coated vesicles in the cytosol proceeds. Now, using mammalian live-cell and single-molecule imaging, Cocucci *et al.* provide a close-up view of the initiation process—the first 5 s in the life of a coated pit. Coated pits appeared to be initiated by the coordinated assembly of individual clathrin triskelions together with their AP2 adaptor proteins. The FCho proteins, known to play important roles in clathrin-coated vesicle assembly, were required for the sustained growth of the incipient coated pits. Working in yeast cells, Kikulski *et al.* used correlated fluorescence microscopy and electron tomography to look at individual endocytic events to reconstruct a virtual ultrastructural movie of membrane invagination. In this system, the coating of the membrane with clathrin was not sufficient to initiate budding—the actin network was required to promote the formation of invaginated tubules, which were severed from the surface once they had penetrated about 100 nm, which took about 9 s. — SMH

Cell **150**, 495; 508 (2012).