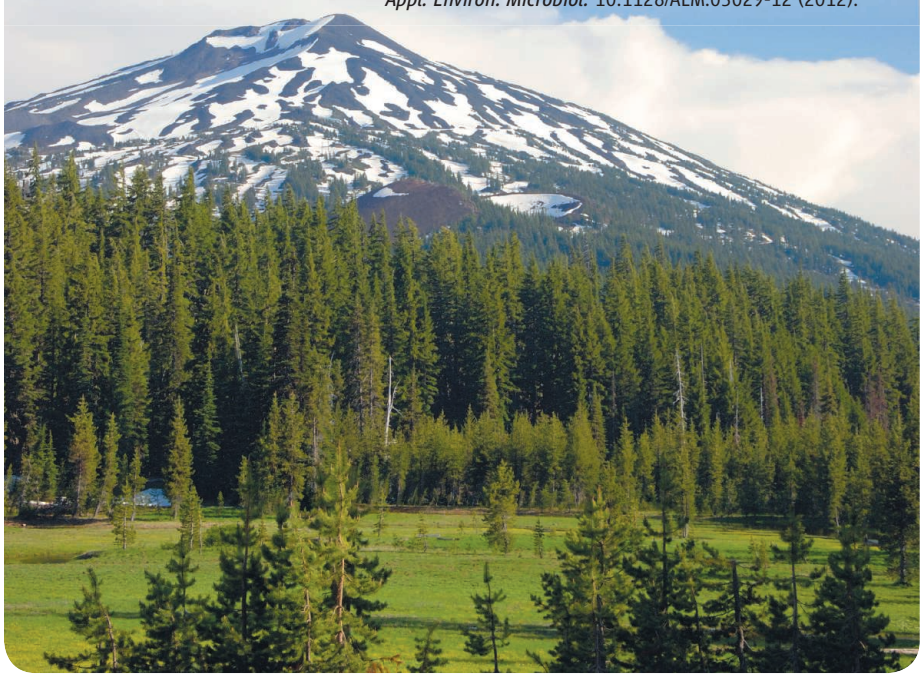
MICROBIOLOGY

Bacterial Breeze

Mount Bachelor in Oregon, USA, is at 2.8 km above sea level and is a useful high point from which to sample trans-Pacific dust plumes in the upper troposphere and lower stratosphere. Using this observatory, Smith *et al*. investigated what living matter gets transported in the ~64-teragram annual aerosol load from Asia. Airborne bacterial numbers and species were measured in two major plume events occurring in April and May 2011, from which some Gram-positive organisms were recovered and cultured. Atmospheric modeling revealed that the air masses lifted and swept through a storm loop from locations near China, Korea, and Japan, and sequencing detected ~2800 bacterial species (operational taxonomic units) from a broad range of phyla. A few marine archaeans were also identified, but what was notable was the preponderance of spore-forming species capable of surviving extreme conditions. The work offers an indication of the potential role microbes play in cloud nucleation and precipitation in large-scale events, as well as their potential to be important air pollutants. — CA

Appl. Environ. Microbiol. 10.1128/AEM.03029-12 (2012).



CHEMISTRY

Clusters Couple Chloroarenes

In the classic Ullmann coupling reaction reported more than a century ago, iodine-substituted aromatic rings were coupled at high temperatures by using copper as a reducing agent to form a carbon-carbon bond. Further work extended this coupling reaction to more conventional chloroarenes by using coreductants and precious-metal catalysts, but reaction temperatures still tended to be high. Dhital *et al*. now show that a wide variety of chloroarenes can be coupled at ambient temperatures (25° to 45°C). The reactions proceeded under basic conditions (in a mixed organic-aqueous solvent) in the presence of gold-palladium nanocluster catalysts. Neither pure gold nor pure palladium clusters could catalyze the reaction, indicating that alloying of the metals was critical for reactivity. Density functional theory calculations indicated that the critical difference for the alloy clusters is that they favor activation of the carbon-chlorine bond through the dissociative adsorption of the arene chlorides. — PDS

J. Am. Chem. Soc. 10.1021/ja309606k (2012).

GEOLOGY

Feeling the Pressure

Volcanism has a substantial impact on climate, the global carbon cycle, the evolution of landforms, and a host of other important processes; establishing how it has varied in the past is thus a key to understanding those topics. It is also known that volcanic activity can be influenced by surface mass loading and the resulting isostatic adjustment of the underlying Earth and that glacial cycles change the distribution of water and ice on the crust. Therefore, the possibility that volcanism might vary in accordance with Milankovich periodicities (changes in the amount and distribution of solar energy incident on Earth due to variations in its orbital configuration) in response to glacial cycling has been an intriguing one. Kutterolf *et al*. present the most comprehensive data set yet to address this idea, developed from an extensive collection of marine sediment cores from around the Pacific Ocean basin. From these cores, they were able to show that the frequency of circum-Pacific volcanism varied with a 41,000-year period, the obliquity band of Milankovich cycles, and that changes in volcanic activity lagged slightly behind glacial unloading, consistent with the idea that eruptions are forced by the mass distribution variations attendant with deglaciations. — HJS

Geology 10.1130/G33419.1 (2012).

ECONOMICS

Marshmallows and Rösti(graben)

Does the language we speak influence how we think? Chen adds to the lengthy and continuing discussion of this question by linking language to future-oriented behaviors, such as a child who resists the temptation to eat one marshmallow right now so as to be given two marshmallows to enjoy just a few minutes later. He does so by noting that the marking of future tense is obligatory in some languages (French) and suggests that this induces a cognitive representation of the future as being distinct from the present; in other words, tomorrow is less a continuation of today and more a new day altogether. This leads to the expectation that countries in which so-called strong future-time reference languages predominate would exhibit lower rates of future-oriented behavior, such as saving and exercise. Looking across countries in the World Values Survey confirms this prediction, even after controlling for various geographic, cultural, and institutional factors. Furthermore, looking within countries, such as Switzerland,

Continued on page 12

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that feature both strong and weak future-time reference language speakers reveals that the German-speaking Swiss save at more than twice the rate of their fellows on the other side of the linguistic divide. — GJC

Am. Econ. Rev., in press (2013); http://cowles.econ.yale.edu/P/cd/d18a/d1820.pdf.

MICROBIOLOGY

Exit Essentials

The bacteria *Salmonella enterica* is a major cause of food poisoning. *Salmonella* invades host cells by injecting these cells with virulence factors by means of a molecular machine called a type 3 secretion system, encoded by the *Salmonella* pathogenicity island 2 (T3SS-SPI-2); replicates, and then rapidly disperses systemically. It is important to check the dynamics and mechanisms of spread in intact animals because new vaccine candidates using strains mutated in T3SS-SPI-2 are being developed for use in humans. Grant *et al.* found that mutant *S. enterica*, in contrast to wild type, replicated to high numbers within individual spleen and liver cells and formed only a few new foci of infection. Further experiments showed that the mutant bacteria were trapped in the initial cell because they were held in check by intracellular oxidase activity that generates free radicals. Unexpectedly, the pathogen appeared to require T3SS-SPI-2 to exit cells and spread through an organ. This implies that a net bacterial cell count alone will not tell you whether a *Salmonella* infection has successfully established and disseminated. — CA

PLoS Pathog. **8**, e1003070 (2012).

CELL BIOLOGY

Waves of Separation

During exocytosis of secretory granules, the actin cortex has two opposing roles: It can act as a mechanical barrier impeding access to the plasma membrane, yet it can also act as a carrier that facilitates secretion. The mechanism by which cells resolve this apparent paradox has been unclear. Working with cultured mast cells, Wollman and Meyer found that cells use phase-shifted oscillations of Ca^{2+} and F-actin assembly to create a cyclic secretory engine that enhances the rate of exocytosis of secretory granules. The cellwide cortical actin oscillations were initiated by Ca^{2+} and phosphatidylinositol 4,5-bisphosphate oscillations that promoted oscillations of N-WASP recruitment (an actin nucleator), thus triggering waves of cortical F-actin assembly and disassembly. These waves of assembly and disassembly alternately allow secretory granules to bind and then move through the cortex en route to Ca^{2+}-stimulated fusion with the plasma membrane. By examining secretion from single cells, the oscillations could be observed to increase the secretion rate, as also predicted by a mathematical model. This oscillatory dynamics may thus allow cells to separate the two opposing roles of the actin cortex (barrier and carrier) temporally and thereby increase secretion efficiency. — SMH

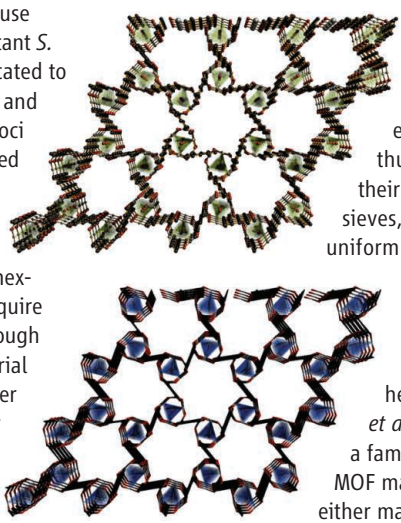
Nat. Cell Biol. **14**, 1261 (2012).

CHEMISTRY

A Washable MOF

Metal organic framework (MOF) materials are highly porous materials that consist of metal atoms linked together with organic ligands. They are useful for capturing, storing, or filtering gases, as well as for catalysis and sensing applications. Most MOF materials are unstable when exposed to water, thus preventing their use as aqueous sieves, where their uniform porosity with pores of just the right size would otherwise be very helpful. Majumder *et al.* have developed a family of water-stable MOF materials based on either magnesium ions or certain first-row transition metal ions—namely, nickel, cobalt, or manganese—that are linked together with perylene tetracarboxylate (PTC) ligands. The reaction between the potassium salt of PTC and the specific metal acetate was performed in water and could readily be done on multigram scales. The authors noted that if either the acetate or potassium salts were varied, only an amorphous material was obtained. Ni-PTC was able to extract methyl viologen, a known toxic herbicide, from parts per million aqueous solutions. The material also absorbed methylene blue, a dye with a similar hydrodynamic radius, although two larger molecules were clearly excluded from the MOF. Ni-PTC also showed 300:1 selectivity of CO_2 versus N_2, with a high binding enthalpy for the CO_2, suggesting possible uses for gas capture applications. — MSL

Chem. Mater. **24**, 4647 (2012).



CREDIT: MAJUMDER *ET AL.*, *CHEM. MATER.* **24**, 4647 (2012)