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In This Issue

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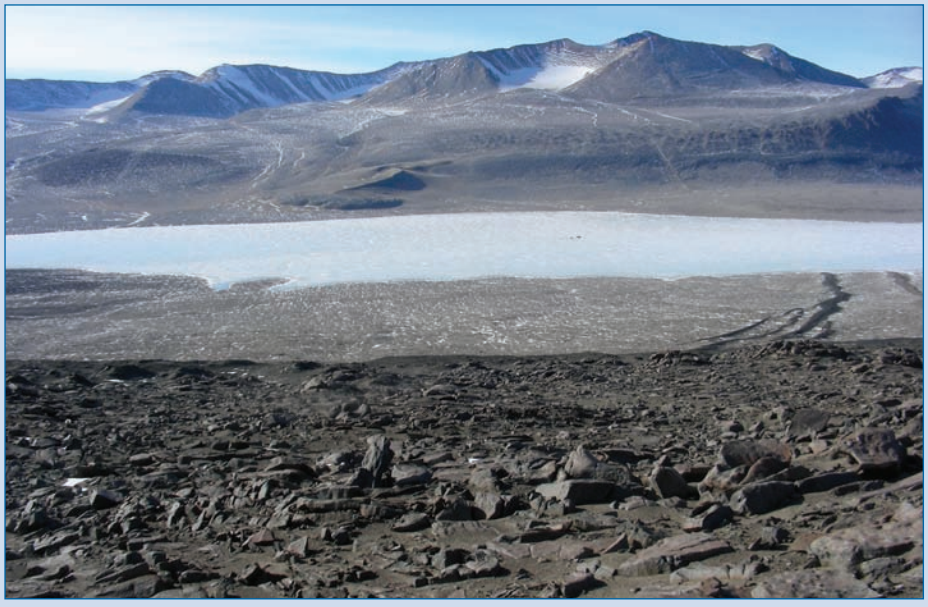
Ancient microbes in a salty, ice-sealed Antarctic lake



Antarctica's Lake Vida.

Antarctica's Lake Vida, which is five times saltier than seawater and permanently covered by more than 20 m of ice, represents one of the least hospitable ecosystems on Earth. Using sanitary procedures and equipment, Alison Murray et al. (pp. 20626–20631) removed cores of ice from the frozen lake, collected samples of the brine in the lake ice, and assessed the brine's potential for sustaining life. Previous studies of Lake Vida indicate that the brine has been isolated from the surface environment for at least 2,800 years. Despite the cold, dark, and isolated nature of the ecosystem, the authors found that the brine harbors a diverse assemblage of metabolically active bacteria. The authors report that the brine is oxygen-free, slightly acidic, and contains very high levels of organic carbon, molecular hydrogen, as well as oxidized and reduced compounds—an unusual finding considering the brine has been isolated from external sources of energy for millennia. Geochemical analyses suggest that chemical reactions between the brine and the underlying sediment generate nitrous oxide and molecular hydrogen, the latter of which may in part provide the energy needed to support the brine's microbes. The findings shed light on the limits to life in extreme environments on Earth and other icy planets, according to the authors. — N.Z.

Neural pathway that couples ejaculation and copulation duration in flies

In many animals that reproduce sexually, the timing of ejaculation is coordinated with the duration of mating. But it remains unclear whether ejaculation determines the duration of copulation. Timothy Tayler et al. (pp. 20697–20702) investigated the question by manipulating the activity of specific subpopulations of neurons that regulate ejaculation in *Drosophila*. The authors found that blocking the activity of four male-specific abdominal interneurons that express the neuropeptide corazonin impaired ejaculation and increased the duration of copulation five-fold. Selective activation of these interneurons caused rapid ejaculation, as did injection of a synthetic corazonin peptide. The authors further found that corazonin promotes ejaculation by activating a set of serotonergic projection neurons that express the corazonin receptor and innervate the male reproductive organs. Selective activation of these projection neurons induced premature ejaculation and shortened the duration of copulation; by contrast, silencing these projection neurons had no effect on the duration of copulation, but caused infertility and impaired ejaculation. Taken together, the findings suggest that ejaculation is not required to set the normal duration of copulation. The authors conclude that corazonin-secreting interneurons independently initiate ejaculation and control the duration of copulation, thereby coupling the timing of the two processes. — N.Z.

Corazonin (red) and corazonin receptor (green) in male abdominal ganglia.

Weather modeling technique can yield real-time flu forecasts

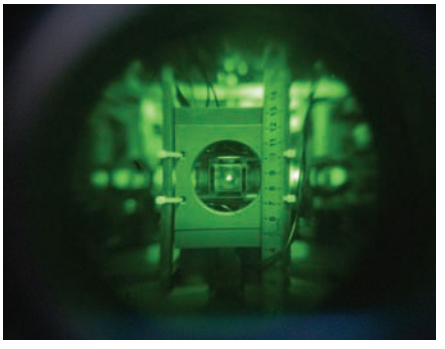
Worldwide, 3–5 million severe cases of influenza kill an estimated 250,000–500,000 people every year. Although mathematical models have revealed important details about the dynamics of disease transmission during historical epidemics, researchers are still unable to predict the timing, duration, and magnitude of future seasonal outbreaks of influenza at local scales. Jeffrey Shaman and Alicia Karspeck (pp. 20425–20430) report a method to perform real-time forecasts of seasonal influenza outbreaks that exploits a technique commonly applied in numerical weather prediction. Using data from the 2003–2008 influenza seasons in New York City, the authors generated weekly retrospective ensemble forecasts from Web-based estimates of influenza infection and showed that the technique can be used to predict the peak timing of outbreaks more than 7 weeks in advance of the peak. In addition, the authors report, the spread of the forecast ensemble provides a means to infer forecast confidence similar to weather forecasters' synthesis of ensemble model runs to make probabilistic predictions. The findings represent a step toward developing statistically rigorous systems that can help forecast seasonal influenza outbreaks in real-time, according to the authors. — T.J.

Image courtesy of Carlye Calvin (National Center for Atmospheric Research).

Doses of flu vaccine at a clinic in Boulder, CO, Nov. 1, 2012.

Quantum teleportation between macroscopic atomic ensembles

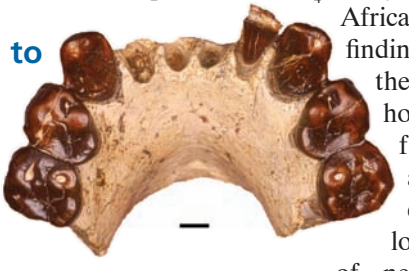
The laws of quantum physics hold that the states of quantum particles can be transmitted to distant locations without transferring the particles themselves. Previous studies have used single photons and atoms to demonstrate rudimentary schemes that accomplish this feat known as quantum teleportation, a crucial element in devising future quantum computing networks. Xiao-Hui Bao et al. (pp. 20347–20351) show that quantum teleportation can be accomplished between two remote atomic ensembles, each consisting of about 100 million rubidium atoms. Atomic ensembles, according to the authors, can serve as a kind of quantum memory that converts the quantum states of rapidly moving photons into stationary matter and stores the information—in this case, a single excitation for the whole ensemble known as a "spin wave." The authors mapped the spin wave into a propagating photon and subjected it to a joint measurement with another photon that was entangled with the second atomic ensemble, thus transmitting the spin wave state between the two nodes with an average fidelity of nearly 90%. By demonstrating that quantum information can be teleported between distant macroscopic storage nodes, the study represents a key step toward quantum networking and distributed quantum computing, according to the authors. — T.J.



Experimental setup of atomic ensemble node in a magneto-optical trap.

Hominin diet shifted to C_4 plants more than 3 million years ago

According to one widely held model, hominins acquired powerful grinding teeth to better process hard foods like nuts and seeds. Recent carbon isotope analyses of fossil tooth enamel, however, have shown that certain early human ancestors such as *Paranthropus boisei* consumed abundant quantities of C_4 plants. Julia Lee-Thorp et al. (pp. 20369–20372) analyzed carbon isotope ratios in the teeth of *Australopithecus bahrelghazali* from the Koro Toro fossil site in Chad, and found a significant enrichment in ^{13}C, suggesting that these individuals consumed a diet rich in foods derived from C_4 resources. The authors propose that based on the site characteristics of Koro Toro the most abundant source of C_4 biomass would likely have been seasonally available grasses and sedges, neither of which is usually considered standard great ape fare. The finding of C_4 reliance in *A. bahrelghazali*, at sites older than 3 million years, extends by more than 1.5 million years the documented pattern of C_4 use by P. *boisei* in East Africa. As such, the findings suggest that the diet of early hominins shifted fundamentally and relatively early to exploit local ecologies of newly emerging habitats, according to the authors. — T.J.



Lower jaw holotype of *Australopithecus bahrelghazali*, lower Pliocene, Chad.