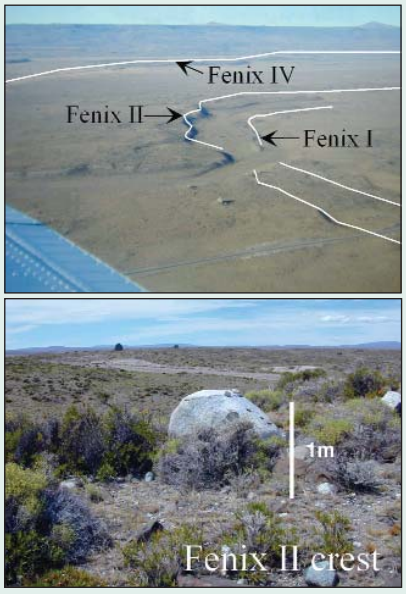
EDITORS' CHOICE

edited by Gilbert Chin



Aerial view of the Fenix moraines (top), east of Lago Buenos Aires, and part of the Fenix II moraine (bottom).

GEOLOGY

Moving in Synchrony

Mountain glaciers in the Northern Hemisphere—in the Alps of Europe and in the Rocky Mountains and Sierra Nevada of North America—generally kept pace with the advance and retreat of the large continental ice sheets at the end of the last glaciation; they advanced until about 22,000 years ago and retreated after about 16,000 years ago. Because glacial cycles are largely thought to reflect changes of incident solar energy in the Northern Hemisphere and because mountain glaciers can respond in a complicated fashion to fluctuations in precipitation and temperature, it has not been clear whether glaciers throughout the Southern Hemisphere would have waxed and waned in lockstep.

Kaplan *et al.* used cosmogenic nuclides in glacial deposits and moraines to date the retreat of a major glacier in Patagonia, Argentina. This kind of isotope record is produced when cosmic rays strike exposed bedrock as a glacier recedes and the protective cover of ice and snow is lost. The data reveal a similar chronology as seen for the Northern Hemisphere mountain glaciers, implying that atmospheric processes synchronized climate in the two hemispheres. — BH

Geol. Soc. Am. Bull. **116**, 308 (2004).

BIOMEDICINE

Deadly Communication

Cisplatin is a platinum-based chemotherapeutic drug that has been used to treat cancer patients for 30 years. Remarkably potent against certain solid tumors, cisplatin played a major role in the recent recovery from testicular cancer of champion cyclist Lance Armstrong. Its antitumor activity has been attributed to its ability to form covalent adducts with DNA that disrupt transcription and replication in individual tumor cells.

Work by Jensen and Glazer reveals an additional explanation for cisplatin's antitumor efficacy—one that, surprisingly, involves cell-cell communication. Studying tumor cells cultured at different densities, they found that cisplatin produces a "death signal" that is transferred to neighboring cells through connecting channels called gap junctions. Although the molecular nature of the damage signal is still unclear, its generation appears to require the activity of DNA-dependent protein kinase, an enzyme already known to play a role in the DNA damage response. This discovery may help explain why tumors show variability in their response to cisplatin, and it suggests new strategies for sensitizing tumors that are resistant to the drug. — PAK

Proc. Natl. Acad. Sci. U.S.A. **101**, 6134 (2004).

ASTROPHYSICS

Dark Clumpuscules

The universe is about 73% dark energy and 36% dark matter. Dark matter tends to be clumpy, which is important for forming luminous structures, like stars and galaxies. About 4% of the dark matter is ordinary matter, consisting of elementary particles, such as protons and neutrons, that take part in strong interactions. Ordinary matter is hard to observe, but much of it might exist as clumpuscules of molecular hydrogen gas, structures of about 100 AU and with masses close to the mass of Jupiter.

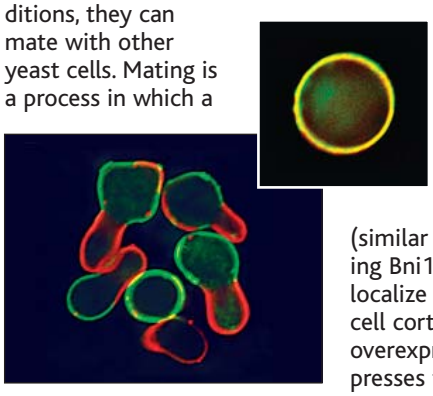
Heithausen has resolved clumpuscules with the IRAM Plateau de Bure interferometer. They obey a fractal distribution and are very dense and overpressurized—significantly in excess of the pressure of the interstellar medium, so that it's hard to understand how these structures can survive. The clumpuscules are moving with a velocity similar to that of nearby molecular clouds, suggesting that the clumps are a natural and perhaps ubiquitous extension of the diffuse interstellar medium. — LR

Astrophys. J. **606**, L13 (2004).

CELL BIOLOGY

Making Advances

Budding yeast cells can divide asexually or, under some conditions, they can mate with other yeast cells. Mating is a process in which a yeast cell orients its growth toward a prospective partner up a pheromone gradient and sends out a mating projection (shmoo) in order to initiate contact and cell-cell fusion. This process relies on the actin cytoskeleton for directional growth, and the formin homolog Bni1p participates by facilitating the assembly of cortical actin cables. Matheos *et al.* show that a component of a previously described signaling cascade, the pheromone-activated kinase Fus3p, can also phosphorylate Bni1p, and that this is required for successful reorientation of growth during mating. Mutant yeast cells that lack Fus3p suffer defects in actin and cell polarization (similar to those in cells lacking Bni1p), and Bni1p fails to localize appropriately to the cell cortex. In these cells, overexpression of Bni1p suppresses these defects, restoring actin assembly, cell polarization, and mating. — SMH



Growth of new cell wall (red) is polarized in wild-type yeast (above), but overlaps with existing cell wall (green) in the absence of Bni1p (right).

J. Cell Biol. **165**, 99 (2004).

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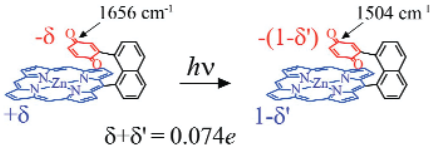
CHEMISTRY

Charge-Transferring Ahead

Small molecules that transfer charge from donor to acceptor groups after absorbing light are of interest as models for the oxidation-reduction components in energy-transducing complexes. Being able to control the degree of charge transfer will be essential for the successful use of organic materials in optical and electronic contexts, yet assessing the degree of charge transfer in donor-acceptor species has proven challenging to quantify.

Rubtsov *et al.* show that vibrational spectra measured with an ultrashort probe pulse just after visible light excitation can provide a measure of the degree of charge transfer in the ground and charge-transferred states. They show that for the same acceptor group, small spacer units can cause a slight decrease in the amount of downfield shift of the asymmetric carbonyl stretch in the charge transfer state. The values measured in this way agree



The partial charge delta reflects the degree of charge transfer in the ground state; for this case, delta is 3.7%.

well with those obtained from analysis of the electronic charge transfer band. However, this pump-probe approach may be particularly helpful when charge transfer bands are not particularly strong or overlap with other bands. — PDS

J. Am. Chem. Soc. 10.1021/ja030674k (2004).

ECOLOGY/EVOLUTION

One if by Land, Two if by Sea

Biogeographers have long debated the relative merits of two competing hypotheses—dispersal and vicariance—to explain similarities in the floras and faunas of widely separated regions such as the Southern Hemisphere landmasses. Similarity by dispersal entails long-distance transport of propagules between landmasses; vicariance entails former terrestrial connections between landmasses, such as those that existed before the continents drifted apart. Phylogenetic methods and increasingly reliable techniques for paleogeographic reconstruction are helping to resolve the relative importance of the two processes. Sanmartín and Ronquist find a distinction between the biogeographic histories of Southern Hemisphere plants and animals. Animal distributions and phylogenies largely match the sequence of the breakup of the Gondwana landmass that produced the modern continents, with evidence for limited dispersal between Australia and South America. In contrast, the plant data indicate a dominant role for dispersal. — AMS

Syst. Biol. **53**, 216 (2004).

MICROBIOLOGY

Switching from a High-Carb to a Low-Carb Diet

Baker's yeast cells are inordinately fond of glucose as a carbon and energy source, and they carry around a set of seven transporters so as to be ready for a meal when glucose levels are anywhere from μM to M. Utilizing glucose depends, in part, on whether oxygen is available and on how abundant the supply of sugar is. Glycolysis, which transforms carbohydrates into pyruvate, is, roughly speaking, faster than aerobic metabolism, which converts pyruvate into carbon dioxide, hence some of the pyruvate spills over into ethanol when large fluxes of glucose are metabolized.

Otterstedt *et al.* have made a mutant yeast strain containing only a single hexose transporter, a hybrid of Hxt1 and Hxt7. The affinity and capacity of this transporter are such that it restricts glucose influx and avoids overflow into lactate. The end result is that this strain makes full use of the glucose by slow and steady respiration, and achieves a higher biomass than wild-type yeast under the same conditions. Having only one transporter means that at external glucose concentrations that wild-type yeast would perceive as high (and hence shift into glucose repression mode), the mutant strain sees a relatively low influx and behaves as if glucose is limiting. By analyzing profiles of transcripts in wild-type yeast, Kaniak *et al.* find that the regulation of repressed (primarily via metabolism of entering glucose) and induced (via a pair of membrane-bound glucose sensors) genes involves what appears to be a small set of intermediaries that speak to each other, which serves to maintain coordinate control of these two pathways. — GJC

EMBO Rep. **5**, 10.1038/sj.embor.7400132 (2004); *Eukaryot. Cell* **3**, 221 (2004).

CREDIT: RUBTSOV *ET AL.*, *J. AM. CHEM. SOC.* 10.1021/JA030674K (2004)

Making Advances

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