EDITORS' CHOICE

edited by Gilbert Chin

CLIMATE SCIENCE

A Regional Weather Forecast

Global climate models (GCMs) predict that doubling the concentration of atmospheric CO_2 from its preindustrial value of 280 parts per million (ppm) to 560 ppm, which is expected to occur over the next 50 to 100 years, will increase the global average surface temperature 1.5° to 4.5°C. The changes in temperature and precipitation that people will experience, however, are expected to vary considerably at regional or local scales. Although GCMs do not yet allow for the calculation of variability in smaller areas, higher resolution regional climate models can provide detailed predictions.

Snyder *et al.* report results from a high-resolution climate model centered on California, run under atmospheric conditions of 280 and 560 ppm CO_2 to predict changes in mean annual and monthly average temperatures, precipitation, and snow accumulation. They find that doubling CO_2 produces annual average temperature increases up to 3.8°C and decreased snow accumulation everywhere in the region, with the greatest monthly surface warming at high elevations and mean annual precipitation increases in northern regions of up to 23%. — HJS

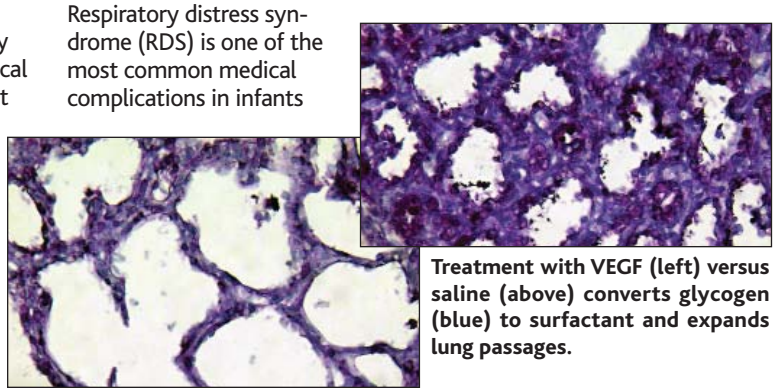
Geophys. Res. Lett. **29**, 10.1029/2001GL014431 (2002).

BIOMEDICINE

Breathing Easier

Respiratory distress syndrome (RDS) is one of the most common medical complications in infants delivered prematurely. This condition is often fatal and is caused by insufficient alveolar production of surfactant, a mixture of phospholipids and proteins that is essential for normal lung mechanics. The pathogenesis of RDS is not well understood.

A study of mouse models by Compernolle *et al.* reveals that vascular endothelial growth factor (VEGF), a secreted protein known for its role in promoting blood vessel growth, may also contribute to fetal lung maturation and thereby protect against RDS. Mice genetically deficient in certain isoforms of VEGF or in hypoxia-inducible factor 2α (HIF-2α), a transcription factor that regulates VEGF expression, were found to succumb to RDS soon after birth. VEGF stimulated surfactant production in cultured alveolar cells and improved lung function in mice with RDS when administered either in utero or immediately after birth. These results suggest that VEGF, which is already in clinical trials for therapeutic angiogenesis, may merit investigation as a possible treatment for RDS in premature babies. — PAK



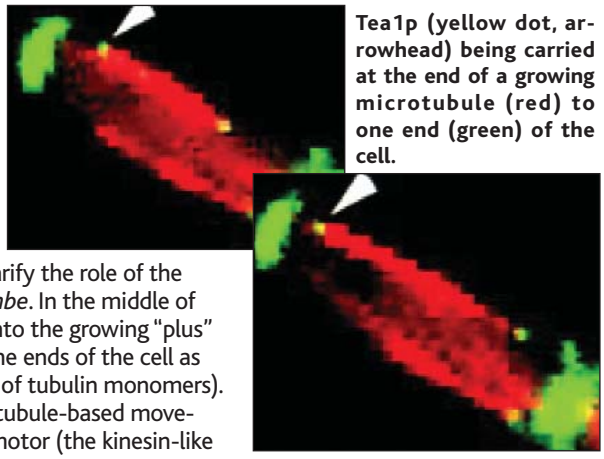
Treatment with VEGF (left) versus saline (above) converts glycogen (blue) to surfactant and expands lung passages.

Nature Med. **8**, 10.1038/nm721 (2002).

CELL BIOLOGY

The Means to the Ends

The fission yeast *Schizosaccharomyces pombe* adopts a cylindrical shape due to linear polarized growth from the ends of the cells and has served as a model system for the study of the generation and maintenance of polarized growth. Behrens and Nurse used immunofluorescence microscopy and in vivo imaging to clarify the role of the protein tea1p in regulating growth in *S. pombe*. In the middle of the cell, near the nucleus, tea1p is loaded onto the growing "plus" ends of microtubules and is carried out to the ends of the cell as the microtubules elongate (via the addition of tubulin monomers). This translocation, unlike many other microtubule-based movements, was not dependent on a molecular motor (the kinesin-like protein tea2p), and the presence of tea1p appeared to signal microtubules to stop growing after they reached the cell ends. Once delivered to and deposited at the ends, tea1p is instrumental in maintaining the distribution of other polarity factors that contribute to linear cell growth. — SMH



Tea1p (yellow dot, arrowhead) being carried at the end of a growing microtubule (red) to one end (green) of the cell.

J. Cell Biol. **157**, 783 (2002).

ECOLOGY/EVOLUTION

Bog Succession

Peat bogs and mires offer the plant ecologist an opportunity to trace—often in minute detail—the development of local vegetation over centuries and millennia. Plant remains preserved in the acid sediments provide a precise picture of successional change. Hughes and Dumayne-Peaty analyze the vegetation sequences in a South Wales bog and find a surprising variety of pathways of succession over the past 6000 years, even when starting from similar initial conditions. Reversals and directional change in the successional sequence appear to occur in response to external forcing (natural variation in precipitation or human disturbances to surrounding land), interrupting the autogenic progression from mire to raised bog. These results suggest that the development of bog plant communities is surprisingly idiosyncratic on a local scale and that concepts of succession, even for these relatively simple, treeless communities, need to be further revised. — AMS

J. Ecol. **90**, 456 (2002).

MICROBIOLOGY

Targeting the CaRRier

Bacterial proteins that do not have eukaryotic counterparts hold special appeal as drug targets. The twin arginine protein translocation pathway (Tat) carries fully folded proteins across the bacterial inner membrane; it

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CREDITS: (TOP) COMPERNOLLE *ET AL., NATURE MED.* **8**, 10.1038/NM721 (2002); (BOTTOM) BEHRENS & NURSE, *J. CELL BIOL.* **157**, 783 (2002)

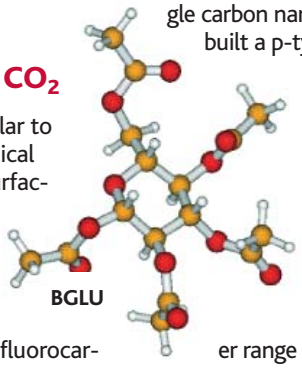
also functions in plants to transport proteins from the cytosol into the thylakoid space of chloroplasts. Ochsner *et al.* show that the Tat system is responsible for the export of virulence factors (such as phospholipase C) in the pathogen *Pseudomonas aeruginosa*. Furthermore, deletion of one of the core Tat components, *tatC*, eliminated the ability of bacterial cells to infiltrate and colonize rat lungs in a model system for *P. aeruginosa* infection. These authors and Yen *et al.* both note that the genomes of other pathogenic bacteria encode TatC proteins. — GJC

Proc. Natl. Acad. Sci. U.S.A. **99**, 8312 (2002); *Arch. Microbiol.* **177**, 441 (2002).

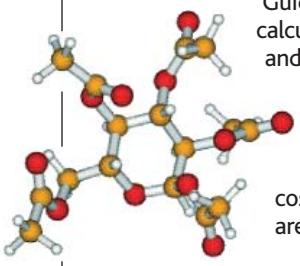
CHEMISTRY

Dissolving Sugar in CO_2

Many biomolecules are too polar to be readily solvated in supercritical carbon dioxide ($scCO_2$), and surfactant molecules must be added to take advantage of the physical and environmental benefits of using $scCO_2$ as a solvent. However, many of these surfactants are fluorocarbons, which are costly and can degrade into undesirable by-products.



BGLU



Calculated structures of AGLU and BGLU.

Guided by recent ab initio calculations, Raveendran and Wallen show that several polysaccharides, such as the α and β forms of 1,2,3,4,6-pentaacetyl-D-glucose (AGLU and BGLU), are CO_2-philic. At room temperature and CO_2 pressures of 35 to 40 atmospheres, BGLU was wetted by gas-phase CO_2, and, at somewhat higher pressures, the solid material turned into a liquid and swelled to many times its original volume, eventually dissolving completely in liquid or $scCO_2$. These results suggest that acetylated sugars and other derivatives may be suitable surfactants for the formation of microemulsions. — PDS

J. Am. Chem. Soc. 10.1021/ja025508b (2002).

APPLIED PHYSICS

A Little Bit of Memory

How far can memory devices shrink before thermal fluctuations corrupt data? Two groups have shown that a memory element can be fabricated in devices based on a single carbon nanotube (CNT). Fuhrer *et al.* built a p-type field effect transistor (FET) by growing a CNT onto a silicon substrate with a silicon dioxide insulating layer. At room temperature, the conductance of the CNT could be switched on and off by applying a gate signal of ±10 V, and, at much lower temperatures (20 K), switching the voltage over a smaller range (–1.3 to –3 V) was sufficient to change the conductance of the FET, revealed as a hysteresis in the current-voltage curves. Radosavljević *et al.* built an n-type ambipolar FET on the same SiO_2/Si substrate but with cobalt electrodes. They annealed the FET in the presence of hydrogen, which they suggest improves the coupling of the CNT to the oxide layer. When the gate voltage was switched between ±20 V, charge was injected from the CNT into the oxide layer, or vice versa, thus changing the conductance of the nanotube. This effect was harnessed to create a room temperature–stable nonvolatile memory, which is capable of storing a bit based on the flow of only a few electrons. — MSL

Nano Lett. 10.1021/nl025577o; 10.1021/nl025584c (2002).

HIGHLIGHTED IN *SCIENCE*'S SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT

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Learning Hesitation

Ishihara *et al.* have studied how neuronal circuits manage integration of multiple signals in *Caenorhabditis elegans*, whose simple nervous system contains 302 neurons. Wild-type animals are attracted to the odorant diacetyl and repulsed by Cu^{2+}. Normally, avoidance of Cu^{2+} can be suppressed by the presence of diacetyl, but, in *hen-1* mutants, diacetyl was less effective in luring the animals across a barrier of Cu^{2+}. In the absence of Cu^{2+}, *hen-1* mutants were equally sensitive to the attractant properties of diacetyl, but *hen-1* mutants were less sensitive than wild-type animals to Cu^{2+} as an inhibitor of chemotaxis toward diacetyl. Thus, the defect seems to lie in the association of the two signals. In a second behavioral assay using NaCl and starvation, *hen-1* mutants were again less sensitive to interacting signals. The HEN-1 protein appears to be a secreted protein and may function as a neuromodulator, like the peptide FMRFamide. — LBR

Cell **109**, 639 (2002).