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PLANT BIOLOGY

A Question of Color

Petal color is a key morphological trait of flowers that influences reproductive success. It is controlled by the pigments produced by the plant, and by the pH at which the pigments are stored. In plants, the anthocyanins—the main class of flower pigments—reside in the vacuoles, an intracellular acidic subcompartment. Because the color of a pigment is often pH-sensitive, variations in petal color have been used to identify mutations in pH regulation. In petunias, Verweij *et al*. now identify PH5 as a P-type proton pump localized to the vacuolar membrane. Similar P-type proton ATPases have previously been found to reside on the cell surface, not on intracellular membranes, which contain their own vacuolar-type proton ATPases. In *PH5* mutants, vacuolar acidification is reduced without changing the expression of the anthocyanin pigments or other coloration-related processes, leading to blue flower coloration (shown to the right of a wild-type flower), which is never observed in natural habitats. Expression of the *PH5* gene is linked to the same transcription regulation involved in anthocyanin production. This coordination of pigment production and pH regulation of the pigment-containing compartment is an important aspect in maintaining flower and also seed coloration, which also requires PH5 activity during pigment accumulation. — SMH

Nat. Cell Biol. **10**, 10.1038/ncb1805 (2008).

APPLIED PHYSICS

Get IT Down on Paper

A few years ago, when you wanted to remember something, the standard thing to do was to jot it down on a piece of paper. Now you might tend to note it in some kind of electronic storage device. At the heart of these storage devices is microelectronic circuitry, with billions of transistors carved out of silicon to do the processing and memory elements that store the information either magnetically or electrically. Martins *et al*. take the process full circle by fabricating electronic transistors and storage elements using paper as the substrate and the dielectric layer within the traditional transistor design. Using multilayer compact natural cellulose fibers, embedded in a mix of ionic resin and adhesive glue to provide mechanical stability, they fabricate transistors with respectable carrier mobilities on the order of 40 $cm^2/V{\cdot}s$. Moreover, when the transistors are switched off, they can retain their memory for more than 14,000 hours because of charge storage effects within the paper dielectric. This demonstration is encouraging for the further development of lightweight and cheap electronic technology. — ISO

Appl. Phys. Lett. **93**, 203501 (2008).

CHEMISTRY

Spinning Bases

The pH of any sample of water is easily measured nowadays and reflects in broad terms the concentration of protons that have physically separated from charge-balancing counterions. These "free" protons are in fact still linked to water molecules, though, and the structural basis of the link—whether H_3O^+, $(H_2O)_2H^+$, or some higher cluster—remains a subject of intense research and debate. Similarly, the OH^- ion left behind when a proton is snatched out of H_2O has its own complex interactions with the water molecules surrounding it. Thøgersen *et al*. have probed the nature of the OH^- solvation shell using ultrafast rotational anisotropy measurements. Specifically, they excited the anion using an ultraviolet pulse resonant with a charge-transfer–to–solvent transition (cleverly chosen to select the ion from among bulk water absorptions), and then tracked its rate in tumbling out of the laser plane across a range of temperatures. Above about 17°C, the OH^- rotates rather similarly to a water molecule, but below that temperature, the rate slows down significantly, suggesting that the ion's motion is restricted by a more tightly bound shell of solvent. — JSY

Chem. Phys. Lett. **466**, 1 (2008).

MICROBIOLOGY

Cation Catcher

The lungs of cystic fibrosis (CF) sufferers always become colonized with antibiotic-resistant bacteria and are traumatized by inflammatory responses as they become blocked with mucus, alginate, and DNA. The DNA may originate from bacteriophage- or host-mediated disruption of bacteria but may also come from the host as infiltrated immune cells lyse. Mulcahy *et al*. noted that DNA is highly anionic and went on to show that, whatever its source, it can act as a chelator of Mg^{2+} and Ca^{2+}. At high concentrations, presumably in areas adjacent to the epithelium of the lung, DNA soaks up cations to cause gross membrane disruption and thus has a strong antimicrobial effect. It's not all good news, though, as physicochemical gradients form deeper within the clots of mucus and the bacterial biofilm within the airways. At

Continued on page 1439

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Continued from page 1437

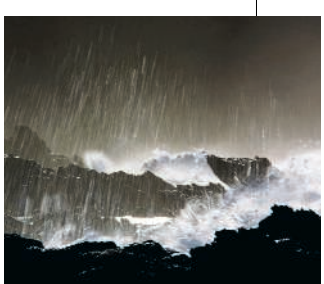
lower concentrations, the DNA soaks up just enough cations to trigger signalling cascades that culminate in the addition of aminoarabinose to the surface lipopolysaccharide molecules of the major pathogen in CF, *Pseudomonas aeruginosa*. This change renders the bacterium resistant to small defensive peptide molecules produced by the host as well as to aminoglycoside antibiotics. — CA

PLoS Pathogens **4**, e1000213 (2008).

GEOPHYSICS

Soft Vibrations

Microseisms—the continuous, low-amplitude background vibrations in the solid Earth observed between earthquakes—are generated by ocean waves. Most microseism studies have concentrated on the vibrations transmitted as surface (*S*) waves, and have concluded that they originate in shallow coastal regions, but relatively little is known about microseisms that propagate as body (*P*) waves. Gerstoft *et al*. show that body waves measured at an array of sites in southern California are generated by distant storms in several distinct regions of the Northern and Southern Hemispheres, where the ocean is deep, and that they propagate through Earth's mantle and core. In addition to identifying source regions, these *P* waves can provide information about deep Earth structure along paths not usually sampled by global tomographic studies, because the earthquakes used in those analyses occur mostly along plate boundaries rather than in the open ocean. — HJS



Geophys. Res. Lett., 10.1029/2008GL036111 (2008).

CELL BIOLOGY

Roping in Rabs

The Golgi apparatus receives vesicles and other membrane-bound carriers from earlier compartments of the secretory pathway and must guide them to the correct cisternae within the Golgi stack. At the same time, it must exclude other large structures such as ribosomes. Sinka *et al*. suggest that coiled-coil domains, termed golgins, which localize to particular Golgi subdomains through their C termini, might play a role in vesicle sorting. They found that the GRIP domain golgins in *Drosophila* bind members of the Rab family of G proteins through binding sites organized along the length of their coiled-coil domains. A single Rab showed binding to multiple GRIP domain proteins and a single golgin coiled-coil domain bound more than one Rab. They suggest that the golgins form an array that surrounds the Golgi with the coiled-coils projecting into the cytoplasm like tentacles. The tentacles might capture Rab-bearing membranes but exclude structures such as ribosomes that lack Rabs. Different binding specificities may both influence the localization of initial capture and allow iterative binding and release in order to move captured membranes to the appropriate Golgi subdomain. This scheme would be analogous to the proposal for the nuclear pore in which importins are moved through the pore by binding to a gel of phenylalanine-glycine repeats formed by nuclear porins. — VV

J. Cell. Biol. **183**, 607 (2008).

BIOMEDICINE

Clues from Outside

Tumors that appear clinically related can respond quite differently to treatment and radically alter the outcome for the patient. Gene expression profiling on tumors is thus useful for detecting differences that can help to improve diagnosis and prognosis and predict patient response to treatment. It has already been used successfully in the clinic, particularly for patients with breast cancer. Hepatocellular carcinoma is often caused by hepatitis infection and liver cirrhosis. It is a major cause of cancer death worldwide, but disease recurrence has so far proven difficult to predict. Expression profiling has been limited by a requirement for frozen tissues, as many specimens have been, and are still being, formalin-fixed. Hoshida *et al*. developed a method for accurately profiling the expression of 6000 genes from formalin-fixed and paraffin-embedded samples, some of which were 24 years old. They found no association between the gene expression profiles of hepatocellular carcinoma tumors and prognosis. Instead, they found an expression signature from the surrounding non-tumoral liver tissue that could predict the late recurrence of tumors. The authors suggest that this survival signature indicates the state of the liver and how likely it is to become malignant, which may be determined by a prior event such as viral exposure. Profiling the surrounding tissue, rather than the actual tumor as is customary, may prove to be a useful tool for the treatment of other cancers. — HP*

N. Engl. J. Med. **359**, 1995 (2008).

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Roping in Rabs

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