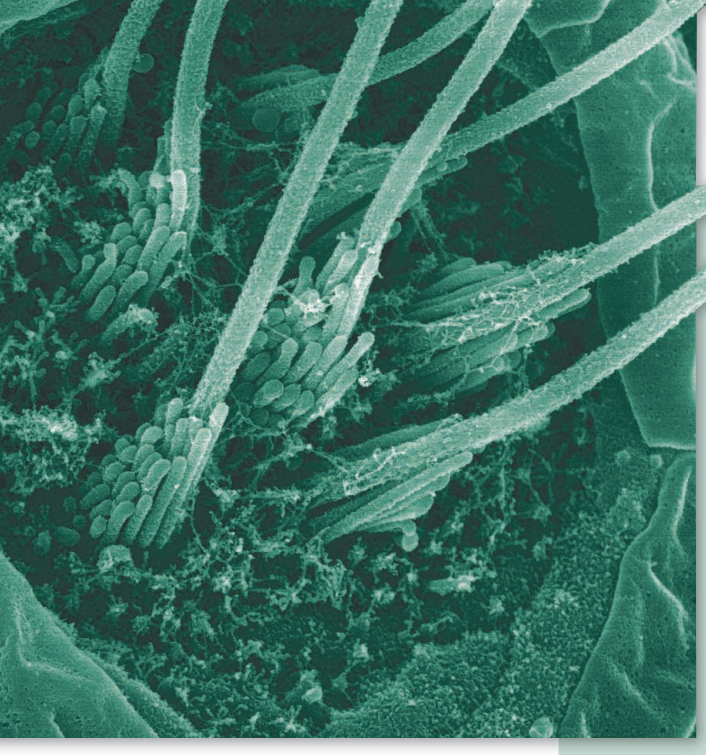
EDITED BY KRISTEN MUELLER AND MARIA CRUZ



GENETICS

At the Tip of Hearing

Individuals with the hereditary disorder Usher syndrome suffer from hearing loss. Associated genetic mutations impair function of the inner ear, where sensory cells fail to convert sound waves into electrical signals. Riazuddin *et al.* have determined that mutations in the gene *CIB2* contribute to Usher syndrome and nonsyndromic deafness. *CIB2* encodes calcium and integrin binding protein 2, which is widely expressed in human and mouse tissue. In the mouse inner ear, the protein localizes to the tips of stereocilia of inner ear cells. When deflected by sound waves, ion channels in these hairlike projections open, triggering a mechanoelectrical signaling cascade. CIB2 interacts with whirlin, a protein that organizes molecular complexes that maintain stereocilia structure and growth. Suppression of CIB2 expression in zebrafish disrupted responses to acoustic stimuli and caused abnormal balance during movement. Overexpression of CIB2 in cultured cells decreased the release of calcium from intracellular stores. CIB2 may help to maintain intracellular calcium homeostasis in inner ear cells by sequestering calcium and influencing the release of stored calcium during mechanoelectrical signal transduction. — LC

Nat. Genet. **44**, 10.1038/ng.2426 (2012).

SOLAR PHYSICS

When the Sun Erupts

Coronal mass ejections (CMEs) are large-scale clouds of plasma that erupt from the solar atmosphere and travel into interplanetary space. They represent the most energetic events in the solar system and can be harmful to satellites in space, Earth-based power grids, and even to humans if they are in space or on airplanes, particularly on polar routes. CMEs are common, occurring four to five times a day during periods of maximum solar activity, but they weren't detected until the early 1970s when satellites were launched to study the Sun. After four decades of research, however, there is still no complete understanding of the physical mechanisms behind CMEs. Roussev *et al.* describe state-of-the art computer simulations that couple a detailed magnetic flux emergence simulation extending from the interior of the Sun to its atmosphere with a global model of the solar atmosphere and the solar wind. The results reproduce x-ray observations of CMEs and show how the injection of magnetic flux leads to a catastrophic evolution of the solar atmosphere. To better understand collisions of CMEs as they travel in interplanetary space, Shen *et al.* analyzed observations of two CMEs that erupted from the Sun on 2 November 2008. The two structures collided as though they were solidlike objects and likely experienced a superelastic collision (i.e., a collision in which the linear kinetic energy of the colliding system increases). — MJC

Nat. Phys. 10.1038/nphys2427; 10.1038/nphys2440 (2012).

ARCHAEOLOGY

Wild Textile

It's been generally thought that the human use of textiles greatly accelerated with the advent of agriculture. Earlier woven textiles using wild materials are known, and indirect evidence for woven fabrics dates back to glacial times. However, early cultivation of plants such as flax and hemp, and also the domestication of sheep, are thought to have provided more reliable raw materials. Bergfjord *et al.* now show that wild nettle was used widely and valued as a textile source as recently as 2800 years ago in Denmark. The Bronze Age textile was found wrapped around a body in a burial site; the orientation of the fibers and the presence of calcium oxalate crystals verify that it was made from woven nettle. Using strontium isotopes, the authors further show that the nettle was likely imported to Denmark, probably from Central Europe—an area that had active flax agriculture at the time. Thus, wild plants were still valued for textiles long after extensive cultivation of flax and hemp. — BH

Sci. Rep. **2**, 664 (2012).

APPLIED PHYSICS

Extended Darkness

Titanium sapphire laser sources rely on a phenomenon termed Kerr lensing to generate ultrashort light pulses. Essentially, the refractive index of the crystal in the laser cavity rises with the intensity of the light passing through it, which induces focusing toward the center where selective amplification sets the mode structure. Kasala and Saravanamuttu have created an environment in which a propagating light beam is instead pushed away from the center. Specifically, they diminish the intensity of a ~0.1-mm central spot in a ~5-mm beam—derived from an incoherent source of incandescent white light—and then direct the beam through a medium containing a photoinitiator and a

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CREDITS (TOP TO BOTTOM): S. RIAZUDDIN *ET AL.*, *NAT. GENET.* **44** 10.1038/NG.2426 (2012); C. BERGFJORD *ET AL.*, *SCI. REP.* **2**, 664 (2012); PHOTO BY ROBERTO FORTUNA/THE NATIONAL MUSEUM OF DENMARK

Published by AAAS

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polymer precursor. Because the polymerization rate is intensity dependent, and the refractive index of the polymer being formed is high, light migrates away from the center, but not too far away—the confining effect of the polymer keeps the dark core region narrow. As a result, a channel forms, impenetrable by light that can be observed relative to the bright background by optical microscopy. Experiments with smaller ratios of the background beam to the central depression bolstered the authors' posited mechanism. — JSY

J. Am. Chem. Soc. **134**, 14195 (2012).

PLANT SCIENCE

Salty Roots, Stunted Roots

Too much salt is as bad for plants as it is for us. For plants, salt stress and drought stress go hand in hand. Some of the more rapid responses to salt stress are signaled through actions of the sucrose nonfermenting-related kinase 2 (*snrk2*) gene family. Members of this

gene family fall into three groups, depending on their response to the hormone ABA. Studying *Arabidopsis*, McLoughlin *et al*. analyzed the specific contributions of two members of this gene family to salt stress. *snrk2.4* and *snrk2.10*, which encode proteins that are not particularly responsive to ABA signaling, responded within minutes to salt stress but delivered different functions. SnRK2.10 seemed to primarily sustain the emergence of lateral roots in excessively salty conditions, whereas SnRK2.4 had a more singular effect supporting primary root growth. After the initial, transient response, SnRK2.4 relocalized into punctate subcellular structures, which suggests that mechanical stress triggered through changes in osmotic pressure also signal subcellular relocalization of these rapid-response kinases. — PJH

Plant J. 10.1111/j.1365-313X.2012.05089.x (2012).

CELL BIOLOGY

Getting Pulled into a Membrane

When proteins are translocated across the endoplasmic reticulum or bacterial membrane, they pass through a proteinaceous tunnel, the translocon. However, transmembrane proteins need to slip sideways out of the translocon to become embedded in the lipid bilayer. The recognition of transmembrane protein helices by the translocon is a poorly understood process, and competing models have been proposed. One model is a thermodynamic partitioning model for membrane insertion, in which hydrophobic segments in a nascent polypeptide partition between the translocon channel and the surrounding lipid during their passage through the translocon. By using the bacterial SecM or the mammalian Xbp1 translation arrest peptides as in vivo force sensors, Ismail *et al.* found that a transmembrane helix is subjected to a strong biphasic "pulling force" at the precise moment that it enters the translocon. The pulling force was seen only for peptide segments with hydrophobicity above the threshold for membrane insertion and increased in proportion to the hydrophobicity of the segment. The biphasic force may reflect when the transmembrane segment interacts with and then partitions from the translocon into the membrane. — SMH

Nat. Struct. Mol. Biol. 10.1038/nsmb.2376 (2012).

CELL SIGNALING

Testing the Signal

In many experiments, cell signaling events are measured in cells given a strong and constant stimulus. Though this has been useful in delineating signaling pathways, cells may often receive signals that are more subtle and dynamic. Tomida *et al*. explored how a common signaling enzyme, the protein kinase known as MAPK-1 (mitogen-activated protein kinase–1), responds to variable input in a sensory neuron of the worm *Caenorhabditis elegans*. They kept living worms in a microfluidic chamber in which they could accurately control exposure of the animals to changes in salt concentration of varied magnitude and duration. They then monitored activity of the enzyme over time within a single neuron by monitoring a synthetic substrate expressed in the cell that gave a fluorescent signal when phosphorylated. Constant stimulation of the neuron did not activate MAPK-1 much. The strongest response came from pulses of stimulation at a moderate frequency—about 20 s of stimulus followed by a rest of the same duration. The authors propose that this pattern of response might make sense in a signaling system that should be inactive in a constant environment, but activated in response to changes, while at the same time filtering out noise. — LBR

Sci. Signal. **5**, ra76 (2012).

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