impact when compared with other predators. — SNV

Science, this issue p. 858; see also p. 784

SIGNAL TRANSDUCTION

Membrane potential regulates growth

Changes in electrical potential across the plasma membrane can affect cell growth. Zhou *et al*. discovered that membrane potential influenced the organization of phospholipids in the membrane of cultured mammalian cells and neurons in intact flies (see the Perspective by Accardi). This in turn regulated localization and activity of the small guanine nucleotide binding protein K-Ras, an important regulator of cell proliferation. The cell membrane may thus function analogously to a field-effect transistor by adjusting the strength of mitogenic signaling. — LBR

Science, this issue p. 873; see also p. 789

BIOCHEMICAL PROCESSES

Protonation by "Newton's cradle"

Imagine raising the ball on one end of a Newton's cradle. Upon release and the subsequent collision, the ball at the other end of the device flips up in response. Using high-resolution neutron diffraction, Nakamura *et al*. discovered an enzymatic proton relay chain that may operate in much the same fashion. In a glycoside hydrolase from the mushroom *Phanerocaete chrysosporium*, protons are relayed along a structure created by the enzyme from a distant asparagine to the catalytic asparagine through sequential tautomerizations. — PLY

Sci. Adv. 10.1126/sciadv.1500263 (2015)

PLANT MICRIOBIOME

Immune signals shape root communities

To thwart microbial pathogens aboveground, the plant *Arabidopsis* turns on defensive signaling using salicylic acid. In *Arabidopsis* plants with modified immune systems, Lebeis *et al*. show that bacterial communities change in response to salicylic acid signaling in the root zone as well (see the Perspective by Haney and Ausubel). Abundance of some root-colonizing bacterial families increased at the expense of others, partly as a function of whether salicylic acid was used as an immune signal or as a carbon source for microbial growth. — PJH

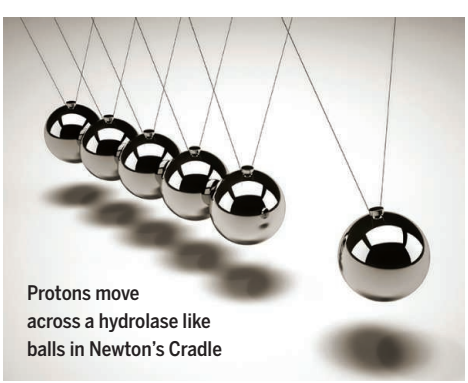
Science, this issue p. 860; see also p. 788

ASTHMA

A tale of two asthmas

Classifying diseases according to symptoms is rapidly becoming an outmoded practice. Targeted therapeutics have shown that sets of symptoms can be caused by different pathogenic mechanisms. Choy *et al*. demonstrate that asthma can be divided into three immunological clusters—T_H2-high, T_H17-high, and T_H2-T_H17-low. The T_H2-high and T_H17-high clusters inversely correlate in a mouse model of asthma, whereby neutralizing one signature promoted the other. Combination therapies targeting both pathways might better treat asthmatic individuals. — ACC

Sci. Transl. Med. **7**, 301ra129 (2015)



Protons move across a hydrolase like balls in Newton's Cradle

PHOTOS: (LEFT TO RIGHT) ORLA/ISTOCK; W.-K. LEE *ET AL*.

IN OTHER JOURNALS

Edited by **Kristen Mueller** *and* **Jesse Smith**

Hierarchical wrinkles made by three generations of sequential wrinkling

MATERIALS SCIENCE

When wrinkling is a good thing

A common feature of gecko feet, which show strong adhesion to many surfaces, and the lotus leaf, which can repel water, is a hierarchical, patterned surface that extends across many length scales with controlled regions of order and disorder. Textured surfaces can be synthetically mimicked, but can require complex lithographic methods to make. Lee *et al.* use a hierarchical wrinkling approach to achieve large-scale patterning, where both the wavelength and orientation of previous-generation wrinkles can be preserved and built upon. Reactive ion etching creates a skin layer on a polystyrene substrate, leading to wrinkling. By adjusting the etching time, they control the wavelength of the wrinkles, with the orientation tuned by prestretching the substrate in one or two directions. — MSL

Nano Lett. 10.1021/acs.nanolett.5b02394 (2015).

MEMBRANE PROTEINS

Probing the activity of two proteases

Presinilin (PS), the transmembrane catalytic subunit of the enzyme γ-secretase, is a drug target of high interest. This is because it cleaves both amyloid precursor protein, which is implicated in Alzheimer's disease, and Notch, a protein involved in several cancers. How potential therapeutics may affect related proteins, such as signal peptide peptidase (SPP), an enzyme that has an active site similar to that of PS, is unclear. To

investigate this, Gertsik *et al*. designed photolabeled molecular probes that targeted different parts of the catalytic subpockets of the enzymes. Comparing the labeling profiles of the probes revealed important similarities and differences between the two enzymes. Scientists should take into account such cross-talk as drug development proceeds. — VV

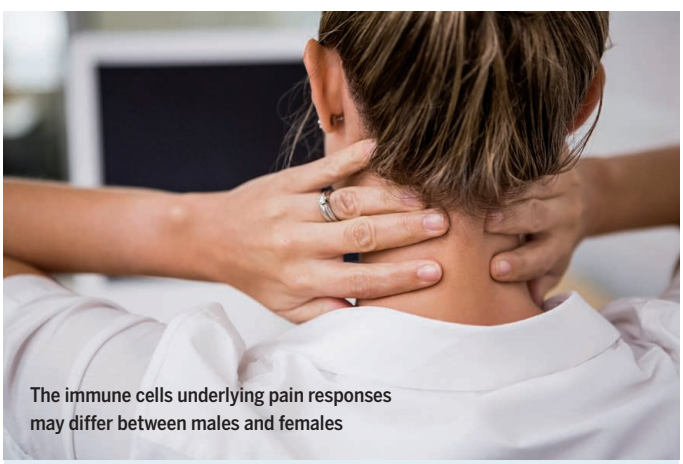
ACS Chem. Biol. 10.1021/acschembio.5b00321 (2015).

MICROBIAL COMMUNITIES

Abundant microbes hiding in plain sight

Natural microbial communities are frustratingly complex—even with the advent of powerful metagenomic tools. Overlooked abundant organisms often result in an incomplete view of the metabolic processes that affect major geochemical cycles. Hug *et al*. developed a subsampling metagenomic assembly technique which, when combined with metaproteomics, reveals a preponderance of highly abundant, novel microbial lineages in subsurface sediments at an old uranium mill tailings site. These organisms cycle carbon, nitrogen, and sulfur through unanticipated pathways. For example, despite low ammonium concentrations in the aquifer, the most abundant community member in the sediment is an ammonium-oxidizing archaeon that partially utilizes ammonium produced by nitrate-reducing bacteria. — NW

Environ. Microbiol. **17**, 10.1111/1462-2920.12930 (2015).



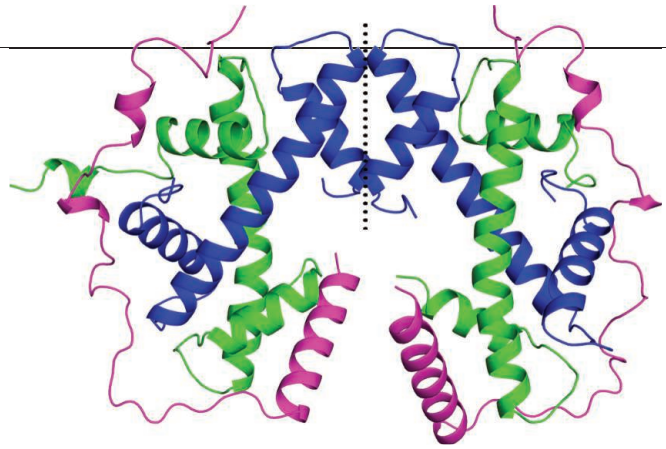
The immune cells underlying pain responses may differ between males and females

NEUROIMMUNOLOGY

For females, a different path to pain

Chronic pain affects more women than men. To better understand why, Sorge *et al*. compared the mechanisms that underlie neuropathic pain in male and female mice. Previous studies suggested that immune cells called microglia trigger pain sensitivity in response to nerve injury. Surprisingly, blocking microglia genetically or pharmacologically reduced pain in male but not in female mice. This sex-specific response depended on testosterone—blocking microglia alleviated pain in testosterone-treated females but not in castrated mice. Lymphocytes, rather than microglia, appeared to promote pain in female mice. These results suggest that scientists may need to examine sex-specific responses when testing new treatments for pain and other neurological diseases involving immune cells. — KLM

Nat. Neurosci. **18**, 1081 (2015).



Structure of the MCM2 histone binding domain–histones H3–H4 tetramer complex

GENETICS

Copying chromatin to ensure identity

When cells divide, they must replicate both their DNA sequence and the chromatin state of their genome to maintain their identity. Huang *et al*. use structural and biochemical analyses to show how a central component of the human DNA replication machinery, the minichromsome maintenance (MCM) helicase, helps chaperone histones (proteins that package DNA into structures called nucleosomes) from old nucleosomes disassembled ahead of the replication fork to new ones formed behind the fork. The MCM2 subunit works with another histone chaperone, ASF1, to bind both old and new histones, together with variant histones, such as those from the centromeres. In this way, the cell likely ensures the accurate copying of chromatin as well as DNA. — GR

Nat. Struct. Mol. Biol. 10.1038/nsmb.3055 (2015).

GENETICS

How starving affects you and yours

Malnourished children are at higher risk for type 2 diabetes, cancer, and cardiovascular disease later in life. Some scientists hypothesize that this is because early-life experiences prime the body for such encounters later in life. Jobson *et al*. used the roundworm *Caenorhabditis elegans* to study this phenomenon. They observed that worms starved early in life were smaller and produced fewer offspring compared to normally fed worms. But the effects did not stop there: Progeny and grandprogeny of starved parents could better resist starvation, and resistance to heat stress persisted for three generations. These results suggest that at least in worms, early stress may be adaptive in an unpredictable environment. — LMZ

Genetics 10.1534/genetics.115.178699 (2015).

EDUCATION

What does one know and not know?

To demonstrate understanding, students need to answer questions correctly, as well as understand why those answers are correct. Lindsey and Nagel examine this metacognition, specifically students' ability to differentiate between questions for which they know the answer and questions that they cannot correctly answer. A knowledge survey mimicking a final exam was used to collect student data. Analysis at the level of students' overall scores showed that students in the lower third of the class misjudged their abilities, whereas students in the top third were better calibrated. However, at the level of individual questions, there was no difference between student level and the ability to identify questions they could answer correctly, suggesting that students at all levels could benefit from metacognitive awareness training. — MM

Phys. Rev. 10.1103/physrevstper.11.020103 (2015).

IMAGES: (TOP TO BOTTOM) WAVEBREAKMEDIA/ISTOCK; H. HUANG *ET AL. NAT. STRUCT. MOL. BIOL.* (13 JULY 2015) © NATURE PUBLISHING GROUP

For females, a different path to pain

Kristen L. Mueller

Science **349** (6250), 839-840.
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