CIRCADIAN RHYTHMS
Molecular clockwork from cyanobacteria
The cyanobacterial circadian clock oscillator can be reconstituted in a test tube from just three proteins—KaiA, KaiB, and KaiC—and adenosine triphosphate (ATP). Tseng et al. studied crystal and nuclear magnetic resonance structures of complexes of the oscillator proteins and their signaling output proteins and tested the in vivo effects of structure-based mutants. Large conformational changes in KaiB and ATP hydrolysis by KaiC are coordinated with binding to output protein, which couples signaling and the day-night transitions of the clock. Snijder et al. provide complementary analysis of the oscillator proteins by mass spectrometry and cryo–electron microscopy. Their results help to explain the structural basis for the dynamic assembly of the oscillator complexes. —LBR
Science, this issue p.1174, p.1181

NANOMATERIALS
Lifting off gold films
A method for growing and removing single-crystal gold films can be used to create a flexible and transparent substrate for devices. Mahenderkar et al. grew gold films on the face of a silicon wafer and then used photoelectrochemistry to undergrow a sacrificial silicon dioxide layer. This layer allowed the gold film to be peeled off with adhesive tape. A 28-nm-thick gold foil showed a minimal increase in sheet electrical resistance after 4000 bending cycles. Flexible films of single-crystal cuprous oxide and of zinc oxide nanowires were then grown on the gold foils. —PDS
Science, this issue p.1203

GEOCHEMISTRY
Archean cratons get a Hadean mash-up
The vast majority of the rock record over Earth’s 4.6-billion-year history has been destroyed through subduction and recycling back into the mantle. Although some slivers of 4-billion-year-old crust remain in the rock record, only isolated zircon mineral grains are dated to be older. However, O’Neil and Carlson found isotopic evidence of reworked basaltic crust more than 4.3 billion years old mixed into some of the 2.7-billion-year-old rocks of the Superior Province in Canada. Thus, our planet’s oldest crust was reworked and retained during formation of at least one continental craton. —BG
Science, this issue p.1199

NANOPHOTONICS
Putting plasmons in a spin
The ability of light to carry angular momentum provides an additional degree of freedom for applications such as optical tweezing and optical communication. Spektor et al. show that the optical angular momentum modes of light can be shrunk down to the nanometer scale through plasmonic transfer. They patterned spiral-like structures into an atomically smooth layer of gold, which allowed them to launch plasmons with controlled amounts of angular momentum. —ISO
Science, this issue p.1187

PLANT SCIENCE
Making more of your stomata
Stomata on grasses are made up of two guard cells and two subsidiary cells. and they perform better than stomata on broad-leaved plants, which are made up only of two guard cells. Raissig et al. found that the MUTE transcription factor in the wheat-like grass Brachypodium is a little bigger than the equivalent protein in the model broad-leaved plant Arabidopsis. The extension in the grass protein promotes its movement into adjacent cells, prompting them to become subsidiary cells. Mutant Brachypodium whose MUTE protein could not move between cells lacked stomatal subsidiary cells and grew poorly. —PJH
Science, this issue p.1215

IN SCIENCE JOURNALS
Edited by Stella Hurtley

Hyperactive MUTE (yellow) induces multiple rows of subsidiary cells around paired stomatal guard cells.

Conductivity links at the atomic scale in gold and platinum
Cui et al., p. 1192
**Antibiotics**

Countering TB drug resistance

The arsenal of antibiotics for treating tuberculosis (TB) contains many prodrugs, such as ethionamide, which need activation by normal metabolism to release their toxic effects. Ethionamide is potentiated by small molecules. Blondiaux et al. screened for more potent analogs and identified a lead compound called SMART-420. This small molecule inactivates a TetR-like repressor, EthR2, and boosts ethionamide activation. SMART-420 successfully promoted clearance of multidrug-resistant strains of *Mycobacterium tuberculosis* from the lungs of mice. —CA


**Infection**

The parasite of my parasite is my friend?

Virulence factors of pathogenic bacteria can be swapped by means of bacterial viruses called phages. In turn, the pathogenic bacteria are under attack by the hosts’ immune responses. Diard et al. discovered that SopE6, a phage parasite of pathogenic *Salmonella* species, is encouraged to spread between bacteria by the mouse host’s inflammatory responses. Conversely, mucosal vaccination against *Salmonella* reduced inflammatory responses and curbed the transfer of SopE6 to naïve bacteria. —CA

Science, this issue p. 1211

**Diagnostic**

Finding the right blood type

Blood type matching is important for pregnancy, blood transfusion, and bone marrow transplantation. Zhang et al. developed a blood typing assay based on color changes assisted by a common pH indicator dye. Red blood cells (RBCs) and plasma were separated from small blood samples by using antibodies immobilized on paper test strips. The assays allowed forward grouping (detecting A and/or B antigens on RBCs) and reverse grouping (monitoring agglutination between RBCs and anti-A and/or anti-B antibodies in plasma) within 2 min. The test could also perform Rh and rare blood typing. This economical and robust assay will be useful in time- and resource-limited environments. —CC

Science, this issue p. 1206

**Wearable Technology**

Sensing touch without touching

Electronic devices that can be integrated into clothing or worn on skin will provide wearable approaches for monitoring human health or motion. Success depends on the development of bendable, stretchable sensors that respond to touch. Sarwar et al. developed sensors based on conductive hydrogel polymer electrodes embedded in a flexible polymer framework. The sensors responded to touch, even when bent or stretched, and were also able to sense an approaching finger. The low-cost, easily manufactured sensors could accelerate the adoption of wearable technology. —LA


**Geophysics**

Sand-driven magnetic field

Earth’s magnetic field is due to convection of its liquid iron-nickel core, which also contains an unknown amount of lighter elements such as silicon, oxygen, and sulfur. Hirose et al. performed experiments that show that silica unexpectedly crystallizes out of a liquid iron alloy at high pressures and temperatures. This discovery identifies a source of compositional buoyancy that would have driven the convection needed for a magnetic field very far back in Earth’s history. It also sets a limit on how much silicon and oxygen remain in the outer core today.

—BG


**Malaria**

Softening up your target

During infection, malaria parasites must invade erythrocytes. Erythrocytes are flexible cells that can easily deform to make it through the tight spaces of the vasculature, but they are nevertheless fortified by a
NEURODEVELOPMENT
The lights go on in order

Grid cells and place cells in the brain function as part of a circuit that helps us figure out where we are in our physical world. Donato et al. examined how that circuit develops in the brains of mice. Expression patterns of doublecortin and parvalbumin revealed that neurons in the circuit mature in the order in which information flows. Maturation of each piece of the circuit depends on excitatory neuronal activity from the preceding portion. Stellate cells, in contrast, follow an endogenous maturation program. The stellate cells are responsible for initiating the circuit’s developmental progression. —PJH

Science, this issue p. 1172

PHYSIOLOGY
Uridine’s rise and fall:
Food for thought

The nucleoside uridine is well known for its role in critical cellular functions such as nucleic acid synthesis. Its role in whole-animal physiology has received comparatively little attention. In mammals, plasma uridine levels are tightly regulated, but the underlying mechanisms are unclear. Studying mouse models, Deng et al. show that plasma uridine levels are controlled by feeding behavior (see the Perspective by Jastrow and Tschöp). Fasting causes an adipocyte-mediated rise in plasma uridine, which triggers a lowering of body temperature. Feeding causes a bile-mediated drop in plasma uridine, which enhances insulin sensitivity in a leptin-dependent manner. Thus, uridine is part of a complex regulatory loop that affects energy balance and potentially contributes to metabolic disease. —PAK

Science, this issue p. 1173; see also p. 1124

METALLURGY
Heavy hydrogen gets frozen in place

Hydrogen embrittlement contributes to the failure of steel in a wide variety of everyday applications. Various strategies to mitigate hydrogen embrittlement, such as adding carbides into the steel, are hard to validate because we are unable to map the hydrogen atoms. Chen et al. combined fluxing steel samples with deuterium and a cryogenic transfer protocol to minimize hydrogen diffusion, allowing for detailed structural analysis (see the Perspective by Cairney). Their findings revealed hydrogen trapped in the cores of the carbide precipitates. The technique will be applicable to a wide range of problems, including corrosion, catalysis, and hydrogen storage. —BG

Science, this issue p. 1196; see also p. 1128

NANOSCALE TRANSPORT
Calorimetry reaches an atomic junction

Electrical and thermal conductivity in metals are linked at the macroscopic length scale because electrons carry both heat and current. Cui et al. found that this relationship, the Wiedemann-Franz law, holds down to the atomic scale in gold and platinum (see the Perspective by Segal). They made thermal and electrical conductance measurements through a point contact only one atom thick. In gold, the thermal and electrical conductance was quantized, owing to the electronic band structure of the metal. The experiments pave the way for high-resolution calorimetry and other thermal measurements at the nanoscale. —BG

Science, this issue p. 1192; see also p. 1125

AGING
Protein aggregation–mediated aging in yeast

Old age in yeast cells results in insensitivity to mating pheromone. Reduced activity of the histone deacetylase Sir2 and consequent alteration of chromatin at mating loci have been implicated in the decreased sensitivity of old cells. However, Schlissel et al. found a different mechanism in the yeast strains that they studied (see the Perspective by Gitler and Jarosz). Proper response to mating pheromone requires arrest of the cell cycle mediated by an RNA-binding protein, Whi3. If aggregation of Whi3 in old cells was inhibited by deletion of a glutamine-rich region that promotes aggregation, loss of sensitivity to mating pheromone was partially prevented, and replicative life span was slightly increased. —LBR

Science, this issue p. 1184; see also p. 1126

CROP DEVELOPMENT
Promise and challenges of gene editing

With traditional plant breeding approaches, it can take a decade or more to develop a new crop. In a Perspective, Scheben and Edwards highlight recent efforts to use the gene editing technology CRISPR-Cas9 for faster plant breeding. This technology can yield an improved experimental crop in just one generation, but the genetic sequence and function of the target gene must be known. Public acceptance and appropriate regulation by governments will be necessary for the technology to be adopted widely. —JFU

Science, this issue p. 1122

LANGUAGE DEVELOPMENT
Nonhuman primates model language evolution

Nonhuman primates were long seen as lacking many of the key elements that enable language in humans. In a Perspective, Snowdon discusses recent research that challenge this assumption: Marmosets and chimpanzees are able to take turns, macaques and baboons have a vocal tract that is capable of human-like speech, and several primate species can learn to modify sounds in response to environmental or social variables. Apes also communicate through complex gestures. As long as the many components that make up speech and language are considered, much can be learned about language evolution from studying nonhuman primates. —JFU

Science, this issue p. 1120

CANCER
Melanoma cells talk to keratinocytes

Although identifying cancer-driving mutations is important, therapeutics usually target proteins, and tumor progression is affected by nearby cells. Ostalecki et al. performed protein profiling in skin samples from human melanoma patients. They observed changes in the levels and subcellular localization of proteins in melanocytes and keratinocytes that were associated with various stages of melanoma development. Early-stage melanoma cells transferred a pair of proteins to adjacent normal keratinocytes, leading to altered protein levels and secretion. Inhibiting this intercellular communication might be therapeutically beneficial for melanoma patients. —LKF


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NK cells in severe asthma: Failed resolution

Anti-inflammatory corticosteroids are a first line of defense against many types of asthma, but individuals with severe asthma frequently do not respond to this therapy. Duvall et al. report that this lack of response may be due in part to defects in natural killer (NK) cells, which are important mediators of inflammation resolution. NK cells from patients with severe asthma had impaired killing abilities, and corticosteroids inhibited the function of these cells further. The proresolving mediator LXA₄ preserved NK cell effector mechanisms. Thus, corticosteroids may be counterproductive for severe asthma, and specifically activating NK cells may provide an alternate therapeutic target. —ACC