**RESEARCH**

**HIGH-TRANSITION-TEMPERATURE THIN FILMS OF SnTe**

*Chang et al., p. 274*

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**IN SCIENCE JOURNALS**

*Edited by Stella Hurtley*

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**OPTICS**

**Making the forbidden allowed**

Spontaneous emission, in which an excited electron lowers its energy by emitting a photon, is a fundamental process in light-matter interactions. In principle, the electron can relax from the excited state to any unoccupied lower energy level. In practice, however, most of these transitions are too slow and so are effectively forbidden. Rivera et al. show theoretically that the plasmonic excitations associated with two-dimensional materials can be used to enhance and control the light-matter interaction. Transitions that were once considered forbidden can thus be accessed, opening up the entire spectrum of an optical emitter.

—ISO

*Science, this issue p. 263*

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**EVOLUTIONARY COGNITION**

**The innate wisdom of ducklings**

Imprinting on an image is one of the first things that a naive brain learns to do. Such rapid identification of relevant signals allows young animals to recognize their mother and caregiver. Martinho and Kacelnik show that mallard ducks are also capable of higher-level learning of relational concepts and can integrate these into their imprinted image (see the Perspective by Wasserman). Ducklings were imprinted on a set of objects that were either the same or different. The ducklings later preferred to follow other objects that showed the same relationship as that on which they had imprinted. Thus, even this most basic form of learning appears to be shaped by higher-level cognitive reasoning.

—SNV

*Science, this issue p. 286; see also p. 222*

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**BIOCHEMISTRY**

**Adaptors conduct the EGFR symphony**

In signaling networks, there are rate-limiting proteins that direct the signal through specific molecular cascades to dictate the response. Shi et al. sought to identify the proteins in the epidermal growth factor receptor (EGFR) signaling network that serve as the conductors of the EGF signal. The levels of several adaptor proteins were highly variable among cells, and the levels of the adaptor proteins—not the receptor or core pathway proteins—were rate-limiting for the EGFR pathway in normal and malignant cells. Thus, the adaptor proteins are the directors of the signaling script.

—LKF

*Sci. Signal. 9, rs6 (2016)*

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**NEURODEVELOPMENT**

**Sending neural stem cells back to the garage**

In the brain’s hippocampus, which modulates memories and emotions, neural stem cells generate new neurons, even during adulthood. How many new neurons are generated, and when, follows from the balance between quiescence and proliferation in the pool of neural stem cells. Urbán et al. asked what signals send proliferating stem cells back into a quiescent state. They found that a key transcription factor that promotes cellular proliferation was degraded through the ubiquitinylation system. This molecular

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**VOLCANOLOGY**

**Driven to collapse**

Volcanic eruptions occur frequently, but only rarely are they large enough to cause the top of the mountain to collapse and form a caldera. Gudmundsson et al. used a variety of geophysical tools to monitor the caldera formation that accompanied the 2014 Bárðarbunga volcanic eruption in Iceland. The volcanic edifice became unstable as magma from beneath Bárðarbunga spilled out into the nearby Holuhraun lava field. The timing of the gradual collapse revealed that it is the eruption that drives caldera formation and not the other way around.

—BG

*Science, this issue p. 262*
interaction regulated the return to a resting state, but one that was not quite as quiescent as the original state. Stem cells in this resting but primed state sustained the stem cell pool. —PJH

SCIENCE

GLACIERS

The heat is on

Rising surface air temperatures are understood to cause glacial melting, but it is becoming increasingly clear that the ocean also has a strong impact. Cook et al. studied glaciers that drain the Antarctic Peninsula and found a strong correlation between mid-depth ocean temperatures and glacier-front changes along the peninsula’s western coastline. Glaciers in the south, which are exposed to warmer waters, have undergone significant retreat, while those in the northwest, which terminate in cooler waters, have not retreated as much or as uniformly. Thus, ocean-induced melting appears to be the main cause of glacial retreat in the region. —HJS

Science, this issue p. 283

STRUCTURAL BIOLOGY

Transmitting signals across the synapse

Glutamate receptors located on neuronal cells play a role in mediating electrical signals at excitatory synapses. These glutamatergic synapses are extremely important for nearly all cognitive functions. Eleegheet et al. analyzed a complex that bridges the synapse, comprising β-neurexin 1, a cell adhesion molecule on the surface of presynaptic axons; cerebellin 1, a synaptic organizer; and the postsynaptic glutamate receptor GluD2. The structural and functional analysis provides insight into the mechanism of synaptic signaling. —VV

Science, this issue p. 295

LITHIUM ION BATTERIES

Carbon nanotubes boost battery storage

Molybdenum disulfide is a promising anode material for lithium ion batteries. However, it is plagued with low intrinsic electrical conductivity and large strain during cycling, which cause low rate capability and fast capacity decay. Lou et al. designed ultrathin nanosheets of molybdenum disulfide tubular structures wired with carbon nanotubes. These modified electrode structures exhibited lithium battery storage performance with very high specific capacity, exceptional rate capability, and ultralong cycle life. —ZH


ORGANIC CHEMISTRY

A light approach to C-N bond formation

The need to form C-N bonds arises frequently in drug discovery research. One versatile approach involves the attachment of the C and N fragments to a Pd catalyst. This approach needs a bulky ligand to “crowd” the fragments together off the metal center. Corcoran et al. present a complementary approach that uses Ni in place of Pd. Instead of the bulky ligand, they used a light-activated cocatalyst that strips an electron from the Ni to accelerate the bond formation. A screen involving elaborately substituted reagents confirmed the utility of this approach in cases that challenge the traditional Pd coupling. —JSY

Science, this issue p. 279

HEALTH ECONOMICS

Why pay more for medicine in some places?

The cost of health care varies widely with geography in the United States, but the role of place-specific supply versus demand has been unclear. Finkelstein et al. studied the migration of elderly Medicare recipients to show that supply features, such as physician preference for aggressive care and the proportion of for-profit hospitals in a region, accounted for 50 to 60% of the variation. Roughly a quarter of the variability was probably due to observable differences in patients’ health, with the rest due to patients’ preferences and unmeasured health issues. The findings suggest that policies aimed at changing doctors’ behaviors by altering incentives could be more promising than those aimed at changing patients’ preferences. —BW


NASA

Smashing bits to show asteroid strength

How strong is an asteroid? Earth rocks are poor analogs because of differences in composition, gravity during formation, and geologic processing. Cotto-Figueroa et al. tested samples from two large meteorites (pieces of asteroid that have fallen to Earth) by crushing them in a vice to measure the bulk material properties. By comparing cubes of different sizes, they extrapolated the strength of meter-sized asteroids, finding values that are consistent with the observed break-up of meteors as they enter Earth’s atmosphere. The results will be useful for planning sample return or asteroid mining missions or for deflecting potentially hazardous asteroids away from Earth. —KTS

Icarus 277, 73 (2016).

TUMOR IMMUNOLOGY

A less personal cancer therapy?

Many new cancer therapies are built around the concept
**MITOCHONDRIA**

**How the ER manages mitochondrial division**

It has been unclear how mitochondrial DNA (mtDNA) replication is spatially controlled in mammalian cells and how the mitochondrial nucleoids—the protein-DNA structure that is the unit of mtDNA inheritance—is distributed at the cellular level. Lewis et al. now show that homeostatic mtDNA synthesis in mitochondrial nucleoids in mammalian cells is spatially linked to a small subset of endoplasmic reticulum (ER)—mitochondria contact sites that are specifically destined for mitochondrial division. Successive events of mtDNA replication, mitochondrial division, and mitochondrial motility function together to ensure the accurate distribution of mtDNA in cells. Furthermore, ER-mitochondria contacts coordinate the licensing of mtDNA replication with division to distribute newly replicated nucleoids to daughter mitochondria. —SMH

*Science, this issue p. 261*

**Biodiversity**

**Crossing “safe” limits for biodiversity loss**

The planetary boundaries framework attempts to set limits for biodiversity loss within which ecological function is relatively unaffected. Newbold et al. present a quantitative global analysis of the extent to which the proposed planetary boundary has been crossed (see the Perspective by Oliver). Using over 2 million records for nearly 40,000 terrestrial species, they modeled the response of biodiversity to land use and related pressures and then estimated, at a spatial resolution of ~1 km², the extent and spatial patterns of changes in local biodiversity. Across 65% of the terrestrial surface, land use and related pressures have caused biotic intactness to decline beyond 10%, the proposed “safe” planetary boundary. Changes have been most pronounced in grassland biomes and biodiversity hotspots. —AMS

*Science, this issue p. 288; see also p. 220*

**Ecology**

**This is no time to be a butterfly**

Around the world, butterfly communities are declining, with specialists replaced by generalists. In a Perspective, Thomas explains that there are two main drivers of these declines: habitat loss and habitat degradation. Many butterfly species are highly specialized as caterpillars and have small population ranges, making them vulnerable to loss of and changes in habitat resulting from human activities. Although such declines can be reversed with judicious conservation measures, this is much more expensive than protecting butterflies in the first place. —JFU

*Science, this issue p. 216*

**Neurodegeneration**

**C9ORF72, a suppressor of autoimmunity?**

Mutations in *C9ORF72* are a common contributor to the neurodegenerative disease amyotrophic lateral sclerosis (ALS), yet the function of this gene is still poorly understood. Burberry *et al.* found that mutations disrupting the normal function of the murine *C9ORF72* ortholog caused mice to develop autoimmunity. Furthermore, transplantation of normal mouse bone marrow into mutant animals ameliorated the disease phenotype, whereas transplantation of mutant bone marrow into normal animals caused autoimmunity. Thus, *C9ORF72* appears to act through hematopoietic cells to maintain normal immune function. Future investigations should ask whether disruptions in immunity contribute to disease in ALS patients. —OMS


**Neurobiology**

**Epigenetic regulation in the brain**

The activation of neurons in the brain controls the transcription of genes that influence the pruning of dendritic connections between neurons, and such modifications can influence animal behavior. Yang *et al.* propose a role for chromatin remodeling by the nucleosome remodeling and deacetylase complex (NuRD) in the inactivation of such activity-dependent transcription in the mouse cerebellum (see the Perspective by Sweatt). Deposition of the histone variant H2A.z at promoters of activity-dependent genes required the NuRD complex. Loss of the NuRD complex function resulted in hypersensitivity of mice to sensory stimuli and excessive neuronal connectivity in animals performing a task on a treadmill. —LBR

*Science, this issue p. 300; see also p. 218*

**Ferroelectricity**

**Thinning a ferroelectric makes it better**

As a ferroelectric material becomes thinner, the temperature below which it develops its permanent electrical polarization usually decreases. Chang *et al.* fabricated high-quality thin films of SnTe that, in contrast to this conventional wisdom, had a considerably higher transition temperature than that of the material in bulk (see the Perspective by Kooi and Noheda). This was true even for single-unit cell films, whereas only slightly thicker films became ferroelectric above room temperature. This finding may enable the miniaturization of ferroelectric devices. —JS

*Science, this issue p. 274; see also p. 221*

**Ecology**

**Ozone hole**

**Turning the corner**

The Antarctic ozone hole is finally showing signs of disappearing, nearly 30 years after the Montreal Protocol came into effect. The Montreal Protocol, an international treaty that phased out the production of many of the human-made compounds responsible for stratospheric ozone destruction, is widely considered to be the most important and successful international environmental agreement. For years, it has slowed the rate of stratospheric ozone depletion, and now there are signs that the ozone abundance over Antarctica has begun to increase. Solomon *et al.* present observational data and model results to illustrate the trends and diagnose their causes. —HJS

*Science, this issue p. 269*