

FERROELECTRICS

Thinning films induces ferroelectricity

Thin ferroelectric films are needed in computers and medical devices. However, traditional ferroelectric films typically become less and less polarized the thinner the films become. Instead of using a good ferroelectric and making it thinner, Lee *et al.* started with SrTiO₃, which in its bulk form is not ferroelectric. This material does have naturally occurring nanosized polarized regions, and when the thickness of the SrTiO₃ films reaches the typical size of these regions, the whole film aligns and becomes ferroelectric. — JS

Science, this issue p. 1314

ORGANIC CHEMISTRY

Lighting the way to aryl C-N bonding

Medicinal chemists like to add N bonds to the C atoms of aromatic rings to make bioactive compounds. By harnessing the energy in visible light, Romero *et al.* made these links and transformed C-H into C-N bonds. They used a blue-absorbing acridinium ion to activate a ring C for an incoming N partner. A nitroxyl radical co-catalyst (TEMPO) then choreographed the transfer of the H atom to O. The reaction worked for a broad range of substrates, including ammonium as a N source. — JSY

Science, this issue p. 1326

NEURODEVELOPMENT

Youthful damage limitation in stem cells

Every day brings more risk of damage to stem cells, which could have consequences for the whole organism. Moore *et al.* observed that dividing neural stem cells in rodents establish a diffusion barrier that restricts damaged proteins to one daughter cell, leaving the other with intact molecules. But

with age this diffusion barrier weakens, so that replicating stem cells of older animals are less able to exclude damaged proteins than are the stem cells of younger rodents. — PJH

Science, this issue p. 1334

PROSTATE CANCER

Circulating signals of drug resistance

Cancer drugs often lose their effectiveness because tumors acquire genetic changes that confer drug resistance. Ideally, patients would be switched to a different drug before tumor growth resumes, but this requires early knowledge of how resistance arose. Miyamoto *et al.* have developed a non-invasive method to spot resistance by sequencing RNA transcripts in single circulating tumor cells (CTCs) (see the Perspective by Nanus and Giannakakou). For example, in prostate cancer patients, drug resistance was triggered by activation of the Wnt signaling pathway. But CTCs are rare and fragile, and the technology needs further development before it is used in clinical practice. — PAK

Science, this issue p. 1351; see also p. 1283

VIROLOGY

A good model for the “good boy virus”

Infection with human pegivirus (HPgV) provides a measure of protection to HIV-infected individuals by slowing HIV replication. This phenomenon has earned HPgV the nickname “good boy virus.” How HPgV achieves this protective effect remains a mystery in part because no animal model of HPgV infection exists. Bailey *et al.* discovered that viruses closely related to HPgV also occur in wild baboons and can infect laboratory macaques, thus providing an opportunity to discover what tissues HPgV infects and how it is transmitted and replicated. — OMS

Sci. Transl. Med. **7**, 305ra144 (2015).

IN OTHER JOURNALS

Edited by Sacha Vignieri and Jesse Smith



Larval silkworms need an extra boost on their way to metamorphosing into adult moths

DEVELOPMENT

The path to metamorphosis

The metamorphosis of a caterpillar into a moth was classically thought to be controlled largely by two hormones: one that promotes metamorphosis and one that maintains juvenile characteristics. Daimon *et al.* definitively tested the role of the latter, juvenile hormone, in larval silk moths. They made knockout mutants that lacked an enzyme that catalyzes juvenile hormone synthesis or lacked the two juvenile hormone receptors. Analysis of these animals showed that juvenile hormone functioned only in the late larval stages, when it restrained metamorphosis until larvae reached a sufficient size. Competence to metamorphose depended not on release from juvenile hormone inhibition but rather on the accumulation of a yet-to-be-identified signal that controlled gene expression. — LBR

Proc. Natl. Acad. Sci. U.S.A. 10.1073/pnas.1506645112 (2015).

NEUROSCIENCE

Cost and outcome shape habit

When rodents or monkeys perform a learned task, neurons in the striatum are active right before and after the performance. Their activity is thought to encode expected and experienced cost and outcome. These

signals may be disrupted in Parkinson's disease, manifesting as problems with the initiation of movements. Desrochers *et al.* asked whether these neurons participate in the formation of habits in naïve monkeys. They therefore measured activity in the striatum while monkeys learned to solve a visual task without instructions

ECOLOGY

A jellyfish smörgåsbord

Jellyfish blooms are a common feature in oceans around the world. Because jellyfish hunt for zooplankton, crustaceans, and other lower-trophic-level prey, such blooms might disrupt food chains and have a negative impact on other marine predators. Sato *et al.* attached video and data loggers to thick-billed murres (*Uria lomvia*), diving seabirds that hunt in the Bering Sea. The seabirds successfully adapted their diving and hunting to feed on fish shoaling among the tentacles of large jellyfish, which suggests that blooms could have a beneficial impact on some seabirds. — GR

Biol. Lett. 10.1098/rsbl.2015.0358 (2015).

Thick-billed murres modify their hunting strategies when diving for fish among jellyfish blooms



(“self-learning”). They found that before-and-after signals existed from the start and that a combination of cost and outcome signals afterward increased when monkeys got into the habit, and their performance improved. — LNS

Neuron 87,853, 10.1016/j.neuron.2015.07.019 (2015).

HUMAN EVOLUTION

Old and new immune genetic variation

The Khloe-San peoples of Africa are one of the most ancient lineages of humans and thus can be examined to identify both ancient and recent human-specific genetic variation. Investigating the alleles of the killer cell immunoglobulin-like receptors and their human leukocyte antigen class I ligands, which are involved in the immune response, Hilton *et al.* found evidence of both old and new genetic variants. Because these genes can affect pregnancy, the identification of one recently evolved variant at relatively high frequencies suggests

that it may have conferred a selective advantage. — LMZ

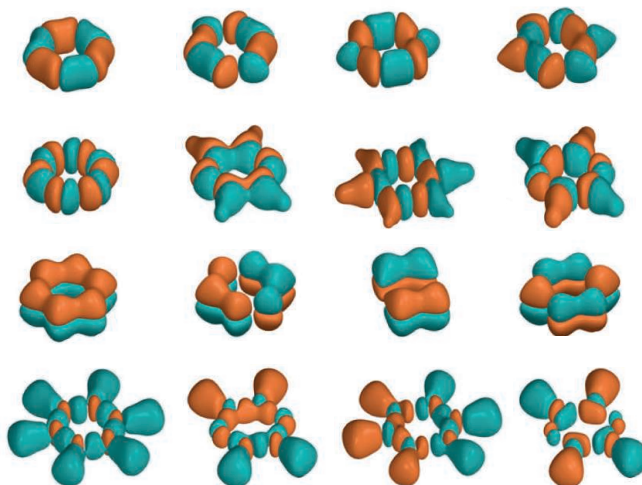
PLoS Genet. 10.1371/journal.pgen.1005439 (2015).

MOLECULAR PHYSICS

Molecular simulation

Determining the electronic structure and dynamics of molecular systems presents an intractable computational challenge for all

but the simplest of molecules. However, the ability to tune the interactions between atoms trapped in an optical lattice provides a versatile quantum system with which to simulate complex condensed-matter systems. Luhmann *et al.* show that such a cold-atom system can be used to simulate the electronic dynamics of complex molecules and to generate three-dimensional high-resolution images of



Calculated molecular single-particle orbitals of an artificial benzene molecule

their molecular orbitals, using benzene as an example. — ISO
Phys. Rev. X 5, 31016 (2015).

MECHANOCHEMISTRY

Pulling for ketenes and imines

Expanding the range of reactive functional groups that can be generated by polymer mechanochemistry—literally pulling the chains apart by applying force—is important for creating new self-healing materials. Robb and Moore show that the Staudinger cycloaddition [the formation of a four-membered β -lactam ring from an imine ($=N-R$, where R is an alkyl or aryl group) and a ketene ($=C=O$)] could be reversed mechanically. Poly(methyl acrylate) polymers with an internal β -lactam ring were cleaved by ultrasonication in organic solvent. The highly reactive ketene was scavenged with isobutanol. — PDS

J. Am. Chem. Soc. 10.1021/jacs.5b07345 (2015).

ENVIRONMENTAL SCIENCE

Fertilizing water contamination

Excess nutrients such as nitrogen and phosphorus can negatively affect aquatic ecosystems. Nutrient-rich fertilizer runoff stimulates productivity, which can lead to harmful algal blooms or fish kills. Nolan and Weber show that such pollution has another wide-ranging consequence: increasing the mobility of uranium in groundwater. Geochemical data for two major aquifers in the United States, which in combination provide drinking water to millions and irrigation for one-sixth of U.S. agriculture, show that increased nitrate levels correlate strongly with the presence of uranium. Nitrate can oxidatively dissolve naturally occurring uranium minerals, which in turn can lead to potentially harmful levels of soluble uranium in groundwater, especially in shallow aquifers. — NW

Environ. Sci. Technol. Lett. 10.1021/acs.estlett.5b00174 (2015).