MECHANOCHEMISTRY
Forcing polymers to be semiconductors
In mechenochemistry, the application of force to a polymer is used to pry open specific chemical bonds. Chen et al. leveraged this technique to produce semiconducting blocks of polyacetylene in an insulating precursor. Ring-opening metathesis polymerization tethered together a series of fused four-carbon rings, reminiscent of the unusual ladderane membrane lipids of anaerobic ammonium-oxidizing bacteria. Subsequently, sonication unzipped these strained rings into alternating C=C double bonds, thereby extending π-conjugation along the polymer backbone. —JSY

SCIENCE, this issue p. 475

CELL BIOLOGY
Fragmented by diabetic stress
High circulating glucose levels in diabetes induce overproduction of reactive oxygen species (ROS), which trigger mitochondrial fragmentation. Abuarab et al. investigated the role of endothelial cell ROS-sensitive TRPM2 channels in this process, which become dysfunctional in diabetics. High glucose–induced oxidative stress triggered Ca^{2+} influx through TRPM2 channels, resulting in lysosomal permeabilization and redistribution of lysosomal Zn^{2+} to mitochondria. The increase in mitochondrial Zn^{2+} led to the recruitment of a fission factor and mitochondrial fragmentation. —WW


MICROBIOTA
Eat more plants for influenza resilience
Antibiotic treatment worsens influenza in mice, possibly because the concomitant loss of the microbiota interrupts the production of bioactive metabolites. Steed et al. found that a microbial product, desaminotyrosine (DAT), produced by an obligate clostridial anaerobe from the digestion of plant flavonoids, is beneficial during influenza. DAT enters the bloodstream and triggers type I interferon signaling, which then augments antiviral responses by phagocytic cells. Without DAT, influenza virus causes inflammation and severe disease. —CA

Science, this issue p. 498

METABOLIC DISEASE
Hitting a dozen enzymes with one drug
The adenosine monophosphate–activated protein kinase (AMPK) controls cellular energy status. AMPK is activated when energy levels fall. This stimulates adenosine triphosphate (ATP)–generating pathways that promote glucose uptake and inhibits ATP-consuming pathways associated with glucose synthesis. In principle, these effects would be beneficial in metabolic diseases, including diabetes. Pharmacological activation of AMPK has been challenging, however, because it requires the enzyme to exist as 12 distinct complexes. Myers et al. describe an orally available compound (MK-8722) that...

ANCIENT DNA
Estimating temperate adaptation in ancient maize
Maize as a staple food crop in temperate North America required adaptation to a shorter growing season. On its first introduction in the southwestern United States ~4000 years ago, maize was extensively grown in the lowlands. Cultivation in the temperate uplands did not occur for another 2000 years. Swarts et al. used ancient DNA data from 1900-year-old maize cobs found in a temperate cave in the southwestern United States and mapped the ancient flowering phenotype. The ancient maize samples were marginally adapted to temperate regions as a result of selection on standing variation. —LMZ

Science, this issue p. 512

Ancient maize shows adaptation to colder climes.
activates all 12 complexes (see the Perspective by Hardie). In animal models, MK-8722 ameliorated diabetes, but it also caused enlargement of the heart. MK-8722 may be a useful tool compound for laboratory research on AMPK function. —PAK

Science, this issue p. 507; see also p. 451

FLUID MECHANICS
Linking fluids as they twist and writhe
Helicity is a measure of cork-screw-like motion described by the amount of twisting, writhing, and linking in a fluid. Total helicity is conserved for ideal fluids, but how helicity changes in real fluids with even tiny amounts of viscosity has been an open question. Scheeler et al. provide a complete measurement of total helicity in a real fluid by using a set of hydrofoils to track linking, twisting, and writhing (see the Perspective by Moffatt). They show that twisting dissipates total helicity, whereas writhing and linking conserve it. This provides a fundamental insight into tornado genesis, atmospheric flows, and the formation of turbulence. —BG

Science, this issue p. 487; see also p. 448

EVOLUTION
Extreme events bring rapid change
Environmental adaptation is often considered a slow process. However, extreme events, such as heat waves or cold snaps, can produce rapid changes, both morphologically and genetically. Campbell-Staton et al. studied a population of green anole lizards during an extreme cold snap in the southern United States (see the Perspective by Grant). After the cold snap, the lizards showed greater cold resistance and displayed changes in six genomic regions that are important for regulation of function in the cold. Understanding how extreme climatic events influence adaptive potential will become increasingly important as the climate becomes more volatile. —SNV

Science, this issue p. 495; see also p. 451

QUANTUM MAGNETISM
Spin-charge separation in atomic chains
Strongly interacting electrons lined up along a string can experience the so-called spin-charge separation, where the electrons “split” into effective carriers of spin and charge, which then move independently. This phenomenon has been observed, somewhat indirectly, in solids. Hilker et al. show spin-charge separation in a direct way by using a one-dimensional (1D) array of cold atoms, playing the role of electrons, whose degrees of freedom of spin and charge can be monitored using a fermionic quantum gas microscope. Empty sites in the 1D lattice moved freely without disturbing the underlying antiferromagnetic order. —JS

Science, this issue p. 484

CANCER THERAPY
Fixing with folate
MicroRNAs (miRNAs), small noncoding nucleotides that regulate gene expression, are attractive therapeutic targets for cancer. The rapid degradation of miRNA mimics in vivo has spurred the use of protection strategies, including administration of liposomes and backbone modification. However, such interventions can hinder miRNA stability, activity, and uptake efficiency. Orellana et al. showed that vehicle-free miRNA could be targeted to cancer cells overexpressing the folate receptor. MiR-34a attached to folate, increased miR-34a copy number, and reduced tumor size when delivered to mice with lung and breast cancer tumors. —CC


IN OTHER JOURNALS
Edited by Caroline Ash and Jesse Smith

A third species of North American flying squirrel

SPECIES DISCOVERY
New flier glides into the Pacific
Current news tends to be about species lost, not gained, so it is encouraging to discover a previously unknown species right under our noses. North American flying squirrels have long been considered to comprise just two species, one in the north and one in the south. Using a combination of genetic tools on museum specimens, Arbogast et al. found that there are in fact three species. No evidence of gene flow among populations was found, even where the species occur sympatrically. The newly identified Pacific coastal lineage is more closely related to the distant southern flying squirrel than it is to its close neighbor, the northern flying squirrel. This level of distinction could elevate the lineage to the status of a new species: Humboldt’s flying squirrel. —SNV


DEMOCRACY DATA
ELECTING THE BEST AND THE BROADEST
Can democracies elect leaders who are both highly capable and broadly representative of society? They can in Sweden. Dal Bó et al. used data on more than 200,000 candidates for national or municipal office, including 50,000 who were elected, from 1982 to 2010. These were combined with individual data on

Published by AAAS
Converting fungal threats to amphibians
In recent decades, parasitic chytrid fungi have infected amphibians around the world. This has resulted in sometimes severe population crashes that have put the survival of a species under threat. In a Perspective, Bower et al. argue that preventing emerging chytrids from reaching uninfected parts of the world, such as New Guinea, is crucial for protecting their amphibian populations. For example, the recent declines in salamanders due to a chytrid emerging in Europe led to a multi-stakeholder effort to prevent its spread to the United States. However, having surveillance plans in place in case of infection is also essential, as has been shown in Madagascar, where recent local chytrid infections have been monitored closely, helping efforts to prioritize conservation measures. —JFU

Conservation
Science, this issue p. 454

Neuroscience
DREADD not the designer compound
Designer receptors exclusively activated by designer drugs (DREADDs) constitute a powerful chemogenetic strategy that can modulate nerve cell activity in freely moving animal preparations. Gomez et al. used radioligand receptor occupancy measurements and in vivo positron emission tomography to show that DREADDs expressed in the brain are not activated by the designer compound CNO (clozapine N-oxide). Instead, they are activated by the CNO metabolite clozapine, a drug with multiple endogenous targets. This may have important implications for the interpretation of results obtained with this popular technology. —PRS

Neuroscience
Science, this issue p. 503

Electrocatalysis
Replacing platinum in air-fed fuel cells
Replacing expensive and scarce platinum catalysts in polymer electrolyte membrane fuel cells for the oxygen reduction reaction (ORR) with ones based on non-noble metals would speed up the adoption of hydrogen fuel vehicles. Most of the candidate replacement catalysts that have shown high performance do so only when running on pure oxygen. Chung et al. developed an iron-nitrogen-carbon catalyst from two nitrogen precursors that forms a high-porosity structure and exhibits high ORR performance when running on air. The proposed catalytically active site is FeNₓ. —PDS

Electrocatalysis
Science, this issue p. 479

Proteostasis
Removing orphan proteins from the system
The degradation of excess subunits of protein complexes is a major quality-control problem for the cell. How such “orphans” are recognized and tagged for degradation is poorly understood. Two papers identify a protein-quality-control pathway that acts on some of the most abundant protein complexes in the human body: hemoglobin and ribosomes (see the Perspective by Hampton and Dargemont). Yanagitani et al. show that the central player in this process is an unusual enzyme (UBE2O) that recognizes substrates and tags them for destruction. Other quality-control pathways tend to use separate factors for target selection (often a chaperone), ubiquitin donation (an E2), and ubiquitin conjugation (an E3). Encoding all three activities in a single factor whose function can be reconstituted in a purified system provides a tractable route to detailed mechanistic and structural dissection. Nguyen et al. show the importance of the UBE2O pathway in the differentiation of red blood cells. —SMH

Proteostasis
Science, this issue p. 472, p. 471; see also p. 450

Genome sequencing
Cas9 endonuclease and off-target activity
The RNA-guided endonuclease Cas9 has brought about a revolution in genetic engineering and genome editing. However, issues with the system include the off-target activity of the endonuclease and promiscuous cleavage, making accuracy in vivo a challenge. Dagdas et al. used smFRET (single-molecule Förster resonance energy transfer) to gain a better molecular understanding of this process, which should enhance the specificity of DNA targeting by Cas9. —ASH

Genome sequencing

Vision ecology
In living color
Animals live in a colorful world, but we rarely stop to think about how this color is produced and perceived, or how it evolved. Cuthill et al. review how color is used for social signals between individual animals and how it affects interactions with parasites, predators, and the physical environment. New approaches are elucidating aspects of animal coloration, from the requirements for complex cognition and perception mechanisms to the evolutionary dynamics surrounding its development and diversification. —SNV

Vision ecology
Science, this issue p. 470
Cas9 endonuclease and off-target activity
Ali Shilatifard

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