An animal model firms up the biological basis for alcohol use as a gateway to cocaine abuse.

Alcohol use primes cocaine addiction

It has long been thought that alcohol use can serve as a gateway to other forms of drug addiction. Griffin et al. studied how alcohol consumption enhances behavioral and neural responses to subsequent cocaine exposure in a rodent model. Prior alcohol consumption led to greater persistence in cocaine self-administration, even in the face of aversive consequences. Long-term alcohol use created a permissive epigenetic environment for cocaine-induced gene expression by reducing histone deacetylase activity in the striatum, a brain region involved in reward-based memory. —KSL


OPTOELECTRONICS

Ultrafast plasmonic modulation

Plasmonics converts light into propagating electrical signals. This approach could allow us to shrink optical components to the nanometer scale, far below the hundreds of wavelengths typically set by conventional optics. Ayata et al. fabricated a plasmonic modulator from a single layer of gold using a substrate-independent process. They created a device with a footprint less than the cross-sectional area of a human hair and with modulation rates exceeding 100 GHz, which could provide a flexible platform for future ultrafast plasmonic technology. —ISO

Science, this issue p. 630

OPTICS

Topological lasing

Resonant cavities that confine light are crucial components of lasers. Typically, these cavities are designed to high specification to get the best possible output. That, however, can limit their integration into photonic devices and optical circuits. Bahari et al. fabricated resonant cavities of arbitrary shape within a hybrid photonic crystal structure. The confinement of light to topologically protected edge states resulted in lasing at communication wavelengths. Relaxing the resonant cavity design criteria should be useful in designing photonic devices. —ISO

Science, this issue p. 636

MATERIALS SCIENCE

Precise chiral colloidal assembly

A challenge for particle assembly is to bring different colloids together in a controlled and uniform way that goes beyond making lattice structures. Ben Zion et al. used DNA origami to pattern colloidal particles and assemble them into clusters with controlled chirality and composition. DNA belts wrapped flat along the curvature of a colloidal particle in an L-like shape. This meant that other achiral colloidal particles, each furnished with a specific complementary DNA belt, could only attach in one orientation. —MSL

Science, this issue p. 633

NEUROSCIENCE

A somatosensory map in the fly brain

The organization of sense organs and sensory brain centers shows conserved principles for many sensory modalities, even

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Science, this issue p. 636
between insects and mammals. Tsubouchi et al. systematically mapped the somatosensory circuits in fruit flies. The findings revealed topological and modality-specific mechanosensory representations in the insect ventral nerve cord and brain. The authors dissected preferential responses to wing and leg movement and contributions to the control of upwind behavior that occur only when the flies are on the ground. —PRS
Science, this issue p. 635

**MEIOTIC DRIVE**

**How selfish genes get their way**

At the core of Mendelian genetics is the concept that gametes are equally likely to carry either of the two parental copies of a gene. Selfish genetic elements can cheat, however, by subverting Mendelian segregation to increase their representation in the gametes. Aker et al. show how the inherent asymmetry of female meiosis is translated to an asymmetry within the spindle machinery that segregates the chromosomes (see the Perspective by McNally). Experiments in mouse eggs revealed how asymmetry is exploited by selfish genetic elements to increase their transmission to the egg. —SMH
Science, this issue p. 668; see also p. 594

**HUMAN EVOLUTION**

**How early human groups were organized**

Sequencing ancient hominin remains has provided insights into the relatedness between individuals. However, it is not clear whether ancient humans bred among close relatives, as is common in some modern human cultures. Sikora et al. report genome sequences from four early humans buried close together in western Russia about 34,000 years ago (see the Perspective by Bergström and Tyler-Smith). The individuals clustered together genetically and came from a population with a small effective size, but they were not very closely related. Thus, these people may represent a single social group that was part of a larger mating network, similar to contemporary hunter-gatherers. The lack of close inbreeding might help to explain the survival advantage of anatomically modern humans. —LMZ
Science, this issue p. 659; see also p. 586

**MOLECULAR IMAGING**

**Condensin is a highly processive DNA motor**

Condensin is thought to regulate genome architecture by creating DNA loops. Terakawa et al. used single-molecule imaging to show that yeast condensin is a highly processive mechanochemical motor capable of translocating along DNA (see the Perspective by Nasmyth). Their findings elucidate how the rapid ATP hydrolysis–dependent motor activity of condensin provides the driving forces necessary to support three-dimensional chromosome organization and compaction through a loop extrusion mechanism. —SYM
Science, this issue p. 672; see also p. 589

**DENDRITIC CELLS**

**Lysosomal calcium in dendritic cell migration**

Activation of dendritic cells (DCs) by stimuli such as bacterial sensing promotes DC maturation. In contrast to random migratory patterns of immature DCs, mature DCs migrate in a continuous and directional manner. Bretou et al. examined the role of lysosomes in regulating mature DC migration. Release of lysosomal calcium connects DC activation with directional migration. Deletion of a lysosomal calcium channel impaired directional DC migration and DC chemotaxis to lymph nodes. Thus, release of lysosomal calcium links stimulus sensing with DC migration. —AB

**PLANT GENOMICS**

**An olive branch for sequencing**

Olive lives are a major component of the Mediterranean diet, especially consumed as olive oil, which may provide health benefits. Unver et al. investigated the composition of the genome of the oleaster (wild olive) tree, the ancestor of cultivated olive trees, and characterized its transcriptome. Evolutionary analyses indicate that the oleaster genome contains multiple signatures of ancestral genome duplication events (paleopolyploidy) after divergence from its close relative, sesame, another oil-producing plant. Comparison of genes in the oil-biosynthetic pathways of oleaster and sesame revealed differences in gene expression resulting from the genome and gene duplications. These differences appear to explain the occurrence of oleic acid in olive and linoleic acid in sesame. —LMZ

**CANCER BIOLOGY**

**Soaking up tumor suppression**

MicroRNAs (miRNAs) regulate gene expression by inducing mRNA decay. But miRNAs can be regulated through other RNAs and DNA that bind and sequester them without inducing any mRNA decay; these are known as miRNA sponges. Gilot et al. show that tyrosinase-related protein 1 (TYRP1) mRNA confers a growth advantage to metastatic melanoma cells by functioning as a sponge for miR-16, a tumor-suppressor miRNA. Blocking miR-16 binding to TYRP1 mRNA induced melanoma cell death and reduced...
CELL BIOLOGY

Molecular mechanisms behind ribosomopathies

Ribosomopathies are tissue-specific disorders that result from mutations in ribosomal proteins or ribosome biogenesis factors. Such disorders include Diamond-Blackfan anemia, isolated congenital asplenia, and Treacher Collins syndrome. Mills and Green review the underlying mechanisms of tissue-specific defects in these and related disorders. Because ribosomes are central to all cellular life, it is puzzling why mutations in components of the ribosome disproportionately affect certain tissues. The authors suggest that ribosome homeostasis is an overarching and simplifying principle that governs the sensitivity of specific cells and tissue types to mutation in components of the translational machinery.

—SMH

Science, this issue p. 608

EVOLUTION

Welcome to the city

Human populations are shifting en masse to cities, which is leading to rapid increases in the number and extent of urban areas. Such changes are well known to cause declines in many species, but they can also act as alternative selection pressures to which some species are able to adapt. Johnson and Munshi-South review the suite of pressures that urban environments exert, the ways in which species may (or may not) adapt, and the larger impact of these evolutionary events on natural processes and human populations. Understanding such urban evolution patterns will improve our ability to foster species persistence in the face of urbanization and to mitigate some of the challenges, such as disease, that adaptation can bring.

—SNV

Science, this issue p. 607

NEUROSCIENCE

The basic modules of the neocortex

The fundamental organization of excitatory and inhibitory neurons in the neocortex is still poorly understood. Subcerebral projection neurons, a major excitatory cell type in neocortical layer 5, form small cell clusters called microcolumns. Maruoka et al. examined large regions of mouse brain layer 5 and observed that thousands of these microcolumns make up a hexagonal lattice with a regular gridlike spacing. The other major layer 5 excitatory cell class, cortical projection neurons, also form microcolumns that interdigitate with those of the subcerebral projection neurons. Microcolumns received common presynaptic inputs and showed synchronized activity in many cortical areas. These microcolumns developed from nonsister neurons coupled by cell type-specific gap junctions, suggesting that their development is lineage-independent but guided by local electrical transmission.

—PRS

Science, this issue p. 610

PLASMONIC MATERIALS

Laser-shaping nanoparticles

For many applications of the plasmon resonances of metal nanoparticles, it is necessary to have narrow resonance lines. However, most methods for synthesizing nanoparticles create a distribution of sizes and shapes that broaden the resonance lines. González-Rubio et al. annealed gold nanorods dispersed in an aqueous solution of a surfactant with carefully tuned ultrafast (femtosecond) laser pulses. This approach reshaped the nanoparticles to create a near-uniform distribution with resonance lines nearly as sharp as for a single nanorod.

—PDS

Science, this issue p. 640

CELL BIOLOGY

Making the right contacts

Contacts between the endoplasmic reticulum (ER) and mitochondria mediate key physiological processes such as Ca\textsuperscript{2+} exchange and lipid biogenesis. In yeast, ER and mitochondria are tethered by a complex of four proteins called ERMES. However, no functional orthologs of these ERMES complex proteins have been identified in metazoans. Hirabayashi et al. identified PDZD8 as a structural and functional ortholog of the yeast ERMES protein MM1 (see the Perspective by Lombardi and Elrod). PDZD8 was found at ER-mitochondria contact sites and was required for ER-mitochondria tethering in mammalian cells. In neuronal dendrites, PDZD8 regulated synaptically evoked Ca\textsuperscript{2+} dynamics, which underscores the importance of interorganellar membrane contacts in cell physiology.

—SMH

Science, this issue p. 623; see also p. 591

GRAPHENE

Exotic states pop up in bilayer graphene

Particles with exotic quantum statistics are expected to be able to support an especially appealing flavor of quantum computing (QC) called topological QC. A particular fractional quantum Hall state in the semiconductor GaAs has long been thought to possess excitations with these favorable properties, but proving so has turned out to be tricky. Working with bilayer graphene instead of GaAs, Li et al. found four states that appear to be consistent with the theoretical description of states with the required quantum statistics. The researchers were able to tune the properties of these states by applying an electric field, adding a valuable control knob.

—JS

Science, this issue p. 648

COLD MOLECULES

Cooling molecules in the spin cycle

A block of ice might look solid, but the molecules inside it are shaking vigorously. Slowing molecules all the way down in the laboratory offers enticing prospects to study and apply their quantum behavior. However, methods to cool dense samples to the necessary temperatures below 1 K have tended to be restricted to rather specialized diatomics. Wu et al. present a general cooling technique that applies to a wide range of conventional polar molecules such as methanol, fluoromethane, and ammonia. Their apparatus combines a preliminary cooling step in a buffer gas with a centrifuge
that spins the molecules down using electric fields. —JSY
Science, this issue p. 645

HUMAN EVOLUTION
Revelations from a Vindija Neandertal genome
Neandertals clearly interbred with the ancestors of non-African modern humans, but many questions remain about our closest ancient relatives. Prüfer et al. present a 30-fold-coverage genome sequence from 50,000- to 65,000-year-old samples from a Neandertal woman found in Vindija, Croatia, and compared this sequence with genomes obtained from the Altai Neandertal, the Denisovans, and ancient and modern humans (see the Perspective by Bergström and Tyler-Smith). Neandertals likely lived in small groups and had lower genetic diversity than modern humans. The findings increase the number of Neandertal variants identified within populations of modern humans, and they suggest that a larger number of phenotypic and disease-related variants with Neandertal ancestry remain in the modern Eurasian gene pool than previously thought. —LMZ
Science, this issue p. 652

VIROLOGY
Unmasking class II membrane fusion
Rift Valley fever virus (RVFV) is transmitted by mosquitoes and enters cells through receptor-mediated endocytosis. The infection process requires class II membrane fusion proteins, which insert a hydrophobic fusion loop into cell membranes and then refold. Guardado-Calvo et al. report the high-resolution crystal structure of RVFV class II fusion protein Gc in its postfusion form complexed with phosphatidylincholine. They find that Gc does not restructure its fusion loop after insertion. Rather, it uses an integrated system that accommodates glycerophospholipid head groups and then initiates membrane reorganization by concentrating cholesterol at the insertion site. Comparison with class II fusion proteins from other virus families suggests a common mechanism, which may provide a target for future antiviral therapies. —STS
Science, this issue p. 653

HUMAN EVOLUTION
Ancient DNA pushes human emergence back
Anatomically modern humans evolved in Africa, but pinpointing when has been difficult. Schlebusch et al. sequenced three ancient African genomes from the Stone Age, about 2000 years old, and four from the Iron Age, 300 to 500 years old. One of the oldest samples, sequenced to 13× coverage, appears most closely to resemble individuals from the present-day San population. However, this individual seems to have lacked genetic contributions from other modern African populations, including pastoralists and farmers, which were observed in modern San individuals. Thus, the earliest divergence between human populations may have occurred 350,000 to 260,000 years ago. —LMZ
Science, this issue p. 655; see also p. 586

ARCHAEOLOGY
A coastal route to the Americas
Archaeologists long thought that the first humans to arrive in the Americas were the Clovis people, who came via an ice-free corridor on the Beringia land bridge no more than 13,500 years ago. Since the early 2000s, evidence for older human sites has accumulated. In a Perspective, Braje et al. highlight recent suggestions that these earlier humans came via a “kelp highway” along the Pacific coasts of Asia and the Americas. However, because most pre-Clovis sites along the coast are likely to be submerged by today’s higher sea levels, it will be difficult to find direct evidence for this route. —JFU
Science, this issue p. 592

STEM CELLS
Refining the gold standard
CD34+ cells are the gold-standard target hematopoietic cells for stem cell therapy and transplantation of stem cell–enriched grafts. However, most of the cells within this population do not contribute to engraftment. Radtke et al. used a robust nonhuman primate transplantation model to identify a stem cell–enriched subpopulation of CD34+ cells that was exclusively responsible for engraftment. Cell doses of this subpopulation correlated with neutrophil and platelet recovery and reliably predicted transplant success. Importantly, the authors observed phenotypic and transcriptomic similarities between these cells and human hematopoietic cells with high engraftment and repopulating potential. —OMS

CELL BIOLOGY
MARKing a change in the cytoskeleton
The kinases of the MARK family are involved in specifying cell polarity. Sandi et al. found that phosphorylation of Ser101 in the cytoskeleton-associated protein ARHGEF2 by MARK3 caused ARHGEF2 to dissociate from microtubules and activate RhoA. As a result, the actin cytoskeleton in cultured cells was remodeled to form three-dimensional structures. Thus, the phosphorylation state of Ser101 of ARHGEF2 determines whether it is sequestered by the tubulin cytoskeleton or released to remodel the actin cytoskeleton and regulate cell polarity. —WW