Male sex determination factor identified in houseflies
Sharma et al., p. 642

Tracing our ancestors in cave sediments

Analysis of DNA from archaic hominids has illuminated human evolution. However, sites where thousand-year-old bones and other remains can be found are relatively rare. Slon et al. wanted to exploit any trace remains that our ancestors left behind. They looked for ancient DNA of hominids and other mammals in cave sediments, even those lacking skeletal remains. They identified mitochondrial DNA from Neandertal and Denisovan individuals in cave sediments at multiple sites. —LMZ
Science, this issue p. 605

3D PRINTING

Personalized printing for human health

The emergence of three-dimensional (3D) printing as a manufacturing method in the early 1980s led to expectations that it would become the tool of choice for fabricating intricate, personalized components for biomedical applications. A stubborn challenge stemming from surface tension–driven wrinkling and peeling instabilities has prevented this from being realized. O’Bryan et al. used oil-swollen microorganogels as hosts for precision printing of 3D components. The reversible liquid-glass transition in the oily microgels yielded silicone structures in a variety of complex forms, including 3D scaffolds, branched perfusable networks, tracheal implants, and functional fluid pumps. —LA

CHEMICAL BIOLOGY

Shipping iron around in small packages

Iron plays a crucial role in a wide variety of biological functions, which in turn rely on the proteins that transport the metal in and out of cells. Grillo et al. used a simple lipophilic small molecule that binds iron ions to restore transport in animal models with deficiencies in iron transporters. This cyclic ketol, hinokitiol, was first tested in yeast and then shown to promote gut iron absorption in rats and mice, as well as hemoglobin production in zebrafish. —JSY
Science, this issue p. 608

FRAMEWORK CHEMISTRY

Intricacy anchored by uranium

Metal-organic frameworks generally have one level of assembly complexity: Organic linkers join inorganic nodes in a repeating lattice. Li et al. created a structure composed of cuboctahedra, assembled from uranium cations and organic linkers, that shared triangular faces to form prisms. These structures formed cages, which in turn joined to make tetrahedra that assembled with a diamond-lattice topology. This hierarchical open structure generated a huge unit cell with more than 800 nodes and linkers, containing internal cavities with diameters of 5 and 6 nm. —PDS
Science, this issue p. 624

EXOPLANET ATMOSPHERES

How much water is in that exoplanet?

Thousands of exoplanets have been identified, but little is known about their atmospheres, especially for bodies smaller than Jupiter. The extent and composition of an atmosphere can provide evidence for how an exoplanet formed. Wakeford et al. used the Hubble and Spitzer space telescopes to measure the spectrum of the atmosphere around HAT-P-26b, a Neptune-sized exoplanet discovered in 2011. They detected signatures of water and clouds; this allowed them to constrain the atmospheric composition, which appears not to have been altered substantially since it formed. —KTS
Science, this issue p. 628

PLANT SCIENCE

Resolution achieved

Chloroplasts possess multiple copies of their own chloroplast DNA that are packaged into DNA-protein complexes known as nucleoids. The shape, number, and distribution of chloroplast nucleoids change markedly depending on the cell cycle,
ENDOCYTOSIS
ER-PM contacts in nonclathrin endocytosis

The epidermal growth factor receptor (EGFR) is internalized through both clathrin-mediated endocytosis and nonclathrin endocytosis (NCE). The two pathways act in concert to sustain EGFR signaling or its long-term attenuation. The mechanistic underpinnings of EGFR-NCE are unclear. Caldieri et al. used a variety of cell and molecular biology approaches to identify nine regulators of EGFR-NCE (see the Perspective by Tan and Anderson). They also identified an additional cargo of the pathway (CD147). One of the regulators of the pathway was the endoplasmic reticulum (ER)–resident protein reticulin 3 (RTN3). Unexpectedly, EGFR-NCE required the formation of specific contacts between the plasma membrane (PM) and the cortical ER, mediated by RTN3. ER-PM contact sites were required in the very early steps of the internalization process for the maturation of NCE tubular intermediates. —SMH

Science, this issue p. 617; see also p. 584

FOREST ECOLOGY
Mapping the world’s dry forests

The extent of forest area in dryland habitats, which occupy more than 40% of Earth’s land surface, is uncertain compared with that in other biomes. Bastin et al. provide a global estimate of forest extent in drylands, calculated from high-resolution satellite images covering more than 200,000 plots. Forests in drylands are much more extensive than previously reported and cover a total area similar to that of tropical rainforests or boreal forests. This increases estimates of global forest cover by at least 9%, a finding that will be important in estimating the terrestrial carbon sink. —AMS

Science, this issue p. 633

IMMUNOTHERAPY
Cancer immunotherapy according to GARP

Cancer, like microbes, can adapt to become resistant to a single therapy, making combination therapies the approach of choice. Complementary therapies that decrease immunosuppression may boost the efficacy of immunotherapies. Rachidi et al. found that targeting platelets improved adoptive T cell therapy of multiple cancers in mice. Transforming growth factor β (TGFβ) from platelets decreased T cell function, largely through the expression of the TGFβ docking receptor, GARP (glycoprotein A repetitions predominant). Thus, combining immunotherapy with platelet inhibitors may improve cancer therapy. —ACC


PHYSIOLOGY
Macrophages feel the heart beat

Macrophages, best known for their phagocytic function in the immune system, also have multiple tissue-specific functions, not least in the heart. Hulsmans et al. explored the role of macrophages that are abundant in the atrioventricular (AV) node of the mouse. These macrophages express the connexin 43 (CX43) protein that forms gap junctions between cells, which allow electrical coupling of cells. Macrophages forming such connections alter the electrophysiological function of cardiomyocytes. Deletion of the CX43 protein from macrophages delays conduction by the AV node, and ablation of macrophages blocks conductance of atrial impulses to the ventricles. Macrophages thus influence normal heart contraction, but, because of their alternative function as immune effectors, they might also contribute to heart abnormalities associated with inflammatory diseases. —LBR


ARTHRITIS
Targeting senescence to combat osteoarthritis

During senescence, cells remain in a state of growth arrest. Accumulation of similar nonfunctional cells has been linked to chronic inflammatory diseases and degenerative disorders. Inflammation after joint injury is a common sequela. Jeon et al. sought to understand whether senescence was
NEUROSCIENCE
Humans have a good sense of smell
In comparison to that of other animals, the human sense of smell is widely considered to be weak and underdeveloped. This is, however, an unproven hypothesis. In a Review, McGann traces the origins of this false belief back to comparative 19th-century neuroanatomical studies by Broca. A modern look at the human olfactory bulb shows that it is rather large compared with those of rats and mice, which are presumed to possess a superior sense of smell. In fact, the number of olfactory bulb neurons across 24 mammalian species is comparatively similar, with humans in the middle of the pack, and our sense of smell is similar to that of other mammals. —PRS
Science, this issue p. 597

ENERGY STORAGE
As with donuts, the holes matter
Improving the density of stored charge and increasing the speed at which it can move through a material are usually opposing objectives. Sun et al. developed a NbO$_2$-holey graphene framework composite with tailored porosity. The three-dimensional, hierarchically porous holey graphene acted as a conductive scaffold to support NbO$_2$. A high mass loading and improved power capability were reached by tailoring the porosity in the holey graphene backbone with higher charge transport in the composite architecture. The interconnected graphene network provided excellent electron transport, and the hierarchical porous structure in the graphene sheets facilitated rapid ion transport and mitigated diffusion limitations. —MSL
Science, this issue p. 599

SYSTEMS BIOLOGY
Maximizing growth by sharing
Bacterial colonies can undergo synchronized oscillations of cell growth, in which individual cells communicate through potassium ion–mediated electrical signals. Liu et al. found that such communication can also occur between adjacent colonies (see the Perspective by Gordon). Furthermore, colonies that would normally oscillate in synchrony adapted to an environment in which the nutrient supply was limited by growing out of phase with one another. Mathematical modeling and further experiments showed that this kept the colonies from having to compete for the limited nutrient and, counterintuitively, allowed the colonies to grow more quickly than they did with a higher nutrient concentration. —LBR
Science, this issue p. 638; see also p. 583

CLIMATE CHANGE
Toward a world without glaciers
Glaciers and ice sheets are very vulnerable to climate warming. In a Perspective, Moon takes stock of the world’s ice and asks what the future holds. With few exceptions, glaciers are retreating or even disappearing around the world, and the Greenland and West Antarctic Ice Sheets are shrinking at an accelerating rate. Studies on the ground and satellite data provide detailed insights into mass loss from the ice sheets. However, it remains difficult to determine the rate of ice loss and, thus, the likely sea level rise and effects on water resources, air and water circulation, and ecosystems. —JFU
Science, this issue p. 580

ALZHEIMER’S DISEASE
A more pathological amyloid-β oligomer
Amyloid-β (Aβ) oligomers promote the aggregation of the cytoskeletal protein tau, which is associated with neuronal death and impaired cognition in neurodegenerative disorders, including Alzheimer’s disease. Various oligomeric forms of Aβ emerge at different stages of the disease. Amar et al. found that the 56-kDa oligomer Aβ*56, but not Aβ dimers or trimers, stimulated Ca$^{2+}$ influx, which triggered the phosphorylation and aggregation of tau in mice and neurons. The findings suggest that targeting this specific amyloid form may prevent the tau pathology underlying Alzheimer’s disease. —LKF

SEX DETERMINATION
Disrupting housefly gene reverses sex
Sex comes in many forms, even when considered at the molecular level. In different animals, the chromosomes and specific genes that function in sex determination vary widely. As a case in point, the familiar housefly displays a highly variable sex determination system. In this animal, the male determinant (M-factor) instructs male development when it is active, but female development results when it is inactive. Sharma et al. now identify the housefly M-factor, which arose via the co-option of existing genes, gene duplication, and neofunctionalization. The findings elucidate the remarkable diversity in sex-determining pathways and the forces that drive this diversity. —BAP
Science, this issue p. 642

CANCER
Tug of war with anti–PD-1
Antibodies against immune checkpoint proteins such as programmed cell death 1 (PD-1) are gaining increasing prominence in cancer treatment, but these promising therapeutics do not always work. To be effective in preventing T cells from becoming exhausted, antibodies against PD-1 must remain bound to the T cells. Arlauckas et al. discovered that although antibodies against PD-1 initially bound to T cells as intended, tumor-associated macrophages quickly removed the antibodies, thus inactivating them. Encouragingly, however, inhibiting Fcγ receptors prevented removal of antibodies against PD-1 and prolonged their effects in vivo. —YN

T CELL BIOLOGY
Search and capture in space and time
How immunological T cells scan target cells for ligands is poorly understood. Cai et al. examined microvillar dynamics in living T cells in three dimensions and real time. The T cells palpat ed all spots on a surface within about 1 min through rapid movements of their microvilli. The time it took to scan the surface matched the movement rate of cells through tissues. These contacts took place in the absence of T cell receptor recognition and were stabilized independently of signaling or the cytoskeleton. Instead, stabilization depended on ligand affinity. The findings explain why many of the previously described components of the immunological synapse and T cell receptor signaling reside on three-dimensional microvillar-derived projections. —SMH
Science, this issue p. 598

RESEARCH
Science, this issue p. 580

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