SUPERCONDUCTIVITY
Massive electrons signify correlations
Thirty years on, and the mechanism of superconductivity in copper-oxide superconductors remains a mystery. Knowledge of their normal nonsuperconducting state is also incomplete; however, we do know that the more robust the superconductivity, the higher the magnetic fields required to suppress it. Ramshaw et al. studied samples of three different compositions of the copper-oxide \( \text{YBa}_2\text{Cu}_3\text{O}_{6+\delta} \) in magnetic fields exceeding 90 T. They found that as the oxygen content increased toward the point of the maximum transition temperature, the conducting electrons became heavier and heavier. This mass enhancement reflected an increase in electronic correlations, which in turn may be a signature of a quantum critical point. — JS

Science, this issue p. 317

BIOGEOCHEMISTRY
Dilution solves the recalcitrance question
The deep ocean is full of dissolved organic carbon, some of which has remained unchanged for thousands of years. What makes these compounds so resistant to microbial degradation? Perhaps their chemical structures make them intrinsically difficult to metabolize? In contrast, Arrieta et al. show that they are simply too dilute to be viable sources of energy for microorganisms (see the Perspective by Middleburg). Further experiments show that if these seemingly recalcitrant organic molecules are concentrated, the ambient microbes can consume them. — HJS

Science, this issue p. 331; see also p. 290

MICROBIAL ECOLOGY
Microbiome of uncontacted Amerindians
Surprisingly, the previously unexplored microbiome of Amerindians contains antibiotic resistance genes. Clemente et al. characterized the fecal, oral, and skin bacterial microbiome of people in a Yanomami Amerindian village with no known previous contact with Western peoples for the past 11,000 years. Their microbiota are the most diverse yet reported for humans. These data offer a rare opportunity to understand what latent antibiotic resistance might have been present in the human holobiont before antibiotic use. — PLY


AXONAL REGENERATION
Progress toward fixing a broken back?
Axon regeneration after a spinal cord injury requires interference with neuronal mechanisms to promote axon extension and early suppression of scar formation. Microtubule stabilization could provide, in principle, a basis for such intervention. Ruschel et al. used animal models of spinal cord injury, time-lapse imaging in vivo, primary neuronal cultures, and behavioral studies to tackle this challenge (see the Perspective by Tran and...
between us and our closest animal companions, dogs (see the Perspective by MacLean and Hare). They found that mutual gazing increased oxytocin levels, and sniffing oxytocin increased gazing in dogs, an effect that transferred to their owners. Wolves, who rarely engage in eye contact with their human handlers, seem resistant to this effect. — SNV

Scientists have used cryo–electron microscopy to uncover the structure of this complex (see the Perspective by Beckmann and Hermann) and reveal an unusual mRNA binding channel. The structure supplies clues for how aminoglycoside antibiotics might inhibit mitoribosomes and how mutations in mitoribosomes might cause human disease. — GR

Mitochondria probably evolved from a prokaryotic cell living within a proto-eukaryotic cell. Consequently, mitochondria have lost much of their genomic DNA, except for a few genes that require highly divergent mitoribosomes for protein translation. Greber et al. and Amunts et al. have used cryo–electron microscopy to uncover the structure of this complex (see the Perspective by Beckmann and Hermann) and reveal an unusual mRNA binding channel. The structure supplies clues for how aminoglycoside antibiotics might inhibit mitoribosomes and how mutations in mitoribosomes might cause human disease. — GR

Resolving whole mitoribosomes

STEM CELLS

Stem cells can sort mitochondria by age

The renewal of tissues in aging organisms requires stem cells, which have the unusual ability to divide asymmetrically into one daughter cell that retains stem cell properties and another that differentiates into a particular tissue type. Katajisto et al. used photoactivated marker proteins to monitor the age of cell organelles in stemlike cells from human breast tissue and their distribution into daughter cells. Most organelles were evenly distributed, but daughter cells that maintained stem-cell properties received more newly produced mitochondria and fewer old ones. — LBR

Species undergo different selective forces, and those that drive immunity are of special interest because they may affect studies of human health. Webb et al. investigated the differences between human and mouse for 456 protein-coding gene families involved in innate immunity. Of these, 2 genes in humans and 35 genes in mice exhibited signatures of positive selection. Examining the evolutionary distance between mice and humans, they further identified many genes likely to be under positive selection in the primate and murid lineages. These changes, for the most part, appear to have been fixed within humans and mice, respectively, demonstrating the different evolutionary trajectories that immune genes have taken during evolution. — LMZ

IMMUNOGENETICS

Of mice and men

Gaze into my eyes

Humans bond emotionally as we gaze into each other’s eyes—a process mediated by the hormone oxytocin. Nagasawa et al. show that such gaze-mediated bonding also exists between us and our closest

In Other Journals

Edited by Sacha Vignieri and Jesse Smith

Selection has shaped immune responses differently in humans and mice

Selection has shaped immune responses differently in humans and mice

Cancer

Will the real mutation please stand up?

When a patient is diagnosed with cancer, tumor samples are analyzed to search for mutations that might guide targeted treatment of the disease. Jones et al. characterized samples from more than 800 patients with 15 different cancer types. For accuracy, this approach requires a matched sample of normal DNA from the same patient. By doing this, mutations present in the patient’s normal tissues can be excluded as therapeutic targets, and therapeutically useful new mutations in the tumor are revealed. — YN

Protein folding

Interfering in an aggregation pathway

Most dementia cases are caused by neurodegenerative Alzheimer’s disease. Plaques composed of fibrils of a 42-residue amyloid-β peptide (Aβ42) are characteristic of this disease. There is evidence that neurotoxicity is caused by Aβ42 oligomers rather than the fibrils, but fibrils catalyze the formation of oligomers. Cohen et al. show that the human chaperone domain Briochos binds to the surface of Aβ42 fibrils and prevents them from catalyzing oligomer formation. In electrophysiology experiments in mouse brain slices, Briochos prevented the inhibition of neural oscillations caused by Aβ42 aggregation. In this case, a chaperone acts not by promoting folding or preventing misfolding but by targeting a

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Biodiversity protects grassland stability
How biodiversity interacts with ecosystem stability and productivity is key to understanding the impacts of environmental changes on ecosystem functions. In a series of decade-long experiments in temperate grassland, Hautier et al. manipulated nitrogen, water, carbon dioxide, herbivory, and fire. In all cases, plant species diversity was important for preserving ecosystem function during environmental change. Hence, the preservation and restoration of biodiversity buffer ecosystems against anthropogenic assault.
— AMS
Science, this issue p. 336

Similar shapes inhabit the sea
Over biological history, several different groups of vertebrate tetrapods have reinvaded the marine environment. Although these groups are widely distributed among reptiles, mammals, amphibians, and birds, the shapes they have evolved are remarkably similar. Kelley and Pyenson review the literature on marine vertebrate groups over time and describe the innovations that facilitated the evolution of these marine forms, the environmental conditions that selected for such convergence of form, and the threats they face from future environment change.
— SNV
Science, this issue p. 301

Fibroblasts in fibrosis
Excess fibrous connective tissue, similar to scarring, forms during the repair of injuries. Fibroblasts are known to be involved, but their role is poorly characterized. Rinkevich et al. identify two lineages of dermal fibroblasts in the dorsal skin of mice (see the Perspective by Sennett and Rendl). A fibrogenic lineage, defined by embryonic expression of Engrailed-1, plays a central role in dermal development, wound healing, radiation-induced fibrosis, and cancer stroma formation. Targeted inhibition of this lineage results in reduced melanoma growth and scar formation, with no effect on the structural integrity of the healed skin, thus indicating therapeutic approaches for treating fibrotic disease.
— BAP
Science, this issue p. 302; see also p. 284

The polarized mark of magnetic fields
Powerful twin jets of plasma often reach more than tens of thousands of light-years from their base in an active galactic nucleus (AGN). Astronomers are still at work investigating what can corral the jets so tightly and propel them so far. Marti-Vidal et al. may have found the answer hiding in polarized light signals that show evidence of a phenomenon called Faraday rotation. This measure can indicate the strength of the magnetic field present, which for the AGN PKS 1830-211 is as strong as a few Gauss. The knowledge that magnetic fields have a driving role brings us closer to understanding this phenomenon.
— MMM
Science, this issue p. 311

Eat your heart out, old galaxies
Most galaxies exceeding 100 billion solar masses are dense spheroids that exhibit no star-forming activity in the present day. Nevertheless, galaxies of the same size were actively forming stars when the universe was only a few billion years old. Tacchella et al. used integral-field spectroscopy and high-resolution imaging to map the distributions of star formation rates and stellar mass densities within ancient galaxies. Star formation apparently quenched first in the center, while remaining lively in the galactic outskirts, with quenching taking a few billion years to proceed outward.
— MMM
Science, this issue p. 314

Traces of collisions within collisions
The Moon is widely accepted to have been created by the collision of a Mars-sized body with Earth. However, information about exactly when this event occurred is still welcome. To find out more, Bottke et al. compared models and the meteorite record with estimates of impact heating. When ejecta was thrown off during the main collision, high-velocity kilometer-sized fragments hit and heated main-belt asteroids. Evidence of such collisions emerges when pieces of those asteroids turn up as meteorites on Earth. The model and empirical record converge on 4.48 billion years ago, confirming previous estimates reached by different approaches.
— MMM
Science, this issue p. 321

Smaller differences and greater extremes
Has recent rapid warming in the Arctic affected weather elsewhere in the world? Coumou et al. find that some key measures of atmospheric circulation in the Northern Hemisphere have weakened during the summer. This change has been caused by the reduction of the temperature difference between mid-latitudes and the North Pole. As summertime circulation has decreased in intensity, episodes of hot weather have become more persistent because there are fewer storms to bring cooler conditions.
— HJS
Science, this issue p. 324

Disappearing faster around the edges
The floating ice shelves around Antarctica, which buttress ice streams from the continent and slow their discharge into the sea, are thinning at faster rates. Paolo et al. present satellite data showing that ice shelves in many regions around the edge of the continent are losing mass. This result increases concern about how fast sea level might rise as climate continues to warm. If warming continues to cause ice shelves to thin, as they have for the past couple of decades, their disappearance may allow land-based ice to collapse and melt.
— HJS
Science, this issue p. 327

Antiviral drugs
For many emerging viruses such as Ebola and dengue, no licensed drug treatments exist. In a Perspective, Bekerman and Einav argue that broad-spectrum antiviral drugs could play a key role in treating infections caused by these and other viruses. These drugs can either target the virus or the host cell. Drugs licensed for treating other diseases, including several cancer drugs, are also showing promise as possible antiviral treatments. If challenges such as toxicity and drug resistance can be addressed, broad-spectrum antiviral drugs will be a useful complement to existing narrow-spectrum approaches.
— JFU
Science, this issue p. 282

Identify important contributors to biodiversity
How biodiversity interacts with ecosystem stability and productivity is key. Experiments in grassland show that plant species diversity is important for preserving ecosystem function during environmental change. Hence, the preservation and restoration of biodiversity buffer ecosystems against anthropogenic assault.

Sensory information may affect taste
Sensory information can affect the perception of taste. For example, sensory information related to olfaction may interact with the brain to influence taste perception.

Climate warming
The floating ice shelves around Antarctica, which buttress ice streams from the continent and slow their discharge into the sea, are thinning at faster rates. Paolo et al. present satellite data showing that ice shelves in many regions around the edge of the continent are losing mass. This result increases concern about how fast sea level might rise as climate continues to warm. If warming continues to cause ice shelves to thin, as they have for the past couple of decades, their disappearance may allow land-based ice to collapse and melt.
**SURFACE STRUCTURE**

**Metal clusters really close-up**

Atomic force microscopy (AFM) can be used to reveal subatomic structures. By this means, Emmrich et al. found that individual copper and iron atoms formed toroidal structures on a copper surface. These shapes arise from the electrostatic attractions in the center of the atoms and Pauli repulsions at their edges. Individual atoms within clusters have underlying surface symmetry and can bind to different surface sites as clusters form. — PDS

*Science*, this issue p. 308

**PROTEIN STRUCTURE**

**Engineering super-enzyme function**

Understanding how protein domains and subunits operate is critical for engineering novel functions into proteins. Arslan et al. introduced intramolecular crosslinks between two domains of the *Escherichia coli* helicase Rep, which unwinds DNA. By inserting linkers of different lengths, the domains can be held either “open” or “closed.” The closed conformation activates the helicase, but it can also generate super-helicases capable of unzipping long stretches of DNA at high speed and with considerable force. Comstock et al. used optical tweezers and microscopy to simultaneously measure the structure and function of the bacterial helicase UvrD. They monitored its DNA winding and unwinding activity and its shape during these activities. The motor domain also has a “closed” conformation during DNA unwinding and switches to a reversed “open” conformation during the zipping-up interaction. — GR

*Science*, this issue p. 344 and p. 352

**PHYSIOLOGY**

**Red cells need leucine for hemoglobin**

Inhibitors of the protein complex mTORC1 are used clinically, but they can cause anemia. Low availability of the amino acid leucine inhibits mTORC1 activity, which suppresses protein synthesis by blocking mRNA translation. The globin proteins in hemoglobin have a particularly high percentage of leucine residues. Chung et al. (see also the Focus by Nathan) found that hemoglobin production by developing red blood cells was decreased by deficiency or inhibition of LAT3, a transporter that enables cells to take up leucine. Specifically, inadequate leucine uptake prevented the translation of globin-encoding transcripts. — WW