Enhanced thermoelectric performance of bulk bismuth telluride

Kim et al., p. 109

IN SCIENCE JOURNALS
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COGNITIVE DEVELOPMENT

Learning when and what to learn

Infants use "unexpectedness" as a cue for learning. Stahl and Feigenson studied how babies reacted when objects behaved in surprising ways (see the Perspective by Schulz). Babies who saw apparently solid and weighty objects moving through a wall or past the edge of a table without falling looked intently at them. When given the opportunity to explore these peculiar objects, they did so by banging them on the floor—as if to test their solidity—or dropping them—as if to test their weightiness. — GJC

Science, this issue p. 91; see also p. 42

STELLAR PHYSICS

Young stars grow up and narrow their focus

Stars are thought to grow by gathering spirals of material from a disk. If this is the case, to balance angular momentum, gas should flow out rapidly along the disk's rotation axis. Carrasco-Gonzalez et al. now seem to have glimpsed the "before" and "after" stages of the onset of such an outflow, over the course of just 18 years (see the Perspective by Hoare). Radio monitoring of the massive protostar W75N(B)-VLA2 reveals a transition from a spherical wind to a collimated one, giving critical insight into what happens as a massive star forms. — MMM

Science, this issue p. 114; see also p. 44

RIBOSOME

The whole mitoribosome at high resolution

Mitochondria are thought to be the descendents of a prokaryotic cell that took up residence in a protoeukaryotic cell. Mitochondria retain a few genes involved in oxidative phosphorylation. To translate these genes, mitochondria contain highly divergent mitochondrial ribosomes, or mitoribosomes. Amunts et al. determined the high-resolution structures of complete mammalian mitoribosomes using cryoelectron microscopy. Mitoribosomes include an unusual mRNA binding channel. The findings elucidate how aminoglycoside antibiotics can inadvertently inhibit mitoribosomes and how mutations in mitoribosomes can lead to disease. — GR

Science, this issue p. 95

MICROBIOLOGY

CRISPRing Candida for health's sake

Candida albicans is a significant cause of mortality in immuno-compromised individuals and a major health concern in hospital-acquired infections. The lack of facile molecular genetic tools has been a major obstacle for a better understanding of this pathogen. Vyas et al. developed a CRISPR system that allows precise gene manipulation in Candida. Their approach could revolutionize our ability to manipulate the Candida genome for a better understanding of the biology of

Pseudohyphae of Candida albicans, an opportunistic fungal pathogen

Evolution of ionized wind during star formation

Enhanced thermoelectric performance of bulk bismuth telluride

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this pathogen and the development of targeted therapeutics.

— ASH


MOLECULAR PHYSICS
Making a molecular fossil lookalike
Atoms are generally compact objects. However, if one of the electrons orbiting the nucleus is given an extra boost of energy so that it’s barely still attached, you get a much larger Rydberg atom. Booth et al. created an even more exotic species: a giant molecule consisting of a regular cesium atom bound within a Rydberg atom of the same element. The molecules are named “trilobites” because their electronic density visually resembles fossils of these extinct marine creatures. — JS

Science, this issue p. 99

PLANT BIOLOGY
Protecting against runaway defense systems
RNA interference defends cells against invading genetic elements, such as viruses or transgenes. But while the invasive RNAs are under attack, what protects the normal endogenous RNAs? Zhang et al. identified, in the small plant Arabidopsis, a surveillance system to do just that: Preserve the normal transcriptome and keep the attack focused on invasive transcripts. — PJH

Science, this issue p. 120

TRIBOLOGY
Additive explanation for anti-wear
Additives in oil are vital for protecting engines from wear by forming films at sliding interfaces. Zinc dialkyldithiophosphate (ZDDP) has been used for decades to reduce engine wear. Now there is a strong incentive for finding a replacement for ZDDP: Its breakdown products shorten catalytic converter lifetime. Gosvami et al. examined exactly how ZDDP produces an anti-wear film under high stress or elevated temperature (see the Perspective by Schwarz). Understanding these mechanisms will help in the development of higher-performance and more effective additives. — BG

Science, this issue p. 102; see also p. 40

VIROLOGY
Evolution in the Ebola virus outbreak
Has rapid mutation produced alarming new virus characteristics in the 2013–2015 Ebola virus outbreak in West Africa? Hoenen et al. sequenced isolates obtained 9 months into the epidemic from cases in Mali. The nucleotide substitution rate was consistent with rates estimated from past Central African outbreaks. In contrast, analysis of sequence data from early in the outbreak indicated rapid mutation. This more recent finding offers confidence that diagnostic methods, vaccines, and other treatment interventions will remain effective. Nevertheless, vigilance must be maintained: A few mutations can radically change the biological properties of other RNA viruses. — CA

Science, this issue p. 117

CANCER IMMUNOLOGY
More mutations predict better efficacy
Despite the remarkable success of cancer immunotherapies, many patients do not respond to treatment. Rizvi et al. studied the tumors of patients with non–small-cell lung cancer undergoing immunotherapy. In two independent cohorts, treatment efficacy was associated with a higher number of mutations in the tumors. In one patient, a tumor-specific T cell response paralleled tumor regression. — KLM

Science, this issue p. 124

PRION TRANSMISSION
Prion-caused wasting
Chronic wasting disease (CWD) is killing deer and elk in the United States and Canada. CWD is caused by an infectious protein, or prion, that is found in meat and blood from infected animals. But is there a risk to humans who eat these animals? Kurt et al. found that mice expressing human prion protein (PrP) resisted CWD, whereas mice expressing human PrP with four elk residue substitutions were susceptible. Only two elk residue substitutions in human PrP were needed for efficient conversion of the protein to the prion conformation. The amyloid-forming propensity of the PrP was important in this conversion, which may explain why some species are highly susceptible to prions from other species. — SMH

FRUSTRATED MAGNETISM
Probing the nature of an exotic magnet
To minimize their energy, materials with magnetic interactions tend to become ordered at low temperatures. However, if the magnetism is frustrated (for example, if the geometry of the crystal lattice gets in the way of minimizing the energy), the material may not reach an ordered state even at very low temperatures. Hirschberger et al. studied the excitations of such a system—the pyrochlore compound Tb$_2$Ti$_2$O$_7$—using thermal transport measurements. Thermal conductivity at very low temperatures resembled that of a disordered metal; a puzzling finding in an electrically insulating transparent material. — JS
Science, this issue p. 106

GENE EXPRESSION
Expression variability under miRNA control
MicroRNAs (miRNAs) repress gene expression by inhibiting translation and increasing mRNA degradation. Schmiedel et al. used single-cell reporter experiments and mathematical modeling to show that miRNAs can reduce not just expression but the expression variability of target genes (see the Perspective by Hoffman and Pipel). Combinatorial targeting principles ensured reduced variability for most miRNA gene targets. Thus, miRNAs may provide safeguards for the precision of gene expression during development or cellular homeostasis. — BAP
Science, this issue p. 128; see also p. 41

ANTITUMOR IMMUNITY
Natural born killers for tumors
Cancer immunotherapies work by activating cytotoxic lymphocytes, usually CD8+ T cells, to kill tumors. But adding new approaches to the arsenal might boost these therapies. Deng et al. now report that natural killer (NK) cells, another type of lymphocyte, can also kill tumors (see the Perspective by Steinle and Cerwenka). Mouse tumors secrete a protein called MULT1 that binds to a protein called NKG2D on the surface of NK cells. This activates NK cells and signals them to kill the tumor cells. Treating tumor-bearing mice with soluble MULT1 caused their NK cells to reject the tumors. — KLM
Science, this issue p. 136; see also p. 45

GEOLOGY
Should we define the start of the Anthropocene?
Human activities influence environmental processes on Earth’s surface to such an extent that scientist have coined the term “Anthropocene” to describe the time we live in. But when did the Anthropocene start? In a Perspective, Ruddiman et al. argue against trying to define a specific start date based on a “golden spike” in the geological record, such as traces from the first atomic tests in 1945. Giving this epoch such a recent start risks neglecting earlier human impacts, such as the megafauna extinctions tens of thousands of years ago and the impacts of early agriculture. — JFU
Science, this issue p. 38

EPIGENETICS
Inheritance of a covalent histone modification
Genomic DNA is the repository of all genetic information and is packaged into chromatin. Chromatin is also a repository of regulatory information in the form of covalent marks added to the histones that package the DNA. These marks can determine tissue- and organ-specific gene expression patterns, which must be transmitted to daughter cells to maintain their identity. Ragunathan et al. and Audergon et al. show that in fission yeast, a chromatin mark, like genetic information, can be inherited across many cell generations. The mark can be inherited independently of DNA sequence, DNA methylation, or RNA interference. Thus, histone marks constitute true epigenetic information. — GR
Science, this issue p. 90; see also p. 132

CANCER
Turning the tables on an inhibitor
Loss-of-function mutations are commonly detected in the tumor suppressor PTEN in various cancers. PTEN is inhibited by PREX2, a protein that promotes cell migration. Mense et al. found that the inhibition was reciprocal: Independently from its activity as a lipid phosphatase, PTEN suppressed the activity of PREX2. Forms of PREX2 with cancer-associated mutations were not inhibited by PTEN, reduced the lipid phosphatase activity of PTEN, and enhanced cancer cell invasion. Analysis of human tumors revealed a correlation between PREX2 mutation and high PTEN expression, suggesting that tumors select for PREX2 mutants that are not inhibited by PTEN. — WW

INFECTION DISEASE
CMV boosts immune response in the young
Cytomegalovirus (CMV) has long been thought of as a sleeper agent—present in a latent form in most people but dangerous when activated in immunosuppressed individuals. Furman et al. looked more closely at the effects of CMV infection in young healthy people. In contrast to older people, in whom CMV infection decreased response to flu vaccine, CMV infection actually enhanced flu vaccine responses in young adults. This beneficial effect was also seen in mice. Thus, latent CMV infection may be beneficial to the host, which may explain the prevalence of CMV infection worldwide. — ACC