**ZEOLITE CATALYSTS**

**Start with the transition state**

Zeolites catalyze a wide range of industrial reactions, but identifying the reactions that they catalyze well tends to be done by trial and error. Gallego et al. propose a way to rationalize the process by using structure-directing agents that act as scaffolds for creating the zeolite pores and channels (see the Perspective by Millini). They picked molecules that mimic the transition states for reactions such as the isomerization of ethylbenzene into xylene, and they successfully identified catalysts with improved reactant conversion and product selectivity. —PDS

*Science, this issue p. 1051; see also p. 1028*

**METALLURGY**

**Bone-inspired steel**

Load cycling of metal components leads to fatigue and ultimately failure through the propagation of cracks. Koyama et al. took inspiration from bone to develop a steel with a laminated substructure that arrests cracks. The resulting hierarchical material has much better fatigue resistance properties than other iron alloys. The strategy need not be limited to steel; other metal alloys should also benefit from this type of microstructural engineering. —BG

*Science, this issue p. 1055*

**OPTICAL METAMATERIALS**

**The lazy way to keep cool in the sun**

Passive radiative cooling requires a material that radiates heat away while allowing solar radiation to pass through. Zhai et al. solve this riddle by constructing a metamaterial composed of a polymer layer embedded with microspheres, backed with a thin layer of silver (see the Perspective by Zhang). The result is an easy-to-manufacture material near the theoretical limit for daytime radiative cooling. The translucent and flexible film can be made in large quantities for a variety of energy technology applications. —BG

*Science, this issue p. 1062; see also p. 1023*

**OCEAN CHEMISTRY**

**The long view of ocean pH**

The acid–base balance of the oceans has been critical in maintaining Earth’s habitability and allowing the emergence of early life. Despite this importance, systematic estimates of historical seawater pH are lacking. Haley

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**RESEARCH**

**IN SCIENCE JOURNALS**

*Edited by Stella Hurtley*

Mice are susceptible to contagious itching.

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**NEUROSCIENCE**

**To scratch or not to scratch**

Observing someone else scratching themselves can make you want to do so. This contagious itching has been observed in monkeys and humans, but what about rodents? Yu et al. found that mice do imitate scratching when they observe it in other mice. The authors identified a brain area called the suprachiasmatic nucleus as a key circuit for mediating contagious itch. Gastrin-releasing peptide and its receptor in the suprachiasmatic nucleus were necessary and sufficient to transmit this contagious behavior. —PRS

*Science, this issue p. 1072*
and Bachan developed a model of seawater chemistry and pH over time scales exceeding ~100 million years. Their highly robust probabilistic history of seawater pH and chemistry reflects evolving properties of Earth’s atmosphere, oceans, and crust. Seawater pH increased from early Archean values of ~6.5 to 7.0 to more recent values of ~7.5 to 9.0 mostly as a result of solar brightening and decreasing interaction between seawater and oceanic crust. —HJS

Science, this issue p. 1069

MOSQUITO BEHAVIOR
Siren molecule calls loudly to mosquitoes
People infected by malaria become more attractive to the mosquito vectors of the disease, which facilitates the spread of malaria. Emami et al. found that red blood cells of the host respond to a parasite-derived isopenoid called HMBPP by increasing the production of carbon dioxide and several monoterpens and aldehydes. Mosquitoes fed HMBPP-spiked blood displayed malaria parasite-specific changes in gene transcription, which reinforced attractiveness for the mosquito. HMBPP also stimulates mosquito feeding and malaria parasite reproduction. Thus, the parasite manipulates its mammalian host to make it more attractive to the insect vectors and exploits the same molecule to amplify transmission. —CA

Science, this issue p. 1076

IMMUNOLOGY
Flexible control of T cell activation
Compared with effector T cells, which have previously encountered antigen, naive T cells require a stronger stimulus to become activated, which prevents spurious activation. Thauland et al. showed that naive cells were stiffer than effector cells and formed smaller immune synapses with antigen-presenting cells. The decreased flexibility of the naive cells depended on the decreased activation of cofilin, which leads to the formation of a stiffer actin cytoskeleton. Thus, pharmacological modulation of T cell stiffness could change the threshold for activation. —JFF


VACCINATION
Time for a booster shot? Open wide!
No one likes to be on the receiving end of a needle, which can make routine childhood vaccinations especially problematic. Aran et al. developed a needle-free drug delivery device that works orally. The MucoJet device uses a simple chemical reaction to deliver a jet of vaccine—in this case, ovalbumin—that penetrates the buccal mucosa when placed against the inside of a rabbit’s cheek. The rabbits showed evidence of antibodies against ovalbumin in cheek tissue and ear vein blood samples 6 weeks after vaccination. —CC


CANCER THERAPY
Exploiting cancer metabolism
Cancer-specific cell surface proteins can be targeted for the delivery of therapeutic agents. However, specific proteins may not always be expressed by a tumor. Wang et al. overcome this challenge by designing sugars to selectively label cancer cells. Small-molecule sugars (azides) can be metabolized by enzymes that are highly expressed in some tumors, including colon and breast cancer cells. Metabolized azides labeled endogenous cell surface proteins in cultured cancer cells and tumor-bearing mice. The azide moiety on the labeled proteins was subsequently recognized by another molecule carrying a drug, which was taken up by the cancer cells. Tumor growth was reduced, and animal survival improved by 86%. —LDC


DIVERSITY
STEM = masculine + feminine
Gender inequalities in science, technology, engineering, and mathematics (STEM) are well documented, but the underlying causes leading to these inequalities are less studied. To test the association between masculinity or femininity and choosing a STEM major, Simon et al. surveyed students at a major public university, using questions regarding academic climate and occupational values coupled with the Bem sex-role inventory, a widely used measure of gendered personality types. Resulting data suggest that the conventional model that men like science because it is “masculine,” whereas women do not like science because it is “anti-feminine,” is flawed. Instead, results show that women pay a femininity penalty in STEM majors, whereas more abundant feminine personality traits
Doped photonics

Doping semiconductor materials with impurity atoms enables control of the optoelectronic properties that enhance functionality. Liberal et al. describe numerically and experimentally an analogous doping effect for a group of photonic materials. They introduced a dielectric into an otherwise nonmagnetic material, which produced a magnetic response. The generality of the method should allow the design of photonic materials with enhanced and controlled electromagnetic response. —ISO

Science, this issue p. 1058

Valleytronics

Going way off resonance

Single atomic layers of transition metal dichalcogenide (TMD) materials have two nonequivalent valleys in their electronic structure. When researchers shine visible light on these monolayers, left-circularly polarized light modifies the electronic levels in one valley but not the other. Sie et al. studied the material WS2. They found that in the infrared regime, if the frequency of the light was far away from the resonance, energy levels in both valleys were affected. The so-called Bloch-Siegert effect could explain the energy shift in the “wrong” valley. The findings should be important for the manipulation of valleytronic properties of TMDs. —JS

Science, this issue p. 1066

Scientific community

Academic merit through a social filter

Scientists prefer to evaluate achievements based on merit alone. But, when it comes to academic advancement, factors other than merit play important roles. In a Perspective, Xie highlights a recent study that reveals the central role of hometown ties, or guanxi, in elections to the Chinese Academy of Sciences and the Chinese Academy of Engineering. Sharing the same place of origin with members of the selection committee boosted the likelihood of success by about 40%. In American science, too, social networks have been shown to play key roles in academic hiring decisions and the recognition of achievements. Scientists thus behave much like other members of society in how they evaluate merit. —JFU

Science, this issue p. 1022

Optics

PhDs crack the histone code

Epigenetic readers are proteins that recognize histone modifications and facilitate histone code–based transcriptional programming. Bromodomain- and plant homeodomain (PHD)–containing proteins often serve as readers of acetylation and methylation on histones, respectively. Mehta et al. examined the function of SP140, a bromodomain- and PHD-containing reader in immune cells. They found that SP140 plays an essential role in repressing lineage-inappropriate genes in macrophages. Furthermore, functionally impaired SP140 polymorphisms are associated with the development of Crohn’s disease. Thus, epigenetic readers can regulate immune responses in normal and diseased states. —AB


Immunogenomics

Gene regulation

Polycomb group gene silencing

Histone proteins wrap around DNA to form nucleosomes that package metazoan DNA into the nucleus. Chromatin compaction is also believed to be critical for the repression of homeotic genes by the Polycomb repressive complex 1 (PRC1) during development. Lau et al. used mutagenesis and expression analyses to examine this gene silencing mechanism. Altering the PRC1 compaction region affected transcriptional repression and patterning of the mouse body axis. Thus, chromatin compaction may drive the stable and heritable silencing of genes involved in body patterning.

—BAP

Science, this issue p. 1081