

PSYCHOLOGY

Social Preferences

The quotidian activity of playing cards (or kibitzing) can just as well be regarded as a self-sustaining institution within which individuals behave according to a shared set of incentives. As such, their behaviors become susceptible to game theoretic analysis, where strategies are formulated on the basis of estimated payouts, even those as intangible as a reputation for selfishness.

Yamagishi *et al.* have adopted this framework in analyzing the motivations for choices made by Japanese and Americans in a simple task. When offered a single colored pen from a group of five pens as a token payment for filling out a survey, Hokkaido students were less likely than Wolverines (Michigan students) to take a particular pen if it were the only one of that color available—that is, they would avoid reducing the scope of choice for subsequent people and thus, by incurring the cost of passing up the uniquely colored pen, not run the risk of making a negative impression on others. In contrast, a cultural psychological assessment would explain this outcome as revealing the preference (higher val-



ation) that East Asians place on conformity as opposed to the affinity of Westerners for individualism. When the choice task was expanded to include situations where the student was told explicitly that he was the first or the last of the five students to receive pens, the East-West difference disappeared; both Japanese and Americans were less likely to take the uniquely colored if they were the first and more likely (equally so) if they were the last to choose. — GJC

Psychol. Sci. **19**, 578 (2008).

APPLIED PHYSICS

Filling the THz Gap

At frequencies below a few hundred GHz, electrons are the information carriers of choice. For frequencies above a few THz, including infrared, the visible, and ultraviolet



wavelengths, optical technologies prevail. The frequency range in between is referred to as the THz gap. Natural materials do not show much response

in this gap range, even though there are many expected applications in the areas of biosensing, imaging, communication, and security. To help fill this gap, Tao *et al.* present a metamaterial—an artificial structure in which the electromagnetic response can be engineered by design—which has a strong response in the THz regime. By engineering a bilayer structure comprising a composite of metallic split-ring resonators, wires, and a polyimide spacer, they show that the electric permittiv-

ity and magnetic susceptibility response can be tuned separately. Such designed materials illustrate the potential of accessing a frequency range normally inaccessible to natural materials. — ISO

Opt. Express **16**, 7181 (2008).

CHEMISTRY

Choice of Phenyls

The formation of carbon-carbon bonds in the synthesis of organic compounds has become relatively straightforward when the sites being coupled are respectively substituted with an electronegative halide and an electropositive boron or tin moiety. The drawback of this approach is the necessity of appending these reactive groups to a precursor skeleton that consists predominantly of C-H bonds. The past decade has seen substantial progress in direct catalytic activation of C-H bonds, in certain cases eliminating the need for either the halide, the boronate, or both. One remaining hurdle is the achievement of enantioselectivity across a wide range of substrates. Shi *et al.* present progress in this vein with a chiral palladium catalyst that selectively couples a boron-substituted alkyl group to

one of two phenyl rings bound to a central carbon, thereby desymmetrizing the compound. The carbon center also bears a pyridine group to direct the catalyst orientation by coordination to the Pd center. Successive trial experiments revealed that the amino acid leucine N-substituted with a menthyl ester proved the most effective ligand, resulting in high yields and enantiomeric excesses as high as 95%. Preliminary studies with a different ligand—an amino acid substituted with a bulky cyclopropyl group—also induced asymmetric coupling to one of the methyl groups in isopropyl pyridine, supporting the potential of this approach for sp^3 as well as sp^2 C-H site activation. — JSY

Angew. Chem. Int. Ed. **47**, 10.1002/anie.200801030 (2008).

PHYSIOLOGY

A Backup Source of Energy

The quality of mammalian semen is often judged by sperm motility, and the impaired movement of sperm toward egg is a common cause of infertility. Prior studies have claimed that the energy (ATP) for spermatozoan flagellar movement originates

from glycolysis or from mitochondrial oxidative phosphorylation; however, the primary pathway for producing ATP may in fact differ across species. Hung *et al.* use the glycolysis inhibitor alpha-chlorohydrin (ACH) or oxidative phosphorylation inhibitor pentachlorophenol (PCP) to determine the source of energy in rhesus monkey sperm. ACH interfered with whiplash motility and sperm velocity, and additional assays showed that glycolysis is the major energy source for sperm motility, hyperactivation, and protein tyrosine phosphorylation. Although flagellar mitochondrial ATP did not appear to be sufficient to sustain sperm motility and hyperactivation, ATP from glycolysis or oxidative phosphorylation did support sperm capacitation and binding to the zona pellucida. — BAP

Biol. Reprod. **78**, 10.1095/biolreprod.107.066357 (2008).

GEOCHEMISTRY

Team Effort

Reactions between water and mineral surfaces control nearly all of Earth's surface environment—they affect weathering and thus the chemistry of the oceans and atmosphere and soil development, and are critical for understanding remediation and waste disposal. Villa *et al.* provide an experiment that reveals the potential complexity of these reactions, suggesting that simple models of reactions with mineral surfaces may need to be reconsidered. They used ^{17}O nuclear magnetic resonance spectroscopy to follow the isotope exchange and dissociation reactions of a niobate cluster with seven distinct oxygen positions in aqueous solution. Analysis showed that all seven

sites participate in the isotope exchange reactions in ways not easily predictable from the structure. Depending on pH, dissociation of part of the complex in some cases occurred faster than the isotope exchange reactions at most of the sites. These results suggest that the extended structure of minerals and their surface complexity need to be considered in modeling and evaluating their reactions with water. — BH

Angew. Chem. Int. Ed. **47**, 10.1002/anie.200801125 (2008).

BIOTECHNOLOGY

A Particulate Sandwich

Using a highly sensitive procedure for the detection of proteins, Kim *et al.* report an enhanced diagnostic test for the presence of HIV in human plasma. In their approach, the HIV p24 Gag protein was trapped between magnetic microparticles, which had been functionalized with sheep antibodies to p24, and gold nanoparticles, which had been decorated with a mix of mouse antibodies directed against p24 or a DNA bar code. The microparticles were then removed from solution magnetically, and the associated DNA was quantified. The sensitivity of this method was an order of magnitude greater than that of standard enzyme-linked immunoassays; the particle-based analysis was performed in solution, which allowed for homogeneous mixing and improved binding kinetics. Furthermore, careful design of the peptides used to raise the mouse and sheep antibodies enabled detection of the six most prevalent HIV subtypes. — BJ

Nanomedicine **3**, 293 (2008).



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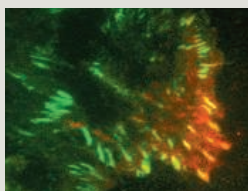
Science Signaling



<< Degrading Polyamines for Migration

Integrins are heterodimeric transmembrane proteins that mediate cell adhesion and migration. The $\alpha 9$ subunit binds the spermidine/spermine- N^1 -acetyltransferase SSAT, which induces the breakdown of the higher-order polyamines spermidine and spermine to the lower-order polyamine putrescine, and this interaction is required for migration mediated by the $\alpha 9\beta 1$ integrin. DeHart *et al.* show that $\alpha 9$ recruitment of SSAT to focal adhesions affects cell migration by modulating the activity of an inward rectifier K^+ (Kir) channel. The expression of catalytically inactive SSAT inhibited migration, suggesting that polyamine metabolism is important for $\alpha 9$ -dependent migration. Higher-order polyamines inhibit Kir channels, and inhibition or knockdown of the Kir4.2 channel inhibited migration of the cells on $\alpha 9$ -specific substrates but did not impair migration on fibronectin. Although $\alpha 9$ was present in focal adhesion-like structures throughout the cell surface, Kir4.2 only colocalized with $\alpha 9$ in focal adhesion-like structures at the leading edge of the cell. Thus, the authors propose that local changes in polyamine concentrations are mediated by SSAT that is recruited to the $\alpha 9$ subunit of integrins; the inhibition of Kir channels allows a localized K^+ efflux, which stimulates migration. — AMV

Proc. Natl. Acad. Sci. U.S.A. **105**, 7188 (2008).



Colocalization (yellow) of integrin and potassium channel.