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 valuation) 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


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 permittivity 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


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 the amino acid leucine N-substituted with a methyl 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 cyclopentane group—also induced asymmetric coupling to one of the methyl groups in isopropyl pyridine, supporting the potential of this approach for sp³ as well as sp² C-H site activation. — JSY


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


GEOCHEMISTRY

Team Effort

Reactions between water and mineral surfaces control nearly all of Earth’s surface environment—they affect weathering and 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


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


< Insoluble microparticles directed against p24 or a DNA bar code were used to trap HIV p24 Gag protein. The microparticles were then removed, and the DNA was quantified.>