EDITED BY KRISTEN MUELLER AND JAKE YESTON

ECOLOGY

The Enemy of My Enemy Is My…?

The factors permitting the coexistence of large numbers of plant species in tropical forests remain a key focus of ecologists. An established mechanism for limiting the abundance of individual tree species is density-dependent predation, whereby specialist natural enemies—especially insect herbivores—congregate where concentrations of their preferred seeds or seedlings are high, typically close to adult reproductive trees. This process, however, which confers an advantage on rarer tree species, can be complicated by the activities of the enemies' enemies. Visser *et al.* studied a tri-trophic interaction in a Panamanian rainforest, between a palm, its predator beetles (right, emerging from a palm seed), and the rodent predators of the beetle. As expected, infestation of palm seeds by beetle larvae increased close to adult plants, but the density-dependent effects were negated by preferential predation by squirrels on beetle-infested seeds. Such top-down control of seed predators, if repeated across other large-seeded tropical tree species, would add new layers of complexity to the conundrum of multiple species' coexistence in tropical forests. — AMS

Ecol. Lett. **14**, 1093 (2011).

CHEMISTRY

More Mass in One Pass

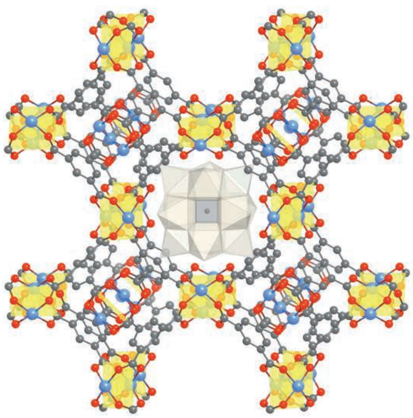
Mass spectrometric imaging of complex surfaces can be achieved with ion microscopy. The analytes of different masses are usually separated by time of flight, but many detection schemes are too slow to image several masses simultaneously for the same desorption pulse from the surface. Jungmann *et al.* were able to achieve multiple-mass imaging by intercepting the ions with a chevron array microchannel plate to generate a pixelated electron signal for the detected region. The electrons were detected with a Timepix chip derived from detectors that are used in high-energy particle detection, allowing a much greater dynamic range of signal intensity than conventional detection. The authors were able to use this instrument to measure multiple mass signals for peptides and proteins, with a range up to 78 kD. — PDS

Anal. Chem. **83**, 7888 (2011).

CHEMISTRY

A Marriage of POM and MOF

Polyoxometalates (POMs) are clusters, typically bearing a net negative charge, that assemble from multiple metal oxide units sharing oxygens and have shown useful catalytic activity for a range of organic oxidation reactions. Metal organic framework (MOF) materials are three-dimensional porous structures that can be designed with specific pore size and composition. As such, they have found use for gas adsorption, separation, and in some cases catalysis. Song *et al.* show that the Keggin-type POM $[CuPW_{11}O_{39}]^{5-}$ can fit snugly into the pores of MOF-199, leading to a strong enhancement of



catalytic properties for the oxidation of thiols to disulfides and the removal of hydrogen sulfide. Analysis of the unit cells shows that the MOF remains intact after inclusion of the POM and associated (tetramethyl)ammonium counter-ion into adjacent large and small pores, and that 50% of the large pores remain empty, allowing for easy movement of reactants and products. Aerobic H_2S oxidation was achieved from aqueous solutions at a rate of 4000 turnovers within 20 hours and was also observed under gas-phase conditions but with lower turnover as the pores were blocked by sulfur accumulation. Tests with a non–copper-containing POM did not show catalytic activity, indicating that the Cu centers in the POM unit are probably the active sites. Air-based oxidations of thiols to disulfides showed excellent selectivity, although decreasing yield as the size of the thiol substituents increased, leading to steric hindrance within the MOF. — MSL

J. Am. Chem. Soc. **133**, 10.1021/ja203695h (2011).

MOLECULAR BIOLOGY

Unmethylating RNA

There is much excitement about the role of the Tet enzymes in the active demethylation of eukaryotic DNA, especially as DNA methyaltion plays such a central role in gene regulation and genome stability. The role of methylation in eukaryotic RNA is more enigmatic: Here, the dominant modification is the conversion of adenosine (A) to N6-methyadenosine (m^6A).

The fat mass–and–obesity–associated (FTO) gene is involved in energy homeostasis, and variants in the human FTO gene are correlated with body mass. FTO has been associated with a number of enzymatic activities, including demethylation of the methylated bases m3T and m3U in single-stranded (ss) DNA and ssRNA. In vitro, Jia *et al.* now show that whereas FTO

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can indeed demethylate m3U, it is much more effective at converting m6A to A in RNA oligomers, including the sequence of a known m6A modification site. FTO had a similar effect in vivo, reducing or increasing the level of m6A in whole-cell RNA when overexpressed or knocked down, respectively. In the nucleus, FTO associated specifically with speckles that contain RNA splicing factors and RNA polymerase II. Although its knockdown does not seem to affect assembly of the spliceosome, the authors suggest that FTO might yet be part of a regulatory system with parallels to DNA and histone methylation. — GR

Nat. Chem. Biol. **7**, 10.1038/NCHEMBIO.687 (2011).

NEUROSCIENCE

Same, But Different

Cephalopods, such as octopus and cuttlefish, are the most advanced of the invertebrates. Their nervous system is as large as that of a dog, and their behavior is complex and sophisticated. Yet the organization of their brain is much simpler than that of vertebrates. Shomrat *et al*. characterized and compared the memory and learning networks in the large vertical lobe of the octopus and the cuttlefish to determine whether the physiology of neuronal networks is constrained by computational considerations. Both systems consisted of a simple two-layered network with a computationally typical fan-out–fan-in organization. The connectivity pattern was also the same in both animals: The first synaptic connection was glutamatergic and the second cholinergic; however, the synaptic sites of short- and long-term plasticity and neuromodulation were different. In the octopus, the first fan-out connection showed short- and long-term plasticity, whereas in the cuttlefish it was the second fan-in connection. These findings may have implications for our understanding of the evolution of microcircuits in the nervous system. The same structures produce similar functions via distinct mechanisms, presumably shaped by evolutionary pressures. — PRS

Curr. Biol. **21**, 1 (2011).

EVOLUTION

Building Bigger Brains

CREDIT: ISTOCKPHOTO

Relative to those of other mammals, the human brain is exceptionally large, although how such a large size evolved is a mystery. Zhang *et al*. investigated differences in genes that are expressed in developing and adult brains in humans and in mice through gene expression profiling. They found an excess of evolutionarily new genes (primate-specific), of diverse functional types, expressed in the developing brains of humans as compared to the mouse. Furthermore, by profiling 13 developing brain regions, the authors observed that many of these genes were more highly expressed in the developing neocortex, one of the most expanded regions of the human brain relative to those of other primates. On the basis of these results, the authors suggest that changes in the regulation of young genes during neural development may have been responsible for the evolutionary changes that account for our large brain size. — LMZ

PLoS Biol. **9**, e1001179 (2011).

CHEMISTRY

Product Placement

Asymmetric catalysis relies on a chiral agent to bias the stereochemical outcome of a reaction. If the desired product has just one chiral center, it is usually straightforward to prepare either enantiomer by using the appropriate enantiomer of catalyst (though in cases where the catalyst is a scantly modified a natural product, it may be moderately more expensive or time-consuming to prepare its unnatural isomer). Reactions that generate two chiral centers in one product pose more of a conundrum though. There is no obvious means of modifying a catalyst to modulate the relative sense of those two centers; in some cases, it may be necessary to pursue entirely different approaches to bond construction, let alone catalyst design, in order to obtain each distinct diastereomer. Tian *et al.* present a rare instance in which fairly simple modifications to the reaction conditions switch the diastereoselectivity of a single catalyst. Depending on the solvent and acid cocatalyst, their quinuclidine-derived organocatalyst directs thiols to add in either syn or anti disposition with respect to the α-alkyl substituent in α,β-unsaturated ketones. Both pathways proceed with high enantioselectivity. — JSY

J. Am. Chem. Soc. **133**, 10.1021/ja207847p (2011).

Science

Unmethylating RNA

Guy Riddihough

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