



ASTROPHYSICS

Stripped in the Dark

Galaxies appear to reside inside dark-matter halos, which over time gather in large clusters held together by the force of gravity. These can be violent places. Dark-matter halos collide and interact with one another, and as they get closer to the cluster's core, they can have matter stripped off them and be ripped apart by strong tidal forces. Although it is not possible to detect dark matter directly, its presence can be inferred from the gravitational effects it has on luminous matter. One such effect is gravitational lensing, whereby light is deflected by the presence of massive objects, producing elongated images of the objects behind them. By analyzing the distorted shapes it is possible to derive the mass distribution of the objects acting as a lens, a technique Natarajan *et al.* used to study the dark-matter halos in the massive lensing cluster Cl 0024+16. They found that the halo masses decreased with decreasing distance to the center of the cluster, as predicted by theories of cosmic structure formation; this result is mimicked in numerically simulated clusters, strengthening the evidence for tidal stripping in clusters of galaxies. — MJC

Astrophys. J. **693**, 970 (2009).

CHEMISTRY

Arene Choreography

Selective substitution of benzene derivatives is a key component of pharmaceutical and fine chemicals synthesis. In general, the easiest positions to modify are the ring carbons directly adjacent to or across from electron-rich substituents already present. Electron-withdrawing groups, in contrast, tend to reduce inherent reactivity toward further substitution, thus hampering direct synthetic strategies for a wide range of desirable products. Zhang *et al.* have addressed this challenge through careful ligand design in palladium-catalyzed addition (via C-H activation) of unsaturated esters to electron-poor arenes to yield olefin-substituted products. The optimal, pyridine-based ligand was sufficiently electron-rich to facilitate reoxidation of the metal after an addition cycle, but also strategically bulky so as to hinder coordination of a second such ligand after the first had bound, thereby leaving a site open for the weakly coordinating arene substrate. The catalyst selectively appended acrylate and cinnamate derivatives at the meta position (two carbons away) of nitro-, trifluoromethyl-, and ester-substituted arenes. More conventional, directed palladium-catalyzed addition facilitated further substitution at the ring carbons in between. The method complements a recently reported

meta-selective arylation employing a copper catalyst (see Phipps and Gaunt, Reports, 20 March 2009, p. 1593). — JSY

J. Am. Chem. Soc. **131**, 10.1021/ja900327e (2009).

NEUROSCIENCE

Cleanup After a Breakup

When nerves are damaged, the parts of the axon fibers that are distal to the point of damage become disconnected from the neuronal cell body whence regulatory and metabolic support comes. The distal axonal segment usually degenerates in a characteristic manner termed Wallerian degeneration. The signals that bring about the orderly disintegration and cleanup of axonal debris are the subject of a study by Miller *et al.* When the axons of *Drosophila* olfactory neurons were broken by removal of the antennae, the remaining axon segments disintegrated in wild-type flies; however, in flies in which the protein kinase DLK had been deleted, disintegration proceeded much more slowly. Similarly, in mice, the disintegration of damaged axons in dorsal root ganglia cultures and in sciatic nerves *in vivo* was slowed in the absence of DLK. The downstream kinase JNK, through which DLK acts, functions in the disconnected axon segment early after the damage occurs. — PJH

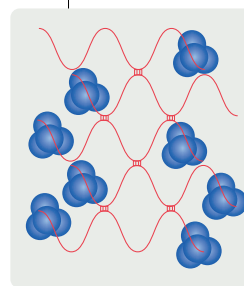
Nat. Neurosci. **12**, 10.1038/nn.2290 (2009).

CELL BIOLOGY

Embodied RNA

More than half of the RNA transcribed from the genome is not translated into protein. A few of the larger noncoding RNAs (ncRNAs) have been found to regulate specific processes such as the silencing of the inactive X chromosome, whereas other ncRNAs may be involved in compartmentalized functions. Paraspeckles are intranuclear bodies that were identified

7 years ago and were predicted to function in mRNA processing as they contain proteins that bind DNA and RNA. Clemson *et al.* find that *NEAT1*, a 4-kb ncRNA, participates in nuclear compartmentalization by forming and maintaining paraspeckles. *NEAT1* RNA localized to paraspeckles in both human and mouse cells and bound to other paraspeckle proteins such as PSP1. Paraspeckles formed at the sites of *NEAT1* transcription, and cells depleted of *NEAT1* contained no paraspeckles. — HP*



Paraspeckle architecture; RNA, red; protein, blue.

Mol. Cell **33**, 10.1016/j.molcel.2009.01.026 (2009).

*Helen Pickersgill is a locum editor in *Science's* editorial department.