TOOLS IN BRIEF

GENOMICS

Light-induced genome editing

For spatiotemporal editing of genomes with the CRISPR (clustered, regularly interspaced, short palindromic repeats) system, the activity of the Cas9 nuclease needs to be tightly controlled. Chemical induction methods can provide temporal but not spatial control. To facilitate the latter, Nihongaki *et al*. created photoactivatable Cas9 by fusing the blue light–responsive Magnet dimerization system (pMag and nMag) to the two parts of a split Cas9 protein. In response to light stimulation, pMag and nMag dimerize and Cas9 reassembles, showing the same activity as its uncleaved wild-type counterpart. This system can be used for the induction of genomic insertions and deletions via nonhomologous end joining as well as for precise genome editing via homology-directed repair. The authors also demonstrated its use for the regulation of gene expression.

Nihongaki, Y. *et al*. *Nat. Biotechnol.* **33**, 755–790 (2015).

PROTEOMICS

A map of the lipid-binding proteome

Lipids interact with proteins in the cell and play important roles in regulating protein function. Niphakis *et al*. investigated these interactions on a global scale, generating a map of the human lipid-binding proteome. To create this map, they developed a set of common fatty acid–based chemical probes that allowed them to enrich for lipid-binding proteins, which they then identified using quantitative mass spectrometry. Using arachidonoyl lipid probes, they identified more than 1,000 lipid-binding proteins in HEK293T and Neuro2a cells. They also used the lipid probes in a competitive ligand screen to identify small-molecule compounds selective for the protein nucleobindin 1. Both the lipid-based probes and the lipid-binding proteome map should be useful for understanding the role of lipids in regulating protein function and for identifying small-molecule drugs and chemical probes.

Niphakis, M.J. *et al*. *Cell* **161**, 1668–1680 (2015).

SENSORS AND PROBES

A DNA-based sensor for intracellular chloride

Chloride concentrations vary widely within the cytoplasm and organelles, yet existing chloride sensors are typically limited in their range and are sensitive to pH. Saha *et al*. developed a DNA nanodevice called Clensor that senses chloride levels at all physiologically relevant concentrations in a pH-independent manner. Clensor consists of three nucleic acid–based moieties. The sensing module harbors a chloride-sensitive compound, and the normalizing module with its chloride-insensitive fluorophore allows for ratiometric measurements. In addition, the targeting module can bear different molecules that result in trafficking along the endocytic pathway. The researchers applied Clensor to measure chloride levels in lysosomes of *Drosophila* hemocytes and to analyze the roles of different chloride channels in endolysosomal compartments.

Saha, S. *et al*. *Nat. Nanotechnol.* **10**, 645–651 (2015).

CELL BIOLOGY

Light-controlled cell adhesion and dissociation

Methods for reversibly controlling the deposition of cells to surfaces have many potential uses in the biological sciences. Li *et al*. have developed a straightforward and robust strategy for using near-infrared (NIR) light to control cell-surface interactions. Their method combines upconversion nanoparticles (UCNPs) with the chemical compound spiropyran. The UCNPs emit either ultraviolet or NIR light when treated with high- or low-power NIR light, respectively. The light emitted from the UCNPs can cause spiropyran to switch between an active form, which can bind fibronectin on cell surfaces, and an inactive form. Thus, using only one wavelength of light, users can reversibly control cell adhesion. The method was shown to be fully reversible over 20 cycles and to result in little damage to cells.

Li, W. *et al*. *J. Am. Chem. Soc.* **137**, 8199–8205 (2015).