TOOLS IN BRIEF

SYNTHETIC BIOLOGY

A minimal bacterial cell

The goal of Hutchison *et al.* at the J. Craig Venter Institute is easily described: to build a viable cell so simple that the function of every gene can be defined. The researchers started with the 1,079-kb genome of *Mycoplasma mycoides*, which they had completely synthesized in 2010, and deleted genes deemed non-essential on the basis of mutagenesis experiments and current knowledge of molecular biology. The initial design failed, but a refined mutagenesis strategy and retention of quasi-essential genes, needed for robust growth, resulted in a viable JCVI-syn3.0 with a 531-kb genome encoding 438 proteins and 35 RNAs. Of these 473 genes, the function of 149 is still unknown, but the design principles developed in this work will allow further testing and the design of more genomes.

Hutchison, C.A. *et al*. *Science* **351**, 1414 (2016).

SINGLE MOLECULE

Putting a spin on high-throughput force spectroscopy

Force spectroscopy is widely used to study single molecules, but it has largely been limited to low-throughput measurements. Yang *et al*. describe a spatiotemporally multiplexed force spectroscopy approach that enables high-throughput measurements. Their approach uses a newly designed miniature centrifuge force microscope in combination with mechanical DNA nanoswitches to study DNA unzipping. Centrifuge force spectroscopy uses a rapidly rotating, high-resolution detection system to simultaneously apply uniform force to objects and observe their motions. The nanoswitches facilitate both automated analysis of large data sets and repeated interrogation of single molecules. Using their approach, the researchers were able to conduct repeated force measurements on hundreds of single double-stranded DNA molecules. The method allows both temperature control and high-precision particle tracking, and it paves the way for future high-throughput studies at the single-molecule level.

Yang, D. *et al*. *Nat. Commun.* **7**, 11026 (2016).

STRUCTURAL BIOLOGY

Delivering crystals with sound

A continuing challenge in utilizing X-ray free-electron lasers (XFELs) to perform serial femtosecond crystallography (SFX) is synching sample delivery with the ultrashort X-ray pulses. Most sample-delivery devices rely on either liquid jets or gel-based extruders to stream a slurry of microcrystals into the path of the XFEL beam, but much sample is wasted between femtosecond X-ray pulses with such devices. Roessler *et al.* introduce two microcrystal-delivery systems that are based on sound—in particular, on acoustic droplet-ejection technology. With these flexible, computer-controlled tools, the delivery of microcrystal-containing droplets to the XFEL beam can be synchronized with the pulse scheme, ensuring less sample waste and more efficient data collection. The developments should be particularly useful for collecting X-ray diffraction data for protein samples that are hard to produce and/or crystallize.

Roessler, C.G. *et al. Structure* **24**, 631–640 (2016).

NEUROSCIENCE

A spotlight on synaptic plasticity

Synaptic strength is regulated by a family of ionotropic glutamate receptors, the NMDA receptors. To unravel the function of NMDA receptors in synaptic plasticity and transmission, Berlin *et al.* developed photoswitchable versions of individual NMDA receptor subunits. These LiGluNs consist of NMDA receptor subunits harboring a cysteine modification close to the ligand binding site, and a photoswitched tethered ligand that attaches to the introduced cysteine and acts as an agonist or an antagonist, depending on the configuration. The researchers generated light-activated GluN2A and GluN2B subunits as well as light-inhibited GluN2A and GluN1a subunits and demonstrated their applications in rat hippocampal cell cultures, mouse organotypic brain slices and zebrafish larvae.

Berlin, S. *et al. eLife* **5**, e12040 (2016).