TOOLS IN BRIEF

SEQUENCING

Nanopore sequencing for bacterial trouble spots

Long-awaited results from the early access program for Oxford Nanopore Technologies' MinION sequencer are beginning to reveal the practical potential for nanopore sequencing. Ashton *et al.* used the long MinION reads to resolve an antibiotic resistance 'island' in multidrug-resistant strains of *Salmonella enterica* that cause typhoid fever. The island contains repetitive elements that are challenging for short-read sequencing; an assembly based only on short-read Illumina data consisted of 86 fragments, or 'contigs', whereas a hybrid approach that also used MinION reads as scaffolds produced an assembly made up of just 34 contigs. The nanopore reads had a median length of 5.4 kilobases and a maximum length of 66.7 kilobases. The work demonstrates that the small sequencers could be used to help diagnose bacterial pathogens.

Ashton, P.M. *et al. Nat. Biotechnol.* doi:10.1038/nbt.3103 (8 December 2014).

NEUROSCIENCE

Retinal analogs for optogenetics

In *Caenorhabditis elegans* or *Drosophila* larvae, optogenetic manipulation with actuators such as channelrhodopsin 2 (ChR2) or ion pumps requires supplementing the animals' diet with the cofactor retinal. AzimiHashemi *et al.* took advantage of this requirement to supply synthetic retinal analogs that confer altered properties to optogenetic actuators. They tested eight different retinal analogs in *C. elegans* and observed a variety of effects on the actuators' action spectra as well as channel kinetics. For example, pairing ChR2 with dimethylamino-retinal (DMAR) results in slower channel kinetics and a broader action spectrum, making it possible to use light of longer-than-usual wavelength for optogenetic activation in *C. elegans* and *Drosophila* larvae. This makes the DMAR-ChR2 combination a more efficient optogenetic actuator in both model organisms than the retinal-ChR2 combination.

AzimiHashemi, N. *et al. Nat. Commun.* **5**, 5810 (2014).

IMAGING

A multifocal approach to whole-cell super-resolution imaging

Super-resolution imaging techniques such as photoactivated localization microscopy (PALM) and stochastic optical reconstruction microscopy (STORM) are increasingly popular. Both techniques are typically carried out using total-internal-reflection fluorescence microscopes, however, which limit imaging depth. To achieve three-dimensional (3D) imaging, Hajj *et al.* implemented PALM/STORM using a multifocus microscope that can simultaneously acquire images from nine equally spaced focal planes. This approach allowed them to acquire images with high axial and lateral precision as well as to an imaging depth of 4 micrometers, which spans a typical mammalian cell and exceeds the depth reached by other super-resolution techniques. The researchers were able to generate super-resolution images of mitochondria in HeLa cells and two-color PALM/STORM images in yeast. This approach should open the door to many 3D super-resolution imaging experiments.

Hajj, B. *et al. Proc. Nat. Acad. Sci. USA* **111**, 17480–17485 (2014).

NEUROSCIENCE

Wireless electrophysiology in behaving animals

Tethered preparations used for analyzing brain activity in animals such as rhesus monkeys typically interfere with the animals' behavioral repertoire. Yin *et al.* have overcome this limitation by developing a lightweight wireless device that can record and transmit brain activity in large quantity and with high fidelity. This neurosensor is compatible with a variety of microelectrode arrays and provides data that are equivalent to data obtained with wired preparations. The researchers demonstrated the capabilities of their wireless device by recording electrical activity from the motor cortex in monkeys walking on a treadmill or sleeping. The device will also be applicable to the electrophysiological analysis of other behaviors in monkeys and perhaps even in human subjects.

Yin, M. *et al. Neuron* **84**, 1170–1182 (2014).