The resulting device weighs around 50 grams and allows high-quality signal recordings to be obtained within a 60-meter range. It can be carried by a medium-sized rat, part of it on the rat's head and part of it as a backpack. Meister's group tested the device by making neural recordings from the primary visual cortex of the rat under diverse experimental conditions. First, they monitored neural activity in the laboratory in a medium-size arena in which they exposed the rats to standardized illumination schemes. Then, they took the rats to a nearby field where the rats were exposed to a rich variety of natural light stimuli and contrasts, and recorded the activity of the rats' neurons while the animals were fully engaged in tasks involving all their senses.

Meister thinks that performing indoor and outdoor recordings in the same rats will be very informative. "Eventually we have to check whether all the things that we learn under laboratory conditions when we try to isolate one sensory modality and study only that, extrapolate to a case where the animal is actually fully engaged," he says.

With this technology, one can catch on to the brain's waves as an animal builds a nest of leaves, travels through a tunnel or runs away from a predator. These studies have the potential to generate a whole set of new data and refine our knowledge of brain function. One day, maybe soon, we might even be able to peek into the brain of a bird and follow its tune as it flies away.

Erika Pastrana

RESEARCH PAPERS

Szuts T.A. *et al.* A wireless multi-channel neural amplifier for freely moving animals. *Nat. Neurosci.* **14**, 263–269 (2011).

works as if we are building railroad switches; you can add an arbitrary number of individual switches that respond to a given unnatural amino acid, each of which controls whether the train continues moving in one direction or not, and the movement of the train integrates the decisions made at each switch," explains Liu. A second advantage is that this system relies on components engineered for expanded genetic codes and as such, the number of unnatural amino acid–induced switches that could be made is large and quickly expanding.

In this work the group used the system to control the expression of GFP in *Escherichia coli*, but this system's potential for more sophisticated applications, such as engineering therapeutic bacteria, is an ongoing effort that Arkin's group is pursuing with the help of collaborators. Notably, other organisms such as yeast or humans also use *cis*-regulatory leader-peptides to control gene expression. Although several adaptations will be needed to translate this tool to eukaryotes, the group is actively at work on this as well.

Once again, this type of research teaches us how the knowledge obtained from basic science studies—here aimed at understanding how microbes control transcription to survive in the world—can be imaginatively put into practice for the building of tools that will one day be of practical value to humans.

Erika Pastrana

RESEARCH PAPERS

Liu, C.C. *et al.* Regulation of transcription by unnatural amino acids. *Nat. Biotechnol.* **29**, 164–168 (2011).

NEWS IN BRIEF

MICROSCOPY

Advances in label-free chemical imaging

Stimulated Raman scattering is a label-free biomedical imaging technique based on vibrational spectroscopy. In its original implementation, narrow-band laser beams had been used to excite a single Raman-active mode, but molecules with overlapping Raman bands could not be distinguished. Freudiger *et al.* now introduce spectrally tailored excitation-stimulated Raman scattering (STE-SRS) microscopy, which applies collective excitation of selected vibrational frequencies to allow specific molecules to be imaged, even when interfering species are present.

Freudiger, C.W. *et al. Nat. Photonics* **5**, 103–109 (2011).

BIOPHYSICS

Transient time-resolved FRET

The integration of structural and kinetic data is necessary to understand protein function. Nesmelov *et al.* describe transient time-resolved fluorescence resonance energy transfer (dubbed $(TR)^2FRET$), a method that allows structural kinetics to be resolved on a sub-millisecond timescale, based on the use of a fluorescence instrument with a pulsed laser and direct waveform recording. They applied the method to investigate the real-time structural kinetics of the motor protein myosin.

Nesmelov, Y.E. *et al. Proc. Natl. Acad. Sci. USA* **108**, 1891–1896 (2011).

GENOMICS

De novo assembly of large genomes

Massively parallel DNA sequencing technologies have revolutionized genomics, but a continuing challenge has been the assembly of high-quality, large mammalian genomes from these short-read technologies. Gnerre *et al.* describe an algorithm and software package called ALLPATHS-LG, optimized for *de novo* assembly of large genomes. The quality of human and mouse genome assembly with ALLPATHS-LG is comparable to that of traditional capillary-based sequencing, but at a much lower overall cost.

Gnerre, S. *et al. Proc. Natl. Acad. Sci. USA* **108**, 1513–1518 (2011).

STRUCTURAL BIOLOGY

A method to measure water-protein interactions

Hydration water molecules that specifically interact with the protein surface can have an important role in protein dynamics and function, but the extremely short residence times of water molecules make them difficult to study. Nucci *et al.* describe a way around this. Using ubiquitin as an example, they tightly confine the protein in a reverse micelle, which slows down the water dynamics and allows site-resolved water-protein interactions to be detected by nuclear magnetic resonance spectroscopy.

Nucci, N.V. *et al. Nat. Struct. Mol. Biol.* **18**, 245–249 (2011).

IMAGING

Imaging organic-inorganic interfaces in the tooth

Gordon and Joester show that atom probe tomography (APT), a widely used technique in materials research, may be applied to generate three-dimensional chemical maps of organic fibers embedded in biominerals, such as in a marine mollusk tooth. APT is uniquely suited to detecting chemical and structural heterogeneity with its high spatial resolution and sensitivity for all elements.

Gordon, L.M. & Joester, D. *Nature* **469**, 194–197 (2011).