reaction, necessitating laborious ligand optimization. Uehling et al. mitigated this problem by isolating the stable product of palladium’s reaction with a complex ary halide ahead of time. Subjecting these compounds to downstream coupling reactions substantially improved yields. —JSY

**NEURODEVELOPMENT**

**Inhibitory synapse specificity**

As neurons build circuits in the developing brain, they select not only what other neurons to connect to but also where on that neuron they will touch base. Working in mice, Favuzzi et al. found that gene expression programs that define subsets of interneurons also define where on the postsynaptic partner those interneurons prefer to build a synapse. One class of interneurons prefers to synapse onto the cell body of pyramidal neurons, another class onto the dendrites, and yet another onto the axon initial segment. —PJH

Science, this issue p. 409

**PLANT SCIENCE**

**Diversity in flowering regulation**

Annual plants flower for one season and then die, whereas perennials can flower repeatedly year after year. Hyun et al. explain how different signaling pathways control such variation in flowering. The perennial pathway requires a floral integrator limited to older shoots. The annual pathway, on the other hand, allows a photoperiodic response to incite flowering on young shoots. Solutions to challenging environments may emerge through evolution as the balance between these regulatory systems shifts. —PJH

Science, this issue p. 413

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**IN OTHER JOURNALS**

Edited by Caroline Ash and Jesse Smith

**CANCER**

**No REST for medulloblastoma**

Medulloblastoma is a pediatric brain tumor with few therapeutic options. Attempts to block the Sonic hedgehog (SHH) pathway that drives various tumor subtypes have been unsuccessful clinically. Dobson et al. found a mechanism by which SHH signaling may be increased in some patients. In a mouse model, increased expression of the transcriptional repressor REST in the disease-causing cells triggered epigenetic silencing of an inhibitor of SHH signaling. These findings suggest potential therapeutic targets for patients with high-REST, SHH-driven medulloblastoma. —LKF


**BIO MATERIALS**

**Guided growth for spinal injury repair**

To repair a spinal cord injury, there is a need to regrow severed nerves while preventing the formation of scar tissue. An ideal biomaterial would conform to and temporarily fill the injury site while supporting the infusion of cells and directing axon regrowth. Dumont et al. use a two-step cross-linking process to create modular porous tubes. Hydrogel beads are initially formed into a tubular structure where the lumen of the tubes provides guidance for regrowing axons while the microspheres control the porosity of the structure to facilitate regenerative support cells. The tubes can be cut to length so that they can be packed to fill any injury shape. —MSL


**EVOLUTION**

**Minor veins are key to photosynthesis**

Carbon fixation via C₄ photosynthesis allows plants to tolerate drought, high temperatures, and nitrogen and carbon dioxide limitations. In plants, the C₄ pathway has evolved from the ancestral C₃ pathway multiple times. To identify developmental changes that accompanied the transition between photosynthetic types, Lundgren et al. investigated leaf anatomy in Alloteropsis semialata. Individuals of this grass species can photosynthesize by either or both pathways. The ratio of mesophyll to bundle sheath tissue, as determined by the number of minor veins, correlates with the photosynthetic route used by a plant. Growth under controlled conditions indicated that the presence...
Noctilionoid bats, including the fishing bat shown, have complex mechanisms for eye pigment evolution.

EVOLUTION
Dropping opsin function

Opsin genes encode photoreceptor proteins that enable perception of dim light by rod cells and color by cone cells in the eye. Cone-opsin loss during the evolution of mammals and reduction in color sensitivity has become a textbook example of rapid trait loss. Sadier et al. examined not only the retention and loss of opsin genes but also their transcripts and proteins in an ecologically diverse group of bats (Noctilionoidea). This taxon ranges from night- and day-flying insectivores and fruit eaters to vampires. They found parallel losses of shortwave opsin pigments in many neotropical species. The changes seen in opsin function resulted not only from mutation but also from variation in transcripts, failures in translation, and protein polymorphisms. This work lends a cautionary note to simple genotype-to-phenotype mapping studies. —BAP

ANTIBIOTIC RESISTANCE
Safe passage for plasmid cargos

Among bacteria, sex and combat both require physical contact. Acinetobacter baumannii carries a constitutively active type VI secretion system (T6SS) for killing potentially competitive cells that it encounters. This species also possesses multiple conjugative plasmids with antibiotic resistance cassettes that require cell-to-cell contact for transmission. Di Venanzio et al. asked how resistance plasmids have managed to become so widespread among the well-defended diversity of A. baumannii strains, making this pathogen a major nosocomial threat. The large conjugative antibiotic resistance plasmids transmit among A. baumannii without provoking defensive mechanisms that kill them, because the plasmids also carry the components of a T6SS repressor system. —CA


EDUCATION
Debunking an active-learning myth

Is there any truth to the notion that college instructors who implement active learning receive lower teaching evaluations? Henderson et al. present data from college physics instructors who attended a new-faculty workshop and attempted to incorporate active learning into their introductory course. Contrary to common belief, 48% of these instructors reported an increase in student evaluations, 32% reported no change, and only 20% reported a decrease in their evaluations. The authors acknowledge the limitations of the study, including the nature of self-reported data as well as changes in student evaluations over time, yet provide the overall recommendation that instructors (and institutions) should not let perceived anxiety over negative student evaluations be a reason to avoid implementing evidence-based teaching practices. —MMc


CHRONOBIOLOGY
Turning on the clock

Every day we wake and sleep under the control of the brain’s master clock or suprachiasmatic nucleus (SCN). If the SCN’s key cryptochrome (Cry) protein components are globally deleted, the clock is disabled. Maywood et al. have developed molecular tools to study the clock’s complex transcriptional and translational feedback loops. A translational switch was designed, by expanding the genetic code, to reversibly control translation of Cry1 in the SCN. This allows an orthogonal aminoacyl–transfer RNA (tRNA) synthetase–tRNA pair to be targeted to the SCN by adeno-associated virus vectors. Cry1 is then only expressed in the SCN when a noncanonical amino acid is supplied. By using this tool, Cry1 expression can be induced in Cry-null mice to initiate circadian behavior in the otherwise arrhythmic mice. —VV


FORCE MICROSCOPY
Putting force laws to the test

In frequency-modulated atomic force microscopy, force is not measured directly. The resonant frequency amplitude and phase of the vibrating cantilever are converted into force through mathematical inversion algorithms. The resolution of this approach now extends to measuring the force between individual atoms, but Sader et al. show that the underlying interatomic forces can also vary rapidly. These conditions can make the inversion of the frequency shifts mathematically ill-posed and lead to unphysical results. They formulate a simple inflection point test of the changes in force with distance of the tip from the surface that ensures that the inversion algorithm problem will yield an accurate force measurement. —PDS

Debunking an active-learning myth
Melissa McCartney

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