

to understand the partitioning of these fluxes on a continental scale; however, model outputs are often inconsistent with stable isotope observations. Maxwell and Condon incorporated dynamic groundwater flow into an integrated hydrologic model simulation for the entire United States. The model showed that water table depth and lateral flow strongly affect transpiration partitioning, thus explaining the inconsistencies between observations and models. —NW

*Science*, this issue p. 377

## MEMORY RESEARCH

### How to link and separate memories

Engrams are the changes in brain tissue that store single memories. Neuroscientists can localize and manipulate them, but until now, little was known about how multiple engrams interact to influence memories. Rashid *et al.* examined how neural assemblies in an area called the lateral amygdala interact. If two frightening events occurred within 6 hours, the same set of neurons was used to express fear memories for both events. However, if the events were separated by 24 hours, distinct memory traces were formed. —PRS

*Science*, this issue p. 383

## BEHAVIORAL ECOLOGY

### Show me a sign of sweetness to come

Communication between humans and domesticated animals is common. Regular communication between humans and wild animals, however, is rare. African honeyguide birds are known to regularly lead human honey-hunters to bee colonies, and the humans, on opening up the nest, leave enough mess for the birds to feast on. Spottiswoode *et al.* show that when the honey-hunters make a specific call, honeyguides are both more likely to come to their aid and

more likely to find them a bee's nest. This interaction suggests that the birds are able to attach a specific meaning of cooperation to the human's call—a rare case of mutualism between humans and a wild animal. —SNV

*Science*, this issue p. 387

## CANCER IMMUNOTHERAPY

### Cyclin suppresses antitumor immunity

Despite the dramatic success of cancer immunotherapy, many types of cancer do not respond. Understanding why could help us to find ways to enhance the overall responsiveness of tumors to immunotherapies. Dorand *et al.* report that cyclin-dependent kinase 5 (Cdk5), an enzyme that is highly expressed by neurons in many brain cancers, may dampen the ability of T cells to reject tumors. In a mouse model of medulloblastoma, if tumors were Cdk5 deficient, T cells were able to remove them. This heightened antitumor immunity correlated with reduced expression of the inhibitory molecule programmed cell death ligand 1 (PD-L1), a target of current cancer immunotherapies. —KLM

*Science*, this issue p. 399

## IMMUNOLOGY

### Blocking ROCK2 to prevent autoimmunity

T follicular helper (T<sub>fh</sub>) cells assist in the production of antibodies. When activated, peripheral blood T cells from patients with the autoimmune disorder lupus can develop into T<sub>fh</sub> cells. Weiss *et al.* found that a pharmacological inhibitor of the kinase, ROCK2, decreased the number and function of human T<sub>fh</sub> cells that were generated in lupus cases. Unlike a general immunosuppressant, the ROCK2 inhibitor was specific and ameliorated disease severity in a mouse model of lupus without interfering with other immune cells. —JFF

*Sci. Signal.* **9**, ra73 (2016).

## IN OTHER JOURNALS

Edited by **Kristen Mueller** and **Jesse Smith**



Bioluminescence, as seen in this moray eel, has evolved many times.

## EVOLUTION

### How fish evolved an abyssal glow

The darkness of the deep sea presents a particular challenge for fish wanting to mate or eat. Rising to this selective challenge, fish inhabiting these deep waters have evolved—very many times, it turns out—an extraordinary array of luminescent appendages. Davis *et al.* amassed sequence data from almost 300 fish genera (representing about 1500 bioluminescent species) to determine the evolutionary origins, age, and patterns of diversity of this phenomenon. Bioluminescence in fish is due to either intrinsic biochemistry or symbiotic relationships with luminescent bacteria. Starting in the Early Cretaceous, intrinsic bioluminescence evolved eight times, and relationships with glowing bacterial symbionts have evolved on at least 17 occasions. This work substantially adds to the tally of independent evolutionary occurrences of bioluminescence. —CA

*PLOS ONE* **10**.1371/journal.pone.0155154 (2016).

## QUALITY CONTROL

### How cells take out the trash

Misfolded proteins are generally sequestered and then degraded by one of a number of quality-control pathways within cells. Lysosomal enzymes in the endolysosomal system or proteasomes in the cytosol can do

this. Lee *et al.* describe a rather unexpected way that some cells, when subjected to proteasomal insufficiency, deal with misfolded cytosolic proteins: They excrete them using an unconventional secretory pathway. The pathway involves an endoplasmic reticulum (ER)-associated deubiquitination enzyme, USP19. Somehow USP19 recognizes

PHOTO: ©WATERFRAME/ALAMY STOCK PHOTO

misfolded cytosolic proteins and delivers them to ER-associated endosomes, which then seem to spit out the aberrant proteins into the medium. How important or widespread this pathway is in normal physiology or disease remains to be seen. —SMH

*Nat. Cell Biol.* **18**, 765 (2016).

## RESEARCH FUNDING

### What price interdisciplinary research?

Although interdisciplinarity is frequently considered to be the path that science is on, it can be rocky for its practitioners. The Australian Research Council Discovery Programme funds research nationally in all academic fields and requires applicants to categorize their proposals according to pre-defined discipline codes and the percent of the research described by that code.

Bromham *et al.* adapted a measure of biodiversity to examine 18,476 proposals and found that interdisciplinarity was associated with a lower probability of funding. This was attributed to distance between the disciplines rather than the number of disciplines or differences between institutions. These results support suspicions that reviewers find it hard to evaluate interdisciplinary research. —BJ

*Nature* **534**, 684 (2016).

## NEURODEVELOPMENT

### A long noncoding RNA for neuronal differentiation

Noncoding RNAs regulate gene expression. Rani *et al.* used bioinformatic analysis to identify a long noncoding RNA with a role in neurodevelopment, *LncND*, that is specific to primates. Human neural progenitor cells expressed higher amounts of *LncND* compared with mature neurons. During neural development, *LncND* appears to act as a sponge for the microRNA miR-143-3p, which represses the expression of Notch proteins,



Sea ice near Kulusuk, Greenland

## ARCTIC SEA ICE

### Change in the air

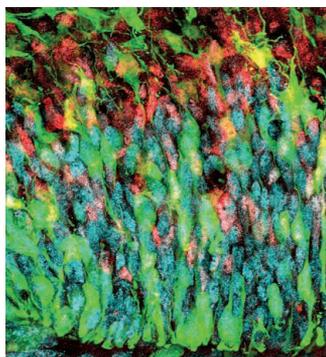
How does atmospheric circulation affect the initiation of seasonal melting of Arctic sea ice? Mortin *et al.* examined 35 years of satellite and meteorological data to tease out the general controls and explain the large annual variability in timing. They found that melt onset is triggered by high water vapor, clouds, and air temperatures, which act to increase the amount of longwave radiation downwelling to the ice surface. Early melts occur when these conditions persist for weeks beforehand because of changes in springtime atmospheric moisture transport.

—HJS

*Geophys. Res. Lett.* 10.1002/2016GL069330 (2016).

key regulators of brain development. In a human cell line, reducing *LncND*, which allows more loose miR-143-3p and therefore reduces Notch signaling, caused precocious neuronal differentiation. In humans, deletions or mutations in *LncND* and its surrounding DNA are linked to multiple neurodevelopmental disorders, including intellectual disability, suggesting the importance of *LncND* to human disease. —PJH

*Neuron* **90**, 1174 (2016).



Expansion of radial glial cells in a mouse brain overexpressing *LncND*

## EDUCATION

### When leadership meets science

Today's STEM (science, technology, engineering, and math) graduates will be tomorrow's leaders. Reed *et al.* have designed an integrated leadership curriculum aimed at increasing student awareness and understanding of what it takes to become a future STEM leader. The curriculum, which is now integrated into biology and chemistry courses at all levels, focuses on several areas where leadership skills and science competencies overlap, including problem-solving, interpersonal communication, and collaborative work. By allowing students multiple opportunities to practice these corresponding skills, the curriculum serves as a metacognitive approach for students to develop their abilities and commitment to leading others. The curriculum is broadly applicable to many different institutions and has the added

benefit of encouraging interdisciplinary collaboration for faculty. —MM

*J. Coll. Sci. Teach.* **45**, 51 (2016).

## ORGANIC CHEMISTRY

### Iron takes alcohols to carboxylic acids

The oxidation of alcohols to carboxylic acids is a widely practiced reaction in organic chemistry. Unfortunately, it often requires the use of metal oxides that generate wasteful, sometimes toxic byproducts. Jiang *et al.* report a mixture of three compounds—iron nitrate, the TEMPO radical, and potassium chloride—that catalyze this reaction for a wide range of substrates, using oxygen in air as the oxidant. The authors demonstrate cetyl alcohol oxidation at a 55-g scale. Preliminary studies of the mechanism implicate NO<sub>2</sub> as an active participant in the reaction. —JSY

*J. Am. Chem. Soc.* 10.1021/jacs.6b03948 (2016).