

refractive index of the lens is varied according to the curvature. Cai *et al.* show that the lenses of squid eyes have an internal structure containing a set of globular proteins that form a gradient of colloidal particles to counter spherical aberration (see the Perspective by Madl). Thus, the evolutionary process has used the principles of patchy colloid theory to construct a self-assembling, complex optical device. —MSL

*Science*, this issue p. 564;  
see also p. 546

## FLOODING

### Flooding along the river

Will a warming climate affect river floods? The prevailing sentiment is yes, but a consistent signal in flood magnitudes has not been found. Blöschl *et al.* analyzed the timing of river floods in Europe over the past 50 years and found clear patterns of changes in flood timing that can be ascribed to climate effects (see the Perspective by Slater and Wilby). These variations include earlier spring snowmelt floods in northeastern Europe, later winter floods around the North Sea and parts of the Mediterranean coast owing to delayed winter storms, and earlier winter floods in western Europe caused by earlier soil moisture maxima. —HJS

*Science*, this issue p. 588  
see also p. 552

## NEURAL EPIGENOMICS

### Methylation and the single neuronal cell

The presence or absence of methylation on chromosomal DNA can drive or repress gene expression. Now, a comprehensive map of methylation variation in neuronal cell populations, including a between-species comparison, illustrates how epigenetic diversity plays important roles in neuronal development. Luo *et al.* examined how DNA methylation is both similar and different within neurons at the single-nucleus level in humans

and mice. They identified 16 mouse and 21 human neuronal clusters, with greater complexity of excitatory neurons in deep brain layers than in superficial layers. —LMZ

*Science*, this issue p. 600

## RESEARCH IMPACT

### Picking up a patent

What is the relationship between patents and scientific advances? Ahmadpoor and Jones devised a metric for the “distance” between patentable inventions and prior research to study this question. They analyzed the relationship between 4.8 million U.S. patents and 32 million research articles. Universities tended to cite their own research directly in their patents (in other words, a distance of 1), but the distance was greater for companies, suggesting that companies may rely on outsiders for their foundational research. The distance varied by discipline, with nanotechnology and computer science having the shortest distances between published research and patents. —BJ

*Science*, this issue p. 583

## CRISPR BIOLOGY

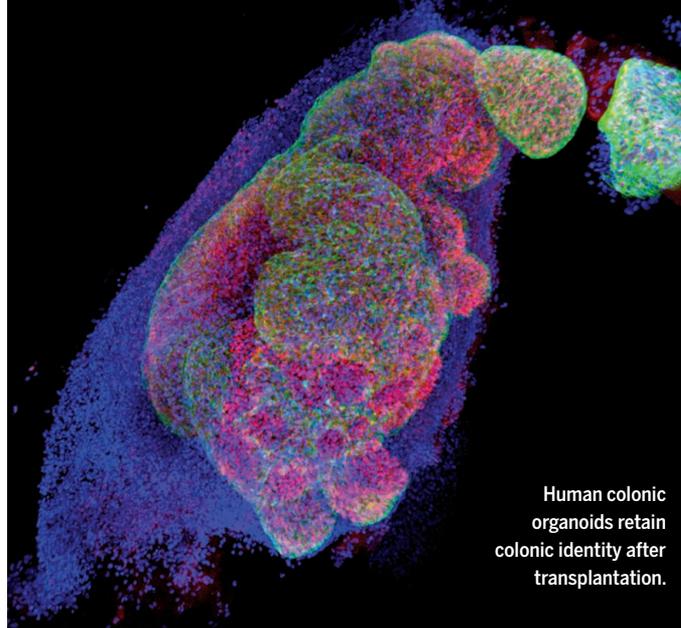
### Bacterial defense amplification

Prokaryotic type III CRISPR systems use the effector complex and additional proteins such as Csm6 to destroy both the genome and the transcripts of invaders. However, how the effector complex and Csm6 coordinate CRISPR activity remains a mystery. Kazlauskienė *et al.* found that a cyclic oligonucleotide-based signaling pathway can regulate the defense response (see the Perspective by Amitai and Sorek). Upon target recognition, the Cas10 subunit of the effector complex synthesizes cyclic oligoadenylates, which act as second messengers to initiate and amplify the nuclease activity of Csm6. —SYM

*Science*, this issue p. 605;  
see also p. 550

## IN OTHER JOURNALS

Edited by **Caroline Ash**  
and **Jesse Smith**



Human colonic organoids retain colonic identity after transplantation.

## DEVELOPMENTAL BIOLOGY

### The making of a distal gut

Organoid research is revolutionizing investigations into development and disease. Gut organoids have proved valuable in elucidating signaling pathways and structures. So far, most advances have focused on the small intestine. The distal gut has seen less progress because of the challenges of deriving organoids from cecum, colon, and rectum stem cells. Múnera *et al.* show that it is essential to have specific growth factors called BMP-HOX present to generate human colonic organoids. When transplanted, these organoids grow into tissues in mice that resemble the human colon. Insights into colitis, colon cancer, and irritable bowel syndrome should now be enabled through the use of these models of the distal human gut. —BAP

*Cell Stem Cell* **21**, 51 (2017).

## EARTHQUAKES

### A new earthquake forecast for California

Earthquakes cannot be predicted, but rupture models can estimate the regional likelihood of an earthquake within a certain time window. Field *et al.* incorporate new data and fault-based information for the Third Uniform California Earthquake Rupture Forecast (UCERF3). The new model better accounts for potential multiple fault ruptures and provides self-consistent

forecasting windows from hours to more than a century. UCERF3 is an important development for operational forecasts that are vital for assessing the evolving seismic hazard in California. —BG  
*Seismol. Res. Lett.*  
10.1785/0220170045 (2017).

## ECOLOGY

### A benevolent invader?

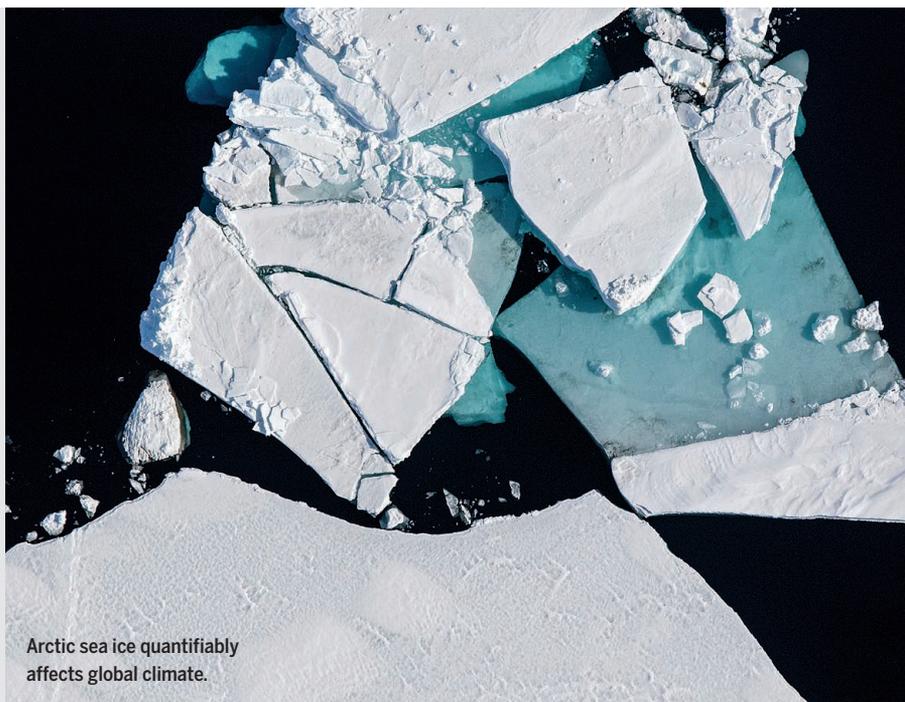
Plant and animal species introduced into non-native localities by humans sometimes become invasive, often with damaging

## CLIMATE CHANGE

## The long reach of Arctic sea ice loss

How might the loss of Arctic sea ice be affecting climate outside that region? Climate change is driven by a number of interacting processes, including sea ice loss and increasing atmospheric carbon dioxide concentrations, and separating their effects is not a trivial exercise. McCusker *et al.* used a coupled ocean-atmosphere general circulation model to unravel the impacts of sea ice loss and atmospheric carbon dioxide increases on temperature and circulation; they found that these impacts can be distinguished quite precisely, on hemispheric to regional scales. The ability to separate these effects might help us better interpret the diverse and sometimes apparently conflicting array of modeling and observational studies of Arctic climate change and its influence. —HJS

*Geophys. Res. Lett.* 10.1002/2017GL074327 (2017).



Arctic sea ice quantifiably affects global climate.

ecological and economic consequences. However, Ramus *et al.* report an unusual case where an invasive species can be beneficial. *Gracilaria vermiculophylla* is a seaweed from the West Pacific that has been introduced to North Atlantic coastlines, where it has become invasive. In experimental manipulations of its abundance in North Carolina, USA, the seaweed enhanced an array of ecosystem functions by assuming the role of a “foundation” species that provides habitat for others. Benefits accrued to the abundance and species richness of gastropods and crustaceans and, through the attenuation of water flow, to coastal protection. Hence,



An invasive West Pacific seaweed proves protective on the U.S. eastern seaboard.

toleration rather than eradication may be a pragmatic management strategy in this case. —AMS

*Proc. Natl. Acad. Sci. U.S.A.* 10.1073/pnas.1700353114 (2017).

### SUPERCONDUCTIVITY Making sense of the cuprate pseudogap

One of the outstanding questions in the physics of cuprate high-temperature superconductors is whether the so-called pseudogap—a depression in the density of states around Fermi energy that occurs above the superconducting transition temperature—is caused by a true phase transition. Sato *et al.*

measured the magnetic torque in the compound  $\text{YBa}_2\text{Cu}_3\text{O}_y$  with high precision and found a kink in the magnetic anisotropy for several samples of varying concentrations of oxygen. For all of these samples, the kink occurred very close to the temperature that marks the beginning of the pseudogap phase. These findings provide evidence that additional rotational symmetry breaking occurs at the entrance to the pseudogap phase. —JS

*Nat. Phys.* 10.1038/NPHYS4205 (2017).

### OBESITY Hold your nose to prevent obesity

The sense of smell (olfaction) can affect the appreciation and anticipation of food. Riera *et al.* found that the activity of olfactory sensory neurons also influences energy regulation. Inhibition of olfactory perception in lean mice and mice with diet-induced obesity showed that losing the sense of smell resulted in leaner mice, but not because they ate less. Mice that could not smell had higher levels of energy expenditure and fat-burning capacity because sympathetic nerve activity became elevated in

adipose tissue. Conversely, mice with hypersensitive olfaction had greater adiposity and exhibited signs of diabetes. It appears that being able to smell has a direct systemic effect on regulating body energy homeostasis. —GKA

*Cell Metab.* 26, 198 (2017).

### NEURAL STEM CELLS Mobilized by electricity

Harnessing neural stem cells to repair brain damage is difficult. Endogenous stem cells are located deep in the brain's hippocampus and subventricular zone (SVZ), and upon transplantation, stem cells often exhibit poor motility. Feng *et al.* have developed a model of transplanted, fluorescent-labeled human neural stem cells in the SVZ of the rat brain. The cells can be encouraged to migrate in a specific direction in response to an intermittent electric field emitted by implanted electrodes. Endogenous stem cells travel along the rostral migratory path from the SVZ to the olfactory bulb. An electric field can coax transplanted stem cells in different directions, and some cells remained viable and expressed differentiation markers several weeks later. —LC

*Stem Cell Rep.* 9, 177 (2017).