

become superconducting at low temperatures. Bismuth, a semimetal with very low carrier density, stays nonsuperconducting down to 10 mK. Prakash *et al.* performed tricky magnetization measurements to show that pure bulk bismuth does undergo the superconducting transition at a tiny temperature of about 0.5 mK (see the Perspective by Behnia). Because bismuth does not fit neatly into the standard picture of superconductivity, further theoretical work is necessary to explain the findings. —JS

*Science*, this issue p. 52;  
see also p. 26

## PLANT EVOLUTION

### Shedding light on fossil lantern fruit

The Solanaceae (or nightshades) are one of the best-studied plant families, yet their evolutionary origins have thus far been relatively obscure. Corroborative fossil evidence of molecular phylogenetic divergence dates has been lacking. Wilf *et al.* present 52-million-year-old fossils of lantern fruits from Argentina, which they ascribe to the modern genus *Physalis*. These fossil finds suggest a much earlier origin of the lantern fruit lineage and indicate that the Solanaceae may have diversified before the final breakup of the Gondwanan supercontinent. —AMS

*Science*, this issue p. 71

## CELL DIVISION

### Recombination revealed by mapping tails

Meiosis is a specialized double cell division that generates haploid gametes from diploid parent cells. Meiotic recombination between homologous chromosomes ensures the proper segregation of chromosomes to the daughter cells. Mimitou *et al.* carried out a genome-wide survey of resection of the ends of DNA double strand breaks in yeast. Resection generates single-stranded tails that are

vital for meiotic recombination. The Tel1 kinase promoted initiation of resection. Nucleosomes, which normally package DNA, needed to be disassembled to allow rapid and efficient resection. —GR

*Science*, this issue p. 40

## FLEXIBLE ELECTRONICS

### Trapping polymers to improve flexibility

Polymer molecules at a free surface or trapped in thin layers or tubes will show different properties from those of the bulk. Confinement can prevent crystallization and oddly can sometimes give the chains more scope for motion. Xu *et al.* found that a conducting polymer confined inside an elastomer—a highly stretchable, rubber-like polymer—retained its conductive properties even when subjected to large deformations (see the Perspective by Napolitano). —MSL

*Science*, this issue p. 59;  
see also p. 24

## STRUCTURAL BIOLOGY

### High-resolution insights into the intasome

An essential step in the life cycle of lentiviruses such as HIV-1 is when viral DNA integrates into the host genome, establishing a permanent infection of the host cell. The viral integrase enzyme catalyzes this process and is a major drug target. During viral integration, integrase binds the ends of viral DNA, forming a higher-order structure called the intasome. Passos *et al.* and Ballandras-Colas *et al.* used cryo-electron microscopy to solve the structures of the intasomes from HIV-1 and maedi-visna virus (ovine lentivirus), respectively. These structures reveal how integrase self-associates to form a functional intasome and help resolve previous conflicting models of intasome assembly. —KLM

*Science*, this issue p. 89, p. 93

## IN OTHER JOURNALS

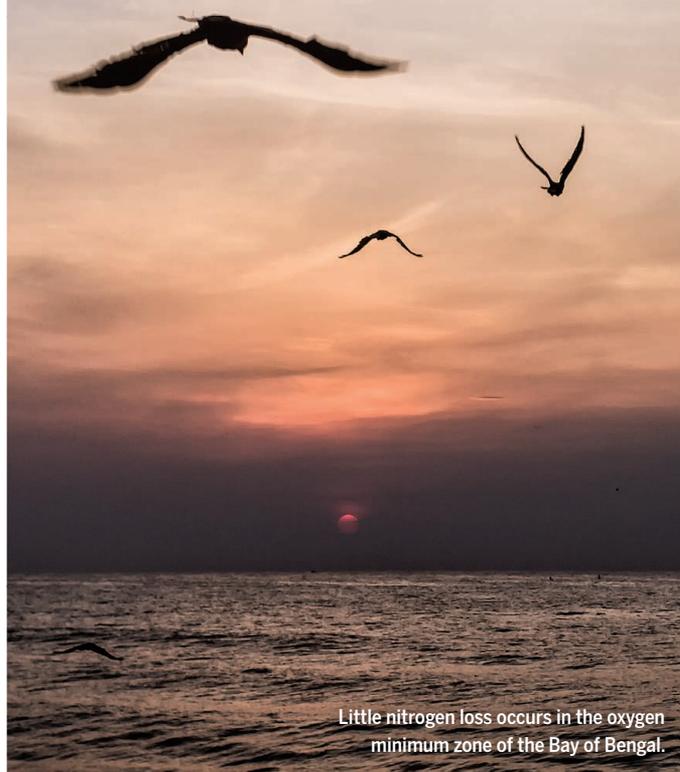
Edited by **Caroline Ash**  
and **Jesse Smith**

### MARINE NITROGEN CYCLE

#### The absence of loss

**A**naerobic microbial processes in oxygen minimum zones cause a disproportionately large fraction of the loss of fixed nitrogen in the open ocean. Interestingly, though, there has been no indication of such nitrogen loss in the oxygen minimum zone of the Bay of Bengal. Bristow *et al.* quantify the abundance of microbial genes associated with N<sub>2</sub> production to help resolve this enigma, finding that the Bay of Bengal supports denitrifier and anammox microbial populations that mediate low but significant N loss while at the same time allowing the trace levels of oxygen to support nitrite oxidation. If this oxygen were removed, nitrogen loss in the Bay of Bengal oxygen minimum zone could accelerate greatly. —HJS

*Nat. Geosci.* 10.1038/NGEO2847 (2016).



Little nitrogen loss occurs in the oxygen minimum zone of the Bay of Bengal.

### MOLECULAR EVOLUTION

#### Beetle ornaments mediated epigenetically

Many male beetles exhibit enlarged ornaments and weapons, which are believed to function in sexual selection. However, the size and degree to which these structures can develop in an individual is variable

and dependent on nutrition. Ozawa *et al.* found that the nutritional effect on the size of the mouthparts of the broad-horned flour beetle is mediated by epigenetic modifying factors, such as histone deacetylases and Polycomb group proteins. Silencing of one histone deacetylase (HDAC1) in the beetle larvae shrank the mandibles of the

ensuing adults, whereas silencing of another (HDAC3) led to exaggerated mouthparts without much affecting other body parts. The results indicate that ornamentation in these beetles is under modular epigenetic control. —LMZ

*Proc. Natl Acad. Sci. U.S.A.* 10.1073/pnas.1615688114 (2016).

## SYNTHETIC BIOLOGY

### Expanding the genetic code in vertebrates

Unnatural amino acids can be incorporated into target proteins by using a transfer RNA (tRNA)–aminoacyl-tRNA synthetase pair that adds an unnatural amino acid at an amber stop codon. The strategy has been used in prokaryotic and eukaryotic cells and for generating transgenic invertebrates. Chen *et al.* have succeeded in integrating a construct coding for the unnatural amino acid *p*-azido-phenylalanine (AzF) into the mouse genome. The artificial gene was transmitted to subsequent generations and caused no obvious physiological defects. Primary cells from adult transgenic mice incorporated AzF into a fluorescent reporter protein containing an amber codon. Similarly, the genetic code of zebrafish was expanded, and *in vivo* incorporation of AzF into reporter protein was achieved. This opens the potential to investigate the function of target proteins in living animals. —VV

*Cell Res.* 10.1038/cr.2016.145 (2016).

## IMMUNOLOGY

### B cells safeguard against premature labor

Around one-third of cases of premature labor are caused by infection and inflammatory responses. B cells are specialized immune cells that should protect from pathogens, but their role in pregnancy is poorly defined. Huang *et al.* have identified a functionally distinct population of B cells in the choriodecidua (a specialized uterine lining that separates the mother from the



B cell failure can cause preterm labor in mice.

fetus) that is associated with preterm labor in women. Mice lacking B cells had diminished levels of progesterone-induced blocking factor 1 (PIBF1) and were also more prone to premature labor after inflammation. But when B cell function was compensated by administering PIBF1, inflammation in the uterus and preterm labor were reduced in the B cell-deficient mice. The cytokine interleukin-33, which normally raises the alarm for inflammation, is responsible for stimulating B cell production of PIBF1. These insights provide therapeutic possibilities for maintaining term pregnancy. —PNK

*Nat. Med.* 10.1038/nm.4244 (2016).

## DEVELOPMENT

### Crumbs2 gets mesoderm moving

The epithelial-to-mesenchymal transition (EMT) is the process by which cells move out of a structured, epithelial tissue and become motile. EMT is implicated in cancer metastasis and is critical during embryonic development. At gastrulation, newly specified mesodermal cells

undergo EMT and move inside the embryo, giving it a trilaminar structure. Ramkumar *et al.* show that in mice, the apical protein Crumbs2 is critical for cells to leave the epithelial epiblast and move inside the embryo to form a new tissue layer. In the absence of this protein, mesoderm formation is disrupted, and cells do not ingress. Instead, a single layer forms, and the embryo fails to properly establish its body plan, leading to embryonic arrest. —SH

*Nat. Cell Biol.* 18, 1281 (2016).

## OPTICS

### An all-optical electron gun

Short bunches of electrons are used extensively to yield information about the structure of materials and the dynamics of phase transitions. Traditionally associated, perhaps, with “big science,” the availability of accelerator beam time and the timing resolution of the pulses can be limiting factors for experimental studies. Huang *et al.* have developed a matchbox-sized all-optical electron gun in which a single terahertz

pulse is injected into a copper waveguide. Synchronized with a photogenerated pulse of electrons, the terahertz pulse accelerates the electron bunch over high fields and with low energy spread so that they can be used for low-energy electron diffraction studies. Further developments could lead to the generation of ultrashort relativistic electron bunches and the prospect of miniaturized accelerators. —ISO

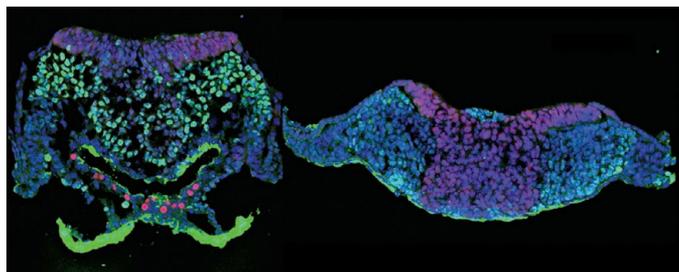
*Optica* 3, 1209 (2016).

## MATERIALS SCIENCE

### A solid approach to improving batteries

Many of the limitations of lithium ion batteries arise from the liquid electrolytes because they limit the operating voltage; they are often flammable and can contribute to the decreased capacity of a cell. Solid-state electrolytes could solve these problems, but there have been challenges at the interfaces to reduce the impedance, and when lithium is used as the anode, it can react with most solid-state electrolyte materials. Han *et al.* show they can solve the interfacial stability and wetting problems between lithium and the garnet-like electrolyte  $\text{Li}_7\text{La}_{2.75}\text{Ca}_{0.25}\text{Zr}_{1.75}\text{Nb}_{0.25}\text{O}_{12}$  by depositing a thin layer of aluminum oxide by means of atomic layer deposition. A full cell using a high-voltage  $\text{Li}_2\text{FeMn}_3\text{O}_8$  cathode robustly cycled at voltages above 4 V. —MSL

*Nat. Mater.* 10.1038/NMAT4821 (2016).



The protein Crumbs2 is essential for gastrulation.

# Science

## An all-optical electron gun

Ian S. Osborne

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