

**NANOPHOTONICS****Sculpting the optical near field**

In the generation of electromagnetic fields, light can be broken down into two components: the far field, which we generally see and is caused by propagating waves, and the near field. The near field presents the nonpropagating component of the electromagnetic field at subwavelength distance from the source of radiation. Probing the near field, however, can also provide detailed, subwavelength information about the emitting source. Ginis *et al.* present a nanophotonic-based method for controlling and manipulating the near-field landscape. This approach provides the possibility of exploiting the near-field component of light for on-chip applications that would normally require bulky optics. —ISO

*Science*, this issue p. 436

**T CELLS****Cytokines for maintaining T cells**

The pathogenic role of the T helper 17 ( $T_H17$ ) subset of  $CD4^+$  T cells in multiple immune-mediated diseases has prompted close scrutiny of the cytokine signals that promote differentiation and maintenance of these cells. Interleukin-6 (IL-6) and transforming growth factor- $\beta$  are key cytokines for  $T_H17$  commitment by naïve T cells, whereas IL-23 supports maintenance of a  $T_H17$  identity. Harbour *et al.* investigated whether persistent IL-6 signaling is also needed to sustain  $T_H17$  cell functions. Mouse T cells deficient in an IL-6 receptor component could not maintain a  $T_H17$  phenotype and were attenuated in their ability to elicit colitis in an in vivo cell transfer model. These studies suggest that there are additional molecular targets for pharmacological interventions aimed at antagonizing

pathogenic  $T_H17$  immunity. —IW  
*Sci. Immunol.* 5, eaaw2262 (2020).

**DEVELOPMENTAL BIOLOGY****Calcium imaging of left-right asymmetry**

The stereotypical left-right asymmetry of our bodies, which is reflected by the positions of the internal organs, is established in the embryo. Two types of cilia collude in this process: motile cilia, which produce directional flow, and immotile cilia, which sense it. Mizuno *et al.* investigated a long-sought role for calcium signaling in breaking symmetry precipitated by the leftward directional flow of fluid at the embryonic midline. Quantitative imaging combined with genetic and pharmacological perturbations revealed two types of calcium transients at the midline: cilium-independent symmetric and cilium-derived asymmetric transients. The asymmetric transients arose in response to leftward fluid flow, and their existence provides an essential missing link in the left-right symmetry breaking cascade. —AKH

*Sci. Adv.* 10.1126/sciadv.aba1195 (2020).

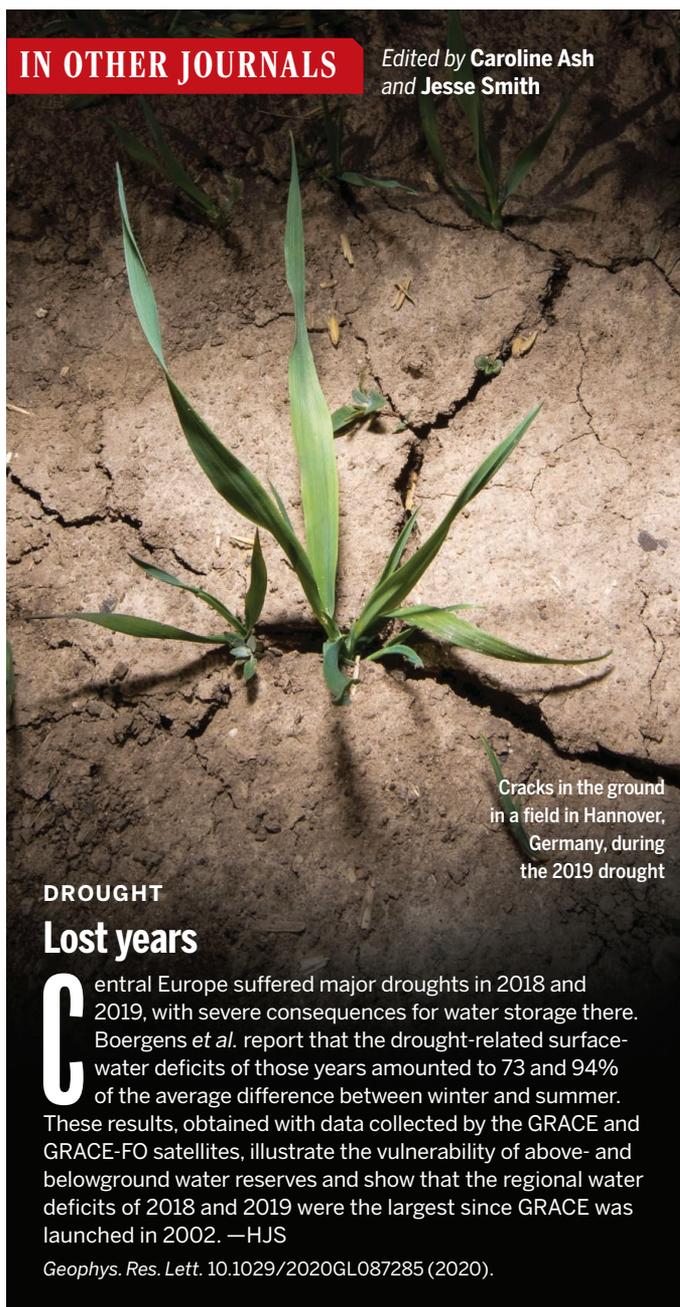
**CELL CYCLE****A cell size sensor**

Efforts continue to uncover the long-sought mechanism by which cells coordinate growth and cell division to maintain a constant size. Zatulovskiy *et al.* propose that human cells sense the concentration of the retinoblastoma family protein Rb. Rb itself acts on transcription factors to inhibit progression through the cell cycle. As cells grow, the concentration of Rb decreases by dilution, and the cell can then divide. In mice heterozygous or homozygous for an Rb gene deletion, the size of liver hepatocytes decreased—and variability in cell size increased—as each Rb allele was lost. —LBR

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**IN OTHER JOURNALS**

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Cracks in the ground in a field in Hannover, Germany, during the 2019 drought

**DROUGHT****Lost years**

Central Europe suffered major droughts in 2018 and 2019, with severe consequences for water storage there. Boergens *et al.* report that the drought-related surface-water deficits of those years amounted to 73 and 94% of the average difference between winter and summer.

These results, obtained with data collected by the GRACE and GRACE-FO satellites, illustrate the vulnerability of above- and belowground water reserves and show that the regional water deficits of 2018 and 2019 were the largest since GRACE was launched in 2002. —HJS

*Geophys. Res. Lett.* 10.1029/2020GL087285 (2020).

**PALEOECOLOGY****Holocene forest dynamics in Africa**

About 2500 years ago, tropical West and Central Africa experienced the so-called Late Holocene Rainforest Crisis, a replacement of forest cover by more open vegetation. How this happened is debated. On the basis of pollen records in lake sediments across the region, Giresse *et al.* conclude that a change to a drier climate likely

caused the forest loss. Their analysis of the archaeological record suggests that human populations were too localized to have created such widespread vegetation changes. Facilitated by seed dispersal by the forest fauna, forest cover gradually recovered over subsequent centuries as the climate ameliorated, even as human populations increased. Present-day forest loss is driven by widespread human deforestation coupled with a warming

climate, with little chance of a similar recovery. —AMS  
*Glob. Planet. Change* **192**, 103257 (2020).

## PHYSICS

### An unusual superconductor

Magnetic fields are often detrimental to superconductivity, causing the electron pairs that form the basis of the superconducting state to break. Some two-dimensional superconductors are unusually resilient to magnetic fields applied parallel to the plane, a phenomenon called Ising superconductivity. This phenomenon typically requires the breaking of inversion symmetry. Liu *et al.* uncovered a different type of Ising superconductivity in high-quality thin films of PdTe<sub>2</sub>, a material in which this symmetry is preserved. When the magnetic field was applied perpendicular to the plane, the researchers observed an unusual metallic state forming at very low temperatures. —JS

*Nano Lett.* 10.1021/acs.nanolett.0c01356 (2020).

## PLANT SCIENCE

### Growing in the light

The tuberous roots of cassava feed over a billion people in Africa, Latin America, and Asia. Cassava will grow productively even on the poorest soils, although yield improves with fertilization. The basis for cassava's productivity is poorly understood. To resolve the effects of photosynthetic rate, cultivar, and environmental inputs, Obata *et al.* profiled the metabolites and enzymes in cassava that contribute to root bulk. They identified source-sink relationships for nitrogen and for the cyanogenic glucosides that protect the plant from herbivores, which must be removed before consumption. Cassava cultivars grown in the lower-nutrient but higher-light environment of African fields were compared with plants grown in greenhouses with better nitrogen supply and lower irradiance. The results point to several

pathways to engineer improved crop yields under suboptimal growth conditions. —PJH  
*Plant J.* **102**, 1202 (2020).

## MEMBRANE PROTEINS

### A stowaway in protein export

In Gram-negative bacteria, outer membrane proteins (OMPs) are inserted by a protein complex known as the  $\beta$ -barrel assembly machinery (BAM). Rodríguez-Alonso *et al.* studied the interactions of a small lipoprotein called RcsF, which is involved in sensing envelope stress, with the BAM complex. They determined a low-resolution crystal structure of the main subunit of BAM in which RcsF binds to the central cavity ahead of an incoming OMP. Biochemical experiments

are consistent with a model in which OMPs are inserted by the BAM-RcsF complex and take RcsF with them, thus avoiding buildup of the BAM-RcsF complex, which is a signal of cell envelope stress. —MAF  
*Nat. Chem. Biol.* 10.1038/s41589-020-0575-0 (2020).

## GENOMICS

### Raising rabbit resistance

European rabbits are a major introduced pest in Australia. As a form of biocontrol, the lethal rabbit haemorrhagic disease virus (RHDV) was introduced to and swept through Australian rabbit populations in the 1990s. Schwensow *et al.* examined the genome-wide genetic changes that occurred in rabbit populations over the 16 years since the introduction of RHDV. During this period, rabbit mortality

has declined, indicating that viral resistance has evolved, as it did for the myxoma virus, which was introduced earlier for rabbit control. Genome-wide sequencing of preserved samples identified 46 single-nucleotide polymorphisms (SNPs) in the rabbit genome that showed signs of selection. Some of these were associated with genes differentially expressed between infected and noninfected rabbits, and simulations confirmed that the observed genetic changes were caused by selection. Moreover, gene ontology indicated that some of the SNPs were associated with mechanisms of viral infection and/or defense. This highlights the value of long-term studies of the coevolutionary race between a virus and host genome. —LMZ  
*Mol. Ecol.* 10.1111/mec.15498 (2020).



Epigenetic comparison of mammals shows that dog methylomes change quickly in early life and they age comparatively rapidly.

## AGING

### Dogs race through development

To get a better understanding of epigenetic changes that occur during development and aging, Wang *et al.* compared lifetime changes in the DNA methylomes of dogs and humans. Changes in methylation of cytosine-guanine dinucleotides in DNA provide an epigenetic clock that corresponds to age in humans and other animals. The authors alleviated some technical difficulties to allow comparison of data from 104 Labrador retrievers with data from humans and mice. The dog methylomes remodeled quickly in early life, reflecting not just life span but also timing of developmental changes. The authors found a strong association of methylation changes in genes that control developmental pathways, indicating that aging is, in some respects, a continuation of development. —LBR *Cell Syst.* **11**, 1 (2020).