

an already effective thin-film dielectric by high-energy ion bombardment further improved the material because of the introduction of specific types of defects that ultimately improved the energy storage performance. The results suggest that postprocessing may be important for developing the next generation of capacitors. —BG

*Science*, this issue p. 81

## SOLAR CELLS

### Stable perovskites with ionic salts

Ionic liquids have been shown to stabilize organic-inorganic perovskite solar cells with metal oxide carrier-transport layers, but they are incompatible with more readily processible organic analogs. Lin *et al.* found that an ionic solid, a piperidinium salt, enhanced the efficiency of positive-intrinsic-negative layered perovskite solar cells with organic electron and hole extraction layers. Aggressive aging testing showed that this additive retarded segregation into impurity phases and pinhole formation in the perovskite layer. —PDS

*Science*, this issue p. 96

## HIV

### Sourcing HIV-1 infection

HIV-1 has a multitude of strain variants, but sexual transmission of HIV-1 is assumed to result from productive infection by only one virus particle. Knowing the genetics of the virus strains that are transmitted could be crucial for developing successful vaccine strategies. Using epidemiological and genetic data from 112 pairs of sexual partners, Villabona-Arenas *et al.* found that individuals with acute infections are more likely to transmit multiple founder virus strains. In a phylodynamic approach that integrated phylogenetic analysis of sequence data with simulation of a transmission chain, the authors

showed that multiple variant transmission is doubled during the first 3 months of infection irrespective of whether transmission was heterosexual or by men who have sex with men. —CA

*Science*, this issue p. 103

## ORGANIC CHEMISTRY

### Using hydrocarbons as reagents

Adding small alkyl groups to complex molecules usually relies on alkyl halide reagents. Laudadio *et al.* now report a convenient method to add ethane and propane directly across conjugated olefins with no prefunctionalization or by-products (see the Perspective by Oksdath-Mansilla). The C–H bond scission in this hydroalkylation is accomplished by a decatungstate photocatalyst that also acts as a hydrogen atom transfer agent to complete the process. The reaction, optimized under flow conditions, works with methane as well, albeit with lower efficiency. —JSY

*Science*, this issue p. 92;  
see also p. 34

## PAIN

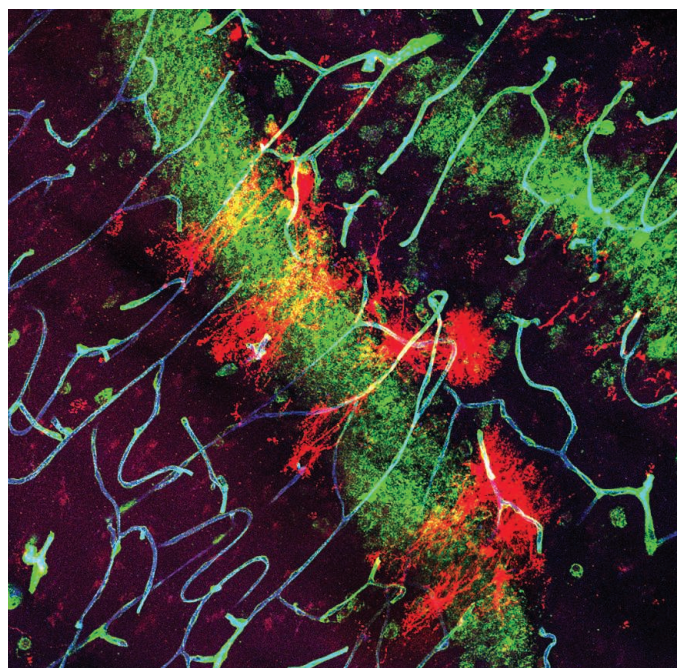
### Inflammatory pain revisits development

An increase in *N*-methyl-D-aspartate (NMDA) glutamate receptors (NMDARs) containing the GluN2B subunit in sensory neuronal synapses is associated with enhanced nociception and pain. In rodents, Zhang *et al.* found that GluN2B content in sensory neurons was progressively restricted during early development and maintained at low abundance by the E3 ubiquitin ligase Cbl-b during adulthood. Peripheral inflammation impaired the interaction of Cbl-b with GluN2B, and the increase in GluN2B abundance enhanced NMDAR activity and neuronal sensitivity to touch. —LKF

*Sci. Signal.* **13**, eaaw1519 (2020).

## IN OTHER JOURNALS

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



Section through the mouse hippocampus showing cellular processes of neural stem cells (red) associating with endothelial cells of blood vessels (blue)

## NEURODEVELOPMENT

### Bloodborne privilege for stem cells

Even in adults, neurons in the brain can regenerate. Progenitor neural stem cells (NSCs) in adult rodents are found in the subventricular zone of the lateral ventricles and the hippocampus. Radial-glia-like NSCs in the hippocampus, as their name suggests, have a tree-like structure. They send thin terminal processes from the subgranular zone into an area called the inner molecular layer. When activated by exercise, for example, NSCs transform into new neurons, but this requires bloodborne components. Licht *et al.* show that NSC processes form direct membrane-to-membrane contact with endothelial cells in specialized areas where the basement membrane is interrupted by zones of vesicular activity. In this way, NSCs circumvent the blood-brain barrier to access molecules that normally cannot penetrate the brain. —PJH  
*eLife* **9**, e52134 (2020).

## CELL BIOLOGY

### Oscillator for centriole formation

Cells are not just bags of enzymes—their functions are orchestrated by organelles. Centrioles, for example, function in cell division and organization of the mitotic spindle and duplicate in coordination with the cell cycle. Centriole formation seems to be

governed by an oscillator that controls the localization and activity of Polo-like kinase 4, the master regulator of centriole biogenesis. Working with the results of experiments in fruit fly embryos, Aydogan *et al.* used a mathematical model to show that this oscillator controls centriole biogenesis independently of the cell cycle oscillator. This model also explains homeostasis of

centriole size. Other organelles may also use such oscillators to time the initiation and duration of growth, and it is possible that circadian and cell cycle oscillators entrain the local organelle-controlling oscillators. —LBR

*Cell* **181**, 1566(2020).

## HUMAN GENETICS Populations of ancient France

Ancient DNA has identified changes in human population genetic structure across Europe for the past 10,000 years or so. However, the area that constitutes modern-day France is a bit of a blank. Brunel *et al.* examined mitochondria, Y chromosomes, and nuclear loci from 243 individuals and low-coverage genomes from 58 people spanning ~7000 years from sites within modern-day France. From this survey, they identified Mesolithic similarities to Iberian hunter-gatherer populations that retained genes from two Late Pleistocene lineages. During the Neolithic, and then again in the Bronze age, transitions in genetic ancestry were observed

during cultural and technological transitions. Fewer changes were observed during the transition from the Bronze Age into the Iron Age; these individuals had a genetic composition similar to that of the modern-day French. This study reveals successive migrations, major cultural changes, and admixture events, the traces of which are still found in current European populations, as well as evidence of an Upper Paleolithic admixture from the Iberian Peninsula. —LMZ

*Proc. Natl. Acad. Sci. U.S.A.* **117**, 12791 (2020).

## ANTIBIOTIC RESISTANCE Gut busters in a slurry

Antibiotic-resistant pathogens exist within species-rich communities of other microorganisms. Interactions between pathogens and commensal organisms are anticipated to influence resistance. The microbiota could act competitively to suppress pathogens but also allow nutrient sharing or horizontal transfer of resistance genes. To work out what might happen in a near-natural community, Baumgartner *et al.* developed

a gut microcosm setup using donated anaerobic human microbiota, an introduced tagged *Escherichia coli*, and the  $\beta$ -lactam antibiotic ampicillin. In this system, antibiotic resistance only evolved in the *E. coli* strain when the resident commensals were knocked back, even when resistance genes and plasmids were present among the commensals. —CA

*PLOS Biol.* **18**, e3000465 (2020).

## ORGANIC CHEMISTRY Ironing out crowded dihydroxylations

It is essential in drug synthesis to select between mirror image products, and asymmetric dihydroxylation of carbon-carbon double bonds is a means of doing so. The chief drawback of this reaction is that it requires the use of rare and toxic osmium. The alternative use of safer, more abundant metals has tended to limit the substrate scope to simple olefins. Wei *et al.* now report through ligand optimization a highly selective and efficient iron catalyst for the dihydroxylation of trisubstituted

olefins. The reaction operates at room temperature with hydrogen peroxide as oxidant. —JSY

*Angew. Chem. Int. Ed.* **10.1002/anie.202002866** (2020).

## NANOMATERIALS Graphene templating of hexagonal BeO

Liquid droplets encapsulated by two graphene sheets can experience high pressure (up to 1 GPa) and can act as vessels for crystallization of two-dimensional materials. Wang *et al.* studied the crystallization of beryllium oxide (BeO) in such a cell with high-resolution transmission electron microscopy and electron energy loss spectroscopy. Instead of forming the bulk wurtzite structure, it crystallized into an  $sp^2$ -coordinated hexagonal structure that was typically 20 to 30 layers thick. This thickness makes the material metastable relative to wurtzite, and the authors argue that the non-interacting graphene surface kinetically templates the hexagonal phase. —PDS

*Angew. Chem. Int. Ed.* **10.1002/anie.202007244** (2020).

Saturn's icy moon Dione may have a subsurface liquid water ocean.

### ICY MOONS

## Does Dione have a liquid water ocean?

Several icy moons orbiting the giant planets have oceans of liquid water beneath their solid ice surfaces. It has been suggested that Dione, the fourth largest moon of Saturn, could have a similar subsurface ocean. Zannoni *et al.* analyzed radio-tracking data taken when the Cassini spacecraft (named after the astronomer who discovered Dione in 1684) flew past the moon on three occasions

between 2011 and 2015. They reconstructed Dione's gravity field, combined it with measurements of topography, and then matched the geophysical properties with models of the interior structure. Their analysis supports the interpretation that Dione has a small, deep, subsurface liquid ocean, but they caution that the models are not fully constrained. —KTS *Icarus* **345**, 113713 (2020).

## Graphene templating of hexagonal BeO

Phil Szuromi

*Science* **369** (6499), 46-47.

DOI: 10.1126/science.369.6499.46-g

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