

being dependent on the size of the nanocube and electrically tunable, the results demonstrate a powerful platform with which to develop sensors in what has been a challenging wavelength regime where molecular fingerprints reside. —ISO

*Science*, this issue p. 1219

## MOLECULAR MACHINES

### Ten rings on one axle

Rotaxanes consist of molecular rings threaded on a central axle. Most approaches to their synthesis have focused on introducing a single ring per axle. Qiu *et al.* now report a systematic approach to threading up to 10 adjacent rings consecutively. The axle's end groups were constructed to attract free-floating rings when reduced and then to push those rings toward the center upon oxidation. Products of each successive reduction-oxidation cycle were characterized by nuclear magnetic resonance spectroscopy and mass spectrometry. —JSY

*Science*, this issue p. 1247

## INSECT LOCOMOTION

### Robot on a wire

Studying the free flight of insects using artificial systems such as tethered flight or flight in confined environments can cause the insect to fly in an

unnatural way. Pannequin *et al.* report a cable robot consisting of an open cage mounted with cameras, which they call "lab-on-cables." The cable robot moves automatically with the flying insect by using reactive controllers to track the insect's flight in natural conditions with limited disturbance. Using this system, the researchers were able to study *Agrotis ipsilon* moths flying freely at speeds of up to 3 meters per second. —MML

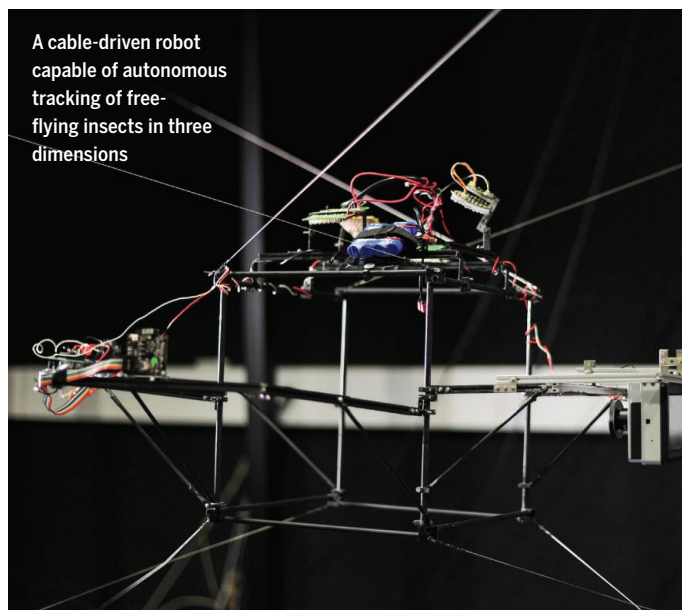
*Sci. Robot.* **5**, eabb2890 (2020).

## ICE SHEETS

### Taking stock of our losses

Earth's ice sheets are melting and sea levels are rising, so it behooves us to understand better which climate processes are responsible for how much of the mass loss. Smith *et al.* estimated grounded and floating ice mass change for the Greenland and Antarctic ice sheets from 2003 to 2019 using satellite laser altimetry data from NASA's ICESat and ICESat-2 satellites. They show how changing ice flow, melting, and precipitation affect different regions of ice and estimate that grounded-ice loss averaged close to 320 gigatons per year over that period and contributed 14 millimeters to sea level rise. —HJS

*Science*, this issue p. 1239



A cable-driven robot capable of autonomous tracking of free-flying insects in three dimensions

## IN OTHER JOURNALS

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

### GENETICS

#### Big cat genomics

The lion may be the king of beasts, but over the past ~14,000 years, their range has decreased substantially and many current populations are in decline. To understand the historical population genomics of lions, de Manuel *et al.* sequenced cave lion remains from ~30,000 years ago, several historic specimens from extinct populations over the past ~500 years, and samples from extant populations. From this, they were able to reconstruct relationships among lion populations over time. No evidence of gene flow between cave lions and recent lion populations was detected. Modern lion groups that diverged into northern and southern lineages show evidence of admixture, especially in extant central African populations. These data could be valuable not only because they indicate the relationships between modern and extinct populations but also because they reveal a historical level of inbreeding that could be relevant to conservation efforts. —LMZ

*Proc. Natl. Acad. Sci. U.S.A.* **117**, 10927 (2020).

### SIGNALING

#### Controlling blood flow in the liver

High blood pressure in the liver created by fibrosis causes serious clinical illness. Blood pressure is regulated by nitric oxide, but this is depleted if hepatic sinusoidal endothelial cells are damaged. The scaffold protein  $\beta$ -arrestin 2 ( $\beta$ -Arr2) regulates the activity of endothelial cell nitric oxide synthase (eNOS) in rodent liver. Liu *et al.* found that in rodents,  $\beta$ -Arr2, which serves several functions in G protein-coupled receptor signaling, helps to control eNOS at endothelin receptors.  $\beta$ -Arr2 promoted the association of another protein called GIT1 with eNOS, which activates eNOS. Apparently,  $\beta$ -Arr2 and other signaling components form a signalsome near the endothelin receptors, which regulates eNOS function. Disruption of this signaling contributes to the liver injury and portal

hypertension that cause lethal liver disease in humans. —LBR

*Proc. Natl. Acad. Sci. U.S.A.* **117**, 11483 (2020).

### MIGRATION

#### Should I stay or should I go?

The global upheaval of seasonal bird migration is an astonishing phenomenon. The European blackcap is a species of small songbird that shows great variation in wanderlust. Delmore *et al.* collected DNA-sequencing data from blackcaps across their breeding range to determine the genetic basis for variations in migratory behavior. The impulse to migrate and the distance and direction of travel are encoded in small genomic regions. Polymorphisms were found in genes for transcription factors such as Clock, Npas2, and Bmal1, which are associated with circadian rhythm. A few genes linked to traits as varied



Gir lions are a remnant population of a few hundred northern lions, mostly found in Africa, that are just surviving in India.

as hyperphagia and fat deposition, learning and memory, and wing length also appear to be under strong selection to rapidly evolve new behaviors. The suite of blackcap migratory genes is distinctive, and it appears that there are many ways to genetically program migration in birds. —CA

*eLife* **9**, e54462 (2020).

## NANOMATERIALS

### Pattering nanoparticles with DNA origami

Complementary DNA strands can be used to assemble nanoparticles through specific connections, but creating multivalent directional connections is still challenging. Xiong *et al.* used DNA origami—a two-dimensional open square and a three-dimensional tetrahedron framework—to position DNA linkers on nanoparticles. These molecular stamping, or MOST, frames were “inked” with

single-stranded DNA that transferred onto a gold nanoparticle bound inside the frame. On release, the particles could then undergo complementary strand binding with smaller gold nanoparticles to form clusters. By using different inks within the frame, gold particles of different sizes could be assembled onto the central particle. The angles between the particles in these heterogeneous clusters could also be controlled through steric effects. —PDS

*ACS Nano*. 10.1021/acsnano.0c00607 (2020).

## PSYCHOLOGY

### Procedural justice improves policing

Research on procedural justice emphasizes the importance of treating people fairly regardless of the outcome they receive. Procedural justice strategies include increased transparency, communication, and

responsiveness to civilian concerns. Wood *et al.* examined whether the introduction of a procedural justice training program for police officers in Chicago had an impact on encounters between police and civilians. It was found that fewer complaints were registered against officers who received the training, and trained officers were less likely to use force during civilian encounters. These findings have implications for designing scalable interventions that build police legitimacy. —TSR

*Proc. Natl. Acad. Sci. U.S.A.* **117**, 9815 (2020).

## MACHINE LEARNING

### Learning macro from micro

Determining atomic structural correlations in condensed-phase systems is crucial for understanding material properties and their behavior

at the macroscale. It represents one of the central challenges in modern statistical mechanics because of the complex collective behavior emerging from microscopic many-body interactions. Using two classical condensed-phase models, a Lennard-Jones system and a hard-sphere fluid, Craven *et al.* show that machine learning methods trained on a set of optimally short molecular dynamics simulations can predict radial distribution functions with increased accuracy by an order of magnitude or even greater compared with traditional analytical approaches. The proposed methodology is general and could be applied more broadly across diverse condensed-phase systems. —YS

*J. Phys. Chem. Lett.* 10.1021/acs.jpcclett.0c00627 (2020).

## NEUROSCIENCE

### Inositol-triphosphate receptors in axons

Inositol-triphosphate (IP<sub>3</sub>) receptors regulate the intracellular calcium concentration in the somatodendritic compartment of central neurons. Whether axons also possess functional IP<sub>3</sub> receptors and what impact their activation might have are not known. Cerebellar Purkinje cells offer an ideal model because they contain a high level of IP<sub>3</sub> receptors. Using chromophore tags that release IP<sub>3</sub> when irradiated, Gomez *et al.* found that functional IP<sub>3</sub> receptors are present in the entire axon. Different axon regions displayed different IP<sub>3</sub>-producing pathways, and IP<sub>3</sub> receptor activation had different consequences depending on receptor localization. For instance, IP<sub>3</sub> receptor activation in synaptic terminals caused neurotransmitter release, and receptor activation in the axon initial segment blocked action potential firing. IP<sub>3</sub> receptor-linked signaling pathways may therefore be important in controlling axon functions. —PRS

*Proc. Natl. Acad. Sci. U.S.A.* **117**, 11097 (2020).



# Science

## Procedural justice improves policing

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