

## CHEMISTRY

**Mating disks and rods into an ordered phase**

Disk-shaped molecules tend to stack in columns, whereas rod-shaped ones tend to align parallel to each other. When the two types of molecules are mixed, they tend to phase separate. Yano *et al.* found the right recipe that allowed enough affinity between the disks and rods so that they formed a blended twisted columnar phase. The phase could be stabilized by polymerizing the disks. The orientation of the twisted columns could be altered using electric fields, whereas optical stimuli could lead to a second ordering transition. —MSL

*Science*, this issue p. 161

## TROPICAL ECOLOGY

**Forest termites mitigate the effects of drought**

In many tropical regions, where drought is predicted to become more frequent in the coming years, termites are key components of ecosystem function. Ashton *et al.* experimentally manipulated termite communities to quantify their role during the 2015–2016 “super El Niño” drought in a Malaysian tropical rainforest. Termite relative abundance more than doubled in control plots during drought, maintaining three major ecosystem processes: decomposition, nutrient heterogeneity, and moisture retention. Seedling mortality increased where termites were suppressed. —AMS

*Science*, this issue p. 174

## SEXUAL SELECTION

**Who’s a clever boy then?**

There is considerable value in choosing a smart mate. The suggestion that mate choice has thus shaped the evolution of cognition has been around since Darwin’s time, but testing this hypothesis is difficult. Chen *et al.* found that female budgerigars shifted their preference to previously nonpreferred males after these males demonstrated

the ability to solve a problem that stumped the originally preferred males (see the Perspective by Striedter). This preference shift was specific to problem-solving and to choosing males. —SNV

*Science*, this issue p. 166;

see also p. 120

## CIRCADIAN RHYTHMS

**Astrocytes can drive the master clock in the brain**

The neurons of the suprachiasmatic nucleus (SCN) of the hypothalamus function as a central circadian clock, coordinating mammalian physiology with the 24-hour light-dark cycle. Brancaccio *et al.* found that these neurons have help from neighboring astrocytes (see the Perspective by Green). In mice lacking the *Cry* gene, which encodes a critical clock component, restoration of *Cry* expression and molecular clock function in the astrocytes, but not the neighboring neurons, restored rhythmic transcriptional oscillations in the SCN and reestablished circadian behaviors in the mice. —LBR

*Science*, this issue p. 187;

see also p. 124

## OPIOID OVERDOSE

**A step toward preventing overdose**

Opioid addiction and overdose remain serious health concerns in the United States. Naloxone can reverse opioid overdose but must be administered in a timely manner. Toward this goal, Nandakumar *et al.* configured a smartphone to detect changes in respiration that precede opioid overdose. Using sonar, the smartphone detected respiratory depression and apnea (temporary lack of breathing) after self-injected drug use in a supervised injection facility. Respiratory changes while under general anesthesia, which simulates opioid-induced overdose, were also detected in a clinical setting. —CC

*Sci. Transl. Med.* **11**, eaau8914 (2019).

## IN OTHER JOURNALS

Edited by Caroline Ash  
and Jesse Smith



## NEUROSCIENCE

**Chronic short sleep and neurodegeneration**

The locus ceruleus is a brain region that is critical for optimal cognitive performance and brain health. Its neurons degenerate during mild cognitive impairment and the early stages of Alzheimer’s disease (AD). Zhu *et al.* investigated the role of chronic sleep deprivation on the protein tau, which is found abundantly in the brain and is associated with AD. In mice, a shortage of sleep in early life advanced the temporal progression of toxic tau accumulation, worsened neurobehavioral impairment, and increased the abundance of soluble tau oligomers within the locus ceruleus and other regions. Lack of sleep promoted neurodegeneration in the locus ceruleus and other tau-affected areas, and the effects persisted for months. Chronic sleep disruption may thus contribute to the progression of AD and related diseases. —PRS

*J. Neurosci.* **38**, 10255 (2018).

## INFLUENZA

**More tricks up its sleeve**

Influenza viruses are famous for generating variants that evade immune surveillance—and our vaccines. Vahey and Fletcher describe another way these viruses elude control. The authors made a strain of influenza A virus that expressed fluorescently labeled components and used them to infect cells. Live-cell imaging was then used to monitor the composition and morphology of virus particles as they were released from infected cells. Influenza A was found to produce very variable virus particles, unlike many other human viruses whose morphology and composition are consistent. This variability appears to be stochastic and allows progeny viruses to escape the effects of neuraminidase drugs, which would normally prevent successful infections. —SMH

*Cell* **10.1016/j.cell.2018.10.056** (2019).



## RAIN

### The meteorological future is here

**C**limatologists have predicted that anthropogenic climate change will cause more and more intense rainfall (along with other meteorological extremes), and it seems like that is occurring, but have precipitation patterns really changed enough to be objectively noticeable? Lehmann *et al.* present data showing that this impression does accurately reflect reality. They show that heavy rainfall events now occur more frequently than they did only 40 years ago in most of the world, except in Central Africa, where record-dry months have become more common. These trends are consistent with the changes in mean monthly precipitation expected to accompany climate change and should become more extreme in the future. —HJS

*Geophys. Res. Lett.* 10.1029/2018GL079439 (2018).

Extreme rainfall events are becoming more common with climate changes in many regions around the world.

## IMMUNOLOGY

### Fungi affect gut-lung cross-talk

Fungal dysbiosis in the gut may occur after antibiotic treatment. This happens because specific microorganisms that support natural resistance are eliminated. In certain cases, fungal dysbiosis can promote allergic airway disease (AAD). Li *et al.* administered fluconazole to mice and found that it exacerbated AAD responses to house dust mite. An environment free of fungi abrogated this effect, whereas feeding mice dysbiosis-associated fungi enhanced AAD, even in mice with otherwise normal microflora. The researchers

then examined the role of CX3CR1<sup>+</sup> mononuclear phagocytes (MNPs), which recognize and take up fungi in the gut. Syk-mediated activation of CX3CR1<sup>+</sup> MNPs was required, potentially through the priming of fungal-specific helper T cells. —STS

*Cell Host Microbe* 24, 847 (2018).

## ANIMAL MECHANICS

### Water-speed-record geckos

House geckos are most commonly observed in acrobatic hunting chases across ceilings of buildings. They are not normally thought of as aquatic. But Nirody *et al.*

have discovered that geckos are adept at hydroplaning across the surface of ponds in Singapore. This lizard's quadrupedal slapping gait creates air cavities under its feet that serve to keep its head above water while leaving its tail underwater. If soap is added to water, the geckos struggle, because they also exploit surface tension. Plus, they can undulate their bodies and tails in the style of alligators. Thus, a complete range of acrobatic and anatomical talent is put to good effect in the gecko's unimpeded scampering across water, all of which might inform future robot design. —CA

*Curr. Biol.* 28, 4046 (2018).

House geckos' agility, gait, and anatomy allow them to run on water just as fast as they do on ceilings.



## ULTRAFAST METROLOGY

### Getting your timing right

The generation of femtosecond and attosecond pulses of light and electrons in the laboratory provides the ability to probe the dynamics of some of the fastest processes that occur in nature. For larger facilities, however, achieving such performance levels requires synchronization across many components, operational wavelengths, and sometimes across infrastructure separated by kilometers. Xin *et al.* review the various approaches and characterization technologies being developed to synchronize the operation of large-scale systems, outlining the obstacles and possible directions to take on the way to meeting those precision timing challenges. Matching the timing capability in large user facilities with devices such as free-electron lasers and extreme light sources would allow these facilities to reach their potential for imaging ultrafast processes in biological and condensed matter systems. —ISO

*Optica* 5, 1564 (2018).

## FUNCTIONAL MATERIALS

### A functional materials map

Chemical bonding is important for understanding and designing new functional materials. In two papers, Wuttig *et al.* and Raty *et al.* propose a bonding type they term "metavalent." Metavalent materials lie between covalently and metallically bound ones but are distinctly different from both. Several of the compounds that plot in the metavalent field have unique and important physical properties that make for good thermoelectric, phase-change, and other functional materials. The new bonding category potentially provides a guide for the development of interesting new materials. —BG

*Adv. Mater.* 10.1002/adma.201803777, 10.1002/adma.201806280 (2018).

# Science

## More tricks up its sleeve

Stella M. Hurtley

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