two orders of magnitude faster than the ion diffusion in bulk water. —MSL

Science, this issue p. 501; see also p. 459

### ACUTE LUNG INJURY

# ROS-mediated lung protection

Neutrophils accumulate in the lung after acute lung injury (ALI) and play a role in the innate immune response through multiple mechanisms, including the production of reactive oxygen species (ROS). Yuan et al. investigated the mechanisms regulating ROS production during ALI and developed a therapeutic intervention. The authors found that the kinases MAP3K2 and MAP3K3 inhibited ROS production from neutrophils. Pazopanib, a specific MAP3K2/3 inhibitor. ameliorated ALI in mice by modulating phosphorylation of p47, a subunit of the NADPH oxidase 2 complex. This treatment was effective in reducing pulmonary edema in a pilot study in patients who underwent lung transplantation. --MM

Sci. Transl. Med. 13, eabc2499 (2021).

#### ECOSYSTEM ENGINEERS Digging for water

Water is scarce in dryland ecosystems. Some larger animals in these regions dig wells that may provide water to other species. This behavior may have been common among megafauna that are now extinct, especially in North and South America, where megafaunal extinctions were the most severe. Lundgren et al. tested whether feral equids (horses and donkeys) reintroduced to desert regions in the North American southwest dig wells that provide ecosystemlevel benefits. They found that equid-dug wells increased water availability, were used by a large number of species, and decreased distance between water sources. Abandoned wells also led to increased germination in key riparian tree species. Such equid-dug wells improve water availability, perhaps replacing a lost megafaunal function. -SNV Science, this issue p. 491

#### IMMUNOLOGY Putting DCs into overdrive

When dendritic cells (DCs) detect signals indicative of infection. cell death, or cancer, they respond by activating a signaling complex known as the inflammasome, which results in proinflammatory cytokine secretion but usually leads to the death of the DCs. By analyzing human primary DCs from the blood, spleen, and bone marrow, Hatscher et al. found that type 2 conventional DCs, in an unusual turn, did not die after inflammasome-induced cvtokine secretion. Instead, these cells entered a hyperactive state that elicited more effective responses from certain T helper cell subsets. —LKF

Sci. Signal. 14, eabe1757 (2021).



Horses and donkeys dig shallow wells that are used by many species.

# **IN OTHER JOURNALS**

Edited by Caroline Ash and Jesse Smith

> Escherichia coli uses several defense systems against T4 phage parasites, one of which is shown here in a colored electron micrograph image.

# рнаде defense toxIN death knell

acteria have diverse mechanisms to protect themselves against phage. Some, such as the CRISPR-Cas system, are always ready to recognize and eliminate invaders. Others, such as toxin-antitoxin systems, are only activated after phage infection. Guegler and Laub investigated the toxIN system that protects Escherichia coli against several bacteriophages. The toxin, toxN, is a ribonuclease and the antitoxin, toxl, is an RNA with an array of repeats. Under normal conditions, toxN cuts toxI and binds the single motif. Infection by the phage T4 shuts off host transcription, including transcription of *toxIN*. Because *toxI* is unstable, toxN is released to cleave mRNA in the cell, which by this time is mainly phage derived. This prevents the production of new phage particles. Thus, by appropriating the host's replicative machinery, phage also risk releasing their toxIN nemesis. –VV Mol. Cell 10.1016/j.molcel.2021.03.027 (2021).

# **3D GENOME** "Slinky" chromatin in archaea

Only eukaryotes and archaea use histones to package their DNA. This observation has prompted suggestions of an evolutionary affinity between these two domains of life. However, there are many differences between the structure of histones between the domains. Bowerman *et al.* extended earlier work to show how archaeal histones store and unpack DNA. In eukaryotes, a packet of four pairs of histones wraps around every ~147 base



#### NANOCARBON SCIENCE

**One-dimensional self-assembly of curved NGs** 

ince the first experimental detection of graphene, a huge research effort has been made to implement its exceptional properties in carbon-based technologies. The well-ordered molecular alignments using small pieces of graphene called nanographenes (NGs) can be used to engineer supramolecular structures for certain practical applications. Kato et al. report the discovery of a negatively curved NG that is able to spontaneously self-assemble in one dimension by continuous  $\pi-\pi$  stacking without any assisting substituents. This NG forms double-helix supramolecular all-sp<sup>2</sup>carbon nanofibers that demonstrate high gelation efficiency. This work paves the way for the design and synthesis of supramolecular materials based on analogous NGs that have great potential in future applications. -YS J. Am. Chem. Soc. 143, 5465 (2021).

pairs of DNA in a structure called a nucleosome. By contrast, the archaeal equivalent of a nucleosome, the archaeasome, forms a histone core with more than four histone pairs. Archaeasomes can expand, in effect stretching the coil, to open up the DNA in a way that is very different from how this process occurs in eukaryotes. —DJ

eLife 10, e65587 (2021).

# **IMMUNOMETABOLISM Mobilizing metabolism** against HIV

HIV-1 alters the metabolism of infected immune cells, targeting lipid, tryptophan, and glucose metabolic pathways by mechanisms that remain poorly understood. Guo et al. used transcriptomics and proteomics to discern the details. HIV-1 infection enhanced associations between NLRX1. a mitochondrial antiviral pattern recognition receptor, and FASTKD5, a protein that modulates mitochondrial energy use. This change increased oxidative phosphorylation (OXPHOS) and glycolysis, which in turn promoted viral replication. HIV-1 replication in vitro became compromised when OXPHOS was inhibited by the antidiabetic drug metformin. Thus, supplementation of combination antiretroviral therapy with metformin and other drugs targeting these metabolic pathways could be helpful in the treatment of HIV-1. -STS Nat. Immunol. 22, 423 (2021).

#### **EVOLUTION Relative immunity**

Humans and other apes tend to respond differently to infection compared with other primates. For instance, baboons can tolerate almost 10-fold greater

exposure to bacterial cell wall material than humans can before developing septic shock. Hawash et al. suspected that innate immune signaling lies at the heart of the differences observed among different types of primates. The authors looked at whole-genome expression patterns of leukocytes from four diverse primates within 24 hours of responding to viral and bacterial pathogens. Indeed, the apes' innate responses were first off the mark. This finding indicates that apes undergo immediate pathogen clearance despite the risk of potential collateral damage to self. This is possibly because, evolutionarily, this strategy favors the longer-lived apes, who experience more pathogen exposure during their lifetimes. -CA

> Proc. Natl. Acad. Sci. U.S.A. 118, e2015855118 (2021).

## CONFINED CATALYSIS Carbon nitride nanotube reactors

Confinement of catalyzed reactions in nanoscale spaces can lead to higher activity and selectivity and may also help to stabilize catalysts. Zou et al. fabricated a free-standing membrane of carbon-nitride nanotubes (~40-nanometer pore diameter) by polymerizing melamine in anodized aluminum membrane templates. After etching and freeing the membrane, exposure to visible light generated electronhole pairs that could be used to degrade methylene blue or, with the addition of gold nanoparticles in the pores, to oxidize amines such as benzylamine in imines in the presence of oxygen. The higher reactivity relative to bulk catalysts was attributed to a strong electric field effect on substrates, longer photogenerated charge lifetimes, and enhanced fluid flow and oxygen diffusion within the channels. -PDS ACS Nano 10.1021/acsnano.0c09661

(2021)

#### **PSYCHOLOGY** Structural whitening

As the US population becomes more racially diverse, it is unclear how ethnic white populations will respond to these demographic changes. Anicich et al. found experimentally that when white Americans were given the opportunity to populate fictional cities, they imposed greater racial segregation in areas that they frequented more often, such as work or school, because they feel greater anxiety around non-whites. In a follow-up study, the authors examined policies at tennis and golf clubs across the United States, and found that in areas with higher racial diversity, clubs engaged in more exclusionary behavior, such as enacting strict dress codes. These findings suggest that as racial diversity increases, white Americans may respond by trying to structure their environment in more segregated ways. -TSR