IMMUNOLOGY

Peptide mimicry breaks the heart

Myocarditis, a prolonged chronic inflammation of heart muscle, can eventually progress to inflammatory cardiomyopathy, a serious condition associated with heart failure. Activated T helper (T_H) cells that recognize myosin heavy chain 6–derived peptides are thought to play a central role in this pathogenesis. Using a mouse model of myocarditis, Gil-Cruz *et al*. found that cardiac myosin–reactive T_H cells are initially primed by myosin-peptide mimics derived from commensal *Bacteroides* species in the gut (see the Perspective by Epelman). Unlike healthy controls, human myocarditis patients also showed detectable immune reactivity to both *Bacteroides* and cardiac myosin antigens. Treatment with antibiotics dampened inflammatory responses and prevented lethal heart disease. —STS

Science, this issue p. 881; see also p. 806

NUTRIENT DELIVERY

Mitigating micronutrient deficiency

Micronutrient deficiencies that impair growth and contribute to disease remain leading public health concerns, particularly within the developing world. Although fortification of food can help treat deficiencies, heat used during cooking and other conditions can degrade vitamins, preventing adequate absorption. Anselmo *et al*. developed a polymer coating to encapsulate micronutrients, 11 of which showed improved stability against oxidation, heat, and other conditions. Micronutrients were absorbed by the intestine when microparticles were administered to rodents. The researchers used data from two clinical trials and experiments using human intestinal tissue to optimize microparticle formulations, enhance iron loading, improve bioavailability, retain stability during cooking, and allow for scale-up. This microparticle platform could help improve oral delivery of micronutrients. —CC

Sci. Transl. Med. **11**, eaaw3680 (2019).

ANTHROPOLOGY

Change in climate withered an empire

From roughly 912 to 609 BCE, the Neo-Assyrian Empire rose as one of the most powerful superpowers of its time, dominating much of the Near East. Sinha *et al*. propose that megadroughts played an important role in the rapid decline in the empire's power, from its height around 670 BCE to its collapse only six decades later. Precisely dated cave deposits from northern Iraq preserved a record of precipitation and effective moisture over a 4000-year period that includes the span of the Neo-Assyrian Empire. This record demonstrates that the rise of the empire occurred during a roughly 200-year interval of abundant rainfall. Subsequently, severe megadroughts characterized the climate across the empire, likely contributing to the empire's rapid decline. —KVH

Sci. Adv. 10.1126/sciadv.aax6656 (2019).

ELECTROCHEMISTRY

Nanocage-chain fuel cell catalysts

The expense and scarcity of platinum has driven efforts to improve oxygen-reduction catalysts in proton-exchange membrane fuel cells. Tian *et al*. synthesized chains of platinum-nickel alloy nanospheres connected by necking regions. These structures can be etched to form nanocages with platinum-rich surfaces that are highly active for oxygen reduction. In fuel cells running on air and hydrogen, these catalysts operated for at least 180 hours. —PDS

Science, this issue p. 850

IN OTHER JOURNALS

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

ORGANIC CHEMISTRY

Anti-Markovnikov hydroamination

Catalytic hydroamination is an efficient and waste-free way to form amines, enamines, and imines, which are important synthetic intermediates in many organic syntheses of bioactive compounds and often have essential physiological and biological activity themselves. The development of these types of hydroamination reactions is a persistent research topic in organic and pharmaceutical chemistry. Miller *et al*. report a synthetic protocol for the intermolecular anti-Markovnikov hydroamination of unactivated alkenes with primary alkylamines to generate secondary amine products in the presence of an iridium photocatalyst and a thiol cocatalyst. This protocol addresses a long-standing synthetic challenge of monoalkylation of primary amines and demonstrates high selectivity for secondary amines over tertiary amine products, though further work is required to understand its underlying mechanism. —YS

J. Am. Chem. Soc. **141**, 16590 (2019).

POLLINATION

Nectar—but not for parasites

Bumble bees are vulnerable to parasitism by a flagellated trypanosome (some species of which are important human pathogens). The parasite *Crithidia bombi*, in combination with environmental stresses, can promote declines in bumble bee populations by reducing foraging and reproductive success. Koch *et al*. developed a chromatographic pipeline to efficiently search for natural products in single-species honey that might protect pollinators. Of the four most bioactive species the authors found, nectar from *Calluna vulgaris*, an iconic moorland plant in the United Kingdom, contains a compound called callunene, which promotes flagella shedding by the parasite, eliminating its ability to attach to the bumble bees' gut epithelial cells and cause infection. If bees ingest *C. vulgaris* nectar in high amounts, they are protected from infection, but if they are already infected, there is no curative effect. —CA

Curr. Biol. **29**, 3494 (2019).

PHOTO: RDW AERIAL IMAGING/ALAMY STOCK PHOTO

FOREST CONSERVATION

Corridors for biodiversity among oil palms

Connections between areas of natural habitat are key to conservation in landscapes fragmented by human activity. Scriven *et al*. modeled the effectiveness of set-aside conservation patches in oil palm plantation landscapes in Borneo for connectivity among forest organisms with different levels of dispersal ability. They found that the connectivity benefits of the set-aside patches, if they are fully reforested, would be greatest for relatively poorly dispersing organisms, such as smaller winged insects. These findings provide guidance for the effective management of the patches of habitat and biodiversity that remain in these highly impacted landscapes. —AMS

J. Appl. Ecol. **56**, 2274 (2019).

Forest corridors in oil palm plantations help the dispersal of smaller organisms.

T CELLS

VISTA is a pH-selective checkpoint

The V-domain immunoglobulin suppressor of T cell activation (VISTA) is a negative checkpoint regulator that restrains T cell antitumor activity. VISTA modulates innate and adaptive immune responses using mechanisms unlike those of other immune checkpoint molecules. Johnston *et al*. report that under acidic pH conditions, such as those found within the tumor microenvironment, VISTA suppresses T cell activity. The researchers further show that VISTA deactivates immune responses because it is a ligand for the adhesion and coinhibitory receptor P-selectin glycoprotein ligand-1 (PSGL-1), which it engages through a histidine-rich interface. Disruption of VISTA–T cell interactions using acidic pH-selective antibodies could reverse T cell suppression. Modulation of VISTA may therefore provide a therapeutic means to enhance antitumor immunity. —PNK

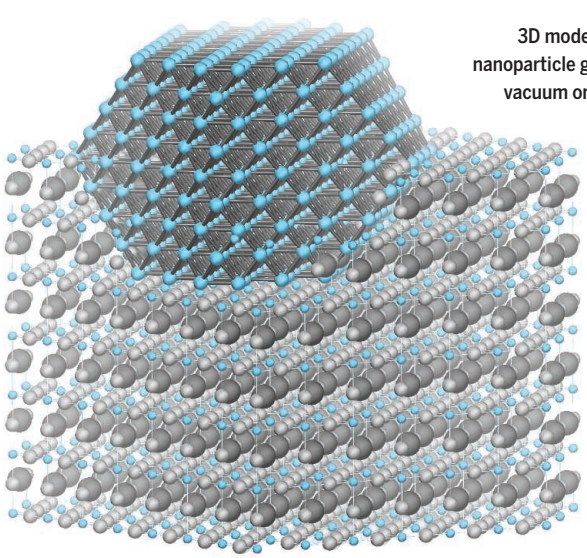
Nature **574**, 565 (2019).

NANOMATERIALS

Watching metal nanoparticle exsolution

Metal nanoparticles (NPs) grown from complex oxides through exsolution can be better anchored to their support in "sockets" than ones deposited on the surface. Neagu *et al.* followed the formation of nickel NPs from two perovskites, $La_{0.43}Ca_{0.37}Ni_{0.06}Ti_{0.94}O_3$ and $La_{0.8}Ce_{0.1}Ni_{0.4}Ti_{0.6}O_3$. An environmental transmission electron microscope enabled kinetics and structural studies of powder samples exposed to reducing gases [hydrogen (H_2) and carbon monoxide (CO)] at high temperatures (650° to 1000°C). Different atmospheric conditions changed NP shape—exposure to H_2 formed rounder NPs, NPs formed in vacuum were more faceted, and exposure to CO formed cubic NPs. NP growth was not monotonic but occurred in a stepwise manner, alternating between growth spurts and periods of quiescence. —PDS

ACS Nano 10.1021/acsnano.9b05652 (2019).



3D model of a nickel nanoparticle grown under vacuum on perovskite

IMAGE: NEAGU *ET AL*., *ACS NANO* 10.1021/ACSNANO.9B05652 (2019)

REPRODUCTION

Organelle fusion in fertility

The fertility of organisms as diverse as male fruit flies and mice requires a mitochondrial fusion gene. But what for? Mitochondria cluster and fuse during early sperm development with the help of guanosine triphosphatases called mitofusins. When mitochondrial fusion fails, oxidative phosphorylation decreases, and mitochondrial transport and degradation are also affected. Varuzhanyan *et al*. tested how reliant the success of male germ cell development in mice is on mitofusins. Mitofusins are needed to trigger a metabolic shift during meiosis. When mitofusins are eliminated, germ cells display damage to the cristae ultrastructure, increased apoptosis, reduced oxidative phosphorylation, and a loss of mitochondrial ribosomes. Thus, mitofusins are vital for maintaining translation of respiratory chain and mitochondrial proteins to enable male fertility. —BAP

eLife **8**, e51601 (2019).

SOCIAL SCIENCE

Predicting future terror attacks

Future attacks by terrorist organizations are difficult to predict because their organizational capabilities and resources are hidden. Yang *et al*. developed a modeling approach for estimating these parameters to predict future terror attacks. By testing their model against the Global Terrorism Database, they could explain about 60% of the variance in a terrorist group's future lethality using only its first 10 to 20 attacks, outperforming previous models. The model also captures the dynamics by which terror organizations shift from random, low-fatality attacks to nonrandom, high-fatality attacks. These results have implications for efforts to combat terrorism worldwide. —TSR

Proc. Natl. Acad. Sci. U.S.A. **116**, 21463 (2019).

Watching metal nanoparticle exsolution

Phil Szuromi

Science **366** (6467), 834-835.
DOI: 10.1126/science.366.6467.834-d