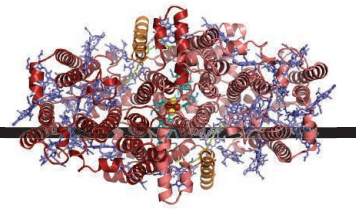
RESEARCH

Heliobacterial photosynthetic reaction center

Gisriel et al., *p. 1021*



IN *SCIENCE* JOURNALS

Edited by **Stella Hurtley**

Spores of the fungus *Aspergillus fumigatus* are constantly inhaled.

FUNGAL PATHOGENS

Survivin' neutrophil surveillance

Humans constantly inhale fungal spores. Why don't we suffer more invasive infections from ubiquitous fungal molds such as *Aspergillus fumigatus*? Working in mice, Shlezinger *et al*. found that neutrophils phagocytosed germinating fungal spores deep in the lungs (see the Perspective by Wiesner and Klein). Once engulfed, the fungal cells underwent programmed cell death, likely induced by phagocyte NADPH oxidase. Fungal strains engineered to overexpress a fungal *survivin* homolog resisted cell death by inhibiting caspase-3 and -7. When a Survivin antagonist was applied, more fungal cells died. These findings may lead to therapies for immunocompromised patients threatened by invasive fungal lung infections. —CA

Science, this issue p. 1037; see also p. 973

INTESTINAL STRESS

Foiling bad bugs' sneaky tricks

Intestinal pathogens can invade host cells and disrupt critical cellular functions, including secretion. Secretion is necessary for the delivery of antimicrobial proteins that kill pathogenic bacteria. Bel *et al*. show that when intestinal epithelial cells sense an invading bacterial pathogen, they "reroute" the antimicrobial protein lysozyme through an alternative autophagy-based secretion pathway (see the Perspective by Kaser and Blumberg). This ensures lysozyme delivery to the gut lumen, which protects against further bacterial invasion. Secretory autophagy was triggered by endoplasmic reticulum stress and required signals from type 3 innate lymphoid cells. Thus, the innate immune response to gut pathogens co-opts autophagy in intestinal immune defense. —SMH

Science, this issue p. 1047; see also p. 976

ASTEROID BELT

Family ties reveal original planetesimals

The asteroid belt originated from leftover debris from the formation of our solar system, including objects that never grew big enough to become planets. Destructive collisions led to the present proliferation of asteroids; groups that were initially part of the same body have related orbits and are known as families. Delbo' *et al*. identified an ancient family mostly consisting of dark asteroids that previously had not been linked to families (see the Perspective by DeMeo). From this, they calculated the original population of the belt, showing that it contained several dozen midsized bodies known as planetesimals. —KTS

Science, this issue p. 1026; see also p. 972

SENSORY TRAPS

Building-blind bats

Human-generated structures now dominate much of the planet, but they have existed for but a blink of an eye from an evolutionary perspective. Animal sensory systems evolved to navigate natural environments and so may not always be reliable in anthropogenic ones. Greif *et al*. show that echolocating bats appear to perceive smooth vertical surfaces as open areas, a mistake that often leads to collisions (see the Perspective by Stilz). With millions upon millions of smooth vertical surfaces in our world today, such misperceptions could have considerable negative impacts on bat survival. —SNV

Science, this issue p. 1045; see also p. 977

Published by AAAS

MARINE CONSERVATION

Charts reveal the ghosts of corals past

Coral reef loss adversely affects fisheries, water quality, and storm protection. McClenachan *et al.* used 18th-century British nautical charts that mapped coral reefs as shipping hazards to quantify changes in the Florida Keys over the past 240 years. Entire sections of reef charted before European settlement are now gone. Invisible to modern surveys, such ghost reefs call attention to the importance of historical data in marine conservation. —SN

Sci. Adv. 10.1126/sciadv.1603155 (2017).

SOCIAL SCIENCE

Life under threat of deportation

What is the effect on a child of having parents who are at risk of deportation as unauthorized immigrants? Hainmueller *et al*. developed a quasi-experimental protocol to address this complicated question. They selected mothers who had birthdates either just before or just after the cutoff for the United States' Deferred Action for Childhood Arrivals (DACA) program. Children whose mothers were protected from deportation by DACA had 50% fewer diagnoses of adjustment and anxiety disorder than children with mothers whose birthdates, by coincidence, preceded the cutoff and who thus were not protected. —BJ

Science, this issue p. 1041

SYSTEMS IMMUNOLOGY

Following the immunological clock

Immune function is altered during pregnancy to protect the fetus from an immunological attack without disrupting protection against infection. Aghaeepour *et al.* used mass cytometry to examine the precise timing of these pregnancy-induced changes in immune function and regulation. They developed an algorithm that captures the immunological timeline during pregnancy, validating previous findings and shedding light on immune cell interactions during gestation. By defining this immunological chronology during normal pregnancy, they can now look for alterations associated with pregnancy-related pathologies. —ACC

Sci. Immunol. **2**, eaan2946 (2017).

METALLURGY

A ductile steel shows its strength

Many industrial applications require materials to have high strength while remaining pliable, or ductile. However, the microstructure that increases strength tends to reduce ductility. He *et al*. used a processing mechanism to create a "forest" of line defects in manganese steel. This deformed and partitioned steel was produced by cold-rolling and low-temperature annealing and contained a dislocation network that improved both strength and ductility. —BG

Science, this issue p. 1029

NEUROSCIENCE

A different form of synaptic plasticity

How do synaptic or other neuronal changes support learning? This subject has been dominated by Hebb's postulate of synaptic change. Although there is strong experimental support for Hebbian plasticity in a number of preparations, alternative ideas have also been developed over the years. Bittner *et al*. provide in vivo, in vitro, and modeling data to support the view that non-Hebbian plasticity may underlie the formation of hippocampal place fields (see the Perspective by Krupic). Instead of multiple pairings, a single strong Ca^{2+} plateau potential in neuronal dendrites paired with spatial inputs may be sufficient to produce place cells. —PRS

Science, this issue p. 1033; see also p. 974

IN OTHER JOURNALS

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

CORALS

A proto-particular path to corals

Coral skeletons form less directly than has long been thought. The classical picture of skeleton formation, involving simple inorganic precipitation of aragonite (a form of calcium carbonate) from a calcifying fluid, is now being supplanted by a body of research that identifies biologically controlled processes occurring within cells as the ones responsible. Mass *et al*. present spectromicroscopic evidence from *Stylophora pistillata* coral showing that amorphous calcium carbonate particles first form within the coral's organic tissue and then attach to the surface of the coral skeleton, where they soon crystallize into aragonite. This allows corals to grow faster than through ion-by-ion growth from solution and may make them less vulnerable to the harmful consequences of ocean acidification than has been assumed. —HJS

Proc. Natl. Acad. Sci. U.S.A. 10.1073/pnas.1707890114 (2017).

False color image of a *Stylophora pistillata* coral skeleton

CELL BIOLOGY

Memories of past morphologies

When developing neurons round and divide during neuronal differentiation, daughter cells tend to take up the same morphology exhibited by their mother. Boubakar *et al*. set up

CREDITS: (TOP) LUIS JAVIER SANDOVAL/GETTY IMAGES; (BOTTOM) PUPA GILBERT, CHANG-YU SUN, CAYLA STIFLER, UNIVERSITY OF WISCONSIN–MADISON, AND MATTHEW MARCUS, ADVANCE LIGHT SOURCE, LAWRENCE BERKELEY NATIONAL LABORATORY

ALSO IN *SCIENCE* JOURNALS

Edited by **Stella Hurtley**

INFLAMMATION

Metabolic programming of tissue APCs

Antigen-presenting cells (APCs) are scattered throughout the body in lymphoid organs and at the portals of pathogen entry, where they act as sentinels of the immune system. Sinclair *et al*. demonstrate that APCs at different sites have distinctive metabolic signatures and that the development and function of these cells are determined not only by their transcriptional program, but also by their metabolic state (see the Perspective by Wiesner and Klein). The authors identified a central role for mTOR in mediating the metabolic adaptation of such tissue-resident APCs by influencing the immunological character of allergic inflammation. Thus, tissues endow resident APCs with distinctive metabolic characteristics that control APC development and function. —SMH

Science, this issue p. 1014; see also p. 973

ENVIRONMENT

The problem with sand

Sand is a crucial ingredient of today's rapidly expanding urban and transport infrastructure. In a Perspective, Torres *et al*. highlight the environmental and social impacts of the resulting rise in sand extraction and transport. Sand extraction degrades ecosystems, threatens the survival of some species, and destabilizes shorelines, putting humans at increased risk from natural hazards. Illegal extraction and trade lead to social and political conflicts, and sand transport can contribute to the dispersal of invasive species. Given that sand demand is likely to rise further, there is an urgent need for effective governance, aided by detailed knowledge of sand budgets in different parts of the world. —JFU

Science, this issue p. 970

ANTIMICROBIALS

Microbes make *diffi*cult decisions

Clostridium difficile infects hundreds of thousands of people each year and is becoming increasingly tough to treat. Kirk *et al.* studied a *C. difficile*–specific antimicrobial derived from a genetically modified bacteriocin. They isolated strains resistant to the treatment, which were found to have mutations in the surface layer of the cell envelope. The mutants had attenuated virulence but were still able to colonize the gut of hamsters. These findings showcase how making targeted antimicrobials can force bacteria to sacrifice virulence in favor of survival. —LP

Sci. Transl. Med. **9**, eaah6813 (2017).

CELL BIOLOGY

Mitochondria for plasma membrane repair

Mechanical strain on cells can cause damage to the plasma membrane that must be repaired before extracellular Ca^{2+} influx reaches levels that trigger cell death. Horn *et al.* found that mitochondria mediated the repair of plasma membrane injuries in mouse muscle cells and human nonmuscle cells (see the Focus by Cooper). Ca^{2+} uptake by mitochondria initiated the generation of reactive oxygen species (ROS), which activated actin polymerization and wound closure. Quenching mitochondrially produced ROS in mouse muscle that was exercised ex vivo resulted in greater damage to myofibers and reduced muscle force. —WW

Sci. Signal. **10**, eaaj1978, eaao3795 (2017).

STRUCTURAL BIOLOGY

A homodimeric complex for anaerobic photosynthesis

In plants, algae, and cyanobacteria, large molecular complexes—photosystems I and II—convert light energy into chemical energy, releasing oxygen as a by-product. This oxygenic photosynthesis is critical for maintaining Earth's atmospheric oxygen. At their cores, photosystems I and II contain a heterodimeric reaction center. Reaction centers evolved in an atmosphere lacking oxygen, and the ancestral complex was likely homodimeric, encoded by a single gene. Gisriel *et al*. describe the structure of a homodimeric reaction center from an anoxygenic photosynthetic bacterium. The structure shows perfect symmetry of the light-collecting antennae and elucidates the electron transfer chain. —VV

Science, this issue p. 1021