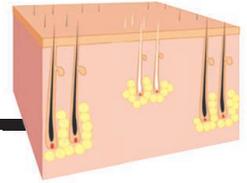


RESEARCH

Hair follicle–derived BMP may help prevent scar formation

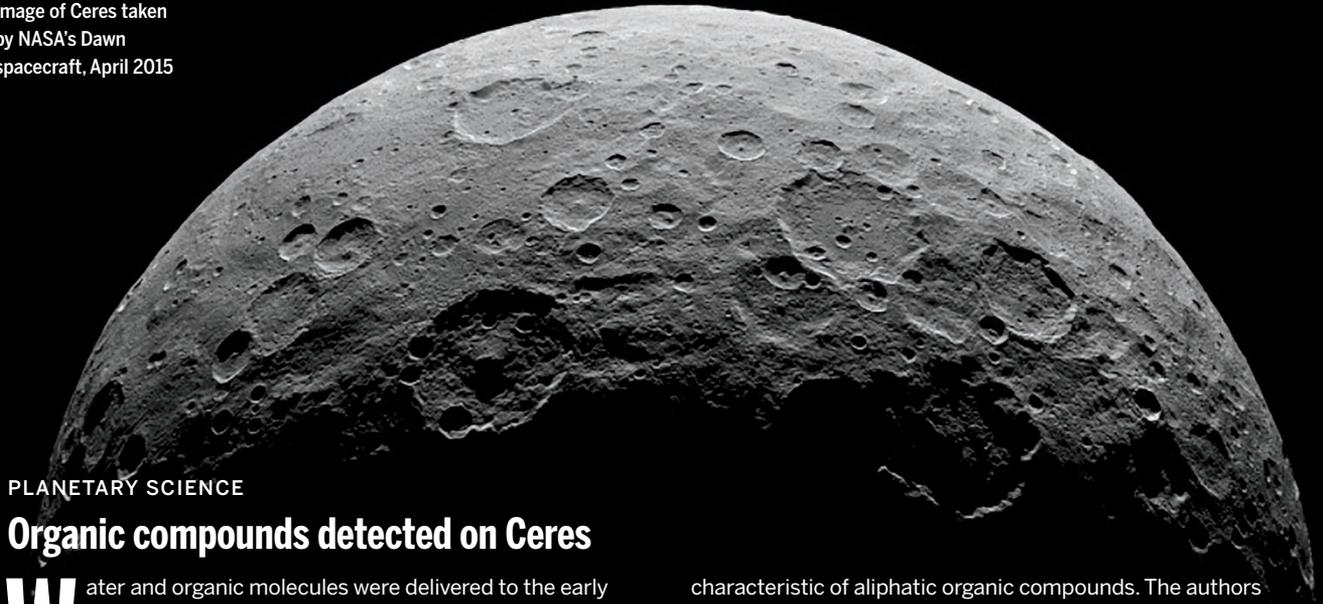
Plikus et al., p. 748



IN SCIENCE JOURNALS

Edited by **Stella Hurtley**

Image of Ceres taken
by NASA's Dawn
spacecraft, April 2015



PLANETARY SCIENCE

Organic compounds detected on Ceres

Water and organic molecules were delivered to the early Earth by the impacts of comets and asteroids. De Sanctis *et al.* examined infrared spectra taken by the Dawn spacecraft as it orbited Ceres, the largest object in the asteroid belt (see the Perspective by Küppers). In some small patches on the surface, they detected absorption bands

characteristic of aliphatic organic compounds. The authors ruled out an external origin, such as an impact, suggesting that the material must have formed on Ceres. Together with other compounds detected previously, this supports the existence of a complex prebiotic chemistry at some point in Ceres' history. —KTS

Science, this issue p. 719; see also p. 692

INFECTIOUS DISEASE

Hypoxic conditioning of immune cells

Oxygen deficiency, or hypoxia, alters immune cell function. How these hypoxia-induced immune cell changes affect the host response to bacterial infection has been unclear. Thompson *et al.* report that although acute hypoxia accentuated morbidity and mortality resulting from bacterial infection in mice, chronic hypoxia before infection actually prevented these pathological responses. This hypoxic preconditioning reduced neutrophil glucose use, decreasing the related pathology. Immune targeting thus might aid

patients with systemic hypoxia and chronic infections resulting from adult respiratory distress syndrome or chronic obstructive pulmonary disease. —ACC

Sci. Immunol. **2**, eaal2861 (2017).

BACTERIAL DIVISION

Coordinating cell wall synthesis and cell division

Most bacteria are protected by peptidoglycan cell walls, which must be remodeled to split the cell. Cell division requires the tubulin homolog FtsZ, a highly conserved cytoskeletal polymer that specifies the future site of division. Bisson-Filho *et al.* and Yang *et al.* found that the

dynamic treadmilling of FtsZ filaments controls both the location and activity of the associated cell wall synthetic enzymes. This creates discrete sites of cell wall synthesis that circle around the division plane to divide the cell. —SMH

Science, this issue p. 739, p. 744

HIGH-PRESSURE PHYSICS

Stamping hydrogen into metal

In 1935, Wigner and Huntington predicted that molecular hydrogen would become an atomic metal at a pressure of 25 GPa. Eighty years and more than 400 GPa later, Dias and Silvera have

finally produced metallic hydrogen at low temperature. The metallization occurred between 465 and nearly 500 GPa at 5.5 K. Spectroscopic measurements verified that hydrogen was in the atomic state. The observation completes an unexpectedly long quest to find the metallic hydrogen that Wigner and Huntington predicted so long ago. —BG

Science, this issue p. 715

PHYSIOLOGY

Sugar rush

Flying requires high levels of energy production, which causes muscular oxidative damage. Food-derived antioxidants can

protect against such damage; however, nectar is devoid of these compounds. Levin *et al.* found that nectar-feeding hawkmoths fed high concentrations of sugar had lower levels of damage than unfed moths. Sugar-fed moths generated antioxidant compounds by shunting glucose through a pentose phosphate pathway. This mechanism may have allowed for the evolution of energy-intensive flying nectarivores. —SNV

Science, this issue p. 733

MUTATION DETECTION

When is a mutation a true genetic variant?

Large-scale sequencing studies have set out to determine the low-frequency pathogenic genetic variants in individuals and populations. However, Chen *et al.* demonstrate that many so-called low-frequency genetic variants in large public databases may be due to DNA damage. They scored libraries sequenced with and without a DNA damage-repairing enzymatic mix to assess the proportion of true rare variants. It remains to be seen how best to repair DNA before sequencing to provide more accurate assessments of mutation. —LMZ

Science, this issue p. 752

GLAUCOMA

Vitamin B3 protects mice from glaucoma

Glaucoma is the most common cause of age-related blindness in the United States. There is currently no cure, and once vision is lost, the condition is irreversible. Williams *et al.* now report that vitamin B3 (also known as niacin) prevents eye degeneration in glaucoma-prone mice (see the Perspective by Crowston and Troncone). Supplementing the diets of young mice with vitamin B3 averted early signs of glaucoma. Vitamin B3 also halted further glaucoma development in aged mice that already showed signs

of the disease. Thus, healthy intake of vitamin B3 may protect eyesight. —PNK

Science, this issue p. 756;
see also p. 688

INFECTION

Touchdown for gut pathogen virulence

Escherichia coli is transformed from a commensal organism into a pathogen by acquisition of genetic elements called pathogenicity islands (PAIs). Katsowich *et al.* investigated how the PAI virulence genes of enteropathogenic *E. coli* (EPEC) respond when the bacterium attaches to a host gut cell. EPEC first sticks to the host by means of pili and then uses a PAI-encoded type 3 secretion system (T3SS) to inject multiple effectors into the host cell. But not all virulence mediators are injected. For example, CesT, a bacterial chaperone, delivers virulence effectors into the T3SS apparatus. Then, within the bacterial cytoplasm, it interacts with a gene repressor called CsrA, which reprograms bacterial gene expression to help the bacteria to adapt to epithelial cell-associated life. —CA

Science, this issue p. 735

HIV

Peak HIV viremia pushes CD8⁺ T cells

HIV induces widespread immune dysfunction. Animal studies with simian immunodeficiency virus have suggested that early CD8⁺ T cell responses may reduce viral burden. Takata *et al.* examined a large cohort of HIV patients given antiretroviral therapy (ART). They evaluated T cell activation and HIV viral load over time, which allowed them to parse out immune function on the basis of acute stages of infection. CD8⁺ T cell responses were a little slow to ramp up, but activated CD8⁺ T cells present after ART initiation reduced the viral reservoir. Thus, targeting CD8⁺ T cells early in infection could lead to viral eradication. —LP

Sci. Transl. Med. **9**, eaag1809 (2017).

IN OTHER JOURNALS

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

Snow avalanches are caused by a complex interplay between different layers of the snow slab.



AVALANCHE RESEARCH

Cracking the code underlying snowslides

Dangerous snow avalanches require failure of a weak layer buried beneath an overlying cohesive slab of snow. Although this process is mostly understood for some avalanche scenarios, observations of low-angle triggered avalanches challenge the traditional models. Gaume *et al.* devised a model that better accounts for failure by including the complex interplay between the weak layer and the overlying snow slab. The model agrees well with field data and has the potential to substantially improve life-saving avalanche forecasting. —BG

Cryosphere 10.5194/tc-11-217-2017 (2017).

POLITICAL SCIENCE

Scientific curiosity versus polarization

Knowledge does not always change biases, and people tend to absorb information that fits their prejudices. However, rather than studying scientific knowledge, Kahan *et al.* studied scientific curiosity—the tendency to look for and consume scientific information for pleasure. Two sets of subjects, including several thousand people, were given questions about their interests and activities. Reactions to documentaries and to news stories that contained surprising or unsurprising material were also tracked. The more

scientifically curious people were (regardless of their politics), the less likely they were to show signs of politically motivated reasoning. People with higher curiosity ratings were more willing to look at surprising information that conflicted with their political tendencies than people with lower ratings. —BJ

Adv. Polit. Psychol. 10.1111/pops.12396 (2017).

CELL BIOLOGY

Dissecting the effects of APOE

Three *APOE* alleles are expressed in humans: *APOE4* allele is the single most important genetic risk

ALSO IN SCIENCE JOURNALS

Edited by Stella Hurtley

CELL BIOLOGY

Understanding insulin release

Insulin release takes place in two phases: a first rapid burst followed by a series of small exocytic bursts that coincide with pulsatile spikes in cytosolic Ca^{2+} levels. The second phase is impaired in patients with type II diabetes, underscoring the importance of understanding its molecular basis. Lees *et al.* report a mechanism through which TMEM24, a lipid transport protein that concentrates at endoplasmic reticulum–plasma membrane contact sites, regulates the pulsatility of cytosolic Ca^{2+} and phosphoinositide signaling. This process in turn regulates pulsatile insulin secretion during the slow insulin release phase. —SMH

Science, this issue p. 709

PLANT SCIENCE

Host-pathogen point-counterpoint

The arms race between pathogen and host is a well-known phenomenon. Ma *et al.* have now identified how an enzymatically inactive protein can abet a pathogen's infectivity. The pathogenic oomycete *Phytophthora sojae* secretes xyloglucanase that damages soybean cell walls. Soybean, in turn, secretes a defense protein that binds to and inactivates the xyloglucanase. To counteract this plant defense, the oomycete deploys a product of its own gene duplication: an inactive enzyme that binds the plant's defense protein. With the defense protein unproductively bound to the decoy, the oomycete can successfully invade the soybean cells. —PJH

Science, this issue p. 710

PHOTOCHEMISTRY

Hydroamination gets a light push uphill

Hydroamination of olefins is a broadly useful method for making carbon-nitrogen bonds. However, when both the amine and the olefin have multiple alkyl substituents, the reaction can become energetically unfavorable. Musacchio *et al.* used the energy in blue light to surmount this obstacle (see the Perspective by Buchanan and Hull). A photo-excited iridium complex oxidized the amine, which in turn bonded efficiently to the olefin, after which a thiophenol cocatalyst shuttled the electron back. The reaction could operate across a wide range of amine and olefin partners. —JSY

Science, this issue p. 727;
see also p. 690

REGENERATION

Hair follicles: Secret to prevent scars?

Although some animals easily regenerate limbs and heal broken flesh, mammals are generally not so gifted. Wounding can leave scars, which are characterized by a lack of hair follicles and cutaneous fat. Plikus *et al.* now show that hair follicles in both mice and humans can convert myofibroblasts, the predominant dermal cell in a wound, into adipocytes (see the Perspective by Chan and Longaker). The hair follicles activated the bone morphogenetic protein (BMP) signaling pathway and adipocyte transcription factors in the myofibroblast. Thus, it may be possible to reduce scar formation after wounding by adding BMP. —BAP

Science, this issue p. 748;
see also p. 693

SOLAR CELLS

Passivating traps in perovskites

Low-temperature processing of planar organic-inorganic perovskite solar cells made through solution processing would allow for simpler manufacturing and the use of flexible substrates. However, materials currently in use form interfaces with charge carrier trap states that limit performance. Tan *et al.* used chlorine-capped TiO_2 colloidal nanocrystal films as an electron-selective layer, which limited interface recombination in solution-processed solar cells. Such cells achieved certified efficiencies of 19.5% for active areas of 1.1 cm^2 . —PDS

Science, this issue p. 722

INFECTIOUS DISEASES

Being selective in fighting infection

Antibiotic-resistant bacterial strains are increasingly found in healthy people who show no symptoms. As a result, they are more vulnerable to invasive infections that can be lethal. In a Perspective, Tacconelli *et al.* argue that existing, mostly broad-spectrum antibiotics are not sufficient for countering this threat and that a new strategy is needed to control the spread of these strains. They call for the development of drugs that selectively target specific pathogens in the human gut while leaving other bacteria unharmed. Together with improved surveillance and reduced use of antibiotics, such selective decolonization agents could help halt the rise in antibiotic-resistant infections. —JFU

Science, this issue p. 689

ANTIVIRAL IMMUNITY

An encephalitis-boosting microRNA

Japanese encephalitis virus (JEV), which is related to the Zika and West Nile viruses, targets the central nervous system. The encephalitis induced by JEV inflicts neurological damage and can be fatal. Hazra *et al.* found that JEV infection of mouse and human neuronal cells reduced the production of antiviral cytokines through the microRNA miR-301a. Treating JEV-infected mice with a miR-301a inhibitor increased antiviral cytokine production, decreased viral replication, and improved survival. Thus, targeting miR-301a may be an effective therapy against JEV infection. —JFF

Sci. Signal. **10**, eaaf5185 (2017).

COASTAL ECOSYSTEMS

Missing meadows fail to mop up microbes

Seagrass meadows, a prominent feature of most healthy coastal ecosystems, are often also associated with shallow coral reefs. Many plants have bioremediation qualities, and seagrasses, of which there are 60 or so species, produce natural biocides. Lamb *et al.* found that the seagrass meadows of inhabited atolls near Sulawesi, Indonesia, ameliorated seawater pollution from human-originating bacteria. This effect extended to potential pathogens of marine invertebrates and fish: Reefs fringing the seagrass meadows showed significantly less impact from coral and fish disease. —CA

Science, this issue p. 731