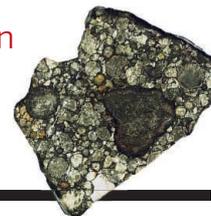


# RESEARCH

## Remnant magnetization in a primitive meteorite

Fu et al., p. 1089



## IN SCIENCE JOURNALS

Edited by Stella Hurlley



Wild cucumber

### PLANT SCIENCE

## Biosynthetic pathway holds roots of domestication

The wild cucumber is a spiky, bitter relative of what we now grow in our gardens. The bitterness comes from cucurbitacin, which helps the plant to ward off herbivores. Cucurbitacin is also useful to people for its anti-tumor properties. Shang *et al.* have now worked out the biosynthetic pathway of cucurbitacin. Along the way, they discovered genetic traces of the domestication process and unraveled the mystery of why some cucumbers, if grown in chilly conditions, become bitter. — PJH

Science, this issue p. 1084

### BLACK HOLE PHYSICS

## Timing tells the structure of the unseen

Nothing can move faster than the speed of light, but some gamma rays seem to break that rule. Powerful jets that balance the angular momentum of accreting black holes are difficult to discern in images, so astronomers often resort to timing their emission to reveal the physics at work. Aleksić *et al.* found that gamma rays from the active galaxy IC 310 varied faster than the time required for light to cross the event horizon of the supermassive black hole at its nucleus. Particle acceleration at the base of the jet may enable this apparent speed, adding a piece to the puzzle of how jets form at supermassive black holes. — MMM

Science, this issue p. 1080

### MATERIALS SCIENCE

## Graphene: A miniature bulletproof vest?

To stop a speeding projectile, you need a combination of strength and toughness so that the impact doesn't just pierce the stopping material. The material also needs to dissipate the absorbed kinetic energy. Lee *et al.* measured the response of multilayer graphene to the projection of microbullets using miniaturized ballistic tests. The findings confirm graphene's exceptional strength and stiffness. — MSL

Science, this issue p. 1092

### CHEMICAL OCEANOGRAPHY

## Polluting the way to more productivity

Most biologically available nitrogen comes from the recycling of organic matter and nitrogen

fixation. However, airborne anthropogenic nitrogen—air pollution—can also provide a source of such nitrogen. Kim *et al.* reconstructed changes in the N content of surface water across the North Pacific Ocean for the past four decades. N concentrations have increased markedly. This trend could enhance microbial growth in the ocean and eventually increase production of the greenhouse gas  $N_2O$ . — HJS

Science, this issue p. 1102

### COGNITIVE PSYCHOLOGY

## Forgetting history one president at a time

Memory for past events and famous people, some of which may have happened or lived before we were born, fades with time. Roediger and DeSoto measured the extent and rate

at which former U.S. presidents have been forgotten (see the Perspective by Rubin). Three cohorts of college students, spanning four decades, forgot in the same way: Each group remembered Washington and Lincoln and also the most recent office holders (Ford, Reagan, and Obama). — GJC

Science, this issue p. 1106; see also p. 1058

### SKIN DISEASE

## Personalized cell therapy for skin disorder

Mutations in the *COL7A1* gene cause severely fragile skin and painful blistering in a rare disease, recessive dystrophic epidermolysis bullosa (RDEB). There is no cure, but Sebastiano *et al.* now show that cell therapy could be a viable option. The authors took skin biopsies from

three patients with RDEB and generated induced pluripotent stem cells, or iPSCs, from the tissue. They genetically corrected the *COL7A1* mutation and made keratinocytes (skin cells) that expressed normal collagen VII. In mice, these “repaired” keratinocytes formed layers of human skin expressing collagen VII. The skin grafts only lasted for a few weeks, but the ability to genetically correct and bank a patient’s own cells is an important step toward treating RDEB. — MLF

*Sci. Transl. Med.* **6**, 264ra163 (2014).

#### PALEOGENOMICS

### Secrets of human ancestor evolution revealed

Studies of ancient humans help us understand the movement and evolution of modern populations of humans. Seguin-Orlando *et al.* present the genome of an ancient individual, K14, from northern Russia who lived over 36,000 years ago. K14 is more similar to west Eurasians and Europeans than to east Asians, indicating that these populations had already diverged. — LMZ

*Science*, this issue p. 1113

#### REPELLENT SURFACES

### Undercutting the surface keeps liquids at bay

The shape of an umbrella is designed both to protect the holder from falling droplets and to have the collected rainwater flow away from the



PHOTOS: (LEFT TO RIGHT) EGDIGITAL/THINKSTOCK; © IMAGEBROKER/ALAMY

person underneath. Liu and Kim exploited the idea of an umbrella to make materials with a surface that repels almost any liquid.

— MSL

*Science*, this issue p. 1096

#### MITOCHONDRIA

### Cross talk between mitochondria and mitosis

Mitochondria, the power houses of the cell, contain their own genome. Nevertheless, the majority of their constituent proteins are encoded by nuclear genes and are translated in the cytosol. During the cell cycle, a cell needs to duplicate each of its constituent parts and organelles. Surprisingly, it has never been clear how or whether mitochondrial protein import is linked with the cell cycle. Harbauer *et al.* (see the Perspective by Schulz and Rehling) now show that one of the main conduits for mitochondrial protein import is directly regulated by phosphorylation during mitosis, and that this in turn promotes respiratory activity. — SMH

*Science*, this issue p. 1109

#### CANCER IMMUNOLOGY

### Retaining a barrier to cancer metastasis

One way cancers can spread, or metastasize, is by invading blood vessels, which are lined with endothelial cells. Pignatelli *et al.* found that cells from biopsies of invasive breast cancers crossed a layer of endothelial cells more readily than those from less aggressive breast cancers, particularly when cultured with macrophages (see the Perspective by Kiersse *et al.*). Macrophages promoted breast cancer cell invasion by secreting the growth factor EGF, which induced breast cancer cells to secrete the cytokine CSF-1. The cytokine acted on macrophages and on some types of cancer cell. Blocking the binding of CSF-1 to its receptor prevented cancer cells from crossing endothelial cultures. — LKF

*Sci. Signal.* **7**, ra112 and pe28 (2014).

## IN OTHER JOURNALS

Edited by **Kristen Mueller**  
and **Jesse Smith**

Common ravens (*Corvus corax*) engaged in a mating behavior.



#### ANIMAL BEHAVIOR

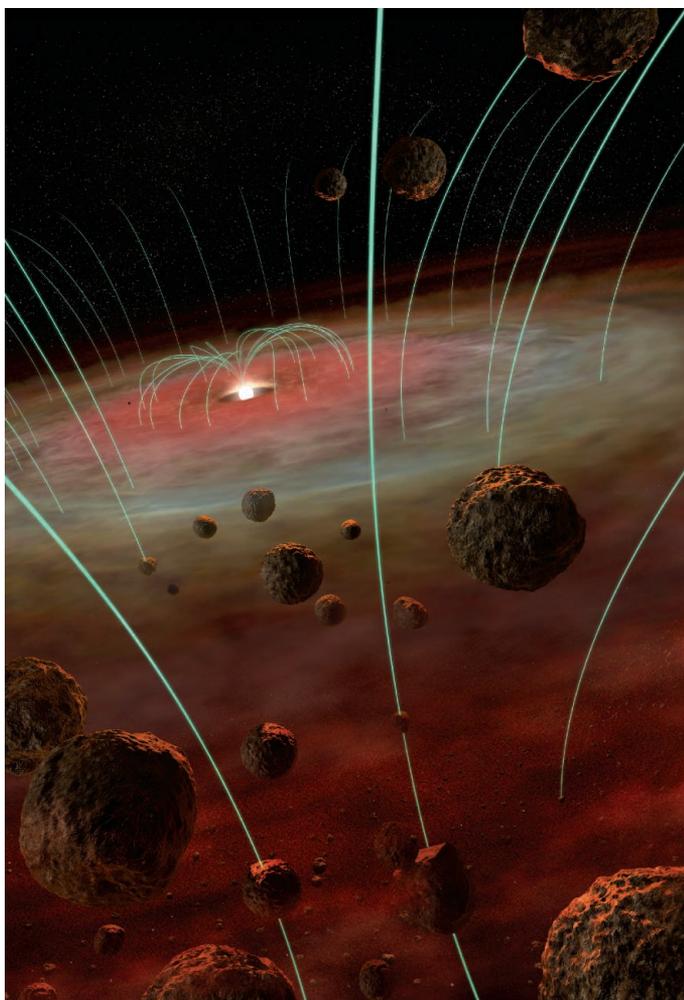
### Up and down the raven social ladder

Social hierarchies are complex, and threats abound for people and, as it turns out, for ravens, too. Massen *et al.* followed a group of approximately 200 individually marked ravens in the Austrian Alps. They found that strongly bonded breeding pairs at the top of the raven social hierarchy disrupted interactions between loosely bonded pairs lower in the hierarchy. They also tended to ignore nonbonded individuals located at the bottom of the hierarchy. In doing so, the higher-ranking birds may prevent the lower-status breeding pairs from rising up the hierarchy and becoming a social threat. — GR

*Curr. Biol.* **24**, 2733 (2014).

## ALSO IN SCIENCE JOURNALS

Edited by Stella Hurtley



## MINERALOGY

**A mineral name for mantle perovskite**

A rock from outer space finally puts a name to Earth's most abundant mineral, frequently referred to as perovskite. Mineral names are only bestowed on specimens that are found in nature and characterized.

Tschauner *et al.* isolate a magnesium silicate in the perovskite structure, now called bridgmanite, in the Tenham L6 chondrite meteorite (see the Perspective by Sharp). Bridgmanite formed in this meteorite during a high-pressure and -temperature shock event. Other minerals associated with bridgmanite allow the pressure-temperature conditions to be narrowly bound,

giving insight into the shock process. The long-sought-after specimen finally puts to rest a confusing nomenclature of this dense deep mantle silicate. — BG

*Science*, this issue p. 1100; see also p. 1057

## PALEOMAGNETISM

**Magnetic moments in planetary history**

To know the magnetic history of the solar nebula in the age of planet formation, researchers turn to the most primitive meteorites. Samples such as the Semarkona chondrite are composed partly of chondrules, which reflect the strength of the ambient magnetic field when

this material was last molten. Fu *et al.* used a SQUID microscope to measure the remnant magnetization in a section of Semarkona. The findings reveal secrets about what goes on inside protoplanetary disks.

— MMM

*Science*, this issue p. 1089

## GENOME ENGINEERING

**CRISPR-cas: A revolution in genome engineering**

The ability to engineer genomic DNA in cells and organisms easily and precisely will have major implications for basic biology research, medicine, and biotechnology. Doudna and Charpentier review the history of genome editing technologies, including oligonucleotide coupled to genome cleaving agents that rely on endogenous repair and recombination systems to complete the targeted changes, self-splicing introns, and zinc-finger nucleases and TAL effector nucleases. They then describe how clustered regularly interspaced palindromic repeats (CRISPRs), and their associated (Cas) nucleases, were discovered to constitute an adaptive immune system in bacteria. They document development of the CRISPR-Cas system into a facile genome engineering tool that is revolutionizing all areas of molecular biology. — GR

*Science*, this issue p. 1077

## TETANUS TOXIN ENTRY

**A potential peptide to prevent tetanus?**

Tetanus (TeNT) and botulinum (BoNT) neurotoxins represent a family of powerful bacterial protein toxins that cause tetanus and botulism in humans and animals. The molecular mechanisms responsible for the entry and axonal retrograde transport of these toxins have been the subject of intense research. However, tetanus and botulism remain incurable, at least in part because

of their high-affinity binding to synapses. Although the receptors for BoNT have recently been characterized at the molecular level, no protein receptor for TeNT at the neuromuscular junction has been identified. Bercsenyi *et al.* now suggest that TeNT exploits nidogen-1 and -2 for its binding to motor neurons. This binding is required for TeNT's internalization and axonal retrograde transport. Nidogens are extracellular matrix proteins that engage in multiple protein-protein interactions essential for the integrity of several tissues, including the nervous system. Interfering with the interaction between nidogens and TeNT by administering short nidogen-derived peptides blocked toxin binding to the neuromuscular junction and protected mice from tetanus. — SMH

*Science*, this issue p. 1118

## T CELL SIGNALING

**Stimulatory signals add up for T cells**

T cell activation is a dynamic process. T cells encounter multiple input signals such as antigens, costimulatory molecules, and cytokines at different times and anatomical locations during an infection. But how do T cells integrate this information to determine the extent to which they divide? To find out, Marchingo *et al.* stimulated mouse T cells in culture with different combinations of inputs and also tracked antigen-specific T cell responses in mice infected with influenza virus. They found that T cells linearly sum the various stimulatory inputs they receive to determine their "division destiny." — KLM

*Science*, this issue p. 1123

## FUNGAL BIOGEOGRAPHY

**Assessing fungal diversity worldwide**

Fungi are hyperdiverse but poorly known, despite their ecological

and economic impacts. Tedersoo *et al.* collected nearly 15,000 topsoil samples from 365 sites worldwide and sequenced their genomes (see the Perspective by Wardle and Lindahl). Overall, they found a striking decline in fungal species richness with distance from the equator. For some specialist groups though, diversity depended more on the abundance of host plants than host diversity or geography. The findings reveal a huge gap between known and described species and the actual numbers of distinct fungi in the world's soils. — CA

*Science*, this issue p. 1078;  
see also p. 1052

#### DNA REPAIR

### Staggered incisions unhook DNA crosslinks

Mutations that covalently link the two stands of DNA together, known as interstrand cross-links (ICLs), can wreak havoc with the many processes that need to separate the DNA strands to read the genome. For example, ICLs are commonly generated in the skin by exposure to UV. Wang *et al.* determined the crystal structure of the ICL repair exonuclease FAN1 bound to a branched segment of DNA that mimics an intermediate on the ICL repair pathway. The enzyme anchors itself at a cut

end of DNA and then cleaves successively at three nucleotide intervals, a pattern ideal for unhooking the ICL. FAN1 seems to have evolved to act, at least in part, at sites coupled to DNA synthesis or homologous recombination. — GR

*Science*, this issue p. 1127

#### SYSTEMS BIOLOGY

### Deciphering information flow in T cells

We can now measure the activation state of multiple components of biochemical signaling pathways in single cells. This ability reveals how

information flows through such cellular regulatory pathways and how it is altered in disease. Krishnaswamy *et al.* applied statistical techniques to overcome the complexity and variation (or noise) in such single-cell measurements. They used these techniques to quantify information transfer between proteins that participate in antigen recognition in cells of the immune system. The methods should prove useful in analysis of other signaling circuits to enhance basic understanding and reveal potential therapeutic targets to fight disease. — LBR

*Science*, this issue p. 1079