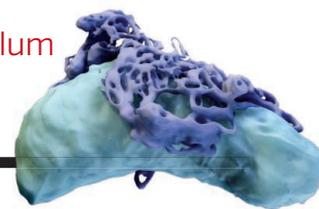


RESEARCH

Superresolution view of the peripheral endoplasmic reticulum

Nixon-Abell et al., p. 433



IN SCIENCE JOURNALS

Edited by Stella Hurtley



Direct nerve stimulation to improve tactile feedback for amputees

NEUROTECHNOLOGY

A touchy subject for neuroprostheses

Without tactile sensory input, amputees discern a firm handshake from a bone-crushing grip by visual cues and learned behavior. Next-generation prostheses aim to lend a more natural feel to artificial touch. Graczyk *et al.* looked at direct stimulation of the radial, ulnar, and median nerves by implanted electrodes in two amputees. By modulating the number of nerve fibers stimulated and the frequency of stimulation, sensory information could be transmitted so that the amputees could distinguish distinct levels of tactile intensity. —CC

Sci. Transl. Med. **8**, 362ra142 (2016).

QUANTUM PHYSICS

Weaving an entangled cluster

Entanglement is a powerful resource for quantum computation and information processing. One requirement is the ability to entangle multiple particles reliably. Schwartz *et al.* created an on-demand entangled cluster state of several photons by addressing a quantum dot with a sequence of laser pulses (see the Perspective by Briegel). They used an internal state of the quantum dot, a dark exciton, and its association with another internal state, a biexciton, to weave successive photons into an entangled cluster, generating entanglement between up to five photons. —ISO

Science, this issue p. 434;
see also p. 416

METABOLISM

Keeping white fat from expanding

Excess body fat caused by adipogenesis—the expansion of white adipose tissue—poses serious health risks. Wong *et al.* found that mice exposed to glucocorticoids or fed a high-fat diet had decreased levels of the extracellular protein ADAMTS1



White adipocytes expand as we fatten.

in white adipocytes, which was associated with increased adipogenesis. Increased caloric intake in human volunteers enhanced the expression of *ADAMTS1* in adipose tissue. Mice that overexpressed *Adamts1* had smaller white adipose deposits, suggesting that *ADAMTS1* treatment could prevent diet- or glucocorticoid-induced obesity. —WW

Sci. Signal. **9**, ra103 (2016).

CATALYSIS

Upgrading CO₂ with methane

The use of carbon dioxide as a reactant could help to mitigate its impact on climate, but it is difficult to activate as an oxidant. Buelens *et al.* combined methane in a high-temperature

“super-dry” reforming process that generates reactive carbon monoxide. Both molecules were fed into a reactor containing a nickel methane-reforming catalyst, an iron oxide solid oxygen carrier, and calcium oxide as a CO₂ sorbent. The adsorbed CO₂ was treated with an inert gas purge that shifted the equilibrium, releasing mainly CO. This isothermal process avoids carbon buildup and can be used with biogas methane that contains substantial levels of CO₂. —PDS

Science, this issue p. 449

CLIMATE DATA

Models and data: A two-way street

Data are used to drive models of climate and other complex

systems, but is the relationship between data and models a one-way process? Massonnet *et al.* used climate models to assess the quality of the observations that such models use. Starting with a simple model and progressing to more complex ones, the authors show that models are better when they are assessed against the most recent, most advanced, and most independent observational references. These findings should help to evaluate the quality of observational data sets and provide guidance for more objective data set selection. —HJS

Science, this issue p. 452

NEURONAL MATURATION

Integration of adult-born brain cells

Physical exercise or exploration of a novel environment greatly influences the production, maturation, and connectivity of adult-born neurons. Alvarez *et al.* investigated how experience affects the incorporation of adult-born neurons into the hippocampal network. A brief period of sensory enrichment when new neurons were 9 to 10 days old led to neurons having larger dendrites and more functional spine synapses. A disinaptic preexisting feedback circuit promoted the growth and integration of the new cells. —PRS

Science, this issue p. 459

VASCULAR DISEASE

Wreaking havoc while (growth-)arrested

Cells enter a state of senescence in response to certain stresses. Studying mouse models, Childs *et al.* examined the role of senescent lipid-loaded macrophages (so-called “foam cells”) in the pathogenesis of atherosclerosis. At early stages of atherosclerosis, senescent foam cells promoted the expression of inflammatory cytokines. At later stages, they promoted the expression of matrix metalloproteases implicated in the

rupture of atherosclerotic plaque, which can lead to blood clots. Experimental removal of the senescent cells had beneficial effects at both stages of the disease. —PAK

Science, this issue p. 472

APE GENETICS

Of chimpanzees and bonobos

Modern non-African human genomes contain genomic remnants that suggest that there was interbreeding between ancient humans and archaic hominoid lineages. Now, de Manuel *et al.* show similar ancestral interbreeding between the ancestors of today’s chimpanzees and bonobos (see the Perspective by Hoelzel). The study also provides population-specific genetic markers that may be valuable for conservation efforts. —LMZ

Science, this issue p. 477;
see also p. 414

IMPACT CRATERS

On the origin of Orientale basin

Oriente basin is a major impact crater on the Moon, which is hard to see from Earth because it is right on the western edge of the lunar nearside. Relatively undisturbed by later events, Orientale serves as a prototype for understanding large impact craters throughout the solar system. Zuber *et al.* used the Gravity Recovery and Interior Laboratory (GRAIL) mission to map the gravitational field around the crater in great detail by flying the twin spacecraft as little as 2 km above the surface. Johnson *et al.* performed a sophisticated computer simulation of the impact and its subsequent evolution, designed to match the data from GRAIL. Together, these studies reveal how major impacts affect the lunar surface and will aid our understanding of other impacts on rocky planets and moons. —KTS

Science, this issue pp. 438 and 441

IN OTHER JOURNALS

Edited by **Sacha Vignieri**
and **Jesse Smith**

COGNITION

Should I stay or should I go?

Much recent research on communication between dogs and humans has shown that dogs understand both our verbal and gestural commands, a fact well known to dog owners. Looking at working water rescue dogs, D’Aniello *et al.* asked which of these two types of commands has priority, especially if conflicting signals are given. Dogs responded better to gestural than to verbal commands, when given separately. Generally, priority was also given to gestures when conflicting commands were made, though females were better at responding to gestures, whereas males responded better to words. Interestingly, when asked both to “stay” and “come,” dogs tended to choose to come, especially when the handler was walking away, suggesting that they sometimes chose the option that better coincided with their own choice. —SNV

Anim. Cogn. 10.1007/s10071-016-1010-5 (2016).

Dogs understand our gestures perhaps even better than our words.



ANTIBIOTIC RESISTANCE

Quantifying the alarm from antibiotic resistance

Antibiotic resistance is a major global fear, but how fearful should we be? Multidrug resistance (MDR) is high among developing economies that are vulnerable to purveyors of

substandard drugs and where over-the-counter sales are not controlled. Lim *et al.* collected mortality data on bacteremia from 10 public hospitals in northeast Thailand between 2004 and 2010. During this period, the incidence of bacteremia increased, and high case fatality rates were observed for MDR strains,

ALSO IN SCIENCE JOURNALS

Edited by Stella Hurtley

METABOLISM

Quantitation of metabolic pathway regulation

Although metabolic biochemical pathways are well understood, less is known about precisely how reaction rates or fluxes through the various enzymes are controlled. Hackett *et al.* developed a method to quantitate such regulatory influence in yeast. They monitored concentrations of metabolites, enzymes, and potential regulators by LC-MS/MS (liquid chromatography–tandem mass spectrometry) and isotope ratio measurements for 56 reactions, over 100 metabolites, and 370 metabolic enzymes in yeast in 25 different steady-state conditions. Bayesian analysis was used to examine the probability of regulatory interactions. Regulation of flux through the pathways was predominantly controlled by changes in the concentration of small-molecule metabolites rather than changes in enzyme abundance. The analysis also revealed previously unrecognized regulation between pathways. —LBR

Science, this issue p. 432

CELLULAR STRUCTURE

A dynamic view of the endoplasmic reticulum

The endoplasmic reticulum (ER) is a complex membranous structure that extends from the nuclear envelope to the cell periphery. It has important roles in many cellular processes, and numerous proteins are involved in maintaining its structure. Nixon-Abell *et al.* used super-resolution approaches to look at the ER at the periphery of the cell, where the ER contacts many other cellular organelles (see the Perspective by Terasaki). This peripheral ER has been thought to comprise tubules and sheets; however, the higher-resolution view revealed that most of the “sheets” consist of a dense clustering of tubules. This dynamic

meshwork may allow the ER to change its conformation rapidly in response to cellular needs. —SMH and VV

Science, this issue p. 433;
see also p. 415

CHEMICAL KINETICS

Combing through CO oxidation kinetics

Carbon monoxide reacts with OH radicals to produce CO₂. This process is central to combustion and atmospheric oxidation chemistry. The reaction sequence is widely assumed to involve the intermediacy of a HOCO adduct that has eluded direct monitoring under thermal conditions. Bjork *et al.* successfully observed the formation of the deuterated analog of this intermediate, DOCO, while simultaneously monitoring OD by using a multifrequency infrared comb. The results confirm the termolecular nature of the formation mechanism and its sensitivity to the ambient bath gas. —JSY

Science, this issue p. 444

CLIMATE CHANGE

A warming limit for the Mediterranean basin

Pollen cores from sediments provide rich detail on the history of vegetation and climate in the Mediterranean during the Holocene (the most recent ~10,000 years). Guiot and Cramer used this information as a baseline against which to compare predictions of future climate and vegetation under different climate-change scenarios. Vegetation and land-use systems observed in the Holocene records may persist under a 1.5°C warming above preindustrial temperature levels. A 2°C warming, however, is likely over the next century to produce ecosystems in the Mediterranean basin that have no analog in the past 10,000 years. —AMS

Science, this issue p. 462

OCEAN CHEMISTRY

Inventory of an essential marine element

Sulfur is necessary for marine primary production and has a large impact on climate processes. Because it is difficult to detect accurately, the amount of dissolved organic sulfur in the ocean is poorly defined. Ksionzek *et al.* measured dissolved organic sulfur in the Atlantic to estimate its distribution and infer its quantity in the world's oceans (see the Perspective by Levine). The findings suggest that dissolved organic sulfur exceeds all other forms of organic sulfur by a factor of 10. —HJS

Science, this issue p. 456;
see also p. 418

GENE EXPRESSION

Plunging into a domain of silence

Female mammals have two X chromosomes. One must be silenced to “balance” gene dosage with male XY cells. The Xist long noncoding RNA coats the inactive X chromosome in female mammalian cells. Chen *et al.* show that the Xist RNA helps recruit the X chromosome to the internal rim of the cell nucleus, a region where gene expression is silenced. Xist is recruited to the domain through an interaction with the Lamin B receptor. This recruitment allows the Xist RNA to spread across the future inactive X chromosome, shutting down gene expression. —GR

Science, this issue p. 468

IMMUNOMETABOLISM

Metabolic support for T cell functions

For immunological T cells, responding to infections is energetically demanding. T cells rewire their metabolism so that they rely more heavily on aerobic glycolysis. This helps them to

support important effector functions such as secreting the cytokine interferon γ (IFN γ). Peng *et al.* now provide insight into how aerobic glycolysis promotes T cell effector function. Activated T cells express the aerobic glycolysis–supporting enzyme lactate dehydrogenase A (LDHA), allowing these cells to maintain high amounts of acetyl–coenzyme A, which in turn promotes histone acetylation and transcription of cytokines such as IFN γ . Engineered mice whose T cells lacked LDHA were protected from IFN γ -dependent pathologies that often characterize autoimmune diseases. —KLM

Science, this issue p. 481

ECOLOGY

How palynology was born

Much of today's understanding of past ecosystems comes from studies of pollen in sediments, a field called palynology. In a Perspective, Birks *et al.* highlight the pioneering work of Lennart von Post, who published the first quantitative analysis of pollen. One hundred years ago, von Post showed that pollen from peat bogs in southern Sweden could be used to reconstruct postglacial vegetation changes. The work heralded a century of advances that has led to dated pollen stratigraphies from all continents. These data have, for example, helped to validate climate models. Palynology continues to play a crucial role by providing long-term overviews of ecosystems, elucidating the effects of climate and other environmental changes around the globe. —JFU

Science, this issue p. 412