RESEARCH

Transcranial magnetic stimulation restores misplaced memories
Rose et al., p. 1136

IN SCIENCE JOURNALS Edited by Stella Hurtley

GALAXY FORMATION
A massive galaxy forming from molecular gas
The most massive galaxies gather their stars by merging with smaller galaxies and by accreting gas, which is then consumed during star formation. Emonts et al. investigated the Spiderweb Galaxy, a massive galaxy in the process of forming in the early universe, seen now as it was over 10 billion years ago (see the Perspective by Hatch). Radio observations of carbon monoxide revealed large quantities of molecular gas around the galaxy. The gas is not associated with the merger process but may have been recycled from earlier phases of galaxy formation. —KTS
Science, this issue p. 1128; see also p. 1102

CANCER
Running interference
Interleukin 2 (IL-2) binds to receptors on different types of T cells. CD8+ T cells, which can kill tumor cells, have IL-2 receptors with two subunits. When IL-2 binds to these, it promotes T cell activation. In contrast, T regulatory cells dampen the antitumor immune response. These cells express a different type of IL-2 receptor, which contains CD25 in addition to the other two subunits. CD25 binds IL-2 tightly but does not activate a T cell response. Arenas-Ramirez et al. developed an antibody that can block CD25. Delivering this antibody together with IL-2 allowed IL-2 to bind specifically to the activating receptors and promote an antitumor immune response without interference from T regulatory cells. —YN

TOPOLOGICAL MATTER
Shining light on a peculiar coupling
One of the long-standing predictions regarding topological insulators is the magnetoelectric effect, a coupling between a material’s magnetic and electric properties. Thanks to this coupling, Maxwell’s equations inside topological insulators are modified, resulting in so-called axion electrodynamics. Wu et al. used time-domain terahertz (THz) spectroscopy to observe signatures of these unusual electrodynamics in a thin film of Be$_2$Se$_3$. They detected tiny changes to the polarization of THz light after it passed through the thin film, confirming the expected quantization of the magnetoelectric coupling. —JS
Science, this issue p. 1124

PAIN RESEARCH
Glial cells contribute to pain
Pain hypersensitivity can spread to unaffected body regions immediately surrounding the initial insult. Sometimes it can even spread to the opposite site of the body or to large body areas and cause widespread pain. Kronschläger et al. discovered a form of synaptic plasticity in the spinal cord that may explain the spread of pain hypersensitivity. This plasticity was induced by

ATMOSPHERIC SCIENCE
How new particles form
New particle formation in the atmosphere produces around half of the cloud condensation nuclei that seed cloud droplets. Such particles have a pivotal role in determining the properties of clouds and the global radiation balance. Dunne et al. used the CLOUD (Cosmics Leaving Outdoor Droplets) chamber at CERN to construct a model of aerosol formation based on laboratory-measured nucleation rates. They found that nearly all nucleation involves either ammonia or biogenic organic compounds. Furthermore, in the present-day atmosphere, cosmic ray intensity cannot meaningfully affect climate via nucleation. —HJS
Science, this issue p. 1119

The CLOUD chamber at CERN, Switzerland
the activation of glial cells. The spread was mediated by glutamate that diffuse widely, even reaching the cerebrospinal fluid at biologically relevant concentrations. —PRS

†Science, this issue p. 1144

**STRUCTURAL BIOLOGY**  
**Zika virus is fit to be tied**

Zika virus (ZIKV) has been associated with fetal microcephaly and Guillain-Barré syndrome. Other mosquito-born flaviviruses, such as dengue virus, encode noncoding subgenomic flavivirus RNAs (sfRNAs) in their 3′ untranslated region that accumulate during infection and cause pathology. Akiyama et al. now report that ZIKV also produces sfRNAs that resist degradation by host exonucleases in infected cells. The authors solved the structure of one of ZIKV’s sfRNAs by x-ray crystallography and found that the multi-pseudoknot structure that it adopts underlies its exonuclease resistance. —KLM

†Science, this issue p. 1103, p. 1152; see also p. 1156

**HEMATOPOIESIS**

**How to maintain hematopoietic stem cells**

Hematopoiesis provides the body with a continuous supply of blood cells (see the Perspective by Sommerkamp and Trumpp). Taya et al. report that amino acid content is important for hematopoietic stem cell (HSC) maintenance in vitro and in vivo. Dietary valine restriction seems to “empty” the mouse bone marrow niche. Ito et al. used single-cell approaches and cell transplantation to identify a subset of HSCs at the top of the HSC hierarchy. Self-renewal relied on the induction of mitophagy, a quality-control process linked to a cell’s metabolic state. Both studies may be helpful in improving clinical bone marrow transplantation. —BAP

†Science, this issue p. 1115

**OXIDATIVE STRESS**

**Overactive antiviral responses in lupus**

Detection of viral RNAs causes oligomerization of mitochondrial antiviral signaling (MAVS) protein, which leads to the production of type I interferons (IFNs). Buskiewicz et al. found that MAVS oligomerization in the absence of virus may contribute to lupus disease severity. Mitochondrial reactive oxygen species (ROS) induced MAVS oligomerization and type I IFN production in uninfected cells. The MAVS C79F variant, which is associated with decreased lupus severity, did not oligomerize in response to ROS, and cells expressing this variant produced less type I IFN. —JFF

†Sci. Signal. 9, ra115 (2016).

**IN OTHER JOURNALS**

Edited by Caroline Ash and Jesse Smith

**INSECT GENOMICS**

**Acquiring the genes to digest wood**

The larvae of the invasive Asian longhorned beetle burrow into and kill trees. On sequencing the genome, McKenna et al. found that gene transfers from fungi and bacteria, followed by functional evolution and gene family expansions, appear to have conferred the ability to the beetles to find plants, digest cellulose, and nullify harmful compounds made by the plants. Interestingly, other wood-feeding beetles appear to have undergone a similar evolutionary trajectory, one that is distinct from that of wood-feeding insects such as termites. —LMZ

†Genome Biol. 17, 227 (2016).

**PLANT BIOLOGY**

**Targeting tip growth**

Tip growth, which characterizes cells as diverse as root hairs and brain neurons, depends on secretory vesicles to add new plasma membrane in a defined subdomain. Bloch et al. show that in growing Arabidopsis pollen tubes, the exocyst subunit SEC3a is a target for secretory vesicles at the tip. SEC3a localization defines the axis of growth and the domain where new pectin is added to the cell wall. Pollen tubes of tobacco, which are fatter than those of Arabidopsis, showed more complex patterns: During isotropic growth, SEC3a was distributed in a broad subapical domain, whereas during rapid elongation growth, SEC3a was localized to the apical tip. —PJH

†Plant Physiol. 172, 980 (2016).
RESEARCH

INNATE IMMUNITY

Shared logic in diverse immune systems

The innate immune systems of both plants and animals depend on the ability to recognize pathogen-derived molecules and stimulate a defense response. Jones et al. review how that common function is achieved in such diverse kingdoms by similar molecules. The recognition system is built for hair-trigger sensitivity and constructed in a modular manner. Understanding such features could be useful in building new pathways through synthetic biology, whether for broadening disease defenses or constructing new signal-response circuits. —PJH

RNA SPlicing

Tie me up, cut me down

Group II introns are mobile genetic elements found in all domains of life. They are large ribozymes that can excise themselves from host RNA. Costa et al. determined the structure of an excised group II intron in its branched conformation. This conformation is comparable to the branched “lariat” seen during the splicing of nuclear RNA transcripts. The lariat conformation helps assemble the group II active site for the reverse splicing reaction. The lariat in spliceosomal splicing may also have a similar role in the second step of messenger RNA intron removal. —GR

WATER CHEMISTRY

Frame-by-frame view of acidic transport

Protons in acidic solution constantly hop from one water molecule to the next. In between the hopping, controversy lingers over the extent to which the proton either sticks largely to one water molecule in an Eigen motif or bridges two of them in a Zundel motif. It has been hard to probe this question directly because the distinguishing vibrational bands in bulk aqueous acid spectra are so broad. Wolke et al. studied deuterated prototypical Eigen clusters, D’(D2O), bound to an increasingly basic series of hydrogen bond acceptors (see the Perspective by Xantheas). These clusters displayed sharp bands in their vibrational spectra, highlighting a steadily evolving distortion toward a Zundel-like motif and pointing the way toward further investigations. —JSY

NEUROSCIENCE

Attention changes local brain activity

There is a well-known correlation between arousal and neuronal activity in the brain. However, it is unclear how these general effects are reflected on a local scale. Engel et al. recorded from higher visual areas in behaving monkeys and discovered a new principle of cortical state fluctuations. A special type of electrodes revealed that the state changes affected neuronal excitability across all layers of the neocortex. When the animals attended to a stimulus, the vigorous spiking states became longer and the faint spiking states became shorter. These states correlated with fluctuations in the local field potential. A sophisticated computational model of the state changes fitted a two-state model of neuronal responsiveness. —PRS

WORKING MEMORY

How to reactivate forgotten memories

Sophisticated techniques can decode stimulus representations for items held in a person’s working memory. However, when subjects shift their attention toward something else, the neural representation of the now unattended item drops to baseline, as though the item has been forgotten. Rose et al. used single-pulse transcranial magnetic stimulation (TMS) to briefly reactivate the representation of an unattended item. A short pulse of TMS enhanced recognition of “forgotten” stimuli, bringing an unattended item back into focal attention. —PRS

ATHEROSCLEROSIS

Letting SLE-Ping plaques lie

Patients with the autoimmune disease systemic lupus erythematosus (SLE) are more likely to develop atherosclerosis than healthy individuals. Smith et al. hypothesized that invariant natural killer T (iNKT) cells contribute to this process because of their connection to both immune responses and lipid metabolism. The authors found that iNKT cells from SLE patients with asymptomatic plaque (SLE-P) produced more of the Th2 cytokine interleukin-4 than those from SLE patients with no plaques. These SLE-P iNKT cells were associated with changes in lipid composition and monocyte skewing to the M2 phenotype. Thus, SLE-P iNKT cells may connect changes in lipids and the immune response, contributing to the development of cardiovascular disease in SLE patients. —ACC

Edited by Stella Hurtley