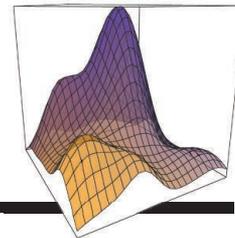


RESEARCH

Dissecting development of the enteric nervous system

Lasrado et al., p. 722



IN SCIENCE JOURNALS

Edited by Stella Hurtley

LATITUDINAL GRADIENTS

Risky in the tropics

It is well known that diversity increases toward the tropics. Whether this increase translates into differences in interaction rates among species, however, remains unclear. To simplify the problem, Roslin *et al.* tested for predation rates by using a single approach involving model caterpillars across six continents. Predator attack rates were higher toward the equator, but only for arthropod predators. —SNV

Science, this issue p. 742



Plasticine caterpillars probe for predator attacks.

BIOCHEMISTRY

ATP boosts protein solubility

Adenosine triphosphate (ATP) has well-characterized roles in providing energy for biochemical reactions within cells. Patel *et al.* find that ATP may also enhance protein solubility, which could help explain why such high concentrations of ATP are maintained in cells (see the Perspective by Rice and Rosen). Protein concentrations in cells can exceed 100 mg/ml. The authors found that ATP at concentrations found in cells could act as a hydrotrope to help solubilize hydrophobic proteins. The results raise the possibility that ATP concentrations could influence processes such as protein aggregation that occur in disease or liquid-liquid phase separations that occur within cells. —LBR

Science, this issue p. 753; see also p. 701

MOLECULAR SORPTION

Drying natural gas efficiently

Natural gas must be purified before it can be transported. The preparation process also includes a drying step to remove water. Microporous adsorbents such as zeolites are used for this purpose, but they often need to be heated to temperatures up to 250°C to remove the water so that they can be reused. Cadiau *et al.* describe a fluorinated metal-organic framework containing nickel metal centers that can remove water from gas streams but that can be regenerated by heating to only 105°C. —PDS

Science, this issue p. 731

PLANETARY TOPOGRAPHY

River systems reveal planetary tectonics

Earth, Mars, and Titan have all hosted rivers at some point in

their histories. Rivers erode the landscape, leaving behind signatures that depend on whether the surface topography was in place before, during, or after the period of liquid flow. Black *et al.* developed two metrics to measure how well river channels align with the surrounding large-scale topography (see the Perspective by Burr). Earth's plate tectonics introduce features such as mountain ranges that cause rivers to divert, processes that

clearly differ from those found on Mars and Titan. —KTS

Science, this issue p. 727; see also p. 708

CELL FATE

Blocking somatic genes to make sperm

To generate cells with a specific identity, only a subset of genes is used. Most studies focus on factors that turn on cell type-specific gene expression.



An ancient river erodes the landscape in Namibia.

PHOTOS: (MIDDLE) TIMOTHY BONEBRAKE; (BOTTOM) ERIC NATHAN/LAMY STOCK PHOTO

However, mechanisms are also needed to block expression of genes that specify other cell lineages. Kim *et al.* identified such a mechanism in the *Drosophila* male germ line. A multiple–zinc finger protein and a chromatin remodeler were found to act together to block transcription from cryptic promoters. These factors prevented aberrant gene expression and enabled proper differentiation in the adult sperm stem cell lineage. —BAP

Science, this issue p. 717

NITROGEN CYCLE

From air to shining sea

Nitrogen is an essential nutrient for phytoplankton growth. Nitrogen is primarily supplied to the surface ocean by mixing from below. However, as fertilizer use and combustion of fossil fuels rise, the atmosphere is expected to become an increasingly important source. Ren *et al.* measured nitrogen isotopes in organic matter from a South China Sea coral (see the Perspective by Boyle). Their findings suggest that atmospheric deposition of anthropogenic nitrogen began right at the end of the 20th century. This pathway now supplies nearly one quarter of the annual nitrogen input to the surface ocean in this region. —HJS

Science, this issue p. 749;
see also p. 700

NEUROSCIENCE

A brain region for social cognition

Monkeys recognize social interactions and their meanings quickly and effortlessly. Little is known about the neural circuitry that underlies this understanding. Sliwa and Freiwald scanned monkey brains as the monkeys watched static or moving stimuli. A subset of brain areas was exclusively active during monkey-monkey interactions, as opposed to physical interactions between two objects. This network shares some of its components with the monkey mirror neuron system mapped

previously by others and with a possible homolog of the human network involved in the theory of mind. —PRS

Science, this issue p. 745

REPRODUCTIVE BIOLOGY

Why antioxidants do not prevent preeclampsia

Preeclampsia impairs fetal growth and can damage maternal organs. Reactive oxygen species (ROS) have been proposed to increase the risk of preeclampsia by blocking blood vessel formation (angiogenesis) in the placenta. However, using a mouse model of preeclampsia, Nezu *et al.* found that decreasing ROS levels led to reduced placental angiogenesis, fetal growth, and maternal survival. In contrast, increased ROS levels resulted in greater placental angiogenesis and improved fetal and maternal outcomes. These results help to explain why antioxidants have been ineffective at preventing preeclampsia in clinical trials. —WW

Sci. Signal. **10**, eaam5711 (2017).

HIV

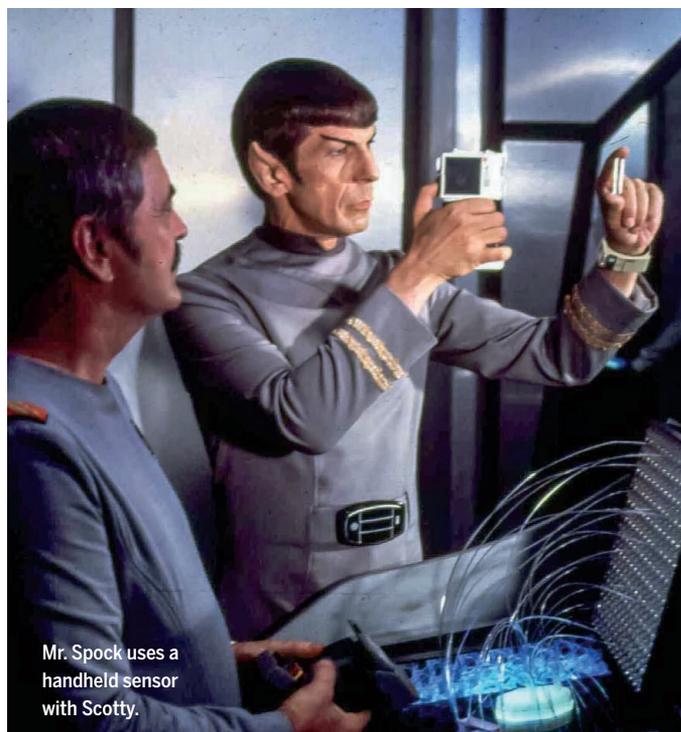
Taking HIV to the gut

Antiretroviral therapy (ART) effectively limits HIV replication. Nevertheless, HIV⁺ individuals need to be medicated for life because ART withdrawal results in rebound of persistent virus. One emerging approach to target HIV is an antibody against integrin $\alpha 4\beta 7$. Integrin $\alpha 4\beta 7$ is a receptor that facilitates homing of CD4⁺ T cells to the gut, a key site for HIV persistence. Guzzo *et al.* found that integrin $\alpha 4\beta 7$ is incorporated into the HIV envelope, suggesting that antibody treatment may directly interfere with the ability of HIV to home to intestinal tissues. Their results change our perception of the role of integrin $\alpha 4\beta 7$, a promising therapeutic target in HIV pathogenesis. —AB

Sci. Immunol. **2**, eaam7341 (2017).

IN OTHER JOURNALS

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



Mr. Spock uses a handheld sensor with Scotty.

NANOTECHNOLOGY

Just one drop will do it

Handheld sensors, often found in science fiction stories as a way of collecting a broad spectrum of data with a single device, are becoming real devices through the continuous miniaturization of technology. Engel *et al.* combine an electronic array of sensors with optical microspectroscopy and atomic force microscopy, based on two-dimensional materials, on a single platform. Liquids can be distinguished both electronically and optically, and dynamic surface wetting can also be monitored. At the limits of the device, the topography and optical spectra of isolated oil emulsion droplets with volumes less than 10 attoliters could be determined. —MSL

Nano Lett. **10**, 1021/acs.nanolett.6b03561 (2017).

DEVELOPMENT

Mom tells virus what to do

Mother's directions must be followed, even in the earliest stage of embryo development. The maternal genome is read up until a phase called the maternal-to-zygotic transition. At this point, which corresponds to the two-cell stage in mice, the embryonic genome takes over. Using

single-cell analyses, Huang *et al.* examined the function of the maternal factor Stella. Widespread transcription changes result when Stella is eliminated. In particular, endogenous retroviruses such as MuERV-L that are normally active in the early embryo display impaired expression when Stella is knocked down in vivo. Hence, the normal activity of ancient viruses must be properly turned on for transitioning

ALSO IN SCIENCE JOURNALS

Edited by Stella Hurtley

NEUROSCIENCE

Glial calcium dynamics in space and time

Astrocytes use calcium signals to process information received from neighboring brain cells and thus generate modulatory responses at the local or network level. Previous studies have relied on calcium imaging in line scans or in a single focal plane mostly focusing on the cell bodies of astrocytes. Bindocci *et al.* used more powerful scanners that can rapidly scan many focal planes. They combined this technique with advanced genetic tools for monitoring calcium gradients with high sensitivity, which allowed three-dimensional calcium imaging of a whole astrocyte. Most of the basal calcium activity occurred in the astrocyte processes, some in the endfeet, and only a small fraction actually in the cell bodies of astrocytes. —PRS

Science, this issue p. 715

GERMINAL CENTERS

Guiding immune cells to the center

Germinal centers (GCs) are the site of antibody affinity maturation. The GC response fundamentally depends on contact-dependent signal exchange between antigen-specific T and B lymphocytes. Lu *et al.* uncovered a repulsive guidance system that inhibits GC recruitment and retention of T follicular helper (T_{FH}) cells while simultaneously promoting their helper activities locally (see the Perspective by Moschovakis and Forster). This system comprises the GC-specific transmembrane ephrin B1 (EFNB1) molecule and two EFNB1 receptors—EPHB4 and EPHB6—expressed by activated T cells, including T_{FH} cells. In the absence of EFNB1 on GC B cells or when EPHB6 was suppressed on T cells, inappropriately large numbers of T cells were recruited to and retained

in the GC as a result of relaxed repulsion of T_{FH} cells. —SMH and KLM

Science, this issue p. 716;
see also p. 703

MATERIALS SCIENCE

Watching defects in heated thin films

The response of materials to external conditions depends on small-scale features such as defects and grain boundaries. Yau *et al.* heated gold thin films and used coherent x-ray diffractive imaging to track how these microstructures developed during grain growth (see the Perspective by Suter). The technique allowed nondestructive visualization of the features in three dimensions. The method should help link external stimuli to material response through changes in microstructure, thereby allowing development of novel materials through microstructural engineering. —BG

Science, this issue p. 739;
see also p. 704

OPTICS

Graphene takes light to a higher level

High harmonic generation is a useful nonlinear effect in which the light-matter interaction within a material results in the conversion of one wavelength to a shorter one. Typically performed in atomic gases, there is now interest in extending such a process to the solid state. Yoshikawa *et al.* pumped single-layer graphene with intense polarized pulses of infrared light to generate ultraviolet light, up to the ninth harmonic. Theoretical analysis of the process suggests that the effect could be transferred to other solid-state systems, providing a possible route to develop coherent light sources across the spectrum. —ISO

Science, this issue p. 736

DEVELOPMENTAL BIOLOGY

Embryo viability relies on placental repression

The insulin-like growth factor (IGF) signaling pathway controls maternal supply of and fetal demands for nutrients. Yang *et al.* report that the essential KRAB–zinc finger protein ZFP568 specifically and directly represses a placental-specific IGF2 transcript during early mouse development. Elimination of ZFP568 in vivo leads to the inappropriate early activation of transcription, which results in embryonic death owing to overexpression of IGF2 peptide. Thus, the specific, targeted preimplantation repression of a promoter is essential for viability. —BAP

Science, this issue p. 757

CLIMATE

No quick fix for climate solutions

Policy scenarios for limiting climate change mostly assume that technologies for removing carbon dioxide from the atmosphere will be able to compensate for ongoing carbon emissions. In a Perspective, Field and Mach caution that most of these technologies are in their infancy and that relying on their future large-scale use is risky. Techniques such as bioenergy with carbon capture and storage, reforestation, and afforestation to remove carbon dioxide would require vast amounts of land and water and thus endanger food security and biodiversity. Furthermore, allowing temperatures to peak as emissions continue and then decline as carbon dioxide is removed risks further instability in the Earth system and human society. —JFU

Science, this issue p. 706

HEART FAILURE

A brainy treatment for heart failure

Respiratory difficulty and diaphragm weakness are known symptoms of heart failure, but they are usually attributed to pulmonary edema damaging the diaphragm through physical stress. Foster *et al.* found that this is not the only contributing factor. In mouse models, diaphragm weakness developed even in heart failure without pulmonary edema. The authors linked this observation to changes in angiotensin II and β -adrenergic signaling, which result in centrally controlled ventilatory overdrive. Drugs targeting β -adrenergic signaling were effective in preventing ventilatory overdrive and subsequent diaphragmatic injury, but only if they penetrated the blood-brain barrier. —YN

Sci. Transl. Med. **9**, eaag1303 (2017).

NEURODEVELOPMENT

Neural crest rules the gut

The neurons and glial cells that regulate gut function derive from neural crest cells that emerge from the developing neural tube. Lasrado *et al.* used single-cell transcriptomics and mosaic mutagenesis to follow how the enteric nervous system is built in mice. Overlapping expression of regulatory programs supports dynamic determination of cell fates, with the developing neurons organized by clonal lineages. The clonal build model may explain how gut motility is coordinated in sequential segments and gut secretion is coordinated with motility. —PJH

Science, this issue p. 722