

This is a case of the nocebo effect seriously interfering with medical treatment. Tinnermann *et al.* investigated whether value information such as the price of a medication can further modulate behavioral nocebo effects and the underlying neural network dynamics (see the Perspective by Colloca). They used brain imaging to characterize the circuits involved in nocebo hyperalgesia within the descending pain pathway from the prefrontal cortex to the spinal cord. Their findings revealed how value information increased the nocebo effect. —PRS

Science, this issue p. 105; see also p. 44

TRANSCRIPTION

Gene expression during mitosis

During mitosis, long-range interactions within chromosomes are lost, and many enhancers become inactive. It is generally thought that gene expression is silent at this time. However, transcription must be reactivated when cells reenter the cell cycle in order to maintain cell identity. Palozola *et al.* used a sensitive nascent RNA labeling and sequencing method to reveal low-level transcription of many genes in mitosis. Upon mitotic exit, the amplitude of gene expression was reestablished with basic cell functions prioritized over cell-specific genes. Thus, transcription itself may retain gene expression patterns through mitosis. —BAP

Science, this issue p. 119

ANTIBIOTIC RESISTANCE

Rapidly recognizing resistance

Reducing the time required to determine whether a bacterial sample is resistant to an antibiotic could hasten proper treatment of infections. Schlappi *et al.* developed an antibiotic susceptibility test that could be performed within 30 min using clinical urine samples. The test uses digital loop-mediated

isothermal amplification to measure the amount of nucleic acid markers of antibiotic susceptibility produced by bacteria present within a clinical sample after a brief incubation with an antibiotic. Performing the test on a microfluidic platform enabled single-molecule amplification and quantification in real time, determining *Escherichia coli* susceptibility comparably to gold-standard methods, but more quickly. —CC

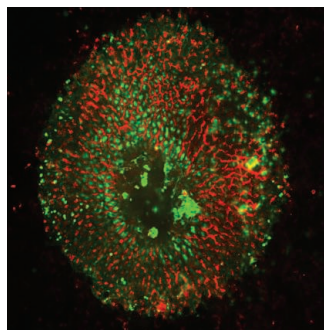
Sci. Transl. Med. **9**, eaal3693 (2017).

IMMUNOLOGY

Imaging the unforeseen fate of neutrophils

Inflammation that results from insults such as ischemia and reperfusion or trauma in the absence of microorganisms is known as “sterile inflammation.” Neutrophils are recruited in vast numbers during sterile inflammation and have been thought to play a detrimental role. Wang *et al.* used intravital microscopy to show that neutrophils actually perform helpful tasks such as removing and regenerating thermally damaged blood vessels in the liver (see the Perspective by Garner and de Visser). Moreover, neutrophils neither die nor are phagocytosed. Instead, they return to the circulation in a process called “reverse transmigration,” making a pit stop in the lungs, before ending their lives where they began—in the bone marrow. Thus, a reconsideration of the use of anti-neutrophil therapies after injury may be warranted. —STS

Science, this issue p. 111; see also p. 42



Neutrophils (red) inside a focal lesion at 12 hours post-injury

IN OTHER JOURNALS

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



Cigarette smoke-induced epigenetic changes sensitize cells for mutation.

CANCER

Initiating lung cancer

Cigarette smoke contributes to epigenetic and genetic changes in lung cancer. But whether and how these alterations interact in lung cancer initiation has remained unclear. Vaz *et al.* showed that in immortalized lung epithelial cells, exposure to cigarette smoke condensate progressively altered the binding of chromatin-modifying enzymes to DNA and induced changes in DNA methylation in the absence of DNA mutations. Such epigenetically altered cells exhibited a stem cell-like chromatin state that sensitized them to later acquire oncogenic mutations and become lung cancer cells. Modeling cancer initiation is extremely difficult, but this is an important process to understand if we hope to find effective strategies to prevent cancer initiation and/or progression. —GKA

Cancer Cell **32**, 360 (2017).

GENE REGULATION

Regulation through clustering

Transcription factors convey information from the environment to influence gene regulation. These proteins bind promoter sequences for gene repression or activation, but the mechanism by which they find their target sequence is unclear. Wollman *et al.* examined gene regulation by the Mig1 repressor and the Msn2 activator. The Mig1 repressor is a

zinc-finger DNA-binding protein that localizes to the nucleus when the yeast *Saccharomyces cerevisiae* is exposed to glucose. Using single-molecule fluorescent microscopy to track localization, the authors found that six to nine transcription factor molecules form clusters that move from the cytoplasm to the nucleus. The clusters may be stabilized in live cells by the properties of the cytoplasmic colloid. Clustered transcription factors seem to reduce promoter search time and



Less involved mothers produce more successful guide dogs

BEHAVIOR

Smothering seeing-eye training

Guide dogs are valued for their ability to follow complex instructions and for resisting impulsive behaviors—admirable human traits, too. Guide dogs undergo controlled rearing and training programs and thus offer an opportunity for investigating the development of adult temperament. Bray *et al.* modeled how maternal behavior predicted the performance of pups. Vigilant, interactive mothers tended to rear pups that barked readily and were more aggressive—fine for a police dog. But for a guide dog, calmness, obedience, and concentration are needed. Puppies with less involved mothers—for instance, who stand up while suckling—are more likely to succeed on these scores. Too much neglect is stressful and a bad thing, but smothering leads to individuals who lack the experience of learning to deal with stress and solving problems. —CA

Proc. Natl. Acad. Sci. U.S.A. 10.1073/pnas.1704303114 (2017).

permit more efficient gene regulation. —BAP

eLife 10.7554/eLife.27451.001 (2017).

BIOCHEMISTRY

How does nitrogenase spring its trap?

It's a bit of a chemical mystery why, after eons of evolution to optimize efficiency, nitrogenase enzymes still make hydrogen as a by-product when they make ammonia. Recent work suggests that this step is key to binding the nitrogen molecule in the active site. Khadka *et al.* attached the molybdenum-iron protein of nitrogenase to an electrode to isolate the kinetics of hydrogen production.

By measuring deuterium isotope effects and performing accompanying density functional theory calculations, they established that the rate-limiting step involves formation of one hydrogen molecule by proton transfer from sulfur to a bridging iron hydride. —JSY

J. Am. Chem. Soc. 10.1021/jacs.7b07311 (2017).

PHYSICS

An atomic ring around the rosie

Although quantum computers are expected to be vastly better at certain tasks than classical ones, they must also simultaneously perform sophisticated

error control and correction. Using topologically protected states could reduce this baggage, but finding a viable physical implementation is tricky. Dai *et al.* engineered an interacting system of bosonic atoms on a square plaquette that could serve as a basis for creating topological states. The researchers had to carefully control the exchange interactions between the atoms to bring out the so-called ring exchange that involved all four atoms on a plaquette. It is expected that further technological progress could lead to scaling up this system into a network of coupled plaquettes with more dominant ring-exchange interactions. —JS

Nat. Phys. 10.1038/NPHYS4243 (2017).

PHYSIOLOGY

Gut bacteria may tell human cells what to do

New studies are providing glimpses of the language through which bacteria in the human gut communicate with us. Cohen *et al.* analyzed the DNA from the human microbiome for members of the *N*-acyl synthase family of proteins—enzymes that catalyze synthesis of molecules that might serve as ligands for human heterotrimeric G protein-coupled receptors (GPCRs). More than 140 such genes were detected, and they produced molecules that bound and efficiently activated human GPCRs. Transfer of bacteria engineered to express such ligands into mice altered glucose metabolism to a similar extent as did a drug used to treat diabetes. Thus, bacteria, which communicate with each other through small excreted molecules, may communicate with their host in a similar manner—thereby offering opportunities for therapeutic intervention. —LBR

Nature 10.1038/nature23874 (2017).

STELLAR ASTROPHYSICS

An expanding shell around an evolved star

When intermediate-mass stars approach the ends of their lifetimes, they begin to shed their outer layers. Bursts of nuclear reactions in the stellar core lead to thermal pulses, temporarily increasing the mass-loss rate for several centuries. Kerschbaum *et al.* have mapped the carbon monoxide gas ejected by the nearby evolved star U Antliae. The gas forms an almost perfectly symmetric expanding shell around the star. By measuring the velocity of the expansion, the authors calculated how the mass-loss rate has changed over several thousand years and showed that it agrees with models of thermal pulses. The results will help to understand how evolved stars enrich the interstellar medium with heavy elements. —KTS

Astron. Astrophys. 605, A116 (2017).