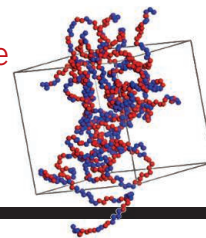


RESEARCH

Self-healing in simple vinyl polymers

Urban et al., p. 220



IN SCIENCE JOURNALS

Edited by Stella Hurtley



PLANT SCIENCE

Keeping the doors open for symbiosis

Nitrogen fixation by legumes results from a symbiotic partnership between plant and microbes. These together elaborate nodules on the plant roots that house the bacteria. Tsikou *et al.* identified a microRNA made in the aboveground shoots of *Lotus japonicus* that translocates to the plant's roots. In the roots, the microRNA posttranscriptionally regulates a key suppressor of symbiosis, thus keeping the uninfected root susceptible to productive infection by symbiotic bacteria. —PJH

Science, this issue p. 233

Legumes like this *Lotus japonicus* send microRNAs from shoot to root to promote root nodule synthesis.

MATERIALS SCIENCE

Modeling collapse with soaked cereal

Naturally brittle and porous media, like ice shelves and rockfill dams, are collapse-prone when they encounter chemically active fluids, or pressure. What happens when these materials are subject to both forces at once is not well understood. Einav and Guillard analyzed a simpler version of a rockfill dam: a vertical cylinder filled with puffed rice. After applying pressure and then injecting liquid into the bottom of the cylinder, they observed “ricequakes.” These abrupt collapses of wetted puffed rice began shortly after liquid injection and were marked by continuous clicking sounds. A model based on these

observations could be applied to analyze the effects of geological pressures over long time scales in crustal rocks and ice sheets. —PJB

Sci. Adv. 10.1126/sciadv.aat6961 (2018).

SUPERNOVAE

Explosive origin of a binary neutron star

Some types of core-collapse supernovae are known to produce a neutron star (NS). A binary NS merger was recently detected from its gravitational wave emission, but it is unclear how such a tight binary system can be formed. De *et al.* discovered a core-collapse supernova with unusual properties, including the removal of the outer layers of the star before

the explosion. They interpret this as the second supernova in an interacting binary system that already contains one NS. Because the explosion probably produced a second NS (rather than a black hole) in a tight orbit, it could be an example of how binary NS systems form. —KTS

Science, this issue p. 201

MOLECULAR BIOLOGY

Cas12 inhibitors join the anti-CRISPR family

Bacteria and their phages continually coevolve in a molecular arms race. For example, phages use anti-CRISPR proteins to inhibit the bacterial type I and II CRISPR systems (see the Perspective by Koonin and

Makarova). Watters *et al.* and Marino *et al.* used bioinformatic and experimental approaches to identify inhibitors of type V CRISPR-Cas12a. Cas12a has been successfully engineered for gene editing and nucleic acid detection. Some of the anti-Cas12a proteins identified in these studies had broad-spectrum inhibitory effects on Cas12a orthologs and could block Cas12a-mediated genome editing in human cells. —SYM

Science, this issue p. 236, p. 240; see also p. 156

MULTIPLE SCLEROSIS

Move over myelin

Although it is well established that autoreactive lymphocytes induce demyelination in multiple sclerosis, the exact

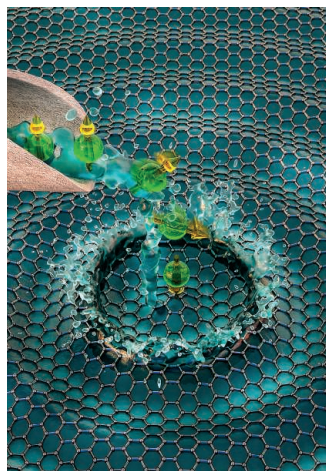
antigenic targets that initiate disease are undefined. Planas *et al.* studied CD4⁺ T cells from the cerebrospinal fluid of patients with multiple sclerosis. One CD4⁺ T cell clone was reactive to the human enzyme guanosine diphosphate (GDP)–L-fucose synthase; T cells from other patients were then identified, as well as myelin-reactive cells. Intriguingly, some of the GDP-L-fucose synthase–reactive cells could also be stimulated by a bacterial version of the enzyme. These results identify an auto-antigen and suggest that one possible trigger of disease could be cross-reactivity to microbiota-derived peptides. —LP

Sci. Transl. Med. **10**, eaat4301 (2018).

MAGNETISM

Magnons propagating in graphene

At sufficiently low temperatures, a two-dimensional electron system placed in an external magnetic field can exhibit the so-called quantum Hall effect. In this regime, a variety of magnetic phases may occur, depending on the electron density and other factors. Wei *et al.* studied the properties of these exotic magnetic phases in graphene. They generated magnons—the excitations of an ordered magnetic system—that were then absorbed by the sample, leaving a mark on its electrical conductance. The



Artist's view of magnon absorption by graphene

magnons were able to propagate across long distances through various magnetic phases in the bulk graphene. —JS

Science, this issue p. 229

VIROLOGY

Pathologizing *Staphylococcus*, fast

Bacteriophages are the main vehicle for gene swapping in bacteria, notoriously of pathogenicity islands and antibiotic resistance genes. Chen *et al.* noticed that the *Staphylococcus aureus* prophages do not excise from their host's genome until very late in their life cycles (see the Perspective by Davidson). Thus, the phage DNA is amplified while embedded in the bacterial chromosome. The resulting concatemers are processively packed into virus capsules while still integrated in the host chromosome. Each virion is only set loose when the capsule has reached physical capacity—a process called “headful” packaging. In situ amplification maximizes viral replication, and the headful mechanism means adjacent bacterial-host DNA also gets grabbed to fill the capsule. This process ensures that host genes are transmitted along with the phage. —CA

Science, this issue p. 207; see also p. 152

NANOMATERIALS

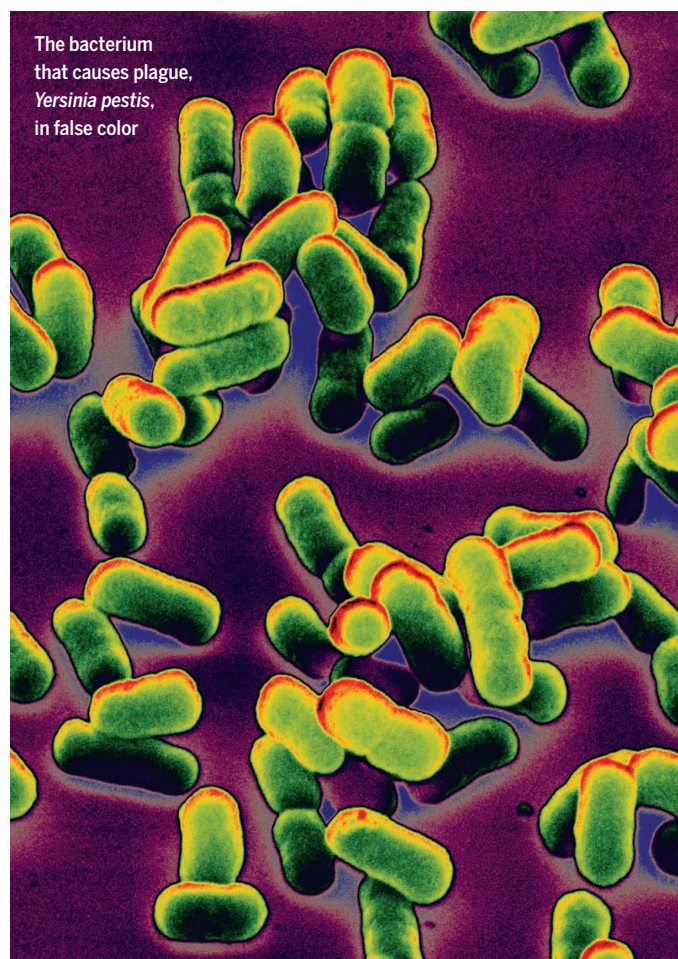
The twisted carbon nanotube story

Despite progress in growing single-walled carbon nanotubes of specific size and chirality, the factors that control their growth are still not fully known. Magnin *et al.* developed a thermodynamic model for the growth of single-walled carbon nanotubes. The model explains the origin of nanotube chirality in terms of the configurational entropy of the nanotube edge. The model should be useful in helping to guide nanotube growth parameters to enhance selectivity. —MSL

Science, this issue p. 212

IN OTHER JOURNALS

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



The bacterium that causes plague, *Yersinia pestis*, in false color

MICROBIOLOGY

Plague, one lymph node at a time

Swollen lymph nodes, or buboes, are the hallmark of plague, which is caused by the pathogen *Yersinia pestis*. Buboes result from a massive influx of immune cells into draining lymph nodes (DLNs). Recently, *Y. pestis* was shown to disseminate by carriage within immune cells migrating from one DLN to the next. Arifuzzaman *et al.* investigated how *Y. pestis* exploits the features of buboes to promote pathogenesis. Infiltration of infected monocytic cells into tightly packed buboes coincided with cytolysis triggered by *Yersinia* outer protein J, resulting in the release of intracellular bacteria and extensive infection of neighboring cells. The dying monocytic cells released sphingosine 1-phosphate (S1P), which attracted yet more cells, and up-regulated expression of the S1P receptor promoted the exit of newly infected monocytic cells from buboes. Preventing necrotic cell death protected mice from otherwise lethal infection. Thus, *Y. pestis* commandeers cell-death and immune-cell trafficking programs to convert the host's DLNs into specialized hubs for dissemination. —SMH

JCI Insight **3**, e122188 (2018).

ALSO IN SCIENCE JOURNALS

Edited by Stella Hurtley

CANCER BIOMARKERS

Mining immunotherapy clinical trials

Clinical trial data can provide a wealth of information about how drugs work. Yet such information often belongs to pharmaceutical companies and is rarely accessible to the scientific community at large. Cristescu *et al.* provide exploratory analysis of a cancer genomics dataset, collected from four separate clinical trials of Merck's PD-1 immunotherapy drug, pembrolizumab. This informative public resource examines more than 300 patient samples representing 22 different tumor types. Two widely used signatures that currently predict immunotherapy response are tumor mutational burden and a "hot" T cell-inflamed microenvironment. The study analyzed these two proposed biomarkers in combination to see what predictive clinical utility they may hold. —PNK

Science, this issue p. 197

PROTEIN HOMEOSTASIS

A way to prevent deadly interaction

Many metazoan proteins form oligomers, which is often mediated by modular domains such as BTB domains. Mena *et al.* now describe a quality control pathway they term dimerization quality control (DQC) (see the Perspective by Herhaus and Dikic). DQC monitors and prevents aberrant dimerization of BTB domain-containing proteins. The system relies on FBXL17, an adaptor protein that recruits an E3 ligase that specifically ubiquitylates nonfunctional BTB heterodimers, triggering their degradation. FBXL17 accesses a degradation signal at the BTB dimer interface in nonphysiological, nonfunctional complexes. The loss of DQC from *Xenopus laevis* embryos leads to lethal neurodevelopmental defects. —SYM

Science, this issue p. 198;
see also p. 151

STRUCTURAL BIOLOGY

From DNA unwrapping to histone exchange

The yeast SWR1 complex, a member of the INO80 family of nucleosome remodelers, exchanges the H2A-H2B histone dimer for the Htz1 variant-containing dimer. Unlike all other remodelers, SWR1 does not translocate the nucleosome. Willhoft *et al.* applied structural and single-molecule analyses to show that the interaction between SWR1 and the nucleosome destabilizes the DNA wrapped around the histone core. This SWR1-catalyzed partial unwrapping of the DNA was regulated by adenosine triphosphate (ATP) binding but did not require ATP hydrolysis. —SYM

Science, this issue p. 199

NEURODEVELOPMENT

Thyroid hormone in color vision development

Cone photoreceptors in the eye enable color vision, responding to different wavelengths of light according to what opsin pigments they express. Eldred *et al.* studied organoids that recapitulate the development of the human retina and found that differentiation of cone cells into their tuned subtypes was regulated by thyroid hormone. Cones expressing short-wavelength (S) opsin developed first, and cones expressing long- and medium-wavelength (L/M) opsin developed later. The switch toward development of L/M cones depended on thyroid hormone signaling through the nuclear thyroid hormone receptor. —PJH

Science, this issue p. 200

ORGANIC CHEMISTRY

An acid inaccessible to aldol products

The aldol reaction is a venerable and widely applicable method

for making carbon-carbon bonds. Ironically, it is most challenged by the simplest substrates. The trouble is that the product looks a lot like one of the reactants, and so it can latch onto the coupling partner instead. Schreyer *et al.* report that a bulky phosphorus-based acid catalyst alleviates this problem. The acidic site is buried in a pocket that is too small to activate the product for further reaction. The chiral geometry of the catalyst also induces high enantioselectivity. —JSY

Science, this issue p. 216

POLYMERS

Simple routes to self-healing

Biology provides many routes for self-healing or repair, but this trait is hard to endow into engineering materials. Although self-repair has been demonstrated for some polymers, it usually required specialized monomers. Urban *et al.* demonstrate that for a very narrow range of compositions, simple vinyl polymers based on methyl methacrylate and *n*-butyl acrylate show repeatable self-healing properties (see the Perspective by Sumerlin). A key characteristic of this system is that it relies on van der Waals interactions rather than the reformation of hydrogen or covalent bonds for repair. —MSL

Science, this issue p. 220;
see also p. 150

ORGANIC CHEMISTRY

Iodine smooths the way to ketyl radicals

Chemists typically transform carbonyl compounds through polar two-electron reactions. It is also possible to pursue radical coupling strategies by adding just one electron to form a ketyl group. However, the strong reductant supplying that electron often limits the reaction's

versatility. Wang *et al.* report a mild means of forming ketyls by first adding acetyl iodides across the C=O bond (see the Perspective by Blackburn and Roizen). A photoactivated manganese catalyst then temporarily pulls the iodine away, leaving a ketyl to couple with alkynes. The iodine then returns to one of the alkyne's carbons, stabilizing the product but remaining poised for further transformations. —JSY

Science, this issue p. 225;
see also p. 157

IMMUNOTHERAPY

The next step for cell therapy?

Considerable advances have been made in engineering T cells for adoptive cell transfer to treat cancer by manipulating the patients' immune system. In a Perspective, Bluestone and Tang discuss the potential for use of regulatory T cells (T_{reg}) to treat patients with autoimmunity and other diseases that involve pathological inflammation. Preclinical research has provided encouraging results with T_{reg} therapies, and numerous clinical trials have been initiated to test adoptive T_{reg} transfer in patients with, for example, type I diabetes, organ transplant rejection, and amyotrophic lateral sclerosis. —GKA

Science, this issue p. 154

CYTOKINES

Stabilizing the IL-17 response

The inflammatory cytokine interleukin-17 (IL-17) can stimulate both antifungal host defense and autoimmunity by promoting the stability of target messenger RNAs (mRNAs). Amatya *et al.* found that IL-17 increased the abundance of the RNA binding protein Arid5a in mouse cells (see the Focus by Puel and Casanova). Arid5a promoted the cellular response to IL-17 by increasing the mRNA stability of

a selection of IL-17–stimulated transcripts. For other transcripts, Arid5a interacted with the translation initiation factor eIF4G to augment their translation. —ERW

Sci. Signal. **11**, eaat4617, eaau8876 (2018).

INFLAMMATION

Brushing up on lung inflammation

Inhaled environmental allergens elicit type 2 lung inflammation and lead to an increase in the risk of developing allergies and asthma. Bankova *et al.* found that one step along this pathway depends on lipid mediator leukotriene E₄ signaling. This occurred via a receptor on respiratory epithelial cells that increased the number of brush cells. These brush cells represent a rare population of chemosensory cells in the lung epithelium that express receptors shared by taste bud cells. The brush cells were identified as the major pulmonary source of interleukin-25, a proinflammatory protein increased in diseases associated with type 2 inflammation. —IW

Sci. Immunol. **3**, eaat9453 (2018).