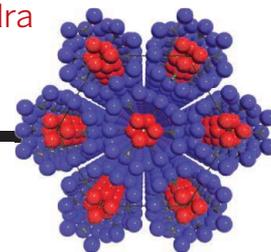


RESEARCH

Supramolecular lattices from nanosized giant tetrahedra

Huang et al., p. 424



IN SCIENCE JOURNALS

Edited by Caroline Ash



The supernova remnant Sagittarius A East is surrounded by dust

SUPERNOVAE

Zap the dust away? Not so fast

It would be great to clean up dust by vaporizing it, but even powerful blasting by an exploding star doesn't seem capable of this. Supernovae produce vast amounts of dust, but it is a mystery how that dust survives ensuing hostile conditions. Lau *et al.* used the SOFIA telescope to observe the dust associated with the supernova remnant Sgr A East. They found that this dust had endured far longer than expected, which indicates that dust in the universe's oldest galaxies can also be attributed to supernovae. — MMM

Science, this issue p. 413

ISOTOPE GEOCHEMISTRY

What controls clumped isotopes?

Stable isotopes of a molecule can clump together in several combinations, depending on their mass. Even for simple molecules such as O₂, which can contain ¹⁶O, ¹⁷O, and ¹⁸O in various combinations, clumped isotopes can potentially reveal the temperatures at which molecules form. Away from equilibrium, however, the pattern of clumped isotopes may reflect a complex array of processes. Using high-resolution gas-phase mass spectrometry, Yeung *et al.* found that biological factors influence the clumped isotope signature of oxygen produced during photosynthesis (see the Perspective by Passey). Similarly, Wang *et al.* showed that away from equilibrium, kinetic

effects causing isotope clumping can lead to overestimation of the temperature at which microbially produced methane forms. — NW

Science, this issue p. 431; p. 428; see also p. 394

EBOLA VIRUS

Ebola virus vaccine candidate

As there are so few possibilities for drugs and vaccines that protect against the Ebola virus (EBOV), we need more options. Marzi *et al.* present initial studies in monkeys of a promising whole Ebola virus vaccine based on a defective form of the virus in which an essential viral gene (VP30) is knocked out. One or two doses of this defective virus, with or without further peroxide inactivation, protected against

a lethal challenge of EBOV. In limited immunological analyses, protection correlated with the production of antibodies to the EBOV envelope. — CA

Science, this issue p. 439

GENOME EDITING

Generating homozygous mutations

Loss-of-function mutations may only produce a mutant phenotype when both copies of the gene are mutated. Gantz and Bier developed a method they call mutagenic chain reaction (MCR) that autocatalytically produces homozygous mutations. MCR uses the initial mutated allele to cause a mutation in the allele on the opposing chromosome and thus the homozygosity of the trait. MCR

technology could have broad applications in diverse organisms. — BAP

Science, this issue p. 442

INFECTIOUS DISEASE

A genetic cause for severe influenza

Although chicken soup and plenty of rest get most kids through an influenza virus infection, some require hospitalization. Ciancanelli *et al.* report on one child who suffered severely from influenza because of null mutations in the gene for transcription factor IRF7. Cells isolated from this patient could not make enough secreted antiviral proteins, called interferons, to halt viral replication. The requirement for IRF7 seems quite specific, because this

patient recovers normally from other common childhood viral infections. — KLM
Science, this issue p. 448

BIOENGINEERING

Drug testing in a patient's own tumor cells

It is not easy to predict a patient's response to chemotherapy with animal models and cultured cells. The true test of responsiveness requires the evaluation of drug activity within human tumors. In two studies, Jonas *et al.* and Klinghoffer *et al.* have engineered devices that deliver microdoses of drugs directly into tumors. After treatment, the researchers removed the tumor tissue and quantified cancer-cell death. In both studies, the local response to chemotherapy matched the systemic response to known, as well as experimental, drugs. However, drug sensitivities were revealed that were not detected in cell culture. — MLF

Sci. Transl. Med. **7**, 284ra57 and 284ra58 (2015).

PROTEIN FOLDING

Ribosomes help careful protein folding

Protein assembly *in vitro* is useful for studying small molecules but is problematic for studying the assembly of larger, more complex proteins. Kim *et al.* analyzed the biogenesis of the mutation-prone nucleotide-binding domain of the cystic fibrosis conductance regulator (CFTR) (see the Perspective by Puglisi). Newly synthesized polypeptides emerged relatively slowly from the ribosome and folded through a modulated pathway that ensured correct protein folding. Some parts of the protein chain folded immediately upon synthesis, whereas other segments did so more slowly. It appears that acquiring the correct conformation for this complex



Polystyrene pellets

protein is partly guided by the ribosome itself. — SMH

Science, this issue p. 444; see also p. 399

CARDIAC PHYSIOLOGY

Keeping hearts at the right size

If left untreated, high blood pressure can lead to abnormally enlarged hearts (a condition called pathological hypertrophy) and heart failure. Inhibitors of protein kinase C (PKC) isoforms are in development for treating heart failure and some cancers. Withal *et al.* report that the inhibition of some PKC isoforms may exacerbate heart pathology. During development, mice lacking two related PKC isoforms, PKC δ and PKC ϵ , had abnormally large hearts and usually died in utero. Thus, drugs that inhibit PKC δ and PKC ϵ could trigger adverse cardiac side effects. — WW

Sci. Signal. **8**, ra39 (2015).

POLYMER CHEMISTRY

A more direct way to synthesize styrene

Foam cups, foam pellets, plastic cutlery: All are made of polystyrene, which in turn is made of styrene. The massive manufacturing scale of this commodity chemical places a premium on the efficiency of its synthesis. The current industrial route requires three steps to make styrene from benzene and ethylene. Vaughan *et al.* present a rhodium catalyst that achieves the coupling in a single step by using a recyclable copper salt as an oxidant. Although the catalyst is slow for industrial application, it demonstrates the viability of a more direct process. — JSY

Science, this issue p. 421

IN OTHER JOURNALS

Edited by Sacha Vignieri and Jesse Smith



The structured surface of a leaf beetle carapace diffracts light to produce spectacular colors

APPLIED OPTICS

A stretch to change color

The reflection of white light from structured surfaces often results in a spectacular display of color as the white light is split into its different wavelengths through diffraction. Structure gives rise to the intense iridescent colors that distinguish some members of the animal kingdom, such as beetles and butterflies. Human-made materials, such as DVD or CD surfaces, also diffract light into a rainbow. Zhu *et al.* combine surface structure with membrane flexibility to show that they can locally select the color of reflected light, as they stretch the membrane and change the periodicity of the structure. This technique could be used in a range of applications, including camouflage coatings, optical sensing and steering, and displays. — ISO

Optica **2**, 255 (2015).

CELLULAR BIOMECHANICS

The mechanics of cellular left and right

Cells need to know their own left and right in order to coordinate with neighboring cells in collective movement or embryonic

development. To do so, each cell has to establish left/right asymmetry. Tee *et al.* studied actin organization in human cells to understand underlying mechanisms, using fluorescence and electron microscopy and simulations. Actin fibers forming

ALSO IN SCIENCE JOURNALS

Edited by Caroline Ash

GALAXY EVOLUTION

Galaxies stripped down and evicted

It is easy to imagine that the relatively small and dense compact elliptical galaxies once had more to them. Especially when massive galactic neighbors are seen nearby that may have robbed them of their matter, but sometimes there are no such neighbors. Chilingarian and Zolotukhin have mined survey data to show that stripped-down galaxies are found in varied environments, with and without obvious disruptive companions. These isolated galaxies may still have been tidally stripped and then ejected from more crowded neighborhoods. — MMM

Science, this issue p. 418

RNA IMAGING

Multiplexed RNA imaged in single cells

The basis of cellular function is where and when proteins are expressed and in what quantities. Single-molecule fluorescence in situ hybridization (smFISH) experiments quantify the copy number and location of mRNA molecules; however, the numbers of RNA species that can be simultaneously measured by smFISH has been limited. Using combinatorial labeling with error-robust encoding schemes, Chen *et al.* simultaneously imaged 100 to 1000 RNA species in a single cell. Such large-scale detection allows regulatory interactions to be analyzed at the transcriptome scale. — VV

Science, this issue p. 412

SELF-ASSEMBLY

Creating unusual nanostructures

Self-assembly often occurs when dissimilar molecular fragments are forced together by covalent bonding. Surfactants

or block copolymers are two common examples. Huang *et al.* grafted four different nanoparticles, based on polyhedral oligomeric silsesquioxanes with slightly different compositions, onto a single tetrahedral core (see the Perspective by Yang). Depending on the type of nanoparticle, they assembled into a range of defined, ordered supramolecular lattices similar to a range of metal alloys. These include phases that have higher coordination numbers than usually found in the packing of spherical objects. — MSL

Science, this issue p. 424;
see also p. 396

RESEARCH FUNDING

Proof that peer review picks promising proposals

A key issue in the economics of science is finding effective mechanisms for innovation. A concern about research grants and other research and development subsidies is that the public sector may make poor decisions about which projects to fund. Despite its importance, especially for the advancement of basic and early-stage science, there is currently no large-scale empirical evidence on how successfully governments select research investments. Li and Agha analyze more than 130,000 grants funded by the U.S. National Institutes of Health during 1980–2008 and find clear benefits of peer evaluations, particularly for distinguishing high-impact potential among the most competitive applications. — BW

Science, this issue p. 434

NEUROBIOLOGY

SARM1-driven axon degeneration

Axons, the long protrusions of nerve cells, are programmed to self-destruct under certain conditions that occur during

development, stress, or disease states. Gerdtts *et al.* outline a biochemical mechanism that controls such axon degeneration. The authors designed versions of SARM1 (sterile alpha and TIR motif—constraining 1) that could be activated or inhibited in cells. Their experiments showed that the activation of SARM1 was necessary and sufficient to cause axon destruction in cultured mouse neurons. SARM1-mediated destruction was associated with depletion of the metabolic cofactor NAD⁺ from cells. — LBR

Science, this issue p. 453

RIBOSOME

Force to unblock a clogged ribosome

The synthesis of proteins from mRNA by the ribosome is highly regulated. But newly synthesized protein chains can still block the ribosome exit tunnel and slow protein synthesis. Goldman *et al.* use optical tweezers to show that by pulling on the stuck protein chain, they can unblock a clogged exit tunnel (see the Perspective by Puglisi). In vivo, the folding of a nascent protein chain just outside the tunnel also generates enough force to unclog a block, indicating that ribosome-peptide interactions fine-tune protein synthesis. — GR

Science, this issue p. 457;
see also p. 399

VASCULAR DISEASE

Matrikine regulates endothelial leakage

The matrikine acetyl-proline-glycine-proline (N- α -PGP) regulates endothelial permeability in inflammatory disease. Xu *et al.* probed the loss of barrier function of the endothelium, which is characteristic of inflammation. Leakiness is stimulated by a signaling cascade initiated by the modified peptide N- α -PGP

and involving CXCR2. N- α -PGP is an extracellular matrix fragment generated by tissue damage. N- α -PGP induces vascular leaks, and its removal attenuates the lipopolysaccharide-induced leak. N- α -PGP is a novel matrikine and could be a new therapeutic target. — PLY

Sci. Adv. 10.1126/sciadv.1500175 (2015).

EVOLUTIONARY BIOLOGY

Symbionts on the road to a single species

Most species of plants and animals live in symbiotic relationships with other organisms. For example, many insects rely on bacteria within their cells—endosymbionts—to supply nutrients, and pea and bean plants have essential relationships with bacteria called rhizobia to fix atmospheric nitrogen. Why do some symbioses progress to ever-tighter partnerships and ultimately form a single new organism? In a Perspective, Kiers and West explore the conditions that favor such major evolutionary transitions in individuality. One key factor is the mode of symbiont transmission; another is the ecological context of the symbiosis. Once a partnership has reached a level of high dependence and low conflict, genetic drift alone can lead to further integration. However, major transitions of this kind require strict conditions to be fulfilled and are thus rare. — JFU

Science, this issue p. 392

MULTILAYER ASSEMBLY

Thin-film fabrication

The deposition of thin films from multiple materials is essential to a range of materials fabrication processes. Layer-by-layer processes involve the sequential deposition of two or more materials that physically bond together. Richardson *et al.*

review some of the techniques and materials that are used to make thin films, including sequential dip coating, spraying, and electrochemical deposition. Despite the versatility of the methods and the range of materials that can be deposited, the techniques remain mostly confined to the lab because of challenges in industrial scaling. But because there is tremendous scope for fine-tuning the structure and properties of the multilayers, there is interest in broadening the use of these techniques. — MSL

Science, this issue p. 411