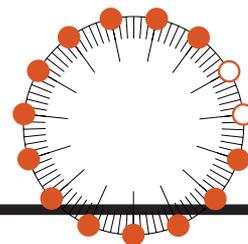


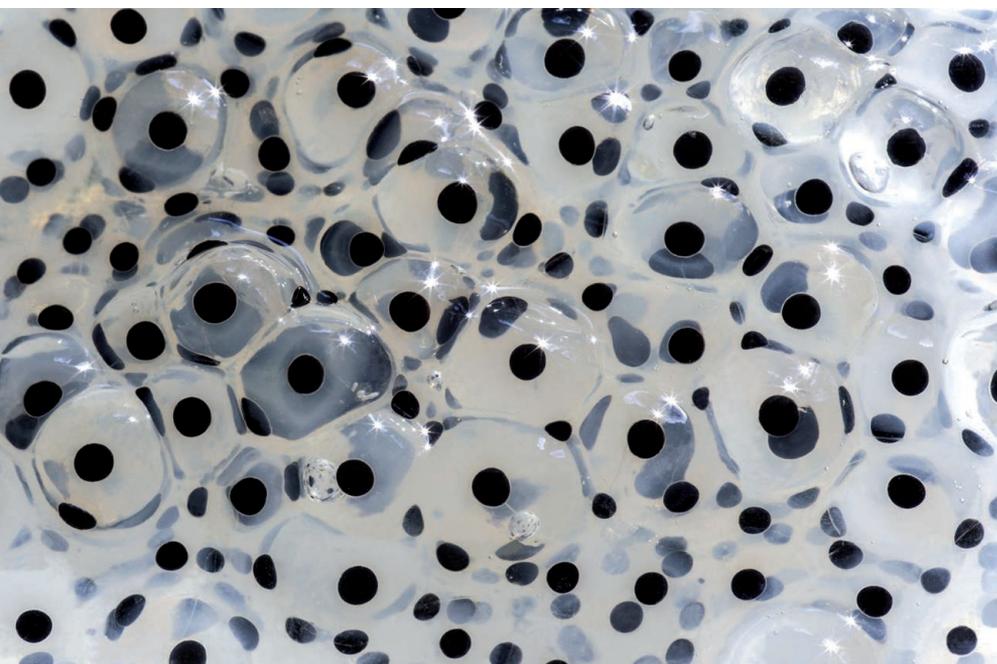
RESEARCH

Kerr solitons for optical combs
Kippenberg et al., p. 567



IN SCIENCE JOURNALS

Edited by Caroline Ash



SIGNAL TRANSDUCTION

Visualizing a traveling wave of cell death

When diffusion is too slow for communication over long distances, cells can use waves of chemical activity. By using fluorescent probes and microscopy, Cheng and Ferrell show that in frog eggs (which are very large cells), waves of apoptotic signals can be seen passing through the egg cytoplasm. The pathways that trigger cell death have positive feedback loops that lead to self-regenerating waves. The speed of the waves (~30 micrometers per minute) is too fast to be explained by diffusion. —LBR
Science, this issue p. 607

Frog eggs are used to observe cell signals.

ANTHROPOLOGY

Peopling the Americas: Which way?

For much of the 20th century, archaeologists firmly believed that the initial pathway into the Americas was via the “ice-free corridor,” a route from interior Alaska that snaked into the high plains of North America between two massive sheets of ice. Over the past 20 years, this consensus has been challenged and, for many, overturned, by data that support the “kelp highway” hypothesis—i.e., migration along the coastline of western North America. In a comprehensive review of genetic, archaeological, and paleoecological data, Potter *et al.* argue that both routes should be considered as viable pathways into the Americas. —MSA

Sci. Adv. 10.1126/sciadv.aat5473 (2018).

NEUROSCIENCE

Feedback reduces opioid prescriptions

Most people addicted to opioids began taking them because they were legally prescribed. Little attention has been paid to changing physicians’ prescribing behavior. Using a randomized controlled trial format, Doctor *et al.* monitored the effect of notifying physicians who had a patient die of opioid overdose within 12 months of a prescription. The physicians received an injunction to prescribe safely from their county’s medical examiner. This intervention led to reductions in high-intensity prescribing, reductions in the likelihood that an opioid-naïve patient received a prescription, and a reduction in overall cumulative opioid intake. —PRS

Science, this issue p. 588

RIVER NETWORKS

Expanding the role of rivers

The surfaces of rivers and streams are interfaces for a host of chemical exchanges with the atmosphere and biosphere. For instance, carbon dioxide outgassing from rivers is estimated to be equivalent to one-fifth of combined emissions from fossil fuel combustion and cement production. Allen and Pavelsky used satellite imagery to estimate the surface area of rivers and streams (see the Perspective by Palmer and Ruhí). The stunning map that they generated results in an upward revision, by about one-third, to the total surface area of rivers and streams on Earth. —BG

Science, this issue p. 585;
see also p. 546

2D MATERIALS

Computers tease out interaction effects

Although graphene is often thought of as a material in which electron-electron interactions are negligible, some of its properties cannot be explained by such a simple picture. Tang *et al.* undertook comprehensive quantum Monte Carlo numerical calculations that consider both long-range and contact interactions in systems that, like graphene, have two-dimensional (2D) Dirac electrons. Different 2D Dirac materials systems, such as topological insulators and graphene on various substrates, reside in different parts of the resulting phase diagram. —JS

Science, this issue p. 570

KIDNEY CANCER

Pediatric and adult kidney tumors differ

Understanding tumor origins and the similarities and differences between organ-specific cancers is important for determining treatment options. Young *et al.* generated more than 72,000 single-cell transcriptomes from healthy and cancerous human kidneys. From these data, they determined that Wilms tumor, a pediatric kidney cancer, originates from aberrant fetal cells, whereas adult kidney cancers are likely derived from a specific subtype of proximal convoluted tubular cell. —LMZ

Science, this issue p. 594

EVOLUTION

Adaptive conflicts with the modern world

Mammals evolved in terrestrial environments. Those that now live in the marine environment have had to adapt to the particular selective pressures that this environment imposes. Meyer *et al.* surveyed the genomes of several marine mammal species to identify regions of convergent change. Multiple losses of the *Paraoxonase 1* gene are evident in marine mammals, likely resulting from remodeling of lipid metabolism or anti-oxidant networks. The multiple occurrences of this loss of function across taxa indicate an evolutionary benefit. However, *Paraoxonase 1* is the primary mammalian defense against



Marine mammals are genetically vulnerable to some pollutants.

organophosphorus toxicity. Marine mammals may be at a great disadvantage in the Anthropocene if run-off of this agricultural product into the marine environment continues. —SNV

Science, this issue p. 591

AUTOIMMUNITY

Pancreatic perturbation

Autoimmune pancreatitis (AIP) is difficult to diagnose and can sometimes be confused with pancreatic cancer, which presents with similar symptoms. AIP is an inflammatory disease involving elevated immunoglobulin G4 (IgG4); however, the target autoantigens are unknown. Previous work pointed to the extracellular matrix providing the target for IgG4. Shiokawa *et al.* now show that a truncated form of laminin 511 may be a major autoantigen in AIP. Half of the AIP patients that they investigated had antibodies against laminin 511, which were absent in healthy controls. Patient pancreatic tissues were positive for laminin 511, and immunization of mice with this protein induced AIP-like symptoms. —LP

Sci. Transl. Med. **10**, eaaq0997 (2018).

CELL BIOLOGY

Going through a phase

Neuronal communication at synapses relies on regulated neurotransmitter secretion. Neurotransmitters are stored in small vesicles that are organized in clusters within nerve terminals. On stimulation, the vesicles fuse with the presynaptic plasma membrane, but despite their tight packing, replacement synaptic vesicles are rapidly recruited. Vesicles newly reformed by membrane recycling randomly intermix with the clusters. Milovanovic *et al.* show that synapsin, an abundant synaptic vesicle-associated protein, organizes these vesicle clusters by liquid-liquid phase separation—like oil in water. —SMH

Science, this issue p. 604

IN OTHER JOURNALS

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



A melt river on Petermann Glacier in northwestern Greenland

ICE SHEETS

A responsive past

One of the ways that we might develop more accurate projections of the Greenland Ice Sheet's response to global warming is to investigate analogous periods in the past and use them to establish constraints for its future behavior. Reusche *et al.* investigated the history of two large outlet glaciers in the northwestern sector of the ice sheet across the Holocene by measuring surface-exposure ages of associated moraines. Their data shed light on the competing effects of generally warming surface air temperatures and discrete climate cooling events. These results help show how quickly the ice sheet can respond to both positive and negative centennial atmospheric temperature fluctuations. —HJS

Geophys. Res. Lett. **10.1029/2018GL078266** (2018).

MICROBIOTA

Establishing bad host relations

The human microbiota is a mixture of microorganisms that are maintained in symbiosis with

the host. However, sometimes this symbiosis goes awry, causing pathogen outgrowth and disease. For example, periodically, *Staphylococcus aureus* emerges from the skin-resident microbiome as a disease-causing

ALSO IN SCIENCE JOURNALS

Edited by **Caroline Ash**

OPTICS

Shrinking optical metrology

The ability to generate laser frequency combs—light sources comprising equidistant laser lines spanning a large range of wavelengths—has revolutionized metrology and precision spectroscopy. The past decade has seen frequency combs being generated in optical microresonator circuits, offering the prospect of shifting precision metrology applications from the realm of national laboratories to that of everyday devices. Kippenberg *et al.* review the development of microresonator-generated frequency combs and map out how understanding and control of their generation is providing a new basis for precision technology. —ISO

Science, this issue p. 567

STRUCTURAL BIOLOGY

The first step in Hedgehog signaling

The Hedgehog (Hh) signaling pathway is important in embryogenesis; overactivation is associated with cancer. Central to the pathway is the membrane receptor Patched 1 (Ptch1), which indirectly inhibits a G protein-coupled receptor called Smoothened. This inhibition is relieved when Ptch1 binds the secreted protein Hh. Gong *et al.* report the cryo-electron microscopy structures of human Ptch1 alone and in complex with its Hh ligand at 3.9 and 3.6 Å, respectively. Both structures include two steroid-shaped densities, and mutational analysis indicates that the interaction between Ptch1 and Hh is steroid-dependent. —VV

Science, this issue p. 568

ORGANIC CHEMISTRY

A rapid screen for complex reactants

Chemists engaged in reaction discovery tend to report outcomes involving a few, relatively simple reactants. It remains a major challenge to fine-tune reported conditions when the reactants become more structurally complex, as often happens in pharmaceutical research. Lin *et al.* developed a protocol for rapidly screening different catalytic conditions for C–N coupling across a wide range of complex substrates. The product detection scheme relies on mass spectrometry of nanomole-scale reaction mixtures without any need for intervening chromatography. —JSY

Science, this issue p. 569

THERMAL CONDUCTIVITY

Moving the heat aside with BAs

Thermal management becomes increasingly important as we decrease device size and increase computing power. Engineering materials with high thermal conductivity, such as boron arsenide (BAs), is hard because it is essential to avoid defects and impurities during synthesis, which would stop heat flow. Three different research groups have synthesized BAs with a thermal conductivity around 1000 watts per meter-kelvin: Kang *et al.*, Li *et al.*, and Tian *et al.* succeeded in synthesizing high-purity BAs with conductivities half that of diamond but more than double that of conventional metals (see the Perspective by Dames). The advance validates the search for high-thermal-conductivity materials and provides a new material that may be more easily integrated into semiconducting devices. —BG

Science, this issue p. 575, p. 579, p. 582; see also p. 549

METABOLISM

Zippering up obesity

Chylomicrons are specialized particles that carry dietary fats from the intestine to the bloodstream for absorption into the body. Lacteals are lymphatic vessels that act as the highway for chylomicron transport, but it is unclear how passage occurs. Zhang *et al.* report that two endothelial cell receptors, neuropilin-1 (NRP1) and vascular endothelial growth factor receptor 1 (VEGFR1, also known as FLT1), are required to convert the entry spaces between lacteals from open junctions to closed, zipped structures (see the Perspective by McDonald). Mice that were fed a high-fat diet were subsequently rendered resistant to weight gain if NRP1 and FLT1 were inactivated. —PNK

Science, this issue p. 599; see also p. 551

ASTHMA

Nefarious neutrophil cytoplasts

In addition to DNA release, neutrophil extracellular trap (NET) formation can result in enucleated cells called cytoplasts. Krishnamoorthy *et al.* examined how neutrophil cytoplasts contribute to asthmatic inflammation in mouse models of allergic lung inflammation and in asthmatic patients. In mice, airway exposure to bacterial lipopolysaccharide with house dust mite allergen induced NET formation in the lung, which was associated with interleukin-17 (IL-17) production on subsequent exposure to allergen. Cytoplasts, rather than neutrophil DNA released in NETosis, triggered neutrophilia on allergen exposure, and cytoplasts alone were sufficient to induce IL-17 production by antigen-specific T cells. Cytoplasts also correlated with IL-17 levels in bronchoalveolar lavage fluid from severe asthmatics. —CNF

Sci. Immunol. **3**, eaao4747 (2018).