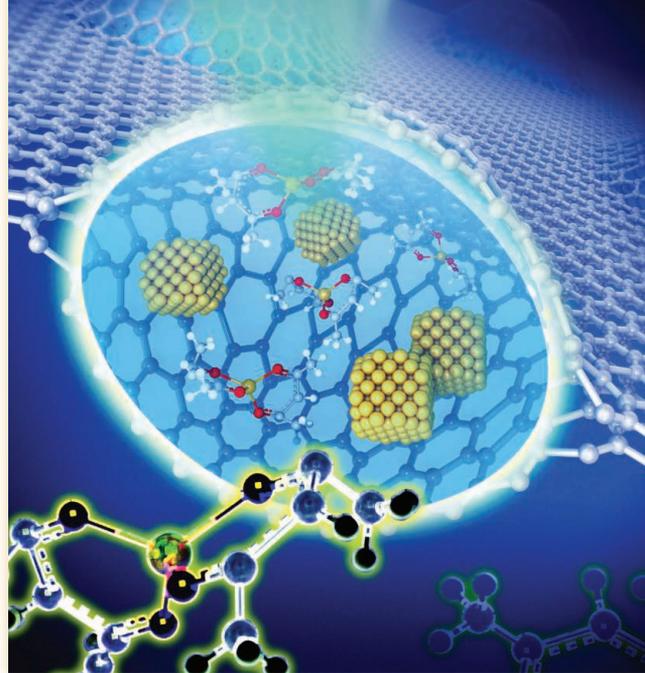


Liquid Nanocrystals >>

In high-resolution transmission electron microscopy, grid materials are used to support solid samples while providing a means for preventing a build-up of static charge. Liquids are difficult to study at the same atomic resolution and require encapsulation to prevent excess sample movement, sample damage, or evaporation. Materials that have been used for liquid cells, like silicon nitride or silicon oxide, need thick layers and have poor electron transmittance at the thicknesses required because they contain high atomic number elements. **Yuk et al.** (p. 61; see the Perspective by **Colliex**) show that liquids can be encapsulated in graphene sheets, and through this technique, they studied the formation of platinum nanocrystals with atomic resolution. The crystals could be tracked as they selectively coalesced, modified their shape, and formed surface facets.

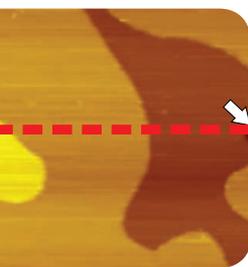


Some Sort of Species

Certain populations of bacteria are known to show ecological differentiation, but how this happens has remained controversial. **Shapiro et al.** (p. 48; see the Perspective by **Papke and Gogarten**) examined whole-genome sequences from ecologically divergent *Vibrio* populations and found that genes and genome regions containing so-called “eco-SNPs” (single-nucleotide polymorphisms) have swept through populations. These regions differentiate the bacteria genetically, apparently according to the type of substratum on which they live. Subsequently, tight genotypic clusters may have emerged as a result of preferential recombination occurring within particular habitats. Although specialization into different habitats may reduce gene flow between bacterial populations, the bacteria will always remain open to taking up DNA from other populations and so they cannot be said to be species in the eukaryotic sense.

All Set for Majoranas

When put in the proximity of a superconductor, topological insulators (TIs) are expected to support Majorana fermions, exotic particles that are their own antiparticles. For this to be realized, the interface between the TI and superconductor layers has to be atomically sharp but electronically transparent. **Wang et al.** (p. 52, published online 15 March) fabricated this heterostructure by growing a film of the TI material Bi_2Se_3 on the superconductor NbSe_2 covered with a Bi bilayer. Scanning tunneling spectroscopy revealed a superconducting gap on the TI surface of the heterostructure with varying thickness of the Bi_2Se_3



film. This coexistence of superconductivity and topological order should now allow observation of exotic phenomena such as Majorana fermions.

Here, There, Everywhere

Random walks are a powerful mathematical method that can be used to simulate certain processes in biology, chemistry, or even the stock market. They present a statistical method for mapping the possible routes that processes can take. Quantum walks are expected to be able to probe multiple paths simultaneously. Quantum walks have been demonstrated for one-dimensional, or straight-line, walks. Now, **Schreiber et al.** (p. 55, published online 8 March) demonstrate an optical system that can simulate quantum walks over a two-dimensional system, thereby providing the capability of describing much more complex processes.

Changing Polarization with Applied Stress

The direction of electric polarization in ferroelectric materials can be switched with an applied field, but mechanical stresses can also couple to the polarization, forming the basis for piezoelectric effects. In principle, it should be possible to change the polarization of a ferroelectric material mechanically through stress gradients. **Lu et al.** (p. 59; see the Perspective by **Gregg**) demonstrate such switching for nanoscale-sized regions created by the stress induced with an atomic force microscope. The substrates are single-crystalline barium titanate films that have a vertically aligned dipole moment created by compressive stresses in the film. This approach may lead to memory devices in which bits are written mechanically but read electrically.

Copper-Bottomed Crust

The formation of volcanic arc chains near subduction zones brings large amounts of magma from the upper mantle to the crust, contributing to the formation of island chains in the ocean and adding material to continents. Over time, arc magmas also contribute indirectly to the composition of the oceans and atmosphere through outgassing and weathering of volcanic minerals; however, it is unclear what determines the oxidized nature of arc magmas themselves. **Lee et al.** (p. 64) measured Cu contents in a range of arc-derived volcanic rocks as a proxy for arc magma redox states. An overall depletion of Cu, which is sensitive to reduced sulfur contents, in global continental crust suggests that there is a hidden reservoir of copper-rich sulfides deep in Earth's interior.

Coming Late to the Planetsimal

Highly siderophile (iron-loving) elements (Re, Os, Ir, Ru, Rh, Pt, Pd, and Au) must have been added to the mantles of Earth, the Moon, and Mars after their iron cores formed; otherwise the mantles would be devoid of these elements, which tend to be segregated to the core. **Dale et al.** (p. 72) report data on highly siderophile elements in rocks from different planetary bodies, including asteroid 4 Vesta and other differentiated asteroids, which are representative of the planetesimals from which the solar system planets formed. Like the larger planetary bodies, differentiated asteroids, which formed over the first few million years of the solar system, bear the evidence of the late addition of highly siderophile elements to their mantles. Thus, this process was not unique to Earth, the Moon, and Mars and happened over an extended period of time in the inner solar system.

Tic TOC1 Plant Clock

The molecular clocks intertwined with cellular physiology regulate daily cycles. In plants, these circadian rhythms affect processes as diverse as carbon metabolism and leaf orientation. **Huang *et al.*** (p. 75, published online 8 March) have now analyzed the interactions driven by a key element of the circadian clock in plants, TOC1 ("TIMING OF CAB EXPRESSION 1"). TOC1 helps to coordinate responses of the morning and evening cycles, functioning to repress activity of other clock components.

Narrowing Down Artemisinin Resistance

Knowing that antimalarial drug resistance is characterized by selective sweeps and reduced diversity around resistance mutations, **Cheeseman *et al.*** (p. 79) looked for signatures of selection in a modified genome-wide association study in parasite populations from Cambodia, Laos, and Thailand. Thirty-three regions showed evidence of selection and enrichment of known antimalarial resistance genes. Fine-mapping of parasite samples taken during the past decade narrowed the association down to a 35-kb region of seven genes on chromosome 13 that seemed to explain at least 35% of the observed reduction in parasite clearance rate. However, the absence of strong candidate mutations suggests the involvement of noncoding regulatory mutations.



Macrophage Development Rewritten

Macrophages provide protection against a wide variety of infections and critically shape the inflammatory environment in many tissues. These cells come in many flavors, as determined by differences in gene expression, cell surface phenotype and specific function. **Schulz *et al.*** (p. 86, published online 22 March) investigated whether adult macrophages all share a common developmental origin. Immune cells, including most macrophages, are widely thought to arise from hematopoietic stem cells (HSCs), which require the transcription factor Myb for their development. Analysis of Myb-deficient mice revealed that a population of yolk-sac-derived, tissue-resident macrophages was able to develop and persist in adult mice in the absence of HSCs. Importantly, yolk sac-derived macrophages also contributed substantially to the tissue macrophage pool even when HSCs were present.

IL-22 Protects the Thymus

One of the side effects associated with radiation treatment and some types of chemotherapy is damage to the thymus. Immunological T cells develop in the thymus, and so damage to this organ results in immunodeficiency and increased susceptibility to infectious disease. Although the organ eventually recovers, therapies that speed this recovery process are of interest. **Dudakov *et al.*** (p. 91, published online 1 March; see the Perspective by **Bhandoola and Artis**) now show in mice that interleukin-22 (IL-22) production in the thymus is increased in response to radiation damage and that this cytokine promotes thymic repair. After radiation treatment, IL-23 production by thymic dendritic cells induced IL-22 secretion by a population of radio-resistant innate lymphoid cells. IL-22 appeared to mediate its effects by promoting the survival and proliferation of thymic epithelial cells.

Looking for Greener Pastures

Humans, like other animals, have evolved to forage. Brain-imaging studies by **Kolling *et al.*** (p. 95) suggest that activity in the dorsal anterior cingulate cortex supplies a continuous signal of environmental richness predicted by foraging theory. The signal exhibits a frame of reference that is tied to the key foraging decision of whether to engage with the current choice or to search for alternatives. The same strategy is used when humans are making other types of decisions. In contrast, the ventromedial prefrontal cortex, a brain region that lacks any signals pertinent to foraging, encodes choice values in a manner uninfluenced by environmental richness.

CREDIT: TIM ANDERSON

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things you didn't
(and 3 you probably
shouldn't) know
about some of
your most
respected
colleagues.

One more data point on why
you should spend more time
at membercentral.aas.org.
There you can enjoy a feast
of blogs, videos, webinars,
discounts, and downloads
created by and for the most
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