feature long response times. Jackson *et al.* created tunable materials that can respond to an applied magnetic field by incorporating liquids that contain ferromagnetic microparticles into 3D-printed polymer tubes. In tests, these structures responded to a magnetic field in under a second. The approach could see broad applications in fields that include soft robotics, transportation systems, and smart wearable technology. —PJB

Sci. Adv. 10.1126/sciadv.aau6419 (2018).

IMMUNOLOGY

Optimal affinity

Germinal center (GC) B cells are essential to generating protective antibody responses and are selected through a process of affinity maturation. Kwak *et al*. now define intrinsic properties of human GC B cells that are critical to antigen affinity discrimination. They identified B cell antigen receptor–containing actin-rich pod-like structures that facilitated formation of highly stable immunological synapses and antigen internalization when GC B cells engaged high-affinity antigens. These structures were important in setting thresholds for affinity selection and driving GC B cell responses. —CNF

Sci. Immunol. **3**, eaau6598 (2018).

COMPUTER SCIENCE

One program to rule them all

Computers can beat humans at increasingly complex games, including chess and Go. However, these programs are typically constructed for a particular game, exploiting its properties, such as the symmetries of the board on which it is played. Silver *et al*. developed a program called AlphaZero, which taught itself to play Go, chess, and shogi (a Japanese version of chess) (see the Editorial, and the Perspective by Campbell). AlphaZero managed to beat state-of-the-art programs specializing in these three games. The ability of AlphaZero to adapt to various game rules is a notable step toward achieving a general game-playing system. —JS

Science, this issue p. 1140; see also pp. 1087 and 1118

BATTERIES

Working toward fluoride batteries

Owing to the low atomic weight of fluorine, rechargeable fluoride-based batteries could offer very high energy density. However, current batteries need to operate at high temperatures that are required for the molten salt electrolytes. Davis *et al*. push toward batteries that can operate at room temperature, through two advances. One is the development of a room-temperature liquid electrolyte based on a stable tetraalkylammonium salt–fluorinated ether combination. The second is a copper–lanthanum trifluoride core-shell cathode material that demonstrates reversible partial fluorination and defluorination reactions. —MSL

Science, this issue p. 1144

QUANTUM MATERIALS

Twisting a route for surface plasmons

Graphene is an atomically thin material that supports highly confined plasmon polaritons, or nano-light, with very low loss. The properties of graphene can be made richer by introducing and then rotating a second layer so that there is a slight angle between the atomic registry. Sunku *et al*. show that the moiré patterns that result from such twisted bilayer graphene also provide confined conducting channels that can be used for the directed propagation of surface plasmons. Controlling the structure thereby provides a pathway to control and route surface plasmons for a nanophotonic platform. —ISO

Science, this issue p. 1153

IN OTHER JOURNALS

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

Fire feedback explains the Miocene expansion of the grassland biome.

PALEOECOLOGY

Fire and grassland evolution

Global grassland underwent a massive expansion in the late Miocene epoch, 5 million to 8 million years ago. Karp *et al.* examined the role of fire in this expansion, through measurements of fire-derived hydrocarbons and grass-diagnostic carbon isotopes in sediments in Pakistan. They found evidence of a simultaneous increase in seasonality of precipitation and the occurrence of regular fire along with the opening of the landscape and the expansion of grasslands. Their results indicate that a grassland-fire feedback system was a key driver in the expansion of grasslands, a relationship that has remained an integral feature of this ecosystem ever since. —AMS

Proc. Natl. Acad. Sci. U.S.A. **115**, 12130 (2018).

NEUROSCIENCE

Inhibition in the fear-learning circuitry

Many mental health disorders can be traced to abnormal associative learning. The basolateral amygdala of the brain plays a central role in associative learning and the formation of emotional memories and motivated behaviors. The relevance of the amygdala's anatomical substructure for the acquisition of memories is less clear. Tipps *et al*. used neuron-specific chemogenetics to systematically probe the circuitry and signaling mechanisms involved in auditory fear learning in mice. Stimulating inhibitory interneurons or inhibiting pyramidal cells was enough to induce an association between a behavior and an auditory cue. This understanding is key to developing

PHOTO: RICHARD DU TOIT/MINDEN PICTURES/GETTY IMAGES

WATER RESOURCES

Managing an unwelcome effect

One of the biggest challenges presented by climate change is water resource management. In the western United States, the storage and release of water by the mountain snowpack is a critical component controlling the summertime flow of headwaters of California's major reservoirs. Rhoades *et al.* describe how mountain snowpacks will be affected by climate change in that region and how that can be expected to influence peak water volume, peak timing, accumulation rate, and melt rate of water discharge. Among other effects, they project that by the end of the century, peak snowpack timing will occur 4 weeks earlier and peak water volume will be 80% lower under a high–greenhouse gas–emissions scenario. —HJS

Geophys. Res. Lett. 10.1029/2018GL080308 (2018).

Climate change will have a large impact on the timing and size of the Sierra Nevada snowpack.

therapies for diseases in which associative learning has been disrupted. —PRS

eNeuro **5**, ENEURO.0272-18.2018 (2018).

CELL BIOLOGY

Keeping a toehold on the matrix

Within our bodies, most tissues are organized in association with an extracellular matrix. The matrix keeps cells where they are supposed to be, and cells adhere to the matrix via integrin-containing cell adhesions. During mitosis, cells round up and release their tight association with the matrix. Lock *et al*. show that despite this, mitotic cells ensure that they retain their correct location by using a so-called reticular form of cell adhesion. A range of adherent cultured human cells was found to show this property. Reticular adhesions lack several components of classical adhesion complexes, including talin and actin. A key constituent of reticular adhesions is integrin β5, and a lack of it interfered with the retention of spatial localization through normal mitotic cell divisions. —SMH

Nat. Cell Biol. **20**, 1290 (2018).

OPTOELECTRONICS

Steering electrons in graphene

Guiding and controlling the movement of electrons in solid-state systems is crucial for applications such as ultrafast electronics and the generation of high-harmonic light. Although such electronic control is readily achieved in semiconductors, metals and small-bandgap materials can pose more of a challenge. Heide *et al*. show that they can control the trajectory of electrons within the two-dimensional plane of graphene using a double pulse from a laser. Tuning the relative polarization between the two pulses by carefully varying the time delay between them allows the direction electron flow to be manipulated on femtosecond time scales. Such an optical technique offers a relatively simple route to study the electronic and topological properties of other two-dimensional materials on ultrafast time scales. —ISO

Phys. Rev. Lett. **121**, 207401 (2018).

PHYSICS

Identifying localization in two dimensions

Disordered interacting quantum many-body systems can become hopelessly localized. This so-called many-body localization has been studied in one-dimensional systems. In two dimensions, experiments indicate that the localization persists, but because it is difficult to tell the difference between no thermalization and slow thermalization, more theoretical work is needed. Relying on an approximate numerical method, Wahl *et al*. undertook large-scale simulations of a two-dimensional lattice of bosonic atoms in the presence of interactions and disorder. At intermediate disorder strengths, the on-site entanglement entropies exhibited a bimodal distribution, indicating a coexistence of localized and thermalized states; as disorder was increased, localized states took over. The authors were able to extract a critical disorder strength and set a benchmark for future experiments. —JS

Nat. Phys. 10.1038/s41567-018-0339-x (2018).

MICROBIOME

Global aeroplankton dispersal

Airborne particulates include large numbers of living organisms, as well as dust, pollutants, and other chemicals. Cáliz *et al*. collected aeroplankton fortnightly for 7 years in the Spanish Pyrenees. High-throughput sequencing of 16*S* and 18*S* amplicons identified microbes, including potential pathogens, that had made landfall in rain and snow. Distinct seasonal and climate signals in the data associated with the origin of the air masses. For example, winter microbial fallout originated from as far away as the North American taiga, and summer-occurring organisms contained desert-adapted bacteria from North Africa. Over the collection period, air-mass origins shifted, possibly as a result of climate change. Most atmospheric microbes are cosmopolitan, and it seems the upper atmosphere acts as a global highway for many taxa. —CA

Proc. Natl. Acad. Sci. U.S.A. **115**, 12229 (2018).

PHOTO: ISTOCK.COM/SIERRARAT