ECOLOGY

Fisheries management and human adaptation

Finding effective ways to mitigate the future impacts of climate change on fisheries is critical. Previous efforts have not incorporated alternative human responses to climate change. These could limit or exacerbate ecosystem changes that affect fish stocks and population locations. Gaines *et al.* analyzed four fisheries management approaches that address fish stock–productivity adaptation and/or range-shift adaptation. They then applied these management scenarios to 915 species stocks worldwide. Implementing proactive and adaptive fishery management approaches would bring about higher global profits (154%), harvest (34%), and biomass (60%) as compared with strategies reflecting no management changes. Addressing both range shifts and productivity changes lead to greater benefits as compared with targeting one challenge alone. —PJB

Sci. Adv. 10.1126/sciadv.aao1378 (2018).

PAIN

A dual-targeting painkiller

Opioids are among the most effective treatments for severe pain. Their pain-relieving effects are mediated by activation of the mu opioid receptor (MOR). Unfortunately, selective MOR agonists induce diverse side effects, including respiratory depression, tolerance, hyperalgesia, and dependence. Recently, activation of the nociceptin/orphanin FQ peptide receptor (NOR) has been reported to enhance MOR agonist–induced analgesia without producing side effects. Ding *et al.* developed a bifunctional MOR/NOR agonist called AT-121, which showed potent analgesic effects in nonhuman primates without inducing hyperalgesia, respiratory depression, or dependence. Bifunctional MOR/NOR agonists might thus represent a safe and effective pharmacological tool for treating severe pain. —MM

Sci. Transl. Med. **10**, eaar3483 (2018).

MOLECULAR MOTORS

Tiny cargos ferried along a track

Control of molecules at the nanometer scale requires motors that convert potential energy into movement. Qing *et al.* designed a small molecule that could hop along a track of cysteine residues within a membrane-embedded protein pore. The direction of processive movement along the track was reversible, driven by an applied potential across the membrane. Cargos were attached to a carrier motor, and their position and chemical identity read out from changes in the current through the pore. These features enabled repeat observations of a single molecule as it moved back and forth on the track. —MAF

Science, this issue p. 908

CLIMATE CHANGE

Warming, crops, and insect pests

Crop responses to climate warming suggest that yields will decrease as growing-season temperatures increase. Deutsch *et al.* show that this effect may be exacerbated by insect pests (see the Perspective by Riegler). Insects already consume 5 to 20% of major grain crops. The authors' models show that for the three most important grain crops—wheat, rice, and maize—yield lost to insects will increase by 10 to 25% per degree Celsius of warming, hitting hardest in the temperate zone. These findings provide an estimate of further potential climate impacts on global food supply and a benchmark for future regional and field-specific studies of crop-pest-climate interactions. —AMS

Science, this issue p. 916; see also p. 846

Conifer pollen from Yellowstone lake sediments reveals vegetation shifts over 18,000 years.

PALEOECOLOGY

Climate change in a mountain ecosystem

Fossil pollen in lake sediments provides valuable records of past vegetation patterns and offers a baseline for assessing how vegetation responds to climate change. To assess how the vegetation composition and distribution of a mountain system has varied with climate change over 18,000 years, Iglesias *et al.* studied pollen sequences from lakes in the Greater Yellowstone Ecosystem of the United States. They found complex patterns, with long-term stability in some plant communities and rapid change in others. The present-day mixed conifer forest cover, known to be vulnerable to climate warming, is now more compressed in its elevation range than in previous postglacial millennia. These data provide a context for assessing future responses to climate change. —AMS

J. Biogeogr. **45**, 1768 (2018).

NEUROSCIENCE

Degrees of stress in neurodegeneration

In the neurodegenerative disorder amyotrophic lateral sclerosis (ALS), the nuclear protein called transactive response DNA binding protein of 43 kDa (TDP-43) accumulates in stress granules within the cytoplasm of neurons and glia and is linked to disease pathology. McGurk *et al.* report that TDP-43 binds to poly(ADP-ribose) (PAR), which triggers phase separation of TDP-43 and its subsequent recruitment to stress granules. Under short-term stress, phosphorylated TDP-43, which is considered a hallmark of disease, is unexpectedly excluded

Exposure to disruptive behavior, like bullying, during primary school can have lifelong effects.

EDUCATION

Disruptive classmates, long-term harm

Children who are behaviorally disruptive during primary school can have harmful impacts on their classmates into adulthood. Carrell *et al.* use data from Florida, USA, to show that a child who experiences domestic violence at home (a well-recognized proxy for that child demonstrating disruptive behavior such as bullying) can lower their classmates' secondary-school math and reading test scores, lower their likelihood of enrolling in college, and reduce earnings in their mid-20s by 3%. Differential exposure to such classmates accounts for roughly 5% of the rich-poor earnings gap in adulthood. —BW

Amer. Econ. Rev. www.aeaweb.org/articles?id=10.1257/aer.20160763 (2018).

from stress granules. This finding indicates that the granules initially prevent phosphorylated TDP-43 aggregation unless stress is prolonged. This work also points to an approach to ALS treatment by inhibition of PAR polymerase (PARP) to reduce PAR production. For instance, a small-molecule inhibitor of PARP that prevents cancer-cell proliferation also blocks cytoplasmic TDP-43 aggregation. —LC

Mol. Cell 10.1016/j.molcel.2018.07.002 (2018).

REPROGRAMMING

FACTs behind control of cell fate

As animals develop, their cells become progressively less plastic and follow defined functional destinies. Kolundzic *et al.* used a genetic screen of the worm *Caenorhabditis elegans* to uncover proteins that prevent cells from straying from their intended fate. They found that the histone chaperone FACT plays a regulatory part in an unexpected way: It is non-repressive and also promotes gene expression. FACT acts as a barrier to cell reprogramming by stabilizing gene expression and thereby safeguarding cell identity. A germline-specific isoform of FACT ensures that cells with intestinal and germline programming confirm their fate and do not adopt a neuronal role. Furthermore, depletion of FACT in human fibroblasts enhances production of induced pluripotent stem cells, indicating that a conserved mechanism is at work to channel cell fate in animals. —BAP

Dev. Cell 10.1016/j.devcel.2018.07.006 (2018).

FRAMEWORK MATERIALS

Transversal zigzag linkers

The linkers for metal-organic frameworks are usually bidentate molecules (for example, dicarboxylic acids) connected by an organic group to create a linear or, in some cases, a bent geometry like isophthalic acid. Guillerm *et al.* explored the effect of a "zigzag" linker, *trans,trans*-muconic acid (tmuc), that forces an offset of inorganic building blocks. Reaction with $ZrCl_4$ formed the metal-organic framework $Zr_6O_4(OH)_4(tmuc)_8(H_2O)_8$, which had an eight-connected **bcu** topology, a subset of the 12-connected **fcu** topology seen with linear linkers. This **bcu** topology was maintained with linkers of even larger transversal width, such as azobenzene-3,3′-dicarboxylic acid. —PDS

J. Am. Chem. Soc. **140**, 10153 (2018).

MICROBIOLOGY

Impermanent permafrost

Permafrost constitutes a quarter of Earth's surface and about half the buried ancient carbon. Thaw releases water, and, together with higher temperatures, this promotes microbial respiration. Thus, permafrost melt during global warming represents a threat for escalating greenhouse gas release. Müller *et al.* extracted 2-meter core samples from Svalbard permafrost in Norway for 16*S* ribosomal RNA gene analysis. Sampling at 3-centimeter intervals, they noted distinctive strata of microbial communities. On thawing and subsequent incubation, each community showed different metabolic rates and different CO_2 fluxes. Within 24 hours, thawing the deepest permafrost layers released most CO_2, but over a longer term, most CO_2 was produced under shallow aerobic conditions. These Svalbard mineral soils also have high iron availability. Intimate knowledge of the microbial, as well as the physicochemical, conditions prevailing in any specific permafrost area is needed to accurately estimate CO_2 emission during anthropogenic climate warming. —CA

Environ. Microbiol. 10.1111/1462-2920.14348 (2018).

QUANTUM COMPUTATION

Trapped ions tackle chemistry

Some of the most likely first applications of future quantum computers may be in quantum chemistry. Even with currently available quantum computers consisting of just a few qubits, it is possible to address certain simple problems, but most of the development has occurred in systems using superconducting qubits. Hempel *et al.* used up to four qubits encoded by trapped ions to calculate the ground-state energies of two simple molecules, H_2 and LiH. They made use of a hybrid classical-quantum method called the variational quantum eigensolver, which relegates parts of the computation such as preprocessing and optimization to a classical computer. —JS

Phys. Rev. X **8**, 031022 (2018).

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