

MICROBIOTA

Gut anaerobes protect against pathogen invasion

Intestinal infections are a common problem for young animals. One explanation is that the protective gut microbiota is not fully established in infants. How the microbiota might protect against pathogens is unclear. Kim *et al.* found that members of the group of strictly anaerobic, spore-forming bacteria known as clostridia protect neonatal mice against diarrhea-causing pathogens. The protective effect is enhanced by giving mice the metabolite succinate in drinking water. Succinate favors colonization of the neonatal gut by cluster IV and XIVa clostridia and concomitantly excludes *Salmonella typhimurium*. —CA

Science, this issue p. 315

PHYSIOLOGY

Safe anaerobic metabolism

Naked mole-rats live in large colonies deep underground in hypoxic conditions. Park *et al.* found that these animals fuel anaerobic glycolysis with fructose by a rewired pathway that avoids tissue damage (see the Perspective by Storz and McClelland). These results provide insight into the adaptations that this strange social rodent has to make for life underground. They also have implications for medical practice, particularly for understanding how to protect tissues from hypoxia. —SNV

Science, this issue p. 307;
see also p. 248

EPIGENETIC INHERITANCE

Ancestral legacy effects

Environmental change can critically affect the lifestyle, reproductive success, and life span of adult animals and their for generations. Klosin *et al.* showed that in the nematode worm *Caenorhabditis elegans*, exposure to high temperatures

led to expression of endogenously repressed copies of genes—sometimes called “junk” DNA. This effect persisted for >10 generations of worms. The changes in chromatin occurred in the early embryo before the onset of transcription and were inherited through eggs and sperm. —BAP

Science, this issue p. 320

MUSCLE DEVELOPMENT

Micromanaging muscle cell fusion

Adult skeletal muscles are characterized by long, multinucleated cells called myofibers. Myofibers form when muscle precursor cells, or myoblasts, differentiate and fuse together during embryogenesis. The fusion process is not fully understood. Studying cell culture and mouse models, Bi *et al.* identified an 84–amino acid peptide that promotes myoblast fusion. This small peptide, called Myomixer, physically interacts with and stimulates the activity of a fusogenic membrane protein called Myomaker. Notably, the Myomaker-Myomixer pair can also promote the fusion of nonmuscle cells, such as fibroblasts. —PAK

Science, this issue p. 323

CANCER

Resident memory responses to cancer

Melanoma patients with vitiligo are more likely to have a positive outcome, but it is not known how. Malik *et al.* report that skin-resident memory T (T_{RM}) cells specific to melanoma antigens are maintained in vitiligo-affected skin. The cells persist and function independently of the lymphoid compartment, indicating that the vitiligo lesions provide a niche for T_{RM} cells. What is more, T_{RM} cells provide durable memory responses to the tumor, even in pigmented skin. —ACC

Sci. Immunol. **2**, eaam6346 (2017).

IN OTHER JOURNALS

Edited by Sacha Vignieri
and Jesse Smith



A combination of local organization and top-down enforcement facilitates successful accommodation of migrating pink-footed geese by farmers.

CONSERVATION

Facilitating refuges

As the human population has grown and spread, conflict between human activities, especially agriculture, and wildlife have become increasingly damaging and unsustainable. Policies that both legally protect wildlife populations and subsidize farmers for allocating resources to wildlife can help to mitigate these conflicts. Eythórrsson *et al.* evaluate the Norwegian portion of a plan put in place to reduce conflict between pink-footed geese (*Anser brachyrhynchus*) and farmers along the goose's northern flyway. They found that local organization of farmers and subsidies contributed to the success of the plan, especially when reimbursements were corrected to be more directly related to damages. However, top-down input (in the form of the intercountry species management plan) was also deemed essential for ensuring that the focus remained on goose conservation, as opposed to farmer reimbursement. Their analysis demonstrates the importance of combining transparency for stakeholders and strict enforcement for species conservation in efforts to facilitate species persistence in the face of human land use. —SNV

Ambio 10.1007/s13280-016-0884-4 (2017).

CANCER TREATMENT

Countering chemo's effects on fertility

Conventional chemotherapy with DNA-damaging agents has helped countless cancer patients become cancer survivors. This

successful outcome is sometimes accompanied by long-term side effects, however. In young female patients, for example, the alkylating agent cyclophosphamide can compromise fertility. This occurs because the drug causes inappropriate activation



Enlargement of eyes prepared ancient aquatic tetrapods for later colonization of terrestrial environments.

EVOLUTION

The eyes have it

Around 385 million years ago, aquatic tetrapods colonized terrestrial environments. We know much about the limb development that this shift from a buoyant to a weight-bearing existence required and shaped, but much less about how these animals managed the equally different sensory challenge of above-water living. Maclver *et al.* used phylogenetic approaches to document considerable expansions in eye size that occurred well before land colonization. Further, computational explorations of visual acuity show that these expansions, though not particularly helpful for improving underwater vision, would have conferred vast visual improvements in air. The changes likely occurred as a result of a crocodylian-type lifestyle wherein aquatically adapted species floated and foraged on the surface—a lifestyle that both preceded, and prepared species for, subsequent colonization of the terrestrial realm. —SNV

Proc. Natl. Acad. Sci. U.S.A. 10.1073/pnas.1615563114 (2017).

of ovarian follicular development, thereby exposing oocytes to its DNA-damaging effects. Studying a mouse model, Goldman *et al.* showed that ovarian function and fertility are preserved when cyclophosphamide is coadministered with drugs called mTORC1/2 inhibitors, which suppress a signaling pathway required for follicular activation. mTORC1/2 inhibitors are already clinically approved for other purposes, including treatment of certain forms of breast cancer, and may merit exploration as a fertility-preserving strategy in female cancer patients. —PAK

Proc. Natl. Acad. Sci. U.S.A. **114**, 3186 (2017).

EDUCATION

The physics of social butterflies

As science education moves toward more active classes, what

can we learn about how student socialization affects learning? Zwolak *et al.* used social network analysis to investigate the academic and social experiences of students in an introductory Modeling Instruction (active learning) physics course. Students were asked to list the names of fellow students with whom they had a meaningful interaction five times throughout the semester. Using centralities, which are measures of position within the social network, intrapersonal interactions between students were quantified. Results showed that students with a higher centrality at the end of the semester were more likely to persist in physics (i.e., continue through the sequence of courses), suggesting that social integration may help in keeping students in science, technology, engineering, and math disciplines. —MM

Phys. Rev. Phys. Educ. Res. 10.1103/PhysRevPhysEducRes.13.010113 (2017).

CELLULAR RESPONSES

Disordered proteins make a dynamic switch

The proteins that regulate cellular responses to hypoxia form a sensitive on-off switch. Cells survive hypoxia by activating the transcription factor HIF-1 α (hypoxia-inducible factor 1 α). HIF-1 α is active when it is associated with the transcriptional coactivator CBP. The protein CITED2 opposes such activation. CITED2 and HIF-1 α bind overlapping regions of CBP with similar affinity. But CITED2 can much more effectively displace HIF-1 α from CBP and inhibit transcription. The flexibility of intrinsically disordered regions of CITED2 apparently allows it to slip in and cause an allosteric change in CBP that hinders interaction with HIF-1 α . Other such switches may exist, and in such cases, modeling on the basis of binary dissociation

constants would be very misleading. —LBR

Nature 10.1038/nature21705 (2017).

BIOMATERIALS

Setting up a recruiting office

The successful growth of large tissues requires the formation of a vascular system to ensure the proper supply of nutrients to the growing cells. One route to angiogenesis in the growing tissue is through the delivery of growth factors such as VEGF, but clinically this method has limitations. An alternative is to harness proangiogenic cells, such as blood-derived CD133⁺ cells, also known as circulating angiogenic cells (CACs). Parlato *et al.* used a cell invasion assay to optimize a hydrogel designed to recruit CACs over a period of 24 hours. Although hydrogel degradability and hydrogel stiffness—two known variables often connected with cell behavior—were found to be important in attracting CACs, a key third factor was the presentation of a gradient of stromal derived factor 1. —MSL

Acta Biomater. 10.1016/j.actbio.2017.03.048 (2017).

METALLURGY

Nanostructured high-strength alloys

Low-density magnesium alloys are a promising type of material for making lighter vehicles and improving fuel efficiency. One challenge for lightweighting is developing high-strength magnesium alloys. Wu *et al.* created a dual-phase magnesium thin film with near-ideal strength. The alloy consists of small nanocrystalline cores surrounded by glass, combining the benefits of both phases to create the high-strength alloy. The strategy for creating this type of nanostructure should translate to other types of alloys, opening a different pathway to creating high-strength metals. —BG

Nature 10.1038/nature21691 (2017).