

growth with availability of required precursor metabolites. Signaling through mTORC1 controls pyrimidine synthesis. Ben-Sahra *et al.* found that mTORC1 also functions by a different mechanism to regulate purine biosynthesis, thus generating precursors for the synthesis of RNA and DNA (see the Perspective by Ma and Jones). Signaling by mTORC1 caused accumulation of the transcription factor ATF4, which enhances production of the enzyme methylenetetrahydrofolate dehydrogenase 2, thus leading to increased production of the purine nucleotides needed for cell growth. — LBR

Science, this issue p. 728; see also p. 670

GLOBAL WATER CYCLE

By land or by sea

How much of an effect does terrestrial groundwater storage have on sea-level rise? Reager *et al.* used gravity measurements made between 2002 and 2014 by NASA's Gravity Recovery And Climate Experiment (GRACE) satellites to quantify variations in groundwater storage. Combining those data with estimates of mass loss by glaciers revealed groundwater's impact on sea-level change. Net groundwater storage has been increasing, and the greatest regional changes, both positive and negative, are associated with climate-driven variability in precipitation. Thus, groundwater storage has slowed the rate of recent sea-level rise by roughly 15%. — HJS

Science, this issue p. 699

IMMUNOLOGY

An unconventional route to protection

One promising approach toward an HIV-1 vaccine involves infecting people with cytomegalovirus engineered to express proteins from HIV-1. This approach, which works by eliciting virus-killing CD8⁺ T cells, provides robust protection in nonhuman primate models. Hansen *et al.* have

found out why this approach is so effective. Normally, peptide antigens presented by major histocompatibility complex-1a (MHC-Ia) activate CD8⁺ T cells. In vaccinated monkeys, however, CD8⁺ T cells reacted to peptide antigens presented by MHC-E molecules instead. Moreover, MHC-E could present a much wider range of peptides than MHC-Ia. — KLM

Science, this issue p. 714

ASTRONOMY

How stars grow

Conventional wisdom has long held that young stars grow gradually through the inward migration of mass within their protoplanetary disks. Liu *et al.* now show that the process may also include violent episodes of especially rapid mass accretion. Although the precise causes of such events are still being studied, the emerging perspective on protoplanetary disk evolution is one that is more dynamic and chaotic than previously believed. — KVH

Sci. Adv. 10.1126/sciadv.00875 (2016).

CARBON CYCLE

Warming making bigger CO₂ swings

The combined effects of climate change and vegetation dynamics at high northern latitudes have amplified the seasonal variation of atmospheric CO₂ concentrations over the past half century. Forkel *et al.* combined observations and models to show that climate warming has caused the photosynthetic uptake of carbon to increase faster than its respiratory release from the terrestrial biosphere. This has increased the difference from summer to winter, as well as the latitudinal gradient. Because of the physiological limitations to carbon uptake by terrestrial vegetation, this negative feedback to warming in the boreal north and Arctic cannot continue indefinitely. — HJS

Science, this issue p. 696

IN OTHER JOURNALS

Edited by Kristen Mueller and Jesse Smith



Soil-dwelling bacteria can protect strawberry plants from fungal wilt

SOIL BIOLOGY

Plant probiotics to the rescue

Some soils protect crops against their microbial attackers without any pesticides or fungicides. Cha *et al.* investigated the microbial and biochemical basis of this effect in a patch of soil that excluded fungal wilt on strawberry plants, despite 15 years of monoculture. Mixing in the protective soil transferred this suppressive effect into neighboring disease-ridden soils, which gained increasingly better disease-control capacity with successive growing cycles. A strain of *Streptomyces* bacteria, a group renowned for producing antibiotics, emerged as the chief agent that suppressed the pathogenic fungi. The *Streptomyces* produced an interesting large heat-stable thiopeptide antibiotic with antifungal properties. Thus, much like the development of probiotics to combat gut diseases, probiotics for soil should be feasible. — CA

ISME J. 10, 119 (2016)

STEM CELLS

Translating stem cell quiescence

Many tissues harbor a reservoir of stem cells that remains quiescent but can be activated as needed for growth and repair. How cells enter, maintain, and then exit quiescence is incompletely defined. Studying skeletal muscle stem cells in mice, Zismanov

et al. reveal a role for translational repression. Stem cell quiescence requires phosphorylation (a posttranslational protein modification) of the translation initiation factor eIF2 α at a particular amino acid residue; dephosphorylation (removal of the phosphoryl group) or blocking phosphorylation causes muscle stem cells to exit quiescence and differentiate. Moreover, inhibiting



Some cetacean species in European waters still harbor high levels of PCBs

ECOTOXICOLOGY

PCBs are still a problem for some marine life

Due to their environmental toxicity, most developed countries banned polychlorinated biphenols (PCBs) in the 1970s and 1980s. Since then, studies in marine regions off North America have shown a continued downward trend in their occurrence and levels in marine mammals and seabirds, but Jepson *et al.* find that this is not the case for marine mammals in European waters. Specifically, they looked at PCB levels in four cetacean species (the harbour porpoise, striped dolphin, bottlenose dolphin, and Atlantic killer whale). PCB levels in three of the four species were at, or above, established toxicity levels. The toxic effects of such high levels may be contributing to the observed declines and recruitment failures currently observed in these species. — SNV

Sci. Rep. 10.1038/srep18573 (2016).

dephosphorylation leads muscle stem cells to self-renew and regenerate. Manipulating eIF2 α phosphorylation may represent a method to regulate the regenerative capacity of stem cells for clinical use. — BAP

Cell Stem Cell **18**, 79 (2016).

KIDNEY DISEASE

Potassium loss stresses out kidney cells

African-Americans are five times more likely than Caucasians to develop advanced kidney disease. Two sequence variants in a gene called *APOL1* confer most of this elevated risk. Scientists think that the prevalence of these sequence variants in people of African descent probably arose because they also confer protection against parasite infection. The *APOL1* gene encodes the protein apolipoprotein L1, which forms ion pores in the kidney cell membrane, but how the risk variants cause kidney disease remains a mystery. Studying cultured kidney cells, Olabisi *et al.* find that

the *APOL1* risk variants cause excessive loss of potassium from the cells. This in turn activates stress-activated enzymes called kinases, which ultimately leads to kidney cell death. — PAK

Proc. Natl. Acad. Sci. U.S.A. **113**, 830 (2016).

EDUCATION

Critical thinking: Not just for majors

Being able to draw conclusions based on evidence in order to make an informed decision is a key aspect of scientific literacy. Rowe *et al.* report on a general education science course designed specifically to teach critical thinking, essentially the nature of science, rather than just the facts of science. Through the incorporation of case studies, the course examined science as it relates to the students' daily lives (for example, the vaccine-autism controversy) by using scientific processes such as argumentation, evaluating data, drawing conclusions, and designing the

next experiment. A pre/post-test survey showed that participating students significantly improved their critical thinking skills and were more willing to engage with science that the public finds controversial. — MM

CBE Life Sci. Educ. 10.1187/cbe.15-02-0032 (2015).

VIRAL ECONOMICS

All aboard the disease train

Economic booms and improved transportation may come with



Expanded transportation networks have increased the transmission of viral diseases in France

a costly downside: increased transmission of viral diseases. Adda studied 25 years of weekly disease surveillance reports from across France, focusing on influenza, gastroenteritis, and chickenpox. He found that rail-worker strikes, which diminished travel, limited disease transmission, whereas the expansion of high-speed rail to new regions promoted disease spread. The estimated cost of this increased health burden was of the same magnitude as the benefit of improved travel. In times of economic prosperity, travel increased, driving up disease transmission. The impacts of holiday school closures suggest that, although closing schools during outbreaks could limit disease spread, this is not cost-effective in the light of lost learning and subsequent earning. — BW

Quart. J. Econ., <http://ftp.iza.org/dp9326.pdf> (2016).

ATOMIC PHYSICS

When is an atomic cloud two-dimensional?

When a three-dimensional (3D) system is flattened into a 2D "pancake," interactions between its constituents play an enhanced role. To study these effects, atomic physicists trap atoms so that their motion is restricted to a 2D plane. The rule of thumb is that both the chemical potential and the temperature of the system must be well below the strong confinement in the transverse direction (perpendicular to the plane). Now, Dyke *et al.* show that the rule is a bit more subtle. As they increased the number of

atoms in the trap at a fixed interaction strength, the size of the cloud in the transverse direction increased suddenly. This suggests that the system left the strictly 2D regime, even when the conditions above were met. — JS

Phys. Rev. A **93**, 011603(R) (2016).

Science

Translating stem cell quiescence

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