operated for more than 1000 hours under full sunlight. — PDS

Science, this issue p. 295

PALEOCEANOGRAPHY

Circulating between different cycles

Around a million years ago, large-scale ocean circulation changed dramatically during the switch from ~41,000- to ~100,000-year long glacial cycles. Pena and Goldstein analyzed the isotopic composition of neodymium in marine sediments from the South Atlantic. The results suggest how the contributions of deep water from northern and southern sources varied across the transition. The boundary between the two glacial states appears to have been marked by a dramatic weakening, perhaps even a shutdown, of deep-water currents. — HJS

Science, this issue p. 318

FOOD SECURITY

How to optimize global food production

Keeping societies stable and managing Earth's resources sustainably depend on doing a good, steady job producing and distributing food. West *et al*. asked what combinations of crops and regions offer the best chance of progress. Their analysis focused on reducing greenhouse gas emissions, nutrient pollution, water use, and food waste. They identify regions that are likely to yield the best balance between applying fertilizer to increase crop yields versus the resulting environmental impact. — AMS

Science, this issue p. 325

ALTERNATIVE SPLICING

Evolving from an enzyme and into a regulator

Proteins, the work-horses of the cell, are made on a messenger RNA (mRNA) template. An enzyme called aminoacyl tRNA synthetases (AARSs) attaches the correct amino acid to a transfer RNA so that mRNA is accurately translated. Over evolution, additional sequences have been added to AARSs. Lo *et al.* found a large number of AARS variants in which the domain responsible for enzyme function was deleted. Ninety-four such variants had diverse signaling activities. Thus, AARSs are used both as enzymes and alternately as regulators of signaling pathways. — VV

Science, this issue p. 328

MITOSIS

Taking a check on chromosome spacing

Animal cells divide by mitosis. Chromosomes become condensed and congregate on the mitotic spindle in the center of the cell—the midzone. The spindle then separates sister chromosomes, pulling them to opposite ends of the cell, ready to form new daughter nuclei. Afonso *et al.* now show that chromosome separation is monitored by the level of midzone-associated Aurora B kinase activity (see the Perspective by Hadders and Lens). This process ensures that daughter nuclei only reassemble after sister chromosomes have successfully separated. — SMH

Science, this issue p. 322; see also p. 265

SYNTHETIC BIOLOGY

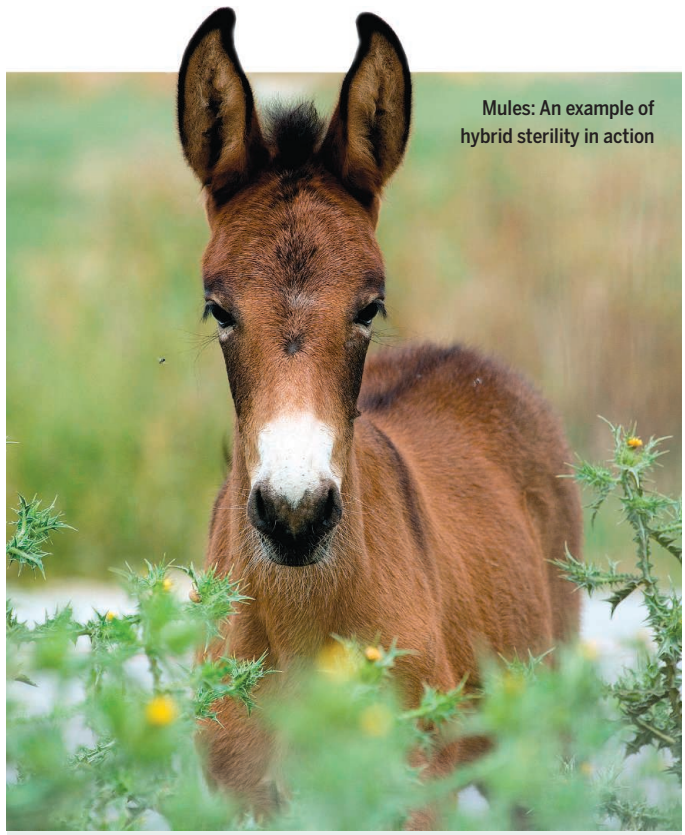
Turning cells into garbage collectors

To protect other cells or tissue from injury, professional garbage-collecting cells called phagocytes gobble up dead cells. Sometimes phagocytes become overwhelmed and could use some help. Onuma *et al*. manipulated nonphagocytic cells to express two proteins: one that recognizes a lipid that marks the surface of dying cells and another that alters the plasma membrane to make the cell phagocytic. The engineered cells bound to and consumed dying cells. Such engineered cells could potentially be used to help the body remove undesirable targets. — JFF

Sci. Signal. **7**, rs4 (2014).

IN OTHER JOURNALS

Edited by **Kristen Mueller** *and* **Jesse Smith**



Mules: An example of hybrid sterility in action

SPECIATION

Putting the genetic breaks on breeding

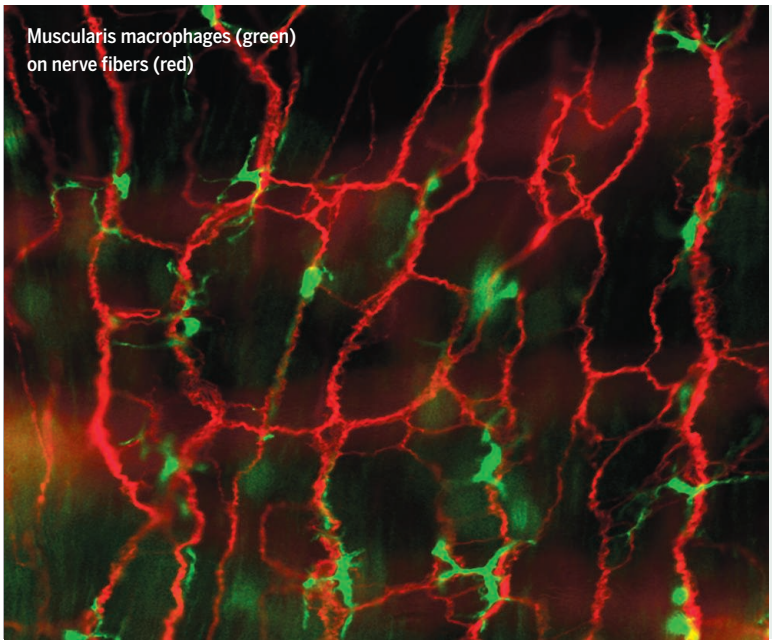
Several genetic barriers prevent species from interbreeding. For instance, when two different species mate, their offspring are often infertile. Identifying the genetic causes of this hybrid sterility provides insight into how species evolve genetically. Zanders *et al*. examined two closely related yeast species, which share 99.5% of their DNA sequence. They found that crosses between the species could not produce fertile offspring because of meiotic drive loci, genetic elements that are preferentially transmitted to the offspring within a species. The three DNA sites, which were present in one of the species, blocked the hybrid from developing spores that contained chromosomes from the other species. This study highlights how quickly barriers to fertility can arise between two closely related species. — LMZ

eLife 10.7554/eLife.02630.001 (2014).

CELL NUCLEUS

Packaging DNA for a better nucleus

Nuclear pores oversee the movement of proteins, DNA, and RNA across the nuclear membrane between the nucleus and cytoplasm—an essential duty for proper cell function and survival. Two studies now report that for these pores to form, the cell requires nucleosomes, short lengths of DNA wrapped around a protein core that package chromosomes into the nucleus.


Muscularis macrophages (green) on nerve fibers (red)

GUT MOTILITY

Macrophages help food move through

Food needs a complex array of cellular interactions to move through the body. Neurons, muscle cells, and interstitial cells all cooperate to ease it through the gastrointestinal (GI) tract. Now Muller *et al*. report intestinal muscularis macrophages, a type of immune cell that resides in the smooth muscles that surround the GI tract, participate, too. These macrophages secrete a substance called bone morphogenetic protein 2 (BMP2), which binds to enteric neurons and directs them to coordinate the muscle cell contractions that squeeze food through. The neurons, in turn, produce a growth factor required by the macrophages. Macrophage-neuron crosstalk is essential: When mice don't have enough of the growth factor, BMP2, or muscularis macrophages, they have defects in gut muscle contractions. — KLM

Cell 10.1016/j.cell.2014.04.050 (2014).

Inoue and Zhang and Zierhut *et al*. use either mouse zygotes or frog (*Xenopus*) egg extracts to show that nucleosomes bind to and recruit the nuclear pore protein ELYS (embryonic large molecule derived from yolk sac) to DNA, driving the initial steps of nuclear pore assembly. In this way, cells might ensure that a functional nucleus only forms around properly packaged chromosomes. — GR

Nat. Struct. Mol. Biol. 10.1038/nsmb.2839; 10.1038/nsmb.2845 (2014).

ATMOSPHERIC SCIENCE

Looking for signs of ozone recovery

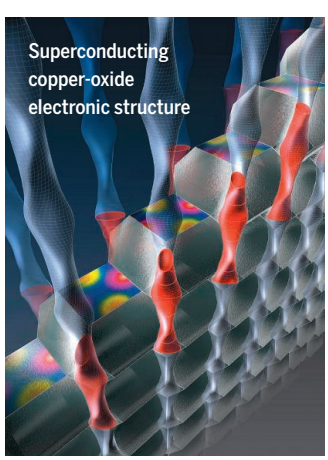
How effective is the Montreal Protocol, the international treaty aimed at protecting the stratospheric ozone layer? Since the treaty was adopted in 1989, manufacturers have gradually stopped producing numerous chemicals that deplete ozone. Scientists have predicted that ozone will recover as a result. Coldewey-Egbers *et al.* use an extensive data set to test whether recovery can be detected yet. They conclude that in mid-latitudes, at least five more years of data are needed to unequivocally detect signs of recovery, because natural variability masks the ozone recovery. At lower latitudes, where the trend in ozone concentration is smaller, even more data will be needed. — JFU

Geophys. Res. Lett. 10.1002/2014GL060212 (2014).

PHYSICS

A copper oxide's electronic structure

Physicists still do not understand why some copper-oxide compounds become superconducting at relatively high temperatures. Even more basic issues have remained controversial as well, such as the electronic structure of the normal (i.e., nonsuperconducting) state from which superconductivity emerges. Sebastian *et al.* chose $YBa_2Cu_3O_{6.56}$ as a good representative of a subclass of these compounds and used high magnetic fields to suppress its superconductivity and reach its normal state. They analyzed the wiggles of the electrical resistivity to map out the shape of the so-called Fermi surface, which separates the quantum states filled with electrons from the empty ones. They found an undulating shape that suggested that the electronic structure was organized differently from what one expects based on the crystal lattice structure alone. — JS


Superconducting copper-oxide electronic structure

Nature 10.1038/nature13326 (2014).

CIRCADIAN RHYTHMS

Tick tock, synchronizing biological clocks

Studies of coupled oscillators started in the 1600s, when the man who invented the pendulum clock set a pair of clocks side by side in a single case and noticed that they started ticking in unison. In mammalian cells, the machinery that controls the cell division cycle turns out to be similarly synchronized with the daily circadian clock, which allows cells to get on the same seasonal and day-night schedules. Feillet *et al.* imaged single live mammalian cells in culture and performed mathematical modeling. They showed that the daily circadian clock and the cell division cycle oscillate together at the same frequency. This may have clinical relevance: Circadian disruption is a risk factor for some cancers. — LBR

Proc. Natl. Acad. Sci. U.S.A. 10.1073 pnas.1320474111 (2014).

CLIMATE CHANGE

Measuring sea ice through thick and thin

Sea ice in the Arctic's Fram Straight is only half as thick as it was a decade ago, Renner and colleagues report. Measuring ice both at the surface and from the air with an instrument towed below a helicopter, they found that the ice in that region thinned by more than 50% between 2003 and 2012. The patterns of variability that they see most likely are caused by thinning occurring more broadly across the Arctic, rather than being just a regional effect. These observations are consistent with the contemporaneous reduction of the area covered by sea ice that has occurred in the Arctic and should help provide a better understanding of both the magnitude and the causes of the loss. — HJS

Geophys. Res. Lett. 10.1002/2014GL060369 (2014).

Packaging DNA for a better nucleus

Guy Riddihough

Science **345** (6194), 281.
DOI: 10.1126/science.345.6194.281-b