

self. After culture with T_{regs}, the silenced T cells proliferated very little and produced almost no cytokines in response to antigen. The authors then examined T cells from healthy donors and from people with an autoimmune disease. Only healthy donors harbored silenced T cells, suggesting that if silencing goes awry, autoimmunity may result. — KLM

Science, this issue p. 1536

EARTH MAGNETOSPHERE

How trans-polar arcs transpire above

Auroral arcs within the polar cap are a visual marvel, and they may also indicate trapped energetic plasma in Earth's magnetosphere. Fear *et al.* combined simultaneous observations of both the aurora and signatures of the trapped plasma in Earth's magnetotail to demonstrate one recent instance of this phenomenon. Some researchers have proposed that flux generated by magnetic reconnection might get trapped in the magnetotail lobe, but the standard magnetosphere model does not predict it. This study confirms the idea by taking advantage of a period when the interplanetary magnetic field points northward, a state not yet well understood. — MMM

Science, this issue p. 1506



Aurora displays such as these over Alaska reflect plasma processes in Earth's magnetosphere

PHOTOS: (LEFT TO RIGHT) © TED RAYNOR/IMAGEBROKER/CORBIS; THE BORTHWICK INSTITUTE FOR ARCHIVES

PROTEIN DESIGN

Building transmembrane zinc transporters

The ability to design proteins gives insight into the relation between a protein's fold and its function and also provides a path to custom proteins for bioengineering applications. Impressive strides have been made in the design of soluble proteins, but designing membrane proteins remains a challenge. Joh *et al.* achieve a milestone by designing a transmembrane Zn²⁺ transporter (see the Perspective by Lupas). The protein comprises four helices: Two tightly interacting pairs form a weaker interface that facilitates the transport of Zn²⁺ with concomitant reverse transport of protons. — VV

Science, this issue p. 1520; see also p. 1455

IMAGING

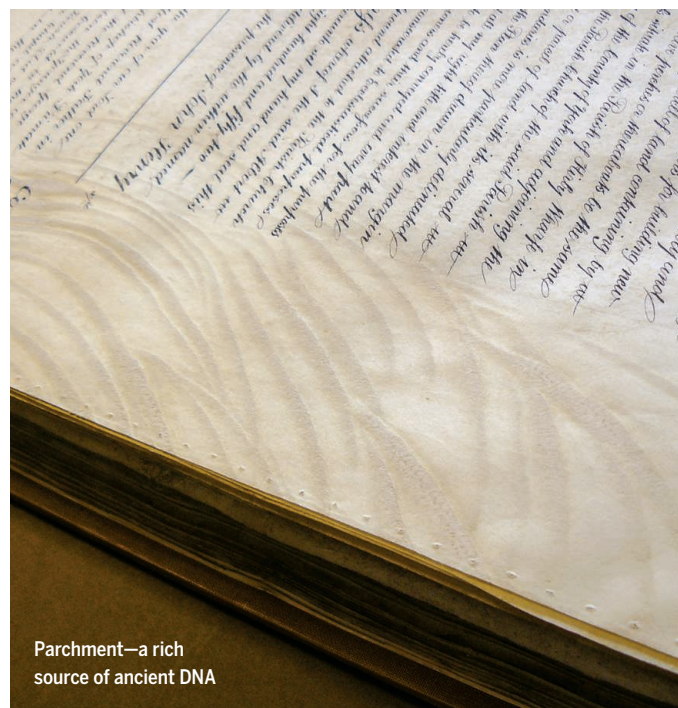
Look, pathologists! No lens!

Imaging entire human tissues with a light microscope requires stitching 500+ images together — a digitization process largely confined to advanced laboratories. Greenbaum *et al.* developed a lens-free microscope based on low-cost holographic technology, which enables fields of view a hundredfold larger than conventional technology allows. This tool employs a small chip and allows for three-dimensional focusing through thick tissue samples. The team imaged human cancer cells, abnormal cells in Pap smears, and sickle cells in whole-blood smears with sufficient resolution and contrast for clinical diagnosis. With its high resolution and speedy readout, the new platform could benefit pathology labs worldwide. — MLF

Sci. Transl. Med. **6**, 267ra175 (2014).

IN OTHER JOURNALS

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



Parchment—a rich source of ancient DNA

ANCIENT DNA

Document DNA shows agriculture's course

Finding a good source of ancient DNA can be tough, due to weathering and bacterial contamination. But parchment—made from livestock hides—offers an abundant, well-preserved, and often dated source of DNA, report Teasdale *et al.* The researchers worked with a 2-cm-square piece, but have so refined their sequencing technique that it only requires a tiny sliver of parchment; they hope eventually to do nondestructive testing. These data, they note, can reveal the history of agriculture over the past 700 years. — EP

Philos. Trans. R. Soc. London Ser. B, 10.1098/rstb.2013.0379(2014).

NETWORK BIOLOGY

Meeting the demands of a complex network

Cells face intense metabolic demands. Meeting these demands requires genes to interact in complex networks. But what happens to these networks when the participating genes acquire mutations? To find out, Bajić *et al.* computationally mapped how genes that regulate cellular metabolism interact in yeast lacking specific metabolic enzymes or in yeast that had accumulated

neutral mutations (mutations that did not affect their overall fitness). Their model predicted that deleting specific genes would lead to alternative enzymatic reactions and rewired signaling pathways, depending on the degree of network connectivity. In the case of neutral mutations, their model suggested that network rewiring would occur along with a loss of plasticity. Experimental data supported these predictions. — LMZ

Genome Biol. Evol. 10.1093/gbe/evu255 (2014).



Scientists used somatic cell nuclear transfer to clone Dolly the sheep

STEM CELLS

Better cloning through expression

One method of generating pluripotent cells for cloning is to transfer the nucleus of a differentiated cell into an oocyte (egg cell) that has had its nucleus removed, a procedure known as somatic cell nuclear transfer (SCNT). However, very few SCNT embryos develop to term. To investigate why, Matoba *et al.* compared gene expression in embryos produced by in vitro fertilization (IVF) and SCNT. They found that SCNT but not IVF embryos repressed certain regions of DNA. Removing this repression enhanced the efficiency of SCNT, suggesting that the expression of one or more of these genes is important for cellular reprogramming. — MDC

Cell **159**, 884 (2014).

NEUROSCIENCE

Neuronal function requires the real deal

Brain slice experiments are a mainstay of modern neuroscience: They allow scientists to probe the molecular details of the brain while keeping brain architecture intact. Scientists usually bathe these slices in artificial cerebrospinal fluid (CSF) instead of CSF obtained from humans. This typically works well, but neurons in brain slices are



Brain slices are an important tool for understanding how neurons work

often quieter than those in intact brains. However, when Bjorefeldt *et al.* replaced artificial CSF with real human CSF, they observed a neuronal activity boost. Pyramidal neurons exhibited lower action potential thresholds and their excitability increased. The authors hypothesized that endogenous neuromodulating

substances in the human CSF increased the excitability of the nerve cells. — PRS

J. Physiol. 10.1113/jphysiol.2014.284711 (2014).

PALEOBIOLOGY

Parasites are rising with the seas

Extrapolating from the fossil record, the prevalence of aquatic parasites should grow along with the extent of anthropogenic climate change. Huntley *et al.* quantified the abundance of pits in nearly 4000 mollusk shells from Holocene Pearl River (China) delta sediments. Pitting is caused by trematodes, or flatworms. Trematode prevalence over the course of ~10,000 years was highest just after the onset of sea-level rise and lowest during maximum flooding. Although a number of variables can change with sea-level rise, parasite prevalence was not statistically explained by changes in salinity or host abundance. — NW

Proc. Natl. Acad. Sci. U.S.A. 10.1073/pnas.1416747111 (2014).

EDUCATION

Translating clicks into efficiency

As the number of web-based resources for science education increases, evaluation of these

websites remains limited. In order to enhance learning experiences, website managers should know how to draw an audience, provide an optimal user experience, and assess any learning that has taken place. Using their own website as an example, Goldsmith *et al.* describe how this evaluation can be done using clickstream analytics. Specifically, the authors determined where their audience came from and what content they did or did not use. With this information, website managers can better allocate their resources to fit their users' needs, making online science education efforts more targeted and efficient. — MM

Ecosphere **5**, 131 (2014).

MATERIALS SCIENCE

The right combination of additives

The formation of ceramic-based materials and composites occurs in nature under mild conditions, aided by a range of organic additives. With this template in mind, Bawazer *et al.* explored whether a combination of organic molecules could be used to make quantum dot assemblies under similar conditions. To discover the right mix, they turned to combinatorial methods paired with genetic algorithms. The recipes that showed the highest

fluorescence intensity became the basis for the next set of experiments. These converged on products that fluoresced after 7 days, and in all three, the same set of four additives was conserved. — MSL

Adv. Mater. 10.1002/adma.201403185 (2014).

PUBLIC HEALTH

The socioeconomics of good sanitation

Diarrheal diseases caused by poor sanitary conditions are a leading cause of childhood mortality worldwide. In Sub-Saharan Africa, improved sanitation has been particularly difficult to implement in rural areas, where the cost to install a latrine toilet is nearly \$190. In a survey of 2000 rural households in Benin, where nearly 95% of the country lacks access to proper sanitation, Gross and Günther found that as much as 50% of the country could have access to latrines if their cost could be reduced to \$50 each. However, the survey also found that cost is not the only socioeconomic factor contributing to poor sanitation, and that sanitation promotion programs should focus on the health security and protection provided by latrines as further reasons to install them. — NW

Water Resour. Res. **50**, 8314 (2014).