Stomach ache for a European mummy

Five thousand years ago in the European Alps, a man was shot by an arrow, then clubbed to death. His body was subsequently mumified by ice until glacier retreat exhumed him in 1991. Subsequently, this ancient corpse has provided a trove of intriguing information about copper-age Europeans. Now, Maixner et al. have identified the human pathogen *Helicobacter pylori* within the mummy’s stomach contents. The strain the “Iceman” hosted appears to most closely resemble pathogenic Asian strains found today in Central and Southern Asia. — CA

Science, this issue p. 162

Mapping the lineage potential of stem and progenitor cells

*Notta et al., p. 139*

PEROVSKITES FOR TANDEM SOLAR CELLS

Perovskites for tandem solar cells

Improving the performance of conventional single-crystalline silicon solar cells will help increase their adoption. The absorption of bluer light by an inexpensive overlying solar cell in a tandem arrangement would provide a step in the right direction by improving overall efficiency. Inorganic–organic perovskite cells can be tuned to have an appropriate band gap, but these compositions are prone to decomposition. McMeekin et al. show that using cesium ions along with formamidinium cations in lead bromide–iodide cells improved thermal and photostability. These improvements lead to high efficiency in single and tandem cells. — PDS

Science, this issue p. 151

STEM CELL NICHE

How HSCs populate the fetal liver

Hematopoietic stem cells (HSCs) undergo dramatic expansion in the fetal liver before migrating to their definitive site in the bone marrow. Khan et al. identify portal vessel–associated Nestin*NG2* pericytes as critical HSC niche components (see the Perspective by Cabezas-Wallscheid and Trumpp). The portal vessel niche and HSCs expand according to fractal geometries, suggesting that niche cells—rather than factors expressed by the niche—drive HSC proliferation. After birth, arterial portal vessels transform into portal veins, and lose Nestin*NG2* pericytes. When this happens, the niche is lost and HSCs migrate away from the neonatal liver. — BAP

Science, this issue p. 176; see also p. 126

PALEOCLIMATE

The difference is all in the water

Glacial cycles are in part controlled by the pattern of incident solar energy determined by the geometry of Earth’s orbit around the Sun. The classic record of the penultimate deglaciation from Devils Hole, Nevada, did not reconcile the presumption of so-called orbital forcing, however, suggesting that deglaciation began ~10,000 years too early. Moseley et al. present analyses of a new set of data from Devils Hole that show that the deglaciation indeed occurred at the time expected on the basis of orbital forcing. The age offset displayed by the older samples apparently was caused by interaction with groundwater, which preferentially affected the deeper original samples but not the new shallower samples. — HJS

Science, this issue p. 165

HIV TRANSMISSION

The ART of HIV prevention

Despite the relative success of antiretroviral therapy (ART) for individuals infected with human immunodeficiency virus (HIV), the rate of new diagnoses has remained fairly constant. Now, Ratmann et al. examined probable sources of transmission in the Netherlands for men who have sex with men. They found that neither ineffective ART nor inadequate retention in care contributed to new infections.
Rather, many of these cases could have been averted with available ART had there been more comprehensive testing coverage among men at risk of transmission. These findings support broader, more frequent testing followed by immediate ART as a strategy to decrease transmission rates. — ACC

PROTEIN AGGREGATES
Location, location, location
Aggregates of certain disease-associated proteins are involved in neurodegeneration. Woerner et al. now show that the exact location of these aggregates in the cell may be the key to their pathology (see the Perspective by Da Cruz and Cleveland). An artificial aggregate-prone protein caused problems when expressed in the cytoplasm but not when expressed in the nucleus. Cytoplasmic aggregates interfered with nucleocytoplasmic import and export. Perhaps if we can shunt pathological aggregates to the nucleus in the future, we will be able to ameliorate some forms of degenerative disease. — SMH
Science, this issue p. 173; see also p. 125

FOREST ECOLOGY
Size distributions of tropical trees
The distribution of tree size in tropical forests follows a power-law regardless of location. This pattern has largely eluded mechanistic explanation. Using 30 years of tree demography and growth data from a forest plot in Panama, Farrior et al. show that the power-law size structure emerges after natural local disturbances such as the gaps formed by falling trees. A model of forest dynamics identifies the structural parameter governing the power-law distribution. A mechanistic understanding of tropical forest structural dynamics will benefit forest carbon cycling studies. — AMS
Science, this issue p. 155

QUORUM SENDING
Plants send out a bacterial mimic
Bacteria use the quorum-sensing pathway to regulate community-level interactions, such as the formation of biofilms. Corral-Lugo et al. determined that a common plant compound mimics a quorum-sensing signal. Rosmarinic acid stimulated the activity of a transcriptional regulator in the quorum-sensing pathway of the plant and human pathogen Pseudomonas aeruginosa, increasing biofilm formation. Because rosmarinic acid could stimulate a premature quorum-sensing response, this compound may strategically disrupt bacterial communication. — NRG

THERMOELECTRICS
Heat conversion gets a power boost
Thermoelectric materials convert waste heat into electricity, but often achieve high conversion efficiencies only at high temperatures. Zhao et al. tackle this problem by introducing small amounts of sodium to the thermoelectric SnSe (see the Perspective by Behnia). This boosts the power factor, allowing the material to generate more energy while maintaining good conversion efficiency. The effect holds across a wide temperature range, which is attractive for developing new applications. — BG
Science, this issue p. 141; see also p. 124

BIOGEOCHEMISTRY
A global census of lake nutrients
Lakes of all sizes are sensitive to local water and pollution management strategies. Excess nutrients in lakes can induce a series of unexpected consequences for water quality or greenhouse gas emissions. Based on previously collected data from over 8000 lakes across six continents, Chen et al. compiled a global estimate of carbon, nitrogen, and phosphorus in lakes. These trace nutrients have intertwined fates in lakes, often related to morphological and climatic factors that change over time. Perturbations of climate or land use by humans will therefore have wide-ranging effects on biogeochemical cycling of nutrients within lakes across the globe. — NW

IN OTHER JOURNALS
Edited by Sacha Vignieri and Jesse Smith

Lake Powell, seen from Alstrom Point in Arizona, USA.

Photo: ©PERCY DELNOS/ALAMY STOCK PHOTO; JOHN SHAW/SCIENCE SOURCE

SCIENCE sciencemag.org
8 JANUARY 2016 • VOL 351 ISSUE 6269 135

Published by AAAS
EARTH HISTORY
Evidence of an Anthropocene epoch
Humans are undoubtedly altering many geological processes on Earth—and have been for some time. But what is the stratigraphic evidence for officially distinguishing this new human-dominated time period, termed the “Anthropocene,” from the preceding Holocene epoch? Waters et al. review climatic, biological, and geochemical signatures of human activity in sediments and ice cores. Combined with deposits of new materials and radionuclides, as well as human-caused modification of sedimentary processes, the Anthropocene stands alone stratigraphically as a new epoch beginning sometime in the mid–20th century. — NW
Science, this issue p. 137

ECOLOGY
Reforest with care
Grasslands throughout the tropics are targeted for forest planting. In his Perspective, Bond argues that such efforts put ancient, highly biodiverse ecosystems at risk. Although some grasslands are the result of deforestation, wide areas have supported mosaics of grassland and forest for millions of years. Examples include grasslands in southern Brazil, South Africa, and Madagascar. Many of these grasslands require frequent fires to maintain them. Plants have evolved to survive fires, for example, by developing extensive root systems. It is crucial that efforts are made to protect these ancient tropical grassy ecosystems. — JFU
Science, this issue p. 120

BRAIN CIRCUITS
Fine-tuned information flow in the brain
In addition to providing well-characterized excitatory inputs, the entorhinal cortex also sends long-range inhibitory projections to the hippocampus. Basu et al. described this input in detail and characterized its role for learning and memory. Multimodal sensory stimuli activate long-range inhibitory input in vivo. This input enables precisely timed information transfer within the cortico-hippocampal circuit. In this way, long-range inhibitory projections play an important role in providing specificity of fear conditioning, and thus help prevent overgeneralization. — PRS
Science, this issue p. 138

HEMATOPOIESIS
Adjusting hematopoietic hierarchy
In adults, more than 300 billion blood cells are replenished daily. This output arises from a cellular hierarchy where stem cells differentiate into a series of multilineage progenitors, culminating in unilineage progenitors that generate over 10 different mature blood cell types. Notta et al. mapped the lineage potential of nearly 3000 single cells from 33 different cell populations of stem and progenitor cells from fetal liver, cord blood, and adult bone marrow (see the Perspective by Cabezas-Wallscheid and Trumpp). Prenatally, stem cell and progenitor populations were multilineage with few unilineage progenitors. In adults, multilineage cell potential was only seen in stem cell populations. — BAP
Science, this issue p. 139; see also p. 126

GEOMORPHOLOGY
Nepal’s quake-driven landslide hazards
Large earthquakes can trigger dangerous landslides across a wide geographic region. The 2015 Mw 7.8 Gorkha earthquake near Kathmandu, Nepal, was no exception. Kargal et al. used remote observations to compile a massive catalog of triggered debris flows. The satellite-based observations came from a rapid response team assisting the disaster relief effort. Schwanghart et al. show that Kathmandu escaped the historically catastrophic landslides associated with earthquakes in 1100, 1255, and 1344 C.E. near Nepal’s second largest city, Pokhara. These two studies underscore the importance of determining slope stability in mountainous, earthquake-prone regions. — BG
Science, this issue p. 140; see also p. 147

MICROBIOME
Decomposition spawns a microbial zoo
The death of a large animal represents a food bonanza for microorganisms. Metcalf et al. monitored microbial activity during the decomposition of mouse and human cadavers. Regardless of soil type, season, or species, the microbial succession during decomposition was a predictable measure of time since death. An overlying corpse leaches nutrients that allow soil- and insect-associated fungi and bacteria to grow. These microorganisms are metabolic specialists that convert proteins and lipids into foul-smelling compounds such as cadaverine, putrescine, and ammonia, whose signature may persist in the soil long after a corpse has been removed. — CA
Science, this issue p. 158

GEOPHYSICS
Mantle minerals won’t share the strain
The deformation of a mixed block of material depends on the strength of the components of which it is made. Weak materials will deform more than the strong ones in a mixture that is squished or stretched. Girard et al. find a large difference in strength between the two primary minerals making up Earth’s lower mantle (see the Perspective by Chen). Deformation in the convecting mantle may occur only near boundary layers as a result, leaving large regions potentially unaffected. This could explain long-lived chemical reservoirs in Earth’s interior and the lack of seismic anisotropy in the lower mantle. — BG
Science, this issue p. 144; see also p. 122

CELL BIOLOGY
Mitochondria migration during mitosis
Every time a cell divides, it is faced with the problem of ensuring adequate distribution of all components to the daughter cells. This includes components that are present in relatively small numbers, like the mitochondria and their DNA-containing nucleoids. Jajo et al. used quantitative time-lapse fluorescence microscopy of single yeast cells to explore how this works. Unlike chromosomes or macromolecules, mitochondria and nucleoids are distributed in proportion to the volume of cytoplasm received by each daughter cell. Partitioning errors are kept low by even distribution of the mitochondrial volume and roughly equal spacing of the nucleoids before they are distributed. — LBR
Science, this issue p. 169

Edited by Nick Wigginton

Published by AAAS
**CHEMOTAXIS**

A chemokine’s sugary release

As immune cells survey the body for pathogens, they circulate through the blood and migrate through the lymphatic system. The latter route allows for tissues and lymph nodes—the central hubs of the immune system—to communicate. Kiermaier et al. reveal the importance of the monosaccharide sialic acid in keeping immune cells in motion. Multiple sialic acids decorate the surface CCR7 on immune cells. CCR7 recognizes proteins called chemokines, which direct where cells move in the body. Sialic acids on CCR7 release one such chemokine present on lymph node endothelial cells from an inhibited state, allowing immune cells to enter lymph nodes. — KLM

*Science,* this issue p. 186

**PROTEIN STRUCTURE**

Going in with a BAM

Integral membrane proteins in bacterial outer membranes play roles in nutrient import and infectivity. These proteins are folded into a barrel shape composed of β-strands and inserted into the outer membrane by the β-barrel assembly machinery (BAM) complex. Bakelar et al. determined the crystal structure of a four-component BAM subcomplex. The structure of a central β barrel in BAM changes in the presence of the accessory components to create a lateral opening that may be involved in how BAM inserts proteins into the outer membrane. — VV

*Science,* this issue p. 180