RESEARCH

IN SCIENCE JOURNALS
Edited by Stella Hurtley

How HIV RNA gets packaged into the virus
Keane et al., p. 917

TUMOR EVOLUTION

Normal skin’s curiously abnormal genome
Within every tumor, a battle is being waged. As individual tumor cells acquire new mutations that promote their survival and growth, they clonally expand at the expense of tumor cells that are “less fit.” Martincorena et al. sequenced 234 biopsies of sun-exposed but physiologically normal skin from four individuals (see the Perspective by Brash). They found a surprisingly high burden of mutations, higher than that of many tumors. Many of the mutations known to drive the growth of cutaneous squamous cell carcinomas were already under strong positive selection. More than a quarter of normal skin cells carried a driver mutation, and every square centimeter of skin contained hundreds of competing mutant clones. — PAK
Science, this issue p. 880; see also p. 867

ORGANIC CHEMISTRY

Stitching C-N bonds from nitro groups
Numerous compounds in pharmaceutical research have carbon-nitrogen bonds, and chemists are always looking for ways to make them more efficiently. Gui et al. present a method that links the carbon in an olefin to the nitrogen in a nitroaromatic compound (see the Perspective by Kürti). Nitroaromatics are readily available, and the method tolerates a wide range of other chemical groups present on either reacting partner. — JSY
Science, this issue p. 886; see also p. 863

CYSTIC FIBROSIS

Skirting quality control to treat cystic fibrosis
Patients with cystic fibrosis (CF) have fluid and mucus buildup in their lungs because of mutations that cause misfolding, intracellular retention, and degradation of the cystic fibrosis transmembrane conductance regulator (CFTR). Although drugs can improve the cell surface delivery of mutant CFTR proteins, which are usually partially functional, cells still degrade the mutant CFTR. Loureiro et al. found that increasing the interaction between the scaffold protein NHERF1 and mutant CFTR prevented mutant CFTR from being marked for degradation. These manipulations increased the levels of partially functional CFTR on the surface of cultured lung epithelial cells from CF patients. — LKF

SANITATION SUBSIDIES

Helping the poor invest in sanitation
Almost a third of the world’s people do not have access to hygienic latrines. Improving access to and increasing the use of latrines would reduce deaths and poor health caused by diarrheal disease. Guiteras et al. tested the relative benefits of supplying health information, offering a financial subsidy to purchasers of hygienic latrines, or increasing the availability of latrines for purchase. Providing the subsidy worked best:

GLACIER MASS LOSS

Increasingly rapid ice sheet melting
Glaciers on the Southern Antarctic Peninsula have begun losing mass at a rapid and accelerating rate. Wouters et al. documented the dramatic thinning of the land-based ice, which began in 2009, using satellite altimetry and gravity observations. The melting and weakening of ice shelves reduce their buttressing effect, allowing the glaciers to flow more quickly to the sea. — HJS
Science, this issue p. 899

Glaciers flowing into the sea off the Southern Antarctic Peninsula
IN OTHER JOURNALS
Edited by Kristen Mueller and Jesse Smith

CANCER

Marrow-infiltrating lymphocytes in ACT
Adoptive T cell therapy (ACT) has had success in treating some types of cancer, but widespread use is limited in part by a lack of tumor-specific targets. Tumor-infiltrating T cells may overcome this limitation for solid tumors. Noonan et al. performed a phase I clinical trial and showed that bone marrow can be a source of ACT for hematologic malignancies such as multiple myeloma. Marrow-infiltrating lymphocytes provided myeloma-specific immunity in the bone marrow for up to 1 year after ACT, and increased progression-free survival. — ACC


NEUROPHYSIOLOGY

Brain imagination to control external devices
Studies in monkeys have implicated the brain’s posterior parietal cortex in high-level coding of planned and imagined actions. Aflalo et al. implanted two microelectrode arrays in the posterior parietal cortex of a tetraplegic patient (see the Perspective by Pruszenski and Diedrichsen). They asked the patient to imagine various types of limb or eye movements. As predicted, motor imagery involved the same types of neural population activity involved in actual movements, which could potentially be exploited in prosthetic limb control. — PRS

Science, this issue p. 906; see also p. 860

PLANETARY SCIENCE

Old minerals expose an ancient field
Mercury is the only terrestrial planet other than Earth with an active, internally generated magnetic field. Results from the MESSENGER spacecraft indicate that the field is as old as the planet. Johnson et al. took advantage of close flybys to extract evidence of an ancient magnetic field. Certain minerals are able to “lock in” the signature of a field at the time they crystallize. This remnant magnetization was found in a region on Mercury believed to be 3.8 billion years old. — BG

Science, this issue p. 892

EVOLUTION

Staying the same across a billion years
How far across evolution do families of genes retain their function? Yeast and humans are separated by roughly a billion years of evolutionary history, and yet genes from one can substitute for orthologous genes in the other. To study this effect systematically, Kachroo et al. replaced over 400 essential yeast genes with their human orthologs. Roughly half of the human genes could functionally replace their yeast counterparts. Genes being in the same pathway was as important as sequence or expression similarity in determining replaceability. — GR

Science, this issue p. 921

IMPLANTATION

Embryos engulf mom to latch on
In mammals, to ensure a viable pregnancy, a developing embryo must implant into the wall of the uterus. Previous studies suggested that this depended on maternal uterine epithelial cells dying by apoptosis, a form of programmed cell death. However, Li et al. now report in mice that cells from the developing embryo actively engulf live cells of the uterine epithelial barrier, in a process called entosis. This then allows the developing embryo to anchor itself to the uterine stromal bed. Although scientists had previously reported a role for entosis in cancer, these results suggest that this process may be more widespread. — BAP


BIOGEOGRAPHY

Unevenly blowing in the wind
Scientists, including Charles Darwin, first reported airborne microbes nearly two centuries ago. Many of these organisms cannot be cultured, and only recently have molecular approaches allowed scientists to begin to identify them. To better understand the distribution of airborne fungi, Barberán et al. examined dust samples collected from homes across...
INNATE LYMPHOID CELLS

Cells acting at the intersection of immunity

For years, scientists divided the immune system into two arms: innate and adaptive. The cell types involved in the two arms differ in specificity and in how quickly they respond to infections. More recently, immunologists discovered a family of immune cells termed “innate lymphoid cells,” which straddle these two arms. Eberl et al. review current understanding of innate lymphoid cells. Like innate immune cells, they respond to infection quickly and do not express antigen receptors; however, they secrete a similar suite of inflammatory mediators as T lymphocytes. Better understanding of the processes regulating these cells may allow for their therapeutic manipulation. — KLM

Science, this issue p. 879

CARBON CYCLE

The difference is found at the margins

The terrestrial biosphere absorbs about a quarter of all anthropogenic carbon dioxide emissions, but the amount that they take up varies from year to year. Why? Combining models and observations, Ahlström et al. found that marginal ecosystems—semi-arid savannas and low-latitude shrublands—are responsible for most of the variability. Biological productivity in these semi-arid regions is water-limited and strongly associated with variations in precipitation, unlike wetter tropical areas. Understanding carbon uptake by these marginal lands may help to improve predictions of variations in the global carbon cycle. — HJS

Science, this issue p. 895

MICROBIOLOGY

Why methanol-oxidizing bacteria love lanthanides

Although the lanthanide elements are not rare in Earth’s crust, they are highly insoluble and difficult to separate. A biological role for these elements has therefore seemed implausible, but recent findings challenge this belief. In a Perspective, Skovran and Martinez-Gomez explain that some methanol-using bacteria contain an enzyme for methanol oxidation that is active only when lanthanide ions are present in the growth medium. Related enzymes have been found in other bacteria, suggesting a wider role of lanthanides in bacterial methanol oxidation. Further insight into the biological role of lanthanides may help toward developing bioremediation for lanthanide mining sites or allow the growth of new species in the lab. — JFU

Science, this issue p. 862

EPIGENETICS

Chromatin state and the single cell

Identifying the chromatin state of any single cell, which may or may not have a different function or represent different stages relative to others collected within any single culture, experiment, or tissue, has been challenging. Cusanovitch et al. skirted previously identified technological limitations to identify regions of accessible chromatin at single-cell resolution. Combinatorial cellular indexing, a strategy for multiplex barcoding of thousands of single cells per experiment, was successfully used to investigate the genome-wide chromatin accessibility landscape in each of over 15,000 single cells. — LMZ

Science, this issue p. 910

RNA STRUCTURE

Structural signals that direct HIV packaging

During the viral replication cycle of HIV, unspliced dimeric RNA genomes are efficiently packaged into new virions at the host cell membrane. Packaging is directed by a region at the start of the genome, the 5′ leader. The architecture of the 5′ leader remains controversial. Keane et al. developed nuclear magnetic resonance methods to determine the structure of a 155-nucleotide-long region of the 5′ leader that can direct viral packaging. The structure shows how the 5′ leader binds to the HIV protein that directs packaging, how unspliced dimeric genomes are selected for packaging, and how translation is suppressed when the genome dimersizes. — VV

Science, this issue p. 917

VIROLOGY

A viral DNA form that survives extremes

The prokaryote Sulfolobus islandicus lives at extreme temperatures (−80°C) and acidity (pH 3). It is infected by the rudivirus SIRV2. DiMaio et al. determined the structure of the SIRV2 virus using cryo–electron microscopy to understand how the virus survives these brutal conditions. Most DNA in nature assumes a B-form shape. The virion, on the other hand, contains highly unusual A-form DNA that may help it survive adverse conditions. The viral capsid protein forms an extended α-helical structure that wraps around the viral DNA, possibly stabilizing the A-form DNA. — GR

Science, this issue p. 914