

## BIOFUELS

### Tricks for boosting yeast's ethanol yields

To become a widely used source of fuel, widespread industrial production of ethanol using yeast needs to be simple and efficient. However, two conditions ideal for boosting production—tolerance of higher temperatures and high concentrations of ethanol—have been limiting (see the Perspective by Cheng and Kao). Now, Caspeta *et al.* have used adaptive laboratory evolution to find yeast strains that can tolerate high temperatures and Lam *et al.* have identified a route to improve yeast's resistance to high concentrations of ethanol. — NW

*Science*, this issue p. 75, p. 71; see also p. 35

## HIV EPIDEMIOLOGY

### The hidden history of the HIV pandemic

Rail and river transport in 1960s Congo, combined with the sexual revolution and changes in health care practices, primed the HIV pandemic. Faria *et al.* unpick the circumstances surrounding the ascendancy of HIV from its origins before 1920 in chimpanzee hunters in the Cameroon to amplification in Kinshasa. Around 1960, rail links promoted the spread of the virus to mining areas in southeastern Congo and beyond. Ultimately, HIV crossed the Atlantic in Haitian teachers returning home. From those early events, a pandemic was born. — CA

*Science*, this issue p. 56

## PHOTOCHEMISTRY

### Illuminating oxygen out of carbon dioxide

It has long been known that high-energy ultraviolet light can split carbon dioxide into CO and O fragments. Lu *et al.* have now uncovered a parallel pathway that appears to yield C and O<sub>2</sub> instead (see the Perspective by Suits and Parker). By precisely measuring the energy and trajectory of the carbon

fragment after CO<sub>2</sub> irradiation, O<sub>2</sub> formation could be inferred. The results introduce a potential mechanism for abiotic oxygen production in CO<sub>2</sub>-heavy atmospheres of other planets. — JSY

*Science*, this issue p. 61; see also p. 30

## ASTHMA

### How the common cold can worsen asthma

Rhinoviruses—the main causes of the common cold—can make asthma attacks worse. Now Beale *et al.* report that one reason may be because rhinoviruses cause lung epithelial cells to make the cytokine interleukin-25 (IL-25). More IL-25 is produced in people with asthma than in those that are healthy. In mice with allergic “asthma,” rhinovirus infection triggered IL-25 production, and blocking the IL-25 receptor eased the increased asthma symptoms. Thus, as the cold season approaches, blocking IL-25 may be a promising therapeutic strategy in asthmatics. — ACC

*Sci. Transl. Med.* **6**, 256ra134 (2014).

## CANCER

### A new approach for treating colon cancer?

Most patients with colon cancer have a mutation that results in the Wnt/ $\beta$ -catenin pathway being “on” all the time. But inhibitors of this pathway interfere with the continuous renewal of the epithelial cells lining the intestinal tract. Pesse *et al.* discovered that the signaling pathway involving the receptor gp130, its associated Jak kinases, and the transcription factor Stat3 enhanced the growth of intestinal tumors in mice. Inhibiting this pathway stopped cell proliferation and reduced tumor growth. Drugs targeting the Jak-Stat3 pathway are currently in clinical trials for treating hematological malignancies, so hopefully may also be useful for treating colon cancer. — JDB

*Sci. Signal.* **7**, ra92 (2014).

## IN OTHER JOURNALS

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



## ATMOSPHERIC PHYSICS

### A light-induced lightning rod

Lightning storms are fantastic examples of the power of nature, but also extremely damaging. They can destroy buildings, create power surges, are a major cause of forest fires, and make golfers abandon their games to seek shelter. Using light pulses fired from a powerful laser, Scheller *et al.* demonstrate the possibility of taming this wild force of nature. In a lab-based experiment, intense pulses of light vaporized a column of air and created a conducting filament of electrons that then acted as a lightning rod to channel the electrical discharge to ground. Scaling up this approach could enable the control of lightning strikes. — ISO

*Optica* **10**, 1364/OPTICA.1.000125 (2014).

## RNA STRUCTURE

### Unlocking the secrets of RNA in 3D

RNA can both store information in its linear sequence and take on critical structural and catalytic roles in the cell, such as during the translation of messenger RNA into proteins. These latter functions depend on the

complex higher-order structures RNA is able to form. Homan *et al.* now report a method to probe these intricate conformational states. They chemically modified exposed segments of three complex RNA structures. They then sequenced the RNA to map the locations of the multiple modifications in each individual linear RNA molecule. This allowed the



## PLANT GENOMICS

## Shelling out the genetics of peanut allergies

**P**eanut allergies are on the rise, but how did the genes that encode these allergens evolve? To find out, Ratnaparkhe *et al.* examined the genomes of the cultivated and wild peanut and compared them to other plants to determine how the major peanut allergens *Arah1*, *Arah2*, *Arah3*, and the closely related *Arah6* evolved. Relative to other plant species, some of these genes changed their position within the genome, duplicated, expanded (added new nucleotides to the sequence), and/or mutated. Despite this, the researchers observed genetic similarities in the specific regions of these peanut genes that cause the immune system to react. — LMZ

*Genome Biol. Evol.* 10.1093/gbe/evu189 (2014).

researchers to deduce interactions in three-dimensional space, and to uncover new and previously hidden conformations, providing valuable information on the folding and function of RNAs. — GR

*Proc. Natl. Acad. Sci. U.S.A.* 10.1073/pnas.1407306111 (2014).

## BIOMEDICINE

## Illuminating brain stimulation therapy

Stroke, the disruption in blood supply to the brain, affects approximately 15 million people worldwide each year. With few treatment options, strokes leave one third of their sufferers

permanently disabled. Magnetic stimulation of the brain is one promising therapy, but it is relatively non-specific. To determine which cell types may promote recovery, Cheng *et al.* engineered mice to express light-activated protein receptors in their neurons. They then used light to activate specific neurons and found that while stimulating neurons in the ipsilesional primary motor cortex had no effect on healthy mice, it did help mice recover after stroke. Stimulating neurons in a targeted manner may be a promising therapy for stroke patients and cause fewer side effects. — MDC

*Proc. Natl. Acad. Sci. U.S.A.* 10.1073/pnas.1404109111 (2014).

## CHEMISTRY

## A drop in a drop in a drop in the bucket

Emulsions consist of droplets of one liquid that are held inside a second liquid, where the two liquids do not normally mix. Haase and Brujic show a simple method to make emulsions in which multiple layers of droplets can be trapped inside each other. By varying the concentrations of oil, a polar solvent, and water, they can get up to five layers of inner droplets as the ternary mixture is dripped into a water solution containing surfactant. It is also possible to fuse droplets to give larger, stabilized droplets with ordered internal structure. — MSL

*Angew. Chemie. Int. Ed.* 10.1002/anie.201406040 (2014).

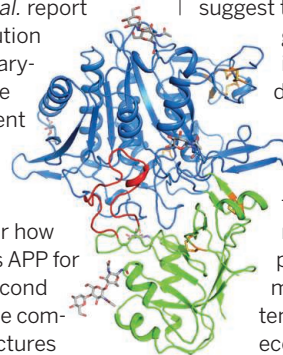
## STRUCTURAL BIOLOGY

## Molecular insights into Alzheimer's

An intramembrane protein called  $\gamma$ -secretase cleaves amyloid precursor protein (APP) to generate amyloid- $\beta$  peptides. These peptides clump together to form the plaques found in the brains of people with Alzheimer's disease. Modulating the activity of the  $\gamma$ -secretase might be a useful strategy in treating Alzheimer's disease. Lu *et al.* recently reported the atomic resolution structure of an intact human  $\gamma$ -secretase complex. Now Xie *et al.* report an atomic resolution structure of eukaryotic nicastrin, the largest component of  $\gamma$ -secretase. Analysis of the structure suggests a model for how nicastrin recruits APP for cleavage by a second component of the complex. These structures may provide important insights for the design of much needed new drug candidates. — VV

*Nature* 512, 166 (2014);

*Proc. Natl. Acad. Sci. U.S.A.* 10.1073/pnas.1414837111 (2014).



Ribbon diagram of nicastrin.

## EARTH HISTORY

## Ancient soils record early oxygen

The Great Oxidation Event marks the permanent appearance of appreciable concentrations of oxygen in Earth's atmosphere 2.4 billion years ago, a consequence of biological activity. Determining the history of oxygen levels leading up to this time, however, is hindered by spotty and incomplete records. Mukhopadhyay *et al.* describe an ancient soil deposit in eastern India that formed 3 billion years ago, or ~600 million years before the Great Oxidation Event. Geochemical clues in the soil and overlying sediments point to a fleeting presence of free oxygen at the time the soil formed. It is likely that several small, short-lived oxygenation events occurred before Earth's atmosphere reached high oxygen levels permanently. — NW

*Geology* 10.1130/G36091.1 (2014).

## BIOGEOGRAPHY

## Economic isolation limits biodiversity

It's an ecological truism that the more isolated an island, the fewer species it will have; isolation (along with island size) is thought to influence colonization, extinction, and speciation. But Helmus *et al.*, mapping the distribution of anole lizard species across the Caribbean, suggest that economic, not

geographic, isolation is determining species diversity. Anole lizards hitch rides on cargo ships, making it easier to reach far-flung islands, so the more trade an island participates in, the more species diversity it tends to have. Conversely, economic isolation might protect native lizards from imported competitors: Cuba would rapidly gain

1.65 lizard species if the United States lifted its trade embargo, the authors say. — LW

*Nature* 10.1038/nature13739 (2014).