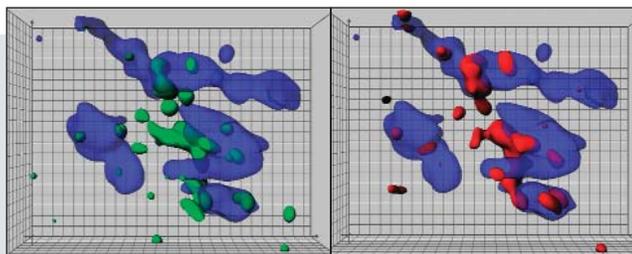


edited by Gilbert Chin

## CELL BIOLOGY

## Actin Up

At the cell periphery, a network of actin filaments is involved in the production of clathrin-coated vesicles during endocytosis. Carreno *et al.* now find that actin dynamics contribute to the formation of clathrin-coated vesicles that carry material from the trans-Golgi network (TGN) to the lysosome. The protein Hip1R, known to be important at the cell surface where it binds to both actin and clathrin, is associated with clathrin-coated vesicles that bud from the TGN. When expression of Hip1R was reduced, Golgi organization was disrupted, and actin that was associated with clathrin-coated vesicles accumulated at the TGN. These effects correlated with a slowing of lysosomal enzyme exit from the Golgi, and inhibition of actin dynamics had a similar effect. Thus, Hip1R and its association with actin appear to be important not only during endocytosis at the cell surface, but also deep within the cell as clathrin-coated vesicles depart the TGN en route to lysosomes. — SMH



Three-dimensional reconstruction shows Hip1R (green) and clathrin (red) colocalization at the TGN (blue).

*J. Cell Biol.* 165, 781 (2004).

## MATERIALS SCIENCE

## Burrowing Fullerenes

One way to determine the composition of a heterogeneous surface such as a multilayer thin-film structure is to use an ion beam to ablate material that subsequently can be analyzed by mass spectrometry. The ability to reconstruct the composition depends critically on how the surface is eroded. For many atomic ion sources, the rate at which material is removed is affected by surface crystallinity and orientation; so special precautions, such as using low ion energies and rotating the sample, are needed to produce uniform profiles.

Sun *et al.* compared the use of  $C_{60}^+$  ions with a  $Ga^+$  ion source in the analysis of nickel-chromium multilayers, which provides a strong test case for depth resolution. For 15-kiloelectron volt (keV) beams, the erosion rate for the  $C_{60}^+$  source was five times greater at one-third the ion current density, and the  $C_{60}^+$  beam induced a much lower root-mean-square roughness (2.5 versus 100 nm) and thus reduced the need for sample

rotation. The simple explanation for this improvement is that the 15-keV  $C_{60}^+$  cluster acts like 60 C atoms, each with a much lower energy of only 250 eV. — PDS

*Appl. Phys. Lett.* 84, 5177 (2004).

## APPLIED PHYSICS

## Tip Top Assembly

Scanning probe microscopy uses the lateral movement of a sharp probe across a specimen and is used to character-



A 60 nm x 5  $\mu$ m nanotube on a cantilever.

ize surface properties. For many applications, carbon nanotubes make ideal probe tips because they are mechanically robust but will buckle elastically instead of damaging the surface. They also can detect deep trenches and can be functionalized for

simultaneous probing and chemical sensing. However, sticking a nanotube onto the end of a probe is a hit-or-miss process, and attempts to grow them in the right place are not yet reliable.

By combining standard silicon micromachining techniques with nanoscale controlled synthesis, Ye *et al.* fabricated 244 probe tips on a single 4-inch wafer. Catalyst particles are deposited by electron beam lithography at select locations and protected from etching. The rest of the cantilever is patterned and etched, and the protection is then removed from the catalyst particles. The nanotubes are then grown using plasma-enhanced chemical vapor deposition, where the plasma induces an electric field that directs the growth of the nanotubes parallel to the field; no trimming or post-synthesis finishing of the nanotubes is necessary. — MSL

*Nano Lett.* 10.1021/nl049341r (2004).

## CLIMATE SCIENCE

## All Rise

The rise in sea level is one of the most important impacts of global warming, but the ex-

act rate of rise is still poorly known. Direct measurements indicate that it has been 1.5 to 2 mm/year over the past century, but that figure is based on data from tidal gauges, which are known to have an uneven global distribution and to be affected by postglacial rebound of coastal regions. Other methods are needed to improve both the accuracy and precision of this value, and one alternative is to adopt a reductionist approach.

Sea level rises by two mechanisms: steric, which is due mostly to the thermal expansion of the oceans; and eustatic, which comes largely from the increase in ocean volume due to melting of continental ice. Wadhams and Munk estimate the size of the eustatic contribution from measurements of the decrease of global seawater salinity. Correcting published values for the effects of melting sea ice (which freshens the ocean but does not affect sea level), they find that glacial melting is causing approximately 0.6 mm/year of the observed sea level rise. Adding that to the generally accepted value of the steric contribution,  $0.5 \pm 0.2$  mm/year, they infer a total rate of 1.1 mm/year. — HJS

*Geophys. Res. Lett.* 31, 10.1029/2004GL020039 (2004).

## NEUROSCIENCE

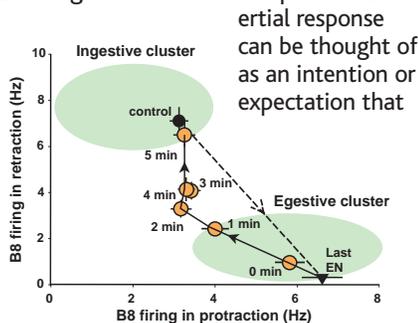
## To Eat or Not To Eat

Repetitive behaviors can be encoded within networks of neurons; one such example is the central pattern generator (CPG) that subserves feeding in the mollusc *Aplysia*. The neuron B8 activates closing of the radula, a hard valve-like structure that is used to grasp food. When the mouth comes into contact with seaweed, the cerebral-buccal interneuron (CBI) triggers closure of

CONTINUED ON PAGE 1879

the radula as it retracts, which serves to bring food into the buccal cavity (ingestion). On the other hand, stimulation of the esophageal nerve closes the radula during protraction, which serves to expel material (egestion) that has been deemed inedible.

Proekt *et al.* show that the feeding program is influenced by history. Thus, identical firing episodes in the CBI can have different effects, depending on the internal state of the network. If it is in egestive mode, this behavior persists until multiple volleys from the CBI shift the pattern of B8 firing into the retraction phase. This inertial response can be thought of as an intention or expectation that



The relation between ingestive or egestive behavior (green ovals) and CBI effects (orange circles) on motor neuron B8 activity.

the next thing to do should probably be pretty similar to the previous thing until overwhelming evidence indicates it's time to switch. — GJC

*Proc. Natl. Acad. Sci. U.S.A.* 101, 9447 (2004).

## MOLECULAR BIOLOGY

### Ambiguous Dogma

In modern organisms, each amino acid in a protein is encoded by a triplet codon. The triplet code is unambiguous (AUA and AUU always encode isoleucine, for example) as is the amino acid sequence of a protein, a feature assumed to be important to its function. But this one-to-one mapping may not always have been so: During early evolution, amino acids may have been assigned to more than one codon. Such an imprecise code would result in "statistical" proteins, where at any particular position, any one of several amino acids could be found.

Pezo *et al.* have generated bacteria with a mutation in the editing function of isoleucine transfer RNA synthetase, which results in the incorporation of a range of related amino acids at positions specified by isoleucine codons. Such proteins are not intrinsically detrimental to growth or health. Indeed, under conditions of limiting isoleucine availability, they have a distinct advantage compared to wild-type bacteria, as they are able to incorporate other, non-limiting amino acids. The authors speculate that statistical coding may have been an advantage in early environments, maximizing the utility of available resources. — GR

*Proc. Natl. Acad. Sci. U.S.A.* 101, 8593 (2004).

#### HIGHLIGHTED IN SCIENCE'S SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT



### Plaguing Caspase-1 Through Rac

The *Yersinia* bacteria, whose most notorious member (*Y. pestis*) is the causative agent of bubonic plague, inject Yop proteins into target cells. These proteins prevent phagocytosis and suppress the inflammatory response. For instance, YopP interferes with NF- $\kappa$ B activation and the transcription of proinflammatory cytokines, whereas the guanine triphosphatase (GTPase)-activating protein YopE inhibits Rho-family GTPases, and thereby blocks cytoskeletal rearrangements involved in phagocytosis. Noticing that Mf4/4 murine macrophages infected with YopP-deficient *Y. enterocolitica* secreted more interleukin-6 (IL-6) than did macrophages infected with wild-type bacteria, but not more IL-1 $\beta$ , Schotte *et al.* discovered that the former contained increased cytoplasmic concentrations of proIL-1 $\beta$  and that YopE inhibited proIL-1 $\beta$  processing. ProIL-1 $\beta$  is converted into IL-1 $\beta$  by caspase-1, and in cells transfected with procaspase-1 and proIL-1 $\beta$ , YopE inhibited autocatalytic processing of procaspase-1 and hence processing of proIL-1 $\beta$ . Cells expressing constitutively active Rac1 (a Rho family GTPase) showed increased procaspase-1 autoproteolysis and secretion of IL-1 $\beta$ , whereas dominant-negative Rac1 or pharmacological inhibition of Rho family GTPase activity suppressed both. These data uncover an unexpected role for Rac1 in caspase-1 activation. — EMA

*J. Biol. Chem.* 279, 25134 (2004).

# Science

## All Rise

*Science* **304** (5679), 1877.  
DOI: 10.1126/science.304.5679.1877d

**ARTICLE TOOLS** <http://science.sciencemag.org/content/304/5679/1877.4>

**RELATED CONTENT** <file:/content/sci/304/5679/twil.full>

**PERMISSIONS** <http://www.sciencemag.org/help/reprints-and-permissions>

Use of this article is subject to the [Terms of Service](#)

---

*Science* (print ISSN 0036-8075; online ISSN 1095-9203) is published by the American Association for the Advancement of Science, 1200 New York Avenue NW, Washington, DC 20005. 2017 © The Authors, some rights reserved; exclusive licensee American Association for the Advancement of Science. No claim to original U.S. Government Works. The title *Science* is a registered trademark of AAAS.