



ECOLOGY

Desperately Seeking Sustenance

Amazonian trees whose roots grow upward on the bark of neighboring trees. The latest discovery—the snow roots of an alpine plant—comes from 2800 m in the Caucasus Mountains. Onipchenko *et al.* found that the herbaceous plant *Corydalis conorhiza* (a member of the poppy family) produces extensive networks of roots that grow upward and laterally into the snowpack that carpets the high slopes until the July thaw. Isotope experiments showed that these roots, which are anatomically distinct from the normal roots that grow downward into the soil, take up nitrogen directly from the snowpack, thus exploiting a resource that would otherwise disappear down the mountainside during the brief summer. — AMS

Ecol. Lett. **12**, 758 (2009).

Land plants have evolved a variety of specialized adaptations to gather nutrients from unlikely substrates, such as

BIOPHYSICS

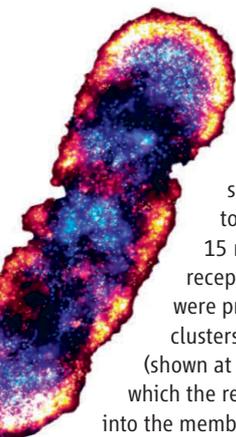
Assembling Gradient Sensors

Bacteria cluster thousands of transmembrane chemoreceptors at opposite ends of the cell, allowing them to detect and follow food mole-

cule gradients. Might the formation and maintenance of such clusters occur via stochastic assembly? To test this idea, Greenfield *et al.* used photoactivated localization

microscopy (PALM) to count single fluorophore-tagged receptors with an optical resolution of 15 nm. They analyzed 1 million receptors and observed that many were present as singletons or small clusters in lateral regions of the cell

(shown at left). A mathematical model in which the receptors are inserted randomly into the membrane, but can then be captured and incorporated into existing clusters, accounted for the observed distribution and predicted that the density of new clusters would be highest at a point farthest from a large cluster. Hence, through stochastic assembly, a cell with a large cluster at one pole will form a new large cluster at the opposite pole. Receptor clusters of



appropriate size and stability thereby assemble without any specific cellular machinery to position the receptors. — LBR

PLoS Biol. **7**, e1000137 (2009).

MATERIALS SCIENCE

Sponges Tough and Soft

A major challenge in designing biologically compatible implants has been achieving the optimal combination of stiffness, porosity, and toughness (resistance to rupture) for any given local environment. Toward this end, Lee *et al.* used an ionic liquid to condense a dispersion of DNA-coated carbon nanotubes. The ionic liquid efficiently removed bound water from the DNA strands, causing them to form intertwined toroids, which upon drying adopted a porous sponge structure with 50-nm-diameter fibers. The fiber diameter, sponge toughness, and stiffness could be adjusted by soaking the networks in water and then in calcium chloride solution: The calcium ions induced DNA cross-linking. The sponge fibers could then be knotted, braided, and woven into fabric structures. Moreover, the material proved electrically conductive and thus potentially applicable in sensing, energy storage, and mechanical actuation. — MSL

Angew. Chem. Int. Ed. **48**, 5116 (2009).

PSYCHOLOGY

Correlates of the Gender Gap

In 2003, the Trends in International Mathematics and Science Study (TIMSS) assessed 8th graders on standardized math and science tests. The median score by country for boys was 516 and for girls 506. Nosek *et al.* have studied the relation between gender stereotyping in the general population and student performance on these tests. In their virtual laboratory, any visitor can take an implicit association test (IAT) in any of 17 languages. In more than 500,000 tests collected from 2000 to 2008, roughly 70% of participants tended to associate words representing male with science faster than with liberal arts, and associated words representing female with liberal arts faster than with science. Across 34 countries, the male-female gap measured in the TIMSS correlated with the association of science and male as assessed in the IAT, with one standard deviation in stereotyping equivalent to 6.3 points on the standardized tests. The association of implicit (but not explicit) stereotypes in adults (mean age 27) with national test scores in kids suggests that initiatives aimed at reducing the gap will need to be multifaceted. — BJ

Proc. Natl. Acad. Sci. U.S.A. **106**, 10593 (2009).

CREDITS (TOP TO BOTTOM): ONIPCHENKO ET AL., *Ecol. Lett.* **12**, 758 (2009); JAN LIPHARDT

NEUROSCIENCE

Detecting Noisy Gradients

Growing neurons are faced with myriad cues as they try to find their designated target. The signals may be soluble or immobile, they may prompt attraction or repulsion, and they may deliver context-dependent messages. Last but not least, any single growth cone interprets its input via a variety of receptors spread across its surface; the growth cone may start or stall, grow quickly or slowly, turn right or left, or reverse course entirely. Mortimer *et al.* have developed a Bayesian model to explain how the growing tips of axons can identify the minute changes in noisy molecular gradients and then interpret them as guidance cues. The optimal strategy for a neuron gives more weight to feedback from receptors that are farther away from the center of the growth cone. Observations of explanted rat neurons facing constructed gradients of signaling ligands in collagen gels showed growth behaviors consistent with this interpretation. — PJH

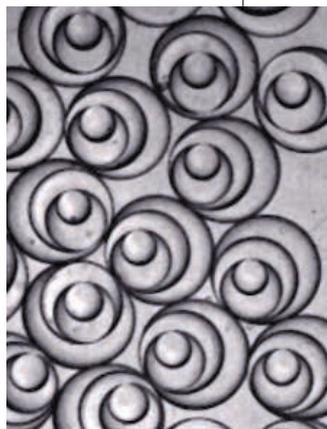
Proc. Natl. Acad. Sci. U.S.A. **106**, 10296 (2009).

APPLIED PHYSICS

Liquid Russian Dolls

Oil and vinegar-based salad dressing is a classic example of an emulsion, wherein the droplets of one fluid are trapped inside the bulk of another. Though techniques exist for making higher-order emulsions (with two or more nested droplet layers), they tend either to be inefficient or else to produce droplets that vary widely in size.

Abate and Weitz used lithography to fabricate polydimethylsiloxane devices that can efficiently create uniform distributions of emulsion droplets with up to five nested layers. Single emulsions were prepared using pinned-jet flow focusing—



injection of the inner fluid from two side ports into a central stream of outer fluid. To increase the number of emulsion layers, additional injection ports with alternating wettability were added along the length of the flow channel. In order to ensure synchronized droplet formation for triple and higher-order emulsions, the nozzles at each injection port were designed to be slightly narrower than the emulsion arriving from upstream; a new droplet thus formed at the injection port only upon perturbation by an

incoming droplet. The droplets exhibited very narrow size dispersity at all orders, as illustrated by their hexagonal packing when confined in two dimensions. — MSL

small **5**, 10.1002/smll.200900569 (2009).

CLIMATE SCIENCE

Learning to Share

Governmental representatives from almost every country will meet at the United Nations Climate Change Conference in Copenhagen, in December 2009, in order to attempt to agree on an effective international response to climate change. One of the thorniest and most important questions on the table is how best to determine CO₂ emission reduction targets for the various participating countries. This task is rendered more difficult by the asymmetry between developed nations, whose emissions have caused most of the increase in atmospheric CO₂ thus far; and less-developed nations, whose emissions have been low in the past but are expected to grow at a faster than average rate in the future.

Chakravarty *et al.* propose that national reduction targets, for the near term, be based not on per capita emissions, but on the net excess emissions from the individual high emitters that are found in every country. This approach has the advantages of treating equally all those with the same emissions, regardless of nationality, and of not specifying how any nation meet its responsibilities for reducing CO₂ emissions. — HJS

Proc. Natl. Acad. Sci. U.S.A. **106**, 10.1073/pnas.0905232106 (2009).

MICROBIOLOGY

Fingers or Toes?

Countless hours have been spent on scrutinizing the morphological subtleties of planktonic organisms, particularly in trying to match shapes to species and to reconcile both with the huge genetic diversity; sometimes, the disconnect can be profoundly misleading. By tracking individuals in culture-well plates, Pizay *et al.* noticed that dinoflagellates changed shape in striking ways. *Ceratium ranipes* grew rigid chloroplast-filled fingers by day and became relatively lethargic, whereas at night, they absorbed the appendages and became more active. Why?

One possibility is that the daytime appendages allow the organisms to maximize photosynthesis at the surface, and nighttime absorption allows them to sink a little, swim a little faster, and escape predator pressure. — CA

Protist **160**, 10.1016/j.protis.2009.04.003 (2009).

Coming Fourth Quarter 2009



Integrating medicine and science

AAAS, publisher of the world's leading general science journal, *Science*, is launching the new weekly journal, *Science Translational Medicine*, in the fourth quarter of 2009.

The journal's mission is to facilitate communication and cooperation among basic and preclinical researchers, physician scientists, regulators, policy makers, industry, and funding agencies in order to improve health around the world. It will present original, science-based peer-reviewed research that successfully moves the field closer to helping patients. Perspectives and reviews from basic and clinical viewpoints along with discussions about research funding and regulatory issues will be included.

With *Science Translational Medicine*, you can expect the same level of breakthrough research that is the hallmark of the journal *Science*. The journal is edited by Katrina L. Kelner, Ph.D. Elias A. Zerhouni, M.D., heads an international advisory group of clinician scientists and other experts.

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