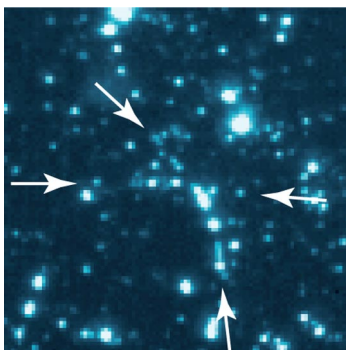


- 13707 Vortex-swapping in superfluid helium  
 13724 The Internet meritocracy  
 13912 Post-mating *Drosophila* oviduct: The whole picture  
 14070 Reversing diabetes without insulin  
 14124 Viral array identifies human viruses  
 14187 “Safe” bisphenol A disrupts synapses in monkeys

## APPLIED PHYSICAL SCIENCES

**Vortex-swapping in superfluid helium**

When two vortices cross—whether in Newtonian fluids, liquid crystals, or a quantized system such as a superconductor—it is possible for them to break at the intersection and, exchanging



Two superfluid helium vortices collide and reconnect.

halves, recombine into two new vortices. Gregory P. Bewley *et al.* developed a technique for observing vortices in superfluid helium, where angular momentum is quantized. The authors found that micron-size particles of solid hydrogen become trapped at the core of a vortex, making it visible as a tiny dark thread. They then used this method to observe the reconnection of colliding helium vortices. Using a complementary metal-oxide semiconductor (CMOS) camera, the authors filmed the motion of vortices in a vertical tube of superfluid helium, illuminated in a plane of laser light. From the resulting footage, they extracted incidents in which hydrogen particles suddenly shot away from each other, inferring that this was the result of two vortices swapping halves. The distance between particles followed a power law as a function of time, with an exponent of  $1/2$ , consistent with the nature of vortex evolution, the authors say. — K.M.

“Characterization of reconnecting vortices in superfluid helium” by Gregory P. Bewley, Matthew S. Paoletti, Katepalli R. Sreenivasan, and Daniel P. Lathrop (see pages 13707–13710)

## COMPUTER SCIENCES

**The Internet meritocracy**

Researchers seeking to understand the dynamics of the Internet’s growth originally worked with models in which the dominant factor was the number of links leading to a web page. In that

scenario, a small number of prestigious sites would enjoy an unbeatable edge. However, as Joseph S. Kong *et al.* explain, the reality is much more complicated. The authors considered how “experience,” quantified as the number of in-links, intrinsic “talent,” and “death,” the removal of web pages, combine in the Internet’s evolution. The authors amassed monthly data for >22 million web pages over the course of a year and graphed

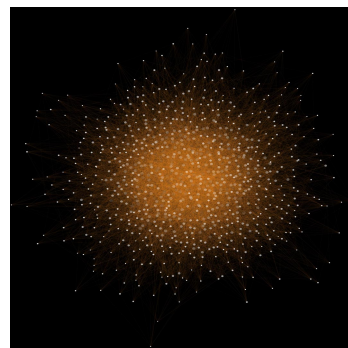
how the number of incoming links varied with time. Their results emphasized that the Web is dynamic: For each new page produced, 0.77 pages were deleted, clearing the way for newly created pages to flourish. The authors found that although experience is an asset, new and talented web sites regularly oust existing leaders. In one model, Kong *et al.* set 1,000 incoming links as a threshold and defined “winners” as those reaching the threshold during the observation period. According to the authors, 48% of the winners used talent to displace more experienced pages. — K.M.

“Experience versus talent shapes the structure of the Web” by Joseph S. Kong, Nima Sarshar, and Vwani P. Roychowdhury (see pages 13724–13729)

## DEVELOPMENTAL BIOLOGY

**Post-mating *Drosophila* oviduct: The whole picture**

In many species, mating initiates biochemical changes in the female that translate to altered physiology and behavior. Some of these changes are directed toward providing newly fertilized eggs with a hospitable environment and protecting them from microbes. Anat Kapelnikov *et al.* analyzed the expression profiles of RNA transcripts and proteins in the oviduct of mated and unmated *Drosophila* females and combined existing maps of the interactome to probe the interactions between the gene products.



The Internet, represented as a “galaxy” of web site nodes.

They found increased levels of RNA transcripts were important in the immune response and in proteins associated with muscle cell function and epithelial cell morphogenesis. In a subset of genes coding for the mating-responsive oviduct proteins, RNA transcription levels remain unchanged while protein quantity increases, suggesting a posttranscriptional control mechanism. Although the largest post-mating increase occurred in immune response genes, one antimicrobial peptide, cecropin, is secreted in what appears to be a plug protecting the entrance to the oviduct. The authors suggest that, after mating, the focus of the insect's immune response shifts to the reproductive tract. — K.M.

*“Mating induces an immune response and developmental switch in the Drosophila oviduct”* by Anat Kapelnikov, Einat Zelinger, Yuval Gottlieb, Kahn Rhissorakrai, Kristin C. Gunsalus, and Yael Heifetz (see pages 13912–13917)

## MEDICAL SCIENCES

### Reversing diabetes without insulin

Insulin injections are synonymous with treating type 1 diabetes, but the injections, and the insulin itself, could one day prove unnecessary. Xinxin Yu *et al.* report that treating terminally ill di-



Nondiabetic (Left), treated (Center), and untreated (Right) rats.

betic rodents with leptin—a hormone produced by fat cells—reversed dangerously high blood sugar levels and restored the animals' health. Leptin was first described in the early 1990s and is known to lower blood sugar. Because leptin's effect on blood sugar had never been tested without insulin present, the authors studied

its role in three different rodent models of type 1 diabetes. Although mice were unable to produce insulin when supplied with a gene that overproduces leptin, all recovered within 2 weeks without insulin treatment. The effect lasted for up to 25 weeks with no other treatment. The authors say leptin likely acts by suppressing glucagon—the hormonal opponent of insulin that causes the liver to release sugars into the blood. Yu *et al.* suggest that leptin deficiency, in addition to insulin deficiency, contributes to the type 1 diabetes phenotype. According to the authors, glucagon-blockers such as leptin may one day replace insulin therapy, which since 1922 has been the only treatment option for diabetes. — T.H.D.

*“Making insulin-deficient type 1 diabetic rodents thrive without insulin”* by Xinxin Yu, Byung-Hyun Park, May-Yun Wang, Zhao V. Wang, and Roger H. Unger (see pages 14070–14075)

## MICROBIOLOGY

### Viral array identifies human viruses

Using microarray analysis, Charles Y. Chiu *et al.* have identified a group of viruses previously undetected in humans. Enteric cardioviruses are known to cause severe illness in rodents, but

previous evidence of human infection was limited to a few historical isolates, including Saffold virus, a cardiovirus isolated from an infant in 1981. To look for cardioviruses in humans, the authors employed a chip containing genetic sequences from all publicly available viral sequences. Testing >700 isolates from patients with neurological diseases, they found several previously undetected cardioviruses, one in a respiratory sample and six in stool samples. The viruses were genetically distinct and contained no mouse-specific sequences, suggesting they represent a group of primarily enteric viruses different from those that infect rodents. In rodents, cardioviruses are known to cause neurological disease and, although the authors found no cardioviruses in ~400 human cerebrospinal fluid samples, they suggest that humans can carry a diverse group of viruses in the gastrointestinal tract that could be linked to enteric and extraintestinal disease. — T.H.D.

*“Identification of cardioviruses related to Theiler's murine encephalomyelitis virus in human infections”* by Charles Y. Chiu, Alexander L. Greninger, Kimberly Kanada, Thomas Kwok, Kael F. Fischer, Charles Runckel, Janice K. Louie, Carol A. Glaser, Shigeo Yagi, David P. Schnurr, Tom D. Haggerty, Julie Parsonnet, Don Ganem, and Joseph L. DeRisi (see pages 14124–14129)

## NEUROSCIENCE

### “Safe” bisphenol A disrupts synapses in monkeys

Bisphenol A (BPA), a synthetic xenoestrogen, is widely used in plastic products. Whether BPA disrupts the human body's hormonal signals is controversial, but the Canadian government recently concluded there was sufficient evidence to label BPA a toxin. Csaba Leranth *et al.* conducted a study on African green monkeys and found that BPA inhibits estradiol-induced formation of synapses at the dendritic spines of the brain's pyramidal neurons. Estradiol—the major form of estrogen—is known to induce permanent synaptic changes. The authors previously showed that BPA prevents estradiol-induced synapse formation in rats. In the present work, they assayed the effect of BPA and estradiol separately and together and compared the number of spine synapses in the monkeys' brains. Each test group, including the control group, consisted of three ovariectomized females. A surgically implanted capsule and pump delivered BPA at 50  $\mu\text{g}/\text{kg}$  per day: the U.S. Environmental Protection Agency's recommended safe limit for humans. The authors found that estradiol induced significant synapse formation, which was nullified by BPA administration. These results, according to the authors, suggest that BPA exposure may be involved in human conditions such as Alzheimer's disease, depression, and schizophrenia, which feature aberrant synapse formation. — K.M.

*“Bisphenol A prevents the synaptogenic response to estradiol in hippocampus and prefrontal cortex of ovariectomized nonhuman primates”* by Csaba Leranth, Tibor Hajszan, Klara Szigeti-Buck, Jeremy Bober, and Neil J. MacLusky (see pages 14187–14191)