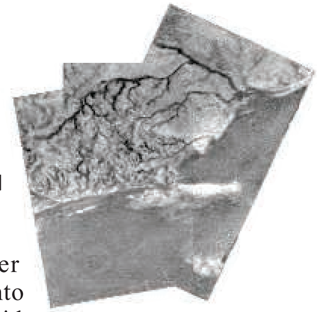
2 Planetary Blitz

Scientists and engineers outdid themselves in 2005 in mounting exploratory expeditions beyond Earth. They had spacecraft at or on the way to the moon, Mercury, Venus, Mars, a comet, an asteroid, Saturn, and the very edge of the solar system. At the Red Planet, three orbiters and two rovers beamed back terabytes of data. The high point of a banner year, however, came on Saturn's haze-shrouded moon Titan. In January, the European spacecraft Huygens drifted down to a familiar-looking but fundamentally weird world.

The first landing on another planet's moon revealed a world where infrequent but drenching rains of liquid methane wash low hills, cutting networks of steep-sided valleys and flushing icy debris and dark organic crud out into shallow lakes. The lakes then evaporate away,



Drenched. Huygens found a familiar-looking world washed by methane rains.

although the lander apparently settled into ground still soaked with methane. The discovery of a sort of hydrologic cycle shaping another world is a first.

A fleet of other explorers joined Huygens this year. The aging Voyager 1 reported approaching the "edge" of the solar system, where the solar wind slows abruptly. The

Scorecard 2004

Slam-dunks and near-fizzles gave our editors a mixed record for prophecy this year.

Recycling pays. New results confirmed that autophagy is much more than just a way for nutrient-starved cells to recycle membrane components and cytoplasmic molecules. Studies indicated that autophagy helps the immune response to bacteria and viruses and that some microbes have developed ways to counter or even exploit the cellular process. Researchers also began to detail how autophagy is connected to both neurodegeneration and cancer.

Obesity drugs. No new drugs for obesity were approved in 2005, but rimonabant continues to show promise in clinical trials, and Sanofi-Aventis may receive U.S. Food and Drug Administration approval for it in 2006.

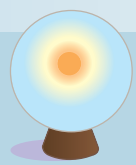
HapMapping along. The International HapMap Project delivered on schedule, publishing its first version this past October. (A finer resolution copy will come out in 2006.) A California company, Perlegen Sciences, published its own map last February. The $138 million map also helped lead scientists to a macular degeneration gene and a gene for skin color; how much it will help next year, and how widely it will be used, remain open questions.

Cassini-Huygens at Saturn. So far the joint U.S., European, and Italian mission to the ringed planet has been a blazing success. Amid the smallest of glitches, the Huygens lander drifted down to Titan's surface, revealing an icy landscape carved by rains of liquid methane. Elsewhere in the system, Enceladus proved energetic for such a little moon, spewing ice and water from its south pole to form the nebulous E ring. The bizarre F ring sported a spiral-necklace companion ring. And another 55 orbits of Saturn are still on Cassini's agenda.

Paper tigers. North Korea says it will give up its nuclear weapons program, but the devil is in the details, none of which have been worked out. Meanwhile, Iran's new hard-line government insists that uranium enrichment is an inalienable right, leaving little hope that negotiations will prevent Iran from acquiring the means and know-how to develop a nuclear arsenal.

European Research Council. The ERC, an agency that would fund top basic research across Europe, has morphed in just a few years from a scrappy grassroots movement to the darling of politicians. In April, the European Commission made the ERC the centerpiece of its bid to double the E.U.'s research funding. And in July the commission appointed 22 high-profile scientists to the ERC's scientific council, which will divvy up the first grants. But political wrangling over the E.U.'s overall budget has left the ERC in limbo. By December, the proposed doubling for research was off the table, and scientists feared that the ERC could be left with only token funding—and disappointed applicants.

Regulating nano. Governments worldwide are working hard to develop standards for nanomaterials, come up with programs to test their safety, and regulate their use.



CREDITS (TOP, LEFT TO RIGHT): JPL/NASA; ESA/NASA/JPL/UNIVERSITY OF ARIZONA; (CRYSTAL BALLS) TERRY SMITH

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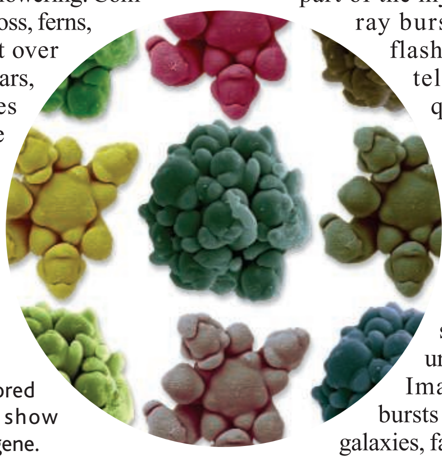
Deep Impact spacecraft plowed into comet Tempel 1 to reveal a fluffy subsurface. Cassini repeatedly swung by Saturn's rings, Titan, and other moons. SMART-1 arrived at the moon on its ion-drive engine. Hayabusa got up-close and personal with asteroid Itokawa. Stardust headed home with bits of comet Wild 2. And all the while, MESSENGER cruised toward Mercury, and the Mars Reconnaissance Orbiter and Venus Express spiraled toward their targets. Planetary scientists, for the time being at least, are in their second golden age of solar system exploration.

3 Blooming Marvelous

Several key molecular cues behind spring's burst of color came to light in 2005. In August, for example, three groups of plant molecular biologists finally pinned down the identity of florigen, a signal that initiates the seasonal development of flowers. The signal is the messenger RNA of a gene called *FT*. When days get long enough, this RNA moves from leaves to the growth tip, where the FT protein interacts with a growth tip–specific transcription factor, FD. The molecular double whammy ensures that blossoms appear in the right place on the plant at the right time of year.

Researchers also gained new insights into the workings of a gene called *LEAFY* that is involved in stimulating flowering. Comparisons of *LEAFY* in moss, ferns, and cress suggest that over the past 400 million years, just a few base changes have converted the gene from a broad-spectrum growth stimulator—as it still is in moss—to one that seems to fire up only for flowering in more recently evolved plants.



Microbouquet. False-colored nascent cress flowers show effects of mutant *LEAFY* gene.

The plant hormone gibberellin helps control the later stages of flower development, as well as other aspects of cell growth involved in cellular expansion. In 2005, researchers identified the receptor for this hormone in rice, a valuable step in improving crops. Plant biologists also pinpointed another key receptor, for the essential plant growth hormone auxin. This receptor is part of the cell's protein-degradation machinery that destroys the proteins that keep auxin activity in check.

Finally, the plant gene *HOTHEAD*—important for putting the finishing touches on flower design—proved to be quite a head-scratcher. Alleles of this gene, found in one generation of the self-fertilizing weed *Arabidopsis* but missing in the next, showed up again in the third generation. The discovery suggests that, surprisingly, cells may have a cache of RNA from which to reconstruct the missing allele.

4 Neutron Stars Gone Wild

Astrophysicists adore neutron stars, the city-sized corpses of stars that pack matter into its most extreme state. This year, new instruments yielded vivid insights into the most violent behaviors of these objects.

The fireworks started on 27 December 2004, when a 0.2-second pulse of radiation from near the center of the Milky Way seared detectors on more than a dozen spacecraft. Despite its distance, the blast was brighter in x-rays and gamma rays than any solar eruption. Weeks of analysis showed that the probable source was a nearly global starquake on a "magnetar," an unstable young neutron star encased by the strongest magnetic fields known. Such flares had happened before, but this one was 100 times more potent.

Astrophysicists proposed that giant magnetar flares in nearby galaxies solved part of the mystery of short gamma ray bursts (GRBs)—random flashes in the heavens that telescopes had not been quick enough to see. But starting in May, NASA high-energy satellites caught several short GRBs at much greater distances. Ground-based telescopes, many of them new robotic systems, swung to measure the fading aftermaths. Images revealed that the bursts were in the outskirts of galaxies, far from nurseries of massive stars that create young neutron stars. Moreover, the telescopes found no traces of supernova explosions, thought to produce longer GRBs.

The evidence matched a favored scenario for short GRBs: a rapid, cataclysmic merger of two ancient neutron stars or a neutron star and a black hole. Researchers can't yet discriminate between the two types of collisions. But that should change as the Swift satellite and other instruments expose more of the fleeting bursts. On the ground, space-rippling gravitational waves from merging neutron stars could trigger the Laser Interferometer Gravitational-Wave Observatory for the first time.

Flash points. Collisions between neutron stars (*top*) or a neutron star and a black hole appear to spark most short bursts of gamma rays.

5 Miswiring the Brain

Although dozens of genes have been linked to brain disorders in recent years, connecting the dots between genetics and abnormal behavior has been anything but child's play. This year, however, researchers gained clues about the mechanisms of diverse disorders including schizophrenia, Tourette syndrome, and dyslexia. A common theme seems to be emerging: Many of the genes involved appear to play a role in brain development.

In November, two reports put meat on the bones of previous claims that variants of a gene called *DISC1* increase the risk of schizophrenia. One research team found that inhibiting *DISC1* activity in mice alters brain development, causing subtle abnormalities in the animals' cerebral cortices similar to those seen in postmortem brains from schizophrenia patients. Another team linked *DISC1* to molecular signaling pathways important in brain development and in regulating neurotransmitter levels, which are often out of whack in psychiatric patients.

In October, researchers described a rare genetic defect that appears to cause Tourette syndrome. The mutation likely causes only a tiny fraction of Tourette cases, but its discovery may be an important lead. One gene that's disrupted, *SLITRK1*, influences branch

CREDITS (TOP TO BOTTOM): NASA/SONOMA STATE UNIVERSITY/AURORE SIMONNET; DANA BERRY/NASA; A. MAIZEL AND J. BERGER

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Breakdown of the Year: U.S. Particle Physics

Particle physicists in the United States would probably like to forget 2005. Budget woes forced the cancellation of two major experiments just as researchers were about to start construction. That leaves none in the works to replace those currently studying particles called quarks—the sorts of experiments that have long been the heart of the field. At the same time, the U.S. Department of Energy (DOE) asked physicists to consider which of two existing particle colliders they would rather shut down early to save money.

Researchers around the globe fear that if U.S. particle physics withers, so will the entire field. "We all need a vitally active U.S. community," says Brian Foster of Oxford University in the U.K. "That's what's driven particle physics in the past, and hopefully that's what will drive it in the future."

Physicists got a shock in February, when DOE nixed BTeV, a $140 million experiment that would have run at the Fermi National Accelerator Laboratory (Fermilab) in Batavia, Illinois (*Science*, 11 February, p. 832). Using beams from Fermilab's Tevatron collider, BTeV would have studied bottom quarks, heavier, unstable cousins of the down quarks found in protons and neutrons. BTeV researchers were expecting to get the final go-ahead for construction.

Early end? Either SLAC's PEP-II collider (*above*) or Fermilab's Tevatron could shut down ahead of schedule.

Less surprisingly, in August the National Science Foundation pulled the plug on the Rare Symmetry Violating Processes (RSVP) experiment at DOE's Brookhaven National Laboratory in Upton, New York (*Science*, 19 August, p. 1163). RSVP would have looked for new physics in the decays of particles called muons and K^0 mesons. But its construction costs had ballooned from $145 million to $282 million, and its lifetime operating costs had tripled to $250 million.

In May, DOE's Office of Science requested a study, due early next year, of the relative merits of shutting down either the Tevatron or the PEP-II collider at the Stanford Linear Accelerator Center in Menlo Park, California (*Science*, 27 May, p. 1241). The Tevatron smashes protons into antiprotons at the highest energies achieved to make top quarks and other particles; PEP-II collides electrons and positrons and cranks out bottom quarks. Researchers plan to turn off PEP-II in 2008 and the Tevatron in 2009, but decommissioning one of them earlier might free up money for future projects.

Meanwhile, researchers in Europe are assembling the Large Hadron Collider at CERN, the particle physics laboratory near Geneva, Switzerland. Scheduled to start up in 2007, the $7.7 billion machine might produce the long-sought Higgs boson, the particle thought to give others their mass. At the same time, physicists in Japan have their KEK-B collider producing bottom quarks and are studying wispy particles called neutrinos. (Fermilab is also pursuing neutrino physics.)

But particle physicists from Europe and Asia aren't celebrating the passing of the torch from the United States. They say a strong U.S. program is essential for the survival of the field, especially if they hope to build the proposed International Linear Collider (ILC), a multibillion-dollar global facility that most see as the future of particle physics. "It is very clear that without the participation of the U.S. it is impossible" to build the ILC, says Akira Masaike of the Japan Society for the Promotion of Science in Washington, D.C.

On that front, at least, 2005 brought some reasons for optimism, says Fred Gilman of Carnegie Mellon University in Pittsburgh, Pennsylvania. Physicists from the United States, Europe, and Asia united in their commitment to the ILC as never before. "Before, the international effort was the sum of three parts," Gilman says. "Now there is central leadership." And officials in DOE's Office of Science remain enthusiastic about the ILC, Gilman says. Physicists plan to have a preliminary design—and a price tag—for that dream machine by the end of 2006.

–Adrian Cho

Flawed circuits? Many brain disorders are linked to genes affecting development.

formation by neurons and is active during development in brain regions thought to be altered in Tourette syndrome and other conditions, including obsessive compulsive disorder. New research also links developmental genes to dyslexia, identifying three genes—*KIAA0319*, *DCDC2*, and *ROBO1*—that may cause faulty wiring in neural circuits involved in reading.

Much of the new work suggests that genetic miscues, rather than causing neuropsychiatric disorders outright, alter brain biology in the womb in a way that predisposes us to problems later in life. A better understanding of how this happens may help reduce the risks.

6 Geochemical Turmoil

When researchers announced in June that they had detected isotopic differences between earthly and extraterrestrial rocks, geochemists had to scrap their long-standing view of how Earth formed and evolved. They no longer believe that thoroughly mixed dust and ice agglomerated 4.5 billion years ago to form an Earth that has remained more or less mixed ever since. Something more interesting must have happened.

Key to the cosmochemical revolution was new technology. In the early 1980s, researchers

Complicated. Young Earth had a more interesting history than scientists believed.

CREDITS (TOP TO BOTTOM): C. PRICE/TAXI/GETTY IMAGES; STANFORD LINEAR ACCELERATOR CENTER; WILLIAM K. HARTMANN/PLANETARY SCIENCE INSTITUTE measured the ratio of neodymium isotopes both in the chondritic meteorites thought to represent the solar system's starting material and in rocks derived from Earth's interior. The neodymium ratios were the same, within analytical error, implying that chondritic meteorites and accessible parts of Earth still resemble the solar system's starting material. But advances in mass-spectrometer technology have whittled away at the error bars. When researchers measured the same sort of rocks this year, they found a 20-part-per-million difference that had been undetectable in the earlier scatter.

The minute isotopic difference has opened a yawning chasm between cosmochemists. One camp simply assumes that Earth got its makings from a part of the nascent solar system that happened to have a distinctive, nonchondritic composition. Others believe that the presolar nebula was compositionally uniform, not lumpy, but that shortly after Earth's formation, while its rock was still roiling in a "magma ocean," a portion enriched in heat-generating elements separated out and sank beyond geochemists' ken. Today, it may still lie between molten core and rocky mantle, its heat helping generate the core's magnetic field and sending plumes of hot rock toward the surface.

7 Protein Portrait

This year, researchers got their best look yet at the molecular structure of a voltage-gated potassium channel, a protein as essential to nerve and muscle as transistors are to computers. Sitting in the cell membrane, these tiny gatekeepers open and close in response to voltage changes, controlling the flow of potassium ions. The new atomic-scale portrait should be extremely useful for biophysicists seeking to understand the workings of these crucial proteins. It may also represent a step toward reconciling a recent debate that has rankled the usually calm community of ion channel researchers. Or maybe not.

It all started in May 2003, when Roderick MacKinnon of Rockefeller University in New York City and colleagues published the first-ever structure of a voltage-gated potassium channel and proposed a model to explain how it worked. Everyone agreed that the snapshot was a technological feat. But many researchers suspected that the channel, called KvAP, had been distorted by the preparations for imaging, and critics complained that MacKinnon's proposed mechanism contradicted decades of experiments. A flurry of angry e-mails ensued. Unpleasant things were said.

This August, MacKinnon (who subsequently won the 2003 chemistry Nobel)

Disasters: Searching for Lessons From a Bad Year

No doubt about it, the 12 months since the last Breakthrough of the Year issue have been an *annus horribilis*. Three major natural disasters—the 2004 "Christmas tsunami" in the Indian Ocean, Hurricane Katrina on the U.S. Gulf Coast, and the Pakistan earthquake—left nearly 300,000 dead and millions homeless. In Pakistan, the disaster is still unfolding as winter engulfs the devastated communities.

Insurance companies classify such events as "acts of God": misfortunes for which no one is at fault. But in their aftermath, many scientists are pointing out that natural disasters are anything but natural: Societies can mitigate their impacts by making the right decisions about where and how people live, how information is shared, and what kind of research to invest in. And some are pushing new ideas to make that happen.

For example, Aromar Revi, a New Delhi–based disaster mitigation consultant to the Indian government, envisions "a public database like Google Earth" that would allow researchers around the world to map the "risk landscape down to the ZIP-code level." Such a system would enable nations with a shared risk to build better warning networks. But there are serious hurdles to going global. For example, India refused to share data for an international tsunami warning system because it could also reveal their nuclear tests (*Science*, 9 December, p. 1604). Nor will such a network come cheap, but Revi says governments will soon realize that it "is worth every cent of the many hundreds of millions of dollars it would cost to build and maintain."

A disaster warning system is only as good as the science behind it. For some events, such as hurricanes and volcanoes, science has vastly improved forecasts. But for others, such as earthquakes, decades of research may have illuminated how and where they are likely to strike, but not when.

Don't blame God. Better planning could make natural disasters much less disastrous, experts say.

Even with greatly enhanced warning systems and infrastructure, natural disasters will continue to wreak enormous damages. Who will pay for it? After the past year's $200 billion in damages from weather-related disasters alone—three times higher than for any previous year—some economists are calling for a radical rethink of disaster relief. Rather than relying on the fickle charity of the international community, countries should invest in a new kind of disaster insurance that transfers the risk to financial markets, says Reinhard Mechler, an economist at the International Institute for Applied Systems Analysis in Laxenburg, Austria. Such a plan relies on scientists to create a finer-grained map of the probability of various disasters and the range of their impacts (*Science*, 12 August, p. 1044).

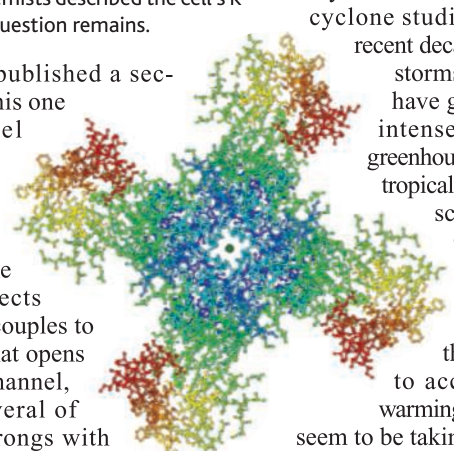
Science funding could soon feel the effects of the past year of disasters. Two months before Hurricane Katrina struck, the U.S. president's National Science and Technology Council capped a 10-year study by publishing a report called Grand Challenges for Disaster Reduction. The report singled out social sciences as an area deserving a boost, citing the need for strategies to get emergency information to populations that often distrust the authorities. More interdisciplinary science is also needed, says one of the report's co-authors, Priscilla Nelson, a civil engineer at the New Jersey Institute of Technology in Newark. Because the causes and impacts of disasters are so broad, she says, we need teams of geophysicists who can talk fluently with epidemiologists, and engineers with psychologists.

One thing is all but certain: Even worse years lie ahead. Vulnerable urban populations of the developing world are set to double by 2030, as are coastal populations everywhere. Meanwhile, changing climate threatens to bring more hurricanes due to warming and chronic coastal flooding due to rising sea levels, among other worrying possibilities. Looking back over 2005, says Nelson, these disasters should be taken as "opportunities to learn."

–JOHN BOHANNON

John Bohannon is a writer in Berlin, Germany.

CREDIT: DISASTER RESEARCH CENTER/UNIVERSITY OF DELAWARE



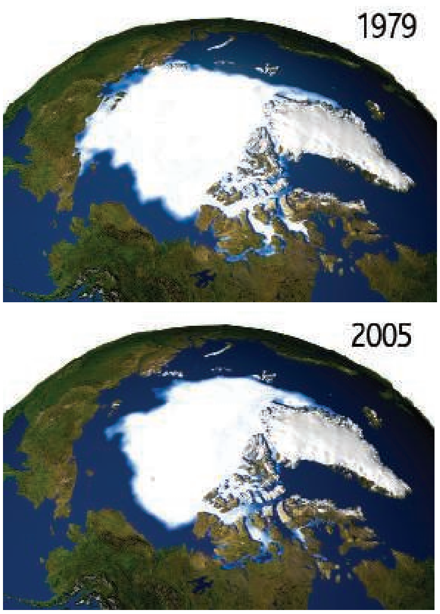
New model. Biochemists described the cell's K^+ channel, but a big question remains.

and colleagues published a second structure—this one of a rat channel called Kv1.2. The new portrait provides an unprecedented look at how the part of the channel that detects voltage changes couples to the mechanism that opens and closes the channel, and it rights several of the perceived wrongs with the KvAP structure. But it doesn't seem to resolve the most contentious issue: how the voltage sensor works. Only time—and more data—will tell.

8 A Change in Climate

The crescendo of evidence indicting humans for global warming produced a breakthrough this year. Some U.S. politicians began talking and occasionally acting as if they will have to do something sooner or later about the growing emissions of greenhouse gases.

The new science was much like that of the past decade, just more insistent and more ominous. In January, climate modelers announced even higher confidence in earlier assertions that the oceans—down to great depths—have warmed in recent decades just as models said they would. Each of two tropical cyclone studies found that over recent decades more and more storms around the world have grown to the most intense levels as rising greenhouse gases have warmed tropical waters. At higher latitudes, scientists announced, Arctic Ocean ice cover had hit another record low, this time with the added warning that the feedbacks expected to accelerate high-latitude warming—and presumably ice loss—seem to be taking hold. And all this climate change is having an effect. It's altering everything from bird migration patterns in Australia to microbial compositions in sea-floor muck.



Less is less. Arctic ice cover hit a new low in 2005 as the world warmed.

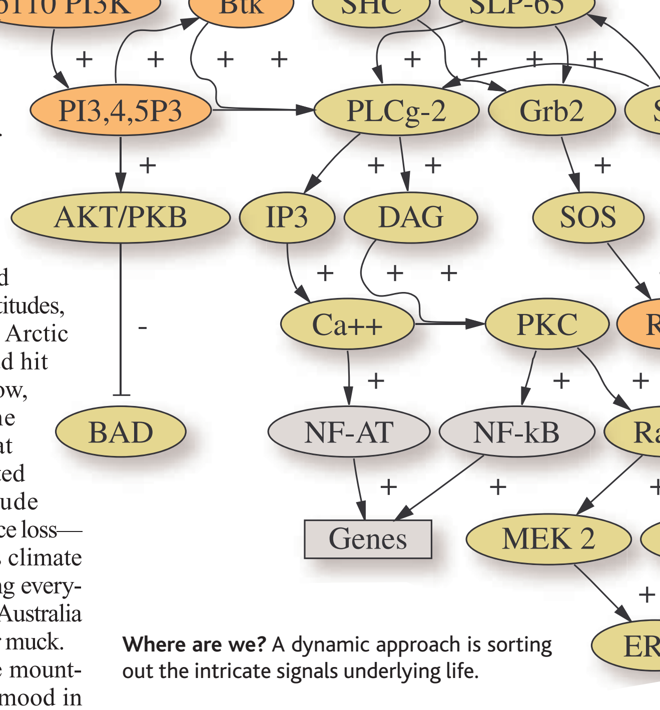
Whether as a direct result of the mounting scientific evidence or not, the mood in the United States showed signs of shifting. The U.S. Senate passed a resolution declaring that the threat warrants mandatory controls on greenhouse emissions if costs to the country are not significant. In the Northeast, nine states have agreed to limit emissions from power plants there. The governors of California, Oregon, and Washington have agreed to jointly encourage energy efficiency. And California Governor Arnold Schwarzenegger called for his state to cut greenhouse gas emissions dramatically over the next 45 years. Show biz or not, the talk is heating up.

9 Systems Biology Signals Its Arrival

Make room in the lab, molecular biologists; the engineers have arrived. Engineers have long excelled at understanding complex systems such as power grids and the Internet by tracking how information moves through a network. This year, that approach took off among systems biologists working to understand how cells respond to the myriad chemical and environmental signals bombarding them from all sides.

Molecular biologists have spent decades teasing apart individual cell signaling pathways, in the process building up ever more complex networks. But a static picture of those networks doesn't do justice to the webs of feedback loops and other complex interactions that produce a given output, such as the release of a particular intracellular messenger. To reveal these dynamics, systems biologists are now tracking multiple inputs and outputs of these networks simultaneously.

This year, for example, researchers in the United States used the approach to cre-



Where are we? A dynamic approach is sorting out the intricate signals underlying life.

ate a model of nearly 8000 chemical signals involved in a network leading to apoptosis, or programmed cell death. Along the way, they discovered new apoptosis signaling routes. Another U.S. team used gene-expression data to identify 40 genes that help trigger obesity, three of which had never been identified before. Other like-minded teams gained novel insights into signaling networks that control immune cells known as T cells and CA1 neurons in the hippocampus.

It's still early days for systems biology. But proponents anticipate that the emerging dynamic view of cell signaling networks will lead to a better understanding of complex diseases such as cancer and diabetes and to new treatments as well.

10 Bienvenu, ITER

After 18 months of often bitter wrangling, the $12 billion International Thermonuclear Experimental Reactor (ITER) has a home at last. In June, international negotiators broke a diplomatic deadlock over whether to build ITER at Cadarache in southern France or in Rokkasho, Japan. The winner: Cadarache.

The basic concept behind ITER—using superconducting electromagnets to hold a plasma of hydrogen isotopes at a temperature and pressure high enough to achieve nuclear fusion—was born in the 1980s. But the design effort, split among centers in Europe, Japan, and the United States, didn't always go smoothly. In the late 1990s, after the engineering design was complete, governments balked at the price and asked the designers to cut the construction cost by half. The United States withdrew from the

CREDITS (CLOCKWISE FROM TOP LEFT): S. B. LONG *ET AL.*, *SCIENCE* **309**, 833 (2005); STKE; NASA

Areas to Watch in 2006

Avian flu. Whether or not a pandemic kicks off in 2006, research on flu vaccines and drugs will expand—as will debates on who should get them first should a pandemic occur. Also look for a wealth of data on the molecular biology, evolution, epidemiology, and even the history of influenza. And keep your fingers crossed.

Gravity rules. After years of refinements, the first phase of the Laser Interferometer Gravitational-Wave Observatory (LIGO) has reached its promised sensitivity. LIGO's laser chambers in Louisiana and Washington state will monitor the sky during most of 2006—with a smaller facility in Germany, called GEO-600, joining the network later in the year. If two neutron stars merge within 50 million light-years or so, the devices could detect the death spiral. It's a long shot, but we're betting they will.

RNAi-based treatments. They're moving into human patients with startling speed, and 2006 should offer the first hints of how well the highly touted technique works. Company-funded trials in macular degeneration and the pediatric illness respiratory syncytial virus are under way; another targeting hepatitis C is supposed to launch soon, with some therapies for neurological diseases to follow. Oh, and another treatment that's coming down the pike: RNAi for permanent hair removal.

Catching rays. The speediest atomic nuclei in the universe, called ultrahigh-energy cosmic rays, may open a new frontier of physics. The sprawling Pierre Auger Observatory in Argentina will near completion in 2006, offering the best chance to explore those limits. Already, Auger's powerful combination of ultraviolet telescopes and water-tank detectors is measuring different aspects of the particle showers sparked by incoming rays. Early results affirm a theorized energy threshold, imposed by interactions in space, that cosmic rays rarely cross.

Small worlds. With ever-better methods of pulling DNA from environments such as soils and the human gut, researchers are documenting the incredible microbial diversity on this planet. In 2006, expect a flurry of papers detailing the evolution and molecular bases of microbial communities and the relationships, both beneficial and pathogenic, between microbes and their partners; more examples of lateral transfer of genes between species; and—just possibly—consensus about a microbial family tree and a much sharper picture of how eukaryotic cells arose.

Seconding supersolidity. Two years ago, physicists reported that solidified helium appears to flow like a liquid without any viscosity. Theorists debate whether such "superflow" is possible in a well-ordered crystal, and no one has reproduced the result yet. Look for someone to confirm the observation—or shoot it down.

Homing in on high-T_c. In 1986, physicists discovered that certain compounds laden with copper and oxygen carry electricity without resistance, some now at temperatures as high as 138 kelvin. Twenty years later, researchers still aren't sure precisely how high-T_c superconductors work. But a variety of exquisitely sensitive experimental techniques should cull the vast herd of possible explanations.

Now you see it? A fleeting glimpse captured on video raised hopes that the ivory-billed woodpecker might not be extinct after all.

Bird to watch for. Early in 2005, a blurry video and new sightings of the ivory-billed woodpecker, considered extinct for the past 60 years, wowed conservationists and birders alike. Some skeptics remained unconvinced by the 1.2-second footage, but many later were swayed by audio tapes of the woodpecker's call and distinctive "tap, tap." Biologists are scouring the Arkansas bayou, where there have now been more than a dozen sightings, for more evidence that they are not seeing a ghost of a bird past. We're betting this "ghost" proves to be the real thing.

project in 1999, only to rejoin in 2003. By late 2003, only one hurdle remained: choosing the site. Government ministers from the by-then six members—China, the European Union (E.U.), Japan, South Korea, Russia, and the United States—gathered in Washington, D.C., for a gala signing ceremony. But when the time came to vote, they split down the middle.

More technical studies of the two sites were carried out, but both sides dug in their heels. Rumors of political skullduggery abounded: Europeans suspected that the United States refused to support the French site to punish France for opposing the war in Iraq, while other whispers suggested that the United States had backed the Japanese site in exchange for Japan's support for the war. In the end, Japan and the E.U. hammered out a deal between themselves. In June this year, after months of delicate diplomacy, Japan withdrew Rokkasho in exchange for a bigger share of construction contracts and a hefty European contribution to a fusion research facility in Japan.

Now ITER researchers can look forward to a few decades working under the warm Mediterranean sun. And who knows? The world may get a working fusion reactor at last.

–THE NEWS STAFF

Closing the circle. After 20 years of research, fusion scientists are ready to start building the ITER reactor.

CREDITS (TOP TO BOTTOM): J. W. FITZPATRICK *ET AL.*, *SCIENCE* **308**, 1460 (2005); ITER

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