Gérard Schwartzenberg said that his "number one priority" is to create opportunities for young researchers. Decrying a lack of positions that has forced talent abroad, Schwartzenberg remarked that "France's job is not to serve as a training institute of young doctorates for the benefit of the United States or other countries." The job creation initiative, which aims to retain young scientists, has earned praise from France's National Union of Scientific Researchers, an organization that's usually highly critical of the government's priorities.

But some prominent scientists are wringing their hands. "I am not optimistic that the government has taken [sufficient] measures to make research a top priority," says cell biologist Jean-Paul Thiery of the Curie Institute in Paris. And Pierre Chambon, director of the Institute of Genetics and Molecular and Cellular Biology near Strasbourg, complains that salaries—which begin at $20,000 per year at agencies such as CNRS, the national basic research agency—are too low to hold on to the best scientists. "We are not competitive," he says. "This is scary for the future."

–MICHAEL BALTER

MAGNETOSPHERIC PHYSICS

Magnetic Storms Have Two Drivers, Not One

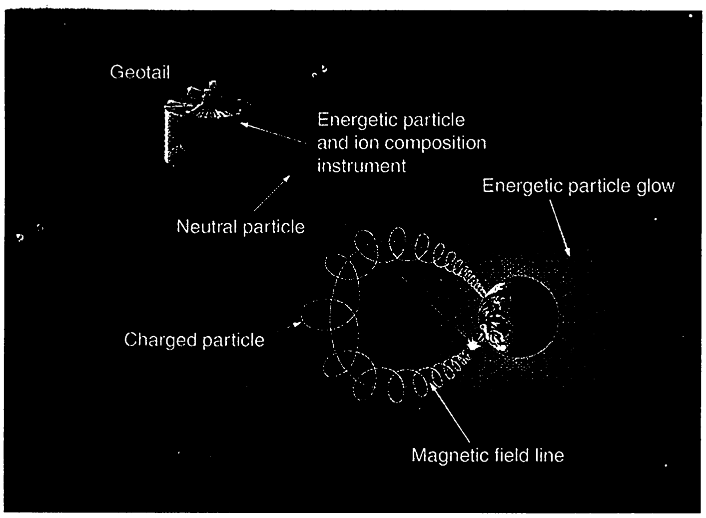
When the skies dance with auroral light, satellites stagger under an onslaught of charged particles, and electrical power systems on the ground collapse, you can blame the solar wind. Space physicists have long known that the gale of charged particles howling by Earth at supersonic speeds bears the ultimate responsibility for magnetic storms, but they have vacillated between two very different explanations of how the solar wind roils Earth's magnetosphere. Now, a study using the latest in magnetospheric probes—published in the 1 September issue of *Geophysical Research Letters*—may settle the sometimes contentious issue: Both explanations appear to be right.

The events that precede the storms are not in dispute: The solar wind constantly peels back magnetic field lines from the sunward side of the comet-shaped magnetosphere into the tail, loading the tail with charged particles and magnetic flux. The controversy focuses on how that excess energy is released.

In the 1960s, Syun-Ichi Akasofu of the University of Alaska, Fairbanks, and the late Sydney Chapman, a founding father of magnetospheric physics, argued that days-long magnetic storms are fed by a string of half-hour-long substorms, which appear as sudden brightenings of the aurora. When the excess energy in the tail reaches a critical point, researchers came to believe, something snaps in the maze of magnetic fields and electric currents that links all parts of the magnetosphere. That snap slings charged particles earthward, where they energize the inner magnetosphere, spawning a huge electrical current that rings the planet above the equator and wreaking havoc on humans' electromagnetic devices.

That explanation held sway in the 1970s and '80s, but in the 1990s another interpretation gained favor: magnetospheric convection. According to this view, the imbalance in the magnetosphere is redressed by magnetic flux and particles steadily drifting or "convecting" back toward the sunward side, energizing the nightside of Earth as they go.

The new study, by Anthony Lui and his colleagues at the Johns Hopkins University Applied Physics Laboratory (APL) in Laurel, Maryland, falls squarely in the middle ground. The APL group assembled observations of a 22 October 1999 storm that had been studied by an international consortium of researchers. Observations had been made from the ground by magnetometers and arctic radars monitoring the effects of the equatorial ring current, magnetospheric convection, and substorm activity.



Seeing the invisible. Magnetically trapped charged particles reveal themselves to an ENA instrument when a few particles are neutralized and escape.

To this mix the group added energetic neutral atom (ENA) data collected by the Geotail spacecraft in distant Earth orbit. ENA is one of the first remote-sensing techniques that can "see" large parts of the magnetosphere in a single look (*Science*, 10 June 1994, p. 1531). Satellite-borne ENA "cameras" form a picture of charged particles trapped in the inner magnetosphere—especially in the ring current—by capturing the few particles that manage to escape after picking up an electron from the outermost fringes of the atmosphere. Their resulting neutrality lets them cut free of the entrapping magnetic field lines.

Lui and his colleagues found that the 22 October 1999 storm seemed to have a different driver at different times. At first, ENA data showed a sharp strengthening of the ring current as substorm activity jumped while magnetospheric convection remained subdued. That's "a very clear example of substorm contribution to storm buildup," says Ioannis Daglis of the National Observatory of Athens. A few hours later, substorms were muted, but convection and the ring current steadily intensified. "This shows enhanced mantle convection can bring the ring current [charged-particle] population up, too," says Lui.

Not everyone is convinced yet. "In the end this paper may even be correct," says Robert McPherron of the University of California, Los Angeles. "However, the data are much more difficult to interpret than the authors would have you believe. [And] the use of a single event to establish the conclusion is highly suspect."

In fact, more cases are on the way. The Imager for Magnetopause-to-Aurora Global Exploration (IMAGE) satellite, launched last year in March, has three instruments specifically designed as ENA imagers. Preliminary analyses of data from IMAGE and the Polar satellite, which also has an instrument useable for ENA, at Los Alamos National Laboratory in New Mexico show both drivers at work in other magnetic storms, says Geoffrey Reeves of LANL. These and other satellite remote-sensing results should be presented in the next few months.

–RICHARD A. KERR

MALARIA RESEARCH

Two New Steps Toward A 'Better Mosquito'

BARCELONA, SPAIN—Motivated by more than a million deaths from malaria a year, scientists have long fantasized about the ultimate method of eradication: replacing existing mosquito populations with ones unable to spread the disease. At a meeting* last week, researchers presented two studies

* Third International Congress of Vector Ecology, Barcelona, Spain, 16–21 September.

CREDIT: JHU/APL

Changeling. An *Anopheles gambiae* larva carrying the GFP gene.

that could help edge that dream closer to reality. Some researchers hailed the new studies as milestones, but skeptics warned that the strategy may never work in practice.

Genetically engineering mosquitoes in any way—let alone making them resistant to infectious diseases—has been tricky. That changed a few years ago when researchers discovered a series of so-called transposons—short, movable stretches of DNA that can help insert new genes into a genome—that worked well in mosquitoes (*Science*, 20 October 2000, p. 440). Now, the field is making "massive strides forward," says molecular entomologist Paul Eggleston of Keele University in the United Kingdom. Last year, for instance, a team at the European Molecular Biology Laboratory in Heidelberg, Germany, reported that it had genetically modified *Anopheles stephensi*, a species that transmits malaria in India. In a proof of principle, the team inserted a gene that encodes green fluorescent protein (GFP) and demonstrated that the gene functioned in its new environment.

Now a team led by Marcelo Jacobs-Lorena of Case Western Reserve University in Cleveland, Ohio, has spliced into the same mosquito species a gene that confers resistance to *Plasmodium*, the parasite that causes malaria. The gene encodes a peptide, called SM1, that appears to block receptors in the mosquito's gut and salivary glands that *Plasmodium* needs to replicate inside the mosquito. In two experiments, mosquitoes carrying the gene lost their ability to infect mice with malaria; in a third study, they became much less effective vectors, Jacobs-Lorena reported.

Also at the meeting, Mark Benedict of the U.S. Centers for Disease Control and Prevention in Atlanta announced that his team has found a way to create transgenic *A. gambiae*, the most common malaria vector in Africa and a much bigger killer than *A. stephensi*. Again, the team slipped the GFP gene into *A. gambiae*. Jacobs-Lorena calls the work "a real landmark," because so many previous attempts to genetically alter *A. gambiae* had failed. Now, it's probably a matter of months before researchers produce a malaria-resistant version of *A. gambiae*, for instance by equipping it with SM1, says Eggleston.

But Harvard medical entomologist Andrew Spielman cautions that huge scientific and practical obstacles remain to be overcome before transgenic mosquitoes can be deployed in the field. These range from finding a way to ensure that they replace existing populations to dealing with ethical problems regarding the protection of inhabitants of a test site. Because of these hurdles, it's "extremely unlikely" that this line of research will ever make good on its promises, Spielman asserts. Eggleston concedes that the field faces many problems. But even if the altered mosquitoes are never released, he says, they will teach researchers a great deal about how malaria parasites interact with their host.

–MARTIN ENSERINK

PALEONTOLOGY

Unhatched Eggs Help Dinos Get a Head

Rugged as they look, fossilized dinosaur skulls are frustratingly hard to find. Exposure, scavengers, and flash floods ensured that few of the information-laden artifacts survived their day. Miraculously, though, the most delicate skulls of all—those of dinosaur embryos—sometimes come to light. In the past 13 years, paleontologists have identified embryonic remains of five kinds of dinosaurs, but only one, a duck-billed dinosaur, had an intact skull. Intact embryos of the long-necked, lumbering sauropods remained unknown—until now.

Heads up. The first complete skulls from embryonic sauropods were discovered in eggs from this site in Argentina.

On page 2444, three paleontologists describe the first articulated skulls—not much bigger than a postage stamp—of titanosaurs, a group of sauropods known only from incomplete skeletons and very few skulls. "This is a really exciting find," says Jeffrey Wilson of the University of Michigan's Museum of Paleontology in Ann Arbor. The embryos come from a site in Patagonia, called Auca Mahuevo, whose rocks are packed with thousands of dinosaur eggs between 71 million and 89 million years old. In 1998, Luis Chiappe of the Natural History Museum of Los Angeles County, Rodolfo Coria of the Carmen Funes Museum in Plaza Huincul, Argentina, and others described cantaloupe-sized eggs containing fragmentary bones—and the chisellike teeth of titanosaurs. Working with Leonardo Salgado of the Museum of Geology and Paleontology in Neuquen, Argentina, the team has now found six more embryos, some with intact skulls.

The 4-centimeter-long skulls may help show which skeletal features of titanosaurs developed in tandem and which are independent. That's important, because scientists determine evolutionary relationships by comparing such features, or characters, and spurious connections can lead them astray. The embryonic titanosaur skulls confirm earlier suspicions that two key sauropod traits—the orientation of the braincase and the position of the nostrils—are independent, Chiappe and his colleagues say. Further study could tease apart even more characters to help paleontologists sort out the sauropod family tree.

The embryos may also shed light on early sauropod evolution, about which relatively little is known. Although development doesn't necessarily replay evolutionary history, says paleontologist Eric Buffetaut of France's basic research agency CNRS, embryonic features may be reminiscent of more primitive sauropods. "If you can use embryos as proxy to reconstruct this early evolution, that's really original," he says. Buffetaut hopes the discovery of sauropod embryos will encourage other paleontologists to examine eggs in their collections.

–ERIK STOKSTAD

CLINICAL RESEARCH

India Acts on Flawed Cancer Drug Trials

THIRUVANANTHAPURAM, INDIA—Reacting to numerous regulatory violations in the testing of an anticancer drug, the Indian government has suspended all human trials for 6 months at the Regional Cancer Center (RCC) here in the southern state of Kerala. It has also closed a loophole allowing the unregulated importation of experimental drugs by requiring organizations to obtain approval before the testing or marketing of any drug.

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