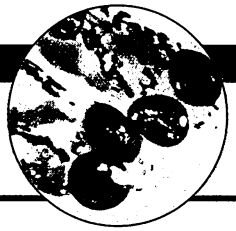
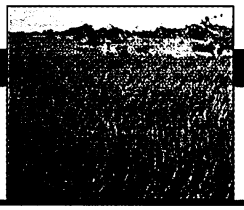




sweepstakes entry the highest. A 153,478-genes entry came in from Sam LaBrie of Incyte Genomics, a California-based company that in September 1999 announced that the human genome had at least 140,000 genes.

But Rubin and other gene minimalists were undeterred, arguing that complexity comes from how genes are regulated or expressed—not in the number of genes themselves. "We don't need large numbers of genes to be an intelligent species," Rosenthal explains. Weissenbach agrees, arguing that "once people go through the EST data, they will realize that many of the clusters [cover] the same gene." His bet: 28,700. And yours?

–ELIZABETH PENNISI

ASTRONOMY

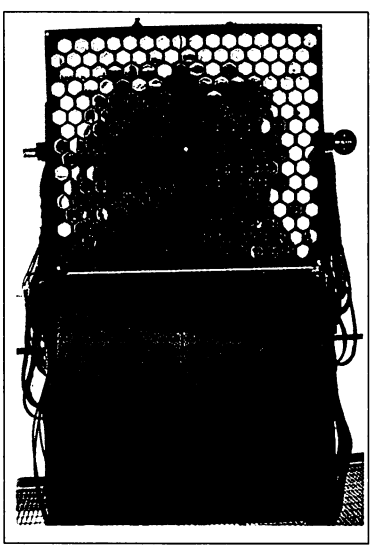
Fly's Eye Spies Highs in Cosmic Rays' Demise

LONG BEACH, CALIFORNIA—On an October evening in 1991, an extraterrestrial intruder tore through the sky over North America. The interloper was a cosmic ray, a high-energy particle from deep space. Astronomers at the Fly's Eye observatory in Utah detected it as a flicker of light from the cascade of secondary particles it left in its wake. On analyzing the glow, they realized that the particle had packed a shocking 320 exa–electron volts (EeV) of energy, the same punch as an 88-kilometer-an-hour baseball pitch. Astrophysicists call it the "Oh-My-God" particle.

Now, observations from Fly's Eye's replacement have shown that the 320-EeV monster was not a freak of nature. This month at an American Physical Society meeting here, astronomers from the High-Resolution Fly's Eye detector, or HiRes, announced that they had found a handful of ultra-superhigh-energy cosmic rays that deepen the mystery about the origin of these strange particles.

Since it began operating in 1997, HiRes has nearly doubled the number of known ultrahigh-energy cosmic rays. It has recorded seven particles with energies greater than 100 EeV, including one that clocked in at an estimated 280 EeV, the second highest cosmic ray energy ever recorded. HiRes has also detected 13 other cosmic rays with energies over 60 EeV. "People are beginning to think these events are real," says Charles Jui, a physicist at the University of Utah in Salt Lake City.

They had reason to be skeptical. In the 1960s, scientists realized that particles with more than about 60 EeV of energy would tend to smack into the ubiquitous microwave background photons left over from the big bang. Such energetic collisions would produce pions, destroying the cosmic rays in the process. "You shouldn't expect these particles to survive for more than 20 to 50 megaparsecs," Jui says. As a result, physicists expected that there would be a sharp cutoff in cosmic ray energies at about 60 EeV, and any particles with energies above that level must have come from nearby. Such energetic particles, they thought, should be easy to trace back to their sources. The HiRes data don't show an abrupt 60 EeV cutoff, however, and no obvious sources have turned up for the superenergetic particles. Indeed, astrophysicists have trouble even figuring out what might give them such a punch. Supernovae, for instance, can't accelerate particles to more than about 1/1000 of an EeV of energy. "This is a burning astrophysical problem that needs to be solved," says University of Chicago astrophysicist Rene Ong.



Fly specs. Clusters of phototubes give HiRes an eye for cosmic rays.

Astrophysicists are hoping that HiRes, with its high sensitivity and ability to pinpoint a cosmic ray's direction and mass, will eventually provide the data that point to the answer. "Given that they've already doubled the sample, every few years they'll probably double it again," Ong says. "HiRes could make a very important statement."

–CHARLES SEIFE

CONSERVATION BIOLOGY

Orangutans Face Extinction in the Wild

LISLE, ILLINOIS—Orangutans, our third-closest living relative, are in crisis, reported several leading primatologists at a meeting here last week on apes.* Indeed, the plight of the orangutans, whose range is now restricted to the shrinking forests of Borneo and Sumatra, dominated the 4-day meeting and sparked two late-night sessions at which researchers and zookeepers hatched a conservation plan. Without urgent action, warns Biruté Galdikas, a biological anthropologist and conservationist who teaches at Simon Fraser University in Burnaby, British Columbia, the apes could be extinct in the wild within 20 years. The culprit is wholesale logging and other habitat destruction, which will be difficult to halt.

Ignorance is bliss. A young orangutan plays in the water, heedless of the threat.

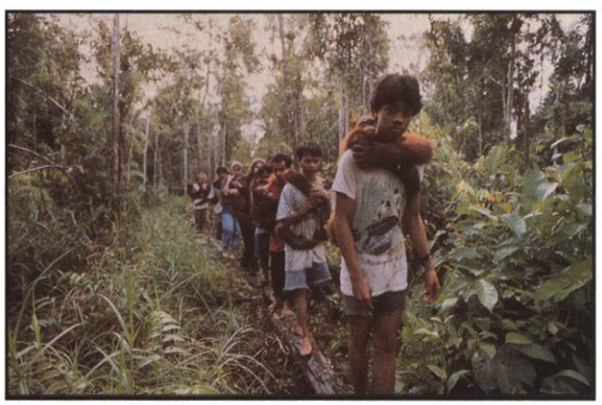
Exact numbers are hard to come by because orangutans, highly intelligent but mostly solitary apes, hang out high in the forest canopy where they are difficult to spot. But two recent surveys, one of which was presented at last week's meeting, show clearly that populations are crashing. Carel van Schaik of Duke University and his colleagues estimated the size of orangutan populations in a section of the 24,000-km^2 Leuser region on Sumatra in 1993 and 1999. Relying on data from satellite imaging and aerial photos of the animals' habitat—combined with their own knowledge from 24 years of field-

* "The Apes: Challenges for the 21st Century," 10 to 13 May, Lisle, Illinois, sponsored by the Brookfield Zoo.

CREDITS: (TOP) MICHAEL TURCO; (BOTTOM) D. BIRD

work—the researchers found that the population had dropped from 12,000 to 6500. The survey, in press at *Oryx*, is likely to be accurate, says primatologist David Chivers of Cambridge University, and "it's great reason to be horrified." Indeed, the entire world population of the red apes was calculated at just 27,000 in 1998, down from an estimated 315,000 in 1900, according to a book published last year by primatologists Herman Rijksen and Erik Meijaard.

Confounding matters, taxonomists have recently agreed that the Bornean and Sumatran orangutans, which have been separated for thousands of years, differ enough in appearance, behavior, and genetic makeup to be classified as separate species. Each is critical to conserve, but the task will be even harder given the small sizes of both populations.



Repatriation. Volunteers return orphaned orangutans to the wild.

The Sumatran species is in critical danger because its last stronghold, Gunung Leuser National Park, is being actively and illegally logged, says van Schaik. The situation is not much better on Borneo, says conservation biologist Jatna Supriatna, who directs the Indonesia program of Conservation International. Although the orangutan population on Borneo is larger, habitat is disappearing fast. In the past 20 years, 4 million of the 13 million total hectares of forest were converted to palm-oil plantations, mostly run by friends of former president Suharto, Supriatna says. While still in power Suharto ordered the conversion of another 1 million hectares of peat swamp forest, prime orangutan habitat, to replace the disappearing rice fields on the overcrowded island of Java. The massive Indonesian forest fires of 1997 also took a huge toll, claiming 8 million hectares on Borneo, part of which had been previously logged. Poverty drives habitat destruction on both islands, as local people log the lucrative timber, Supriatna says.

As the forests go, so do the orangutan groups, and with them a unique opportunity to understand the dawn of human culture, van Schaik says. Researchers have learned only recently that different populations of orangutans, like chimpanzees, exhibit signs of what some primatologists call culture: behaviors unique to the population that are learned from other group members (*Science*, 25 June 1999, p. 2070). For example, all orangutans near the Suaq Balimbing research station in Gunung Leuser National Park make Bronx cheer–like sounds with their mouths as they build their nightly nest high in the canopy. None of the orangutans near the Ketambe station, 70 kilometers away, do. "It's irrelevant behavior that doesn't affect survival," says van Schaik, but "it's culture in the making."

Other orangutan cultural behaviors, however, could offer substantial benefits. For example, apes in a swampy forest on the east side of the Alas River harvest the oil-rich seeds of the woody neesia fruit by ripping open the fruit with their hands. But orangutans on the other side of the river use a peeled stick to pry open the fruit. Because those apes can spend up to 70% of their feeding time harvesting the fruit when it is in season, the more efficient stick users save lots of time and energy.

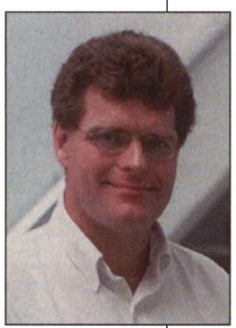
Alarmed by the new survey data, field researchers and zookeepers at last week's meeting hammered out an action plan, launching a group called the "Orangutan Network," led by van Schaik, to conserve the species. They plan to scatter new study sites in the remaining areas of healthy forest, staffed by researchers and students, because a research presence is known to dramatically boost local conservation efforts. They hope to increase interest in orangutan conservation by enlisting individual zoos to "adopt" (and help fund) a research site.

In the field, Galdikas has expanded her focus from research to saving as many of the apes as she can. A conservation group she directs, the Orangutan Foundation International, operates a rescue and rehabilitation center in Tanjung Puting National Park in Borneo that saves young orangutans orphaned by logging, fires, or hunting. About 500 orangutans are housed at such centers. So far, about 800 apes have been successfully returned to the wild. But the apes need intact forest, so Galdikas uses money from supporters to pay 100 local Dayak and Melayu men—"left out of the economic pie," she says—to patrol the forest, recycle, plant trees, and educate their neighbors. As a result, the illegal loggers have not touched a 50-km^2 patch of forest near her research station.

Although the situation is indeed grim,

ScienceScope

Sanger Taps Homegrown Talent After nearly a year's search, the Sanger Centre, a major genome sequencing institute near Cambridge, U.K., has found a new director. Mouse geneticist Allan Bradley (below), 40, of Baylor College of Medicine in Houston will replace outgoing Sanger chief John Sulston on 1 October.



For Bradley, a pioneer in the use of stem cells to study mouse development, the move will be something of a homecoming: The British-born scientist did his undergraduate, graduate, and postdoctoral studies in Cambridge. He says that he intends to take Sanger, which is mostly funded by the Wellcome Trust and is currently sequencing about one-third of the human genome, to the next stage of genome research, called functional genomics. "There will be a huge opportunity in discovering [gene] function," Bradley says. He will also continue some of his mouse research in Cambridge, although he realizes that running his own lab and a center with 550 staff members will not be easy. Sulston, he predicts, "will be a hard act to follow."

Sulston, who has directed Sanger since 1992, says he has "no plans" for his next step, but adds: "I shall be looking around."

One for All The world's science academies agreed at a 14 May confab in Tokyo to establish an international version of the U.S. National Research Council. The new InterAcademy Council (IAC) will organize expert panels to provide scientific advice to the United Nations, World Bank, and other international organizations on issues ranging from food safety to emerging diseases (*Science*, 11 February, p. 943).

The IAC, to be based at the Netherlands Academy in Amsterdam, will produce peer-reviewed reports by scientists who serve without compensation, and who will communicate mainly via e-mail. The enterprise "is envisioned as an electronic one," said U.S. National Academy of Sciences president Bruce Alberts. The council's budget is still uncertain, but reports will be paid for by commissioning organizations. Member academies will chip in to cover the salary of an executive director, to be hired after an international search. Alberts says the IAC's "first few projects will be critical" to determining its success.

CREDITS: (LEFT TO RIGHT) MICHAEL TURCO; SANGER CENTRE

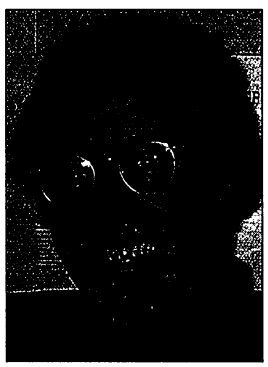
these efforts, along with recent changes in Indonesia, offer glimmers of hope, says Supriatna. For example, Indonesia has a freer press than it used to, which is publicizing the crisis. In addition, the International Monetary Fund has put conditions on new loans to Indonesia, forbidding extension of oil-palm plantations and loans to loggers. International conservation groups are funneling money to the national parks and pressing the World Bank to tie debt forgiveness to forest protection. They have also established a trust fund to promote ecotourism and boost such forest crops as spices and rattan. "We're looking at a very serious problem," van Schaik says, "but for the first time in decades, there's reason for optimism." **–DAN FERBER**

Dan Ferber is a writer in Urbana, Illinois.

EUROPEAN SCIENCE

Spain Opens Coffers to Keep Talent at Home

Like many top Spanish scientists in recent years, Miguel Beato coped with his country's prolonged science funding funk by working abroad. "I'd given up ever going back to Spain," he says. But now that Barcelona is building a $55 million biomedical research park and planning a biocenter at the University of Barcelona, Beato, a cell biologist at the University of Marburg in Germany, is contemplating the unthinkable: coming home.



Brighter skies? Miguel Beato sees Spanish science picking up.

Beato is not the only one impressed with Spain's sudden scientific resurgence. Late last month, the government announced a plan to boost science and technology spending over the next 4 years from $2.8 billion, or 0.9% of the gross national product in 1999, to the European average of 2% by 2003. Tasked with pushing this agenda is a new Ministry for Science and Technology, created last month by Prime Minister José Maria Aznar. "There is a real commitment by the government to give a major boost to research and development," says the ministry's newly appointed science policy chief Ramón Marimón. That's sorely needed, says molecular biologist Margarita Salas of the Center for Molecular Biology in Madrid. "Without this step," she says, "Spanish science is in serious danger of going downhill."

Researchers have been waiting for good news for more than a decade: The last significant hike for science funding was in the mid-1980s, when a booming economy allowed the government to more than double the science budget. "The consequences were remarkable," says Salas. "The number of scientists and the quality of the research shot up in a very short time." Beginning in the early 1990s, however, Spain's science budget stagnated, the victim of a general belt-tightening aimed at shrinking Spain's budget deficit.

Marimón and his boss, Science Minister Anna Birulés, have revealed little about how they plan to dole out the budget increase. However, they do say that basic research will be the main beneficiary in next year's budget, and that they hope to create 25% more positions for scientists by 2003. The latter initiative would address the worst problem nationwide, scientists say. "We can't even offer positions to the many well-trained young scientists who want to come back to Spain" after completing postdocs abroad, says Salas. Some help is coming from the regional governments, particularly Catalonia. Besides sponsoring the two new biomedical initiatives and for the first time appointing its own regional science minister earlier this year, Spain's affluent northeastern state has freed up funding for about 30 life science faculty positions at the University Pompeu Fabra in Barcelona. "Catalonia is showing Spain the way," says Beato, who now spends about 2 months a year at Pompeu Fabra as a visiting professor.

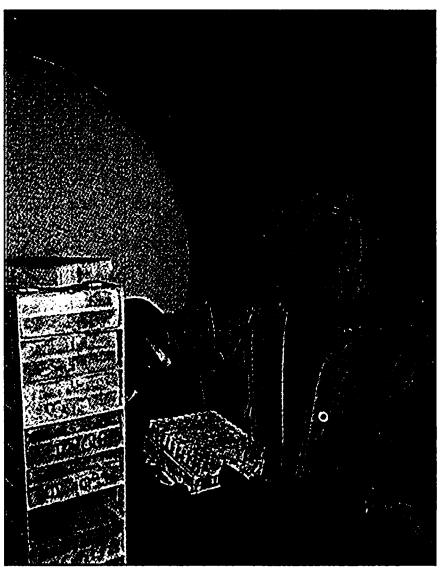
Private donors are also stepping up efforts to retain key scientists. In January, the Botin Foundation, run by the Bank of Santander, bestowed a windfall on cellular biologist José Jorcano of the National Research Center for Energy, Environment, and Technology—a grant for $1 million a year for up to 9 years to support his work on the etiology of cancer. And in February, the Juan March Foundation, known for endowing the arts, made a splashy entrance into Spanish science by announcing that it would award one $800,000-plus grant every year to a promising biomedical researcher under the age of 50. An international review panel is expected to select the first winner this fall.

Despite these promising signs, some observers are not convinced that the long drought is over. "There have been too many words and too little action in the past. We have to wait and see what really happens," says neurobiologist José Lopez-Barneo of the University of Seville Medical School. However, he adds, "simply having the word 'science' back on the political agenda and a ministry devoted to it is a giant step forward." **–MICHAEL HAGMANN**

CONSERVATION BIOLOGY

California Team to Map Rare Species' DNA

To help unravel genetic kinship among mammals, the San Diego Zoo and Amersham Pharmacia Biotech announced last week that they are launching the first systematic effort to decode the DNA of endangered species. Over the next year, the team plans to sequence key portions of the genetic code of one representative of each of the 146 mammalian families. Many of the animals are from a menagerie that most visitors to the San Diego Zoo never get to see—a "Frozen Zoo" of stockpiled DNA, from rare Przewalski's horses to western lowland gorillas.



DNA on ice. Sequencing effort will tap CRES's Frozen Zoo of tissue samples.

Using Amersham's capillary sequencing machines, the project aims to generate complete sequences of the DNA in the mitochondria, tiny powerhouses outside the cell's nucleus that produce chemical energy. Because mitochondrial DNA mutates at a fairly reliable rate, scientists can judge how long ago species diverged according to differences in mtDNA sequences. These biochemical clocks will help sort out little-known relationships within families such as the insectivores, says geneticist Oliver Ryder of the San Diego Zoo's Center for Reproduction of Endangered Species (CRES): "I think we'll gain fantastic insights into molecular evolution."

Conservation experts welcome the project. "It's a positive step toward unlocking important new genetic data that eventually will be useful for managing endangered species," says David Wildt of the Smithsonian Institution's Conservation and Research Center in Front Royal, Virginia. Indeed, such projects

CREDITS: (LEFT TO RIGHT) M. BEATO; SAN DIEGO ZOO