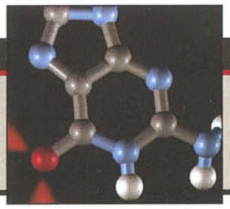
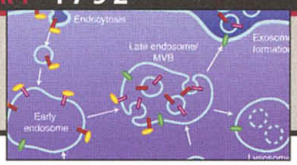
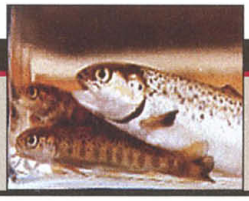


1789
Why A, T, G, C?

LEAD STORY 1792
Ubiquitin's newfound powers





1797
Promises and perils of GM fish

SUSTAINABLE DEVELOPMENT

World Summit Adopts Voluntary Action Plan

Cynics might say that the summit in Johannesburg demonstrated only that rhetoric is a sustainable resource. But several scientists put a more positive spin on the 10-day gathering of global leaders in the South African capital that ended last week.

"There's something to build upon, but it's more like a statement of intentions," says economist Jeffrey Sachs, head of Columbia University's Earth Institute. Like others, Sachs was disappointed by the dearth of concrete plans that emerged, including the lack of support for his own suggestion to triple the budget of the world's global network of agricultural research. "But there's at least a fighting chance of making this a real plan of action," he says.

Nobody expected great things from the meeting, seen as a follow-on to the 1992 Earth Summit in Rio. Officially called the United Nations World Summit on Sustainable Development, the meeting did produce a 65-page Plan of Implementation in which more than 100 governments agreed to work together to protect the environment and reduce poverty. Delegates "made halting progress on some new sustainable issues, which is great," says Brooks Yeager, vice president of the Worldwide Fund for Nature (WWF). But a U.S.-led campaign against specific timetables and goals undermined efforts to go further, says Sachs, who serves as an adviser to U.N. Secretary-General Kofi Annan.

Still kicking? Activists declared the sustainability summit dead, but others—including scientists—say some progress was made.

CREDIT: SAURABH DAS/AP

At the meeting, delegates agreed to restore fisheries to maximum sustainable yields by 2015 and establish a network of marine protected areas by 2012. The action plan also calls for slowing biodiversity loss by 2010 and slashing by half the number of people without access to sanitation by 2015. But proposed language was often softened during the course of the meeting; for example, a suggested 10% boost by 2010 in the use of renewable energy became "substantially increase." In addition, the plan is not binding and, unlike the 1997 Kyoto treaty to curb production of greenhouse gases, does not include plans for individual countries.

Science didn't make it into the political summation of the meeting, but it is discussed in the action plan, which encourages research collaborations between developed and developing countries. And scientists were featured prominently at the meeting. The Paris-based International Council for Science (ICSU), together with other international science and engineering groups, submitted reports and sent delegates, unlike at Rio. The groups also joined with the South African science ministry in a concurrent science forum that "people said was one of the most useful sessions," Sachs says. According to ICSU executive director Thomas Rosswall, "We are extremely pleased with the high profile of science and technology during the summit itself and at many side events."

If the summit lacked substance, it at least served as the backdrop for various initiatives that Yeager predicts "will have lasting impact." The United States committed at least $36 million over 3 years to protect the Congo rainforest, including new protected areas and training of park managers. "I'm very excited by that," says ecologist Stuart Pimm of Duke University in Durham, North Carolina. "It's one of the most important places on the planet for biodiversity." Brazil, the United States, WWF, and other donors also announced a contribution of $81 million toward an ambitious 10-year plan by the Brazilian government to triple the country's strictly protected areas.

Canada and Russia used the summit to declare their intention to ratify the Kyoto climate treaty. Those parliamentary votes would allow it to enter into force without the United States, the world's biggest polluter. Countries also agreed to boost funding for the Global Environment Facility to $2.9 billion (*Science*, 31 May, p. 1596), and a campaign was launched to save crop seed banks (*Science*, 6 September, p. 1625).

The U.N. says that "partnerships" are essential to fulfill the summit's objectives, and Rosswall says that scientific societies now hope to flesh out their own action plans and find ways to fund them. "To go from words to action, that's the challenge," Rosswall says.

–JOCELYN KAISER

IMPACT HAZARD

A Little Respect for the Asteroid Threat

ARLINGTON, VIRGINIA—Asteroids fall to Earth. They always have and always will, unless humankind finds a way to intervene. If one were to strike tomorrow, it could rain death and destruction on a scale that would threaten civilization's very existence.

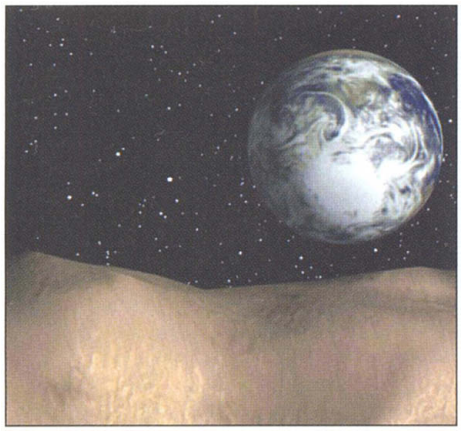
At a NASA-sponsored workshop* held here last week, researchers heard mixed tidings about the asteroid threat. The good news is that the search for civilization-ending asteroids seems to have passed the halfway point and is on track to reach NASA's goal of detecting 90% of them before the end of the decade. On the other hand, astronomers haven't gotten far finding the tens of thousands of smaller bodies that could still wreak havoc across a megalopolis. And if an asteroid of whatever size were detected on a collision course with the home planet, no one would know what to do about it.

"In some sense, we have the future of the world in our hands," said astronomer David Morrison of NASA Ames Research Center in Mountain View, California. In principle, the asteroid hazard, unlike any other natural hazard, can be totally predictable, he notes. But scientists and the public have yet to decide how hard astronomers should look for smaller killer asteroids and how much planetary scientists need to learn about the enemy before confronting it.

By the end of the decade, astronomers

* Workshop on Scientific Requirements for Mitigation of Hazardous Comets and Asteroids, 3–6 September. See www.noao.edu/meetings/mitigation/index2.html

should have a good idea whether there's a sizable asteroid out there with our name on it. Recent estimates of the number of asteroids that can cross Earth's orbit and can therefore hit us—based on measures such as the rate at which such near-Earth asteroids (NEAs) are being discovered—have ranged from 700 to 1200 NEAs 1 kilometer in diameter and larger.



Predictably safe passage. The asteroid Toutatis will pass Earth in 2004.

Those are the ones thought capable of disrupting the environment badly enough to deal civilization a death blow. At the meeting, astronomer Alan Harris of NASA's Jet Propulsion Laboratory in Pasadena, California, reported that the current discovery rate of about nine NEAs per month now supports a range of 1000 to 1200 NEAs that size.

At the behest of Congress, NASA began an NEA search in 1998 with the goal of finding 90% of NEAs 1 kilometer and larger by 2008. So far, 635 of them have been discovered and tracked. Only one looks to have any chance of ever hitting Earth (*Science*, 5 April, p. 27), and that's a slim 1-in-300 chance at most in 2880. "It looks like we're going to be real close to making" the 2008 goal, said Harris, "if not making it."

Many researchers, however, think more needs to be done. Monster 1-kilometer asteroids jolt Earth on average only every few hundred thousand years, but a still-formidable 300-meter body strikes every 60,000 years or so, they point out. As telescopic imaging technology has improved, surveying such 200- or 300-meter "subkilometer" objects might soon be practicable. If such an impactor hit within hundreds of kilometers of the U.S. Atlantic coast, it could send a 100-meter tsunami into Boston, New York City, and Charleston, planetary scientist Erik Asphaug of the University of California, Santa Cruz, reminded the meeting attendees.

NASA has just begun looking at how seriously subkilometer asteroids threaten us and what could be done to find the dangerous ones, NASA Solar System Exploration Division Director Colleen Hartman told those attending the meeting. A subkilometer survey would cost considerably more than the $4 million per year NASA is spending on the current 10-year search. In the past 2 years, the National Research Council has twice recommended that NASA and the National Science Foundation (NSF) jointly fund a survey facility such as the ground-based Large-Aperture Synoptic Survey Telescope (LSST) currently under study by NSF (*Science*, 19 July, p. 317). With something like a $95 million start-up cost, LSST could find 90% of 300-meter NEAs in 10 years if it did no other scientific work, Harris says.

But even if found, dangerous NEAs present an as-yet-insurmountable problem. Any number of ways of nudging an asteroid off its collision course have been offered, among them blowing it out of the way with a nuclear explosion, attaching a rocket engine of some sort, creating a jet of vaporizing rock by focusing sunlight with a giant solar mirror, and scooping rock off the asteroid and hurling it away. But every method depends to varying degrees on the nature of the particular asteroid. NEAs range from solid chunks of rock or iron-nickel at the small end (less than a few hundred meters) to "rubble piles" of shattered rock covered by a loose layer of pulverized rock. Physicist Keith Holsapple of the University of Washington, Seattle, warned listeners that "whacking" a porous, debris-covered rubble pile out of the way with a nuclear blast would be "like trying to punch a very large marshmallow"—bad news if many near-Earth asteroids fit that description.

To understand NEAs well enough to deflect them effectively, space agencies would need to send interplanetary missions for radar and seismic probing, said astronomer Michael Belton of Belton Space Exploration Initiatives LLC in Tucson, Arizona. Belton estimates that such studies would probably take $1.5 billion and 25 years, not to mention another $3 billion or so to fashion practical deflection methods for every sort of beast in the asteroid zoo. But given the odds for the next impact, noted planetary scientist Daniel Durda of the Southwest Research Institute in Boulder, Colorado, "Captain Kirk is probably going to be out there before we have to do mitigation" of the asteroid hazard. **–RICHARD A. KERR**

CREDITS: (TOP TO BOTTOM) JPL/NASA; YERKES NATIONAL PRIMATE RESEARCH CENTER

BIODIVERSITY

Bid to Save Kamchatka's Wildlife

PETROPAVLOVSK-KAMCHATSKIY, RUSSIA—For decades, the Soviet military cloaked the far-eastern region of Kamchatka from the outside world because of the 1500-kilometer-long peninsula's proximity to Alaska and Japan. That isolation and its unique climate preserved Kamchatka as a haven for thou-

ScienceScope

Insel to Head NIMH A psychiatrist and neurobiologist who began his career at the National Institute of Mental Health (NIMH) has been tapped as its next director. As *Science* went to press, National Institutes of Health director Elias Zerhouni was expected to appoint Thomas Insel (below), now at Emory University in Atlanta, Georgia, to the post.

Insel, 50, spent 15 years at NIMH before leaving to head Emory's Yerkes primate center in 1994. Originally a clinician, he later moved to the lab, studying the neurobiology of attachment. In 1999, he became head of a new National Science Foundation–funded center for behavioral neuroscience (*Science*, 26 July, p. 506).

Insel says one of his top priorities will be to use genomics results to improve patient care, a goal his new boss shares. But Insel did not ask Zerhouni to let him keep his lab; it was a "tough decision," he says, but NIMH "really deserves a full-time director."

Insel "brings to the table exactly what the institute needs in terms of expertise," says Harvard provost Steven Hyman, who stepped down as NIMH director in December 2001. Colleagues describe Insel as a warm and likable manager, if more low-key than some institute directors. He expects to formally take the reins in mid-November.

Ready to Rumble French scientists are gearing up to fight projected cuts in the nation's research budget. Three researcher unions were expected to hold a war council this week to oppose the cuts, which—according to government documents leaked to the daily *Le Monde*—might take a 1.3% slice out of the $9 billion civilian R&D budget and ax 50 research posts. A final decision is expected at a 25 September meeting of the Council of Ministers.

The proposed cuts are smaller than the initially rumored 7.6% reduction (*Science*, 16 August, p. 1112). But many scientists say that any cut would break a campaign promise by President Jacques Chirac to boost R&D spending to 3% of gross domestic product by 2010, from its current level of 2.2%. "They say we are lagging behind, and then the first thing they do is cut the budget," says Jacques Fossey, secretary-general of the National Union of Scientific Researchers (SNCS). Government spending needs to rise by 5% to 7% annually to keep Chirac's promise, says SNCS.

Contributors: Jocelyn Kaiser, Michael Balter