won awards.) Both collaborations dissolved in the 1970s, partly over Chagnon's belief that his work was not receiving proper credit. Asch died in 1994, Neel early this year.

Even as Chagnon continued his research, other researchers began to question his description of the Yanomamo as aggressive and "liv[ing] in a state of chronic warfare." The dispute grew heated in 1988, when Chagnon published an article (*Science*, 26 February 1988, p. 985) dismissing the common view that groups like the Yanomamo fight over scarce natural resources. Instead, he said, Yanomamo battles are mostly about women. Moreover, the killers—unokai, in the language—end up with dominant social positions that entitle them to more female partners, who provide them with more offspring, suggesting a genetic payoff for violence. At least three books attacked this sociobiological conclusion.

Among other points, *Darkness* argues that Chagnon's picture of the Yanomamo is not only wrong, but that some evidence for it was manipulated. Tierney—who spent more than a decade researching the book, including 15 months in the field—alleges that the anthropologist staged many of the fights recorded in his films with Asch. Worse, Tierney claims, some of these phony wars turned into real wars, as Chagnon introduced steel goods that led to deadly violence.

"There is no credible evidence to support Tierney's fantastic claims ...," responds Chagnon, who rejected *The New Yorker*'s offer to "submit to an interview." "Intelligent people base their judgements on evidence. Only believers in conspiracy theories and a large number of cultural anthropologists from the academic left leap to conclusions that are not only not supported by the available scientific evidence but contradicts and thoroughly refutes them."

Tierney's investigation of a 1968 measles epidemic has drawn the most attention. In a research trip to the area early that year, Neel, Chagnon, Asch, and the other members of the University of Michigan team vaccinated many Indians with Edmonston B measles vaccine, which was discontinued in 1975 and was already being replaced by vaccines with fewer side effects. Because the epidemic seems to have started at the places the research team vaccinated, Tierney suggests that the vaccine may have contributed to what became a terrible epidemic. Afterward, Neel apparently gave contradictory accounts about the way the epidemic started and did not explain why he used an older vaccine than the one used elsewhere in Venezuela.

In an e-mail to AAA officers that was leaked to the news media last week, Sponsel and Cornell University anthropologist Terence Turner—who are among the few anthropologists who have read the book—even speculate that Neel may have used the risky vaccine to test what they call his "fascistic eugenics" theory that dominant males like unokai could better survive catastrophes and pass on their genes.

Angered by these allegations, Neel's colleagues are lining up rebuttals. Samuel L. Katz, a measles specialist at Duke University, says the vaccine simply is not deadly, even to people without prior exposure. Doctors have "given hundreds of thousands of doses to malnourished infants in Upper Volta (now Burkina Faso) and Nigeria with no severe consequences," he argues in an e-mail passed on to *Science*. "Indeed, in the history of Edmonston B (a licensed U.S. product), I know of only two fatalities—two Boston children with acute leukemia under heavy chemotherapy."

The contretemps is not likely to end soon, although it may get better informed. Because Tierney is being kept mum by his publishers until the book appears, he cannot defend it. And some of his critics concede the oddity of attacking a work that they have not read. But even when both sides can fully argue their cases, in Sponsel's view, the debate will last a long time. "There's an incredible amount in the book," he says. "People are going to be working at it for years to come."

—CHARLES C. MANN

PALEOFORENSICS

Ice Man Warms Up for European Scientists

After spending about 45 million hours in a deep freeze, Italy's "Ice Man" was thawed for 4 hours earlier this week in an Italian museum to allow scientists to snip out tiny fragments of bone, teeth, skin, and fat. Scientists hope that turning up the heat on the famous emissary from Neolithic Europe could help solve such lingering puzzles as who his kin were and what caused his death.

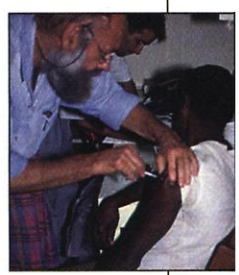
Hacked from a glacier in the Ötztaler Alps in 1991, the 5200-year-old mummy, known as Ötzi, has already provided researchers with a breathtaking view of life in that prehistoric era. He carried a copper ax—a precious object indicating a high social rank, perhaps that

Cool science. Researcher takes samples from Ötzi during 4-hour thaw in his frozen state.

CREDITS: (TOP TO BOTTOM) T. JENKINS/AP PHOTO; A. OCHSENREITER/AP PHOTO

ScienceScope

Big Bucks for Big Diseases? The European Commission (EC) is gearing up to spend as much as $1 billion a year on three diseases closely linked to poverty. The windfall, to help countries suffering from AIDS, malaria, and tuberculosis, represents Europe's share of the commitment to combat the diseases made by the G8 group of industrialized countries at its summit in Okinawa, Japan, last July. Japan is also working on its post-Okinawa aid plan, said to amount to $3 billion over the next 5 years. The United States is unlikely to spell out its commitment until after the November elections, officials say.



A high-level roundtable this week in Brussels was expected to discuss how best to spend the additional aid. Meeting participants included EC president Romano Prodi, WHO Director-General Gro Harlem Brundtland, and the health ministers of potential recipient nations such as South Africa and Brazil. But no spending decisions are likely before December, says Lieve Fransen, an EC health policy analyst who is coordinating the roundtable. "The EC clearly recognizes that we have to do more, and do it better and faster," she says.

Fieldwork China has begun to draw up a detailed plan for handling genetically modified organisms in the wake of last month's signing of a biosafety protocol to implement a 1992 treaty. The so-called framework, which officials say will take years to implement, will attempt to strengthen the country's biosafety capabilities as well as conform to international standards.

China's previous regulations for transgenic materials mainly addressed laboratory practices and were promulgated by individual ministries. But the new rules will have "a much grander scope" that encompasses protecting the country's biodiversity, says Bai Chengshou of the State Environmental Protection Agency, which will manage the effort. Bai says the new framework will allow the country to improve its assessment of bioengineering technologies and stimulate biosafety research.

Chinese scientists have responded favorably to the framework. "We should pay more attention to the possible impact of transgenetic engineering on future generations, not just on its economic returns," says Wang Changyong, a research fellow at the Nanjing Environmental Scientific Research Institute. "We should take strict precautions against any risks."

with new clues to conditions ranging from antibiotic resistance to cholesterol metabolism, says Rockefeller's Stephen Burley, who heads the five-institution consortium.

Each new center is slated to receive about $20 million over 5 years, a number that will vary depending on indirect costs paid to the institutions involved. But more money is in the pipeline. In July, NIGMS released another request for additional structural genomics centers to be funded next year. And when the current program is finished, NIH is expected to select two or three of the current crop of centers and ramp up their funding considerably.

–ROBERT F. SERVICE

CEPHEID VARIABLES

Astronomers Measure Size of a Giant's Sighs

To stargazers, Zeta Geminorum makes up the kneecap of one of the twins in the constellation Gemini. To astronomers, it is also one of the brightest Cepheid variables in the sky—giant yellow stars that grow dimmer and brighter over periods of days or weeks. Astronomers have long presumed that the surface layer of a Cepheid variable, called the photosphere, physically expands and contracts to cause this odd behavior. Now, they have caught Zeta Geminorum in the act of swelling and shrinking, making it the first Cepheid that astronomers have actually seen change its size.

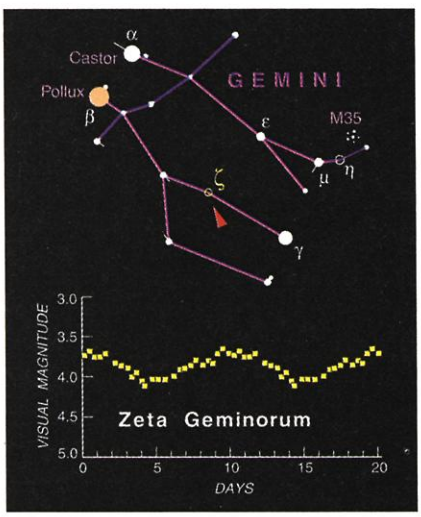
"It's been something that we've always wanted to do," says graduate student Ben Lane of the California Institute of Technology (Caltech) in Pasadena, part of the five-person team that made the observations. Earlier astronomers inferred the size of the oscillations indirectly, through the well-known phenomenon of the Doppler shift. As a Cepheid variable grows, its surface moves closer to Earth, causing its light to appear bluer; as it shrinks, the surface moves away from Earth and the light is redshifted.

Seeing the size change directly, however, has been a daunting challenge in precision astronomy. The angular diameter of Zeta Geminorum, as seen from Earth, is only about 1.5-thousandths of an arc second, or 0.0000004 degrees, and the change in its diameter over a 10-day cycle is only one-tenth of that. Picking out such a small change is equivalent to spotting a basketball on the moon—a feat beyond the ability of either the largest Earth-based telescopes or the Hubble Space Telescope.

Astronomers have now gotten around that problem by linking two telescopes into a 110-meter-wide interferometer. The Palomar Testbed Interferometer (PTI) in California has as much angular resolving power as a telescope with a mirror larger than a football field. (No such telescope exists, of course.) That makes the interferometer perfect for detecting small motions in relatively nearby objects, such as the wobble of a star with a large planet orbiting it or the pulsing of a Cepheid variable. Nevertheless, previous attempts at the PTI, as well as at two other large interferometers in Arizona and France, failed to separate the expected motion from the random jitters caused by Earth's atmosphere.

Lane attributes the Caltech astronomers' success, reported in this week's issue of *Nature*, to three factors. First, they hiked the interferometer's resolution by retuning the instrument to collect a shorter wavelength of infrared light than it had gathered in previous attempts. Second, the group filtered out atmospheric turbulence with a type of optical fiber that some of the other groups did not have. The third ingredient, Lane says, was "persistence. It took a lot of observing time," which had to be squeezed in around the higher profile search for extrasolar planets.

By last Christmas, Lane already had clear evidence of the star's growth and shrinking, and by this spring he had the most accurate estimate ever of the angular size of the oscillations. Then, by dividing the angular size of the oscillations into their absolute size (as inferred from redshift measurements), Lane calculated the distance of Zeta Geminorum as 1100 light-years from Earth.



Throbbing knee. As Zeta Geminorum changes size, it flickers on a 10-day cycle.

But the significance of the result extends far deeper into space. "In time, measurements like these will simplify and therefore strengthen astronomers' measurements of the distances of galaxies, and thus the size and age of the universe," says Jeremy Mould, an astronomer at the Australian National University in Canberra. That is because Cepheid variables are used to calibrate the distances to nearby galaxies, which in turn form a

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ScienceScope

Burning Questions The National Science Foundation (NSF) has been given some high-level advice on how to get the biggest bang for the bucks it wants to spend on environmental research. *Grand Challenges in Environmental Sciences*, released by a National Academy of Sciences panel this week, outlines the eight "most important environmental research challenges of the next generation."

Most in need of "immediate" funding are studies on biodiversity and ecosystem functioning, the consequences of changes in land use and land cover, infectious disease and the environment, and hydrological forecasting of floods and droughts. Also on the list are understanding biogeochemical cycles, climate variability, and how the world uses natural resources and recycles materials.

The report will fuel a bid by the National Science Board (NSB), NSF's overseer, to boost environmental science funding by $1 billion within 5 years; it says funding for the first four topics falls "well within the NSB's recommended increase." NSF environmental czar Margaret Leinen says the recommendations "allow us to proceed with confidence."

Deadly Embrace For the third year in a row, the U.S. Senate has endorsed the idea of doubling federal spending on civilian R&D. But opposition from Representative James Sensenbrenner (R–WI), head of the House Science Committee, will likely doom the bill—along with killing his own bid to boost information technology (IT) research.

The Federal Research Investment Act (S. 2046) passed easily last week. It calls for doubling nondefense R&D spending to more than $70 billion over the next decade. But Sensenbrenner has opposed the bill because it won't force Congress to spend the money (*Science*, 28 May 1999, p. 1452). It allows lawmakers "to champion science once, then forget about it for the next 10 years," he complained in a 19 September letter to Senator Bill Frist (R–TN), an advocate.

Frist tried to sweeten the deal this year by including Sensenbrenner's own IT research bill, already passed by the House. But joining the two bills, Sensenbrenner says, "will only ensure that neither is enacted."

Contributors: Michael Balter and Dennis Normile, Wu Qi, Jocelyn Kaiser, David Malakoff