pattern of sidebands in the climate record, including a prominent 107,000-year oscillation. Frequency modulation "changes periodically the duration of the ice ages," says Rial. "It's a pretty idea."

He can't point to a particular physical mechanism that would translate the 413,000-year cycle into a lengthening and shortening of the 100,000-year cycle, although he says that the longer cycle of sunlight changes may interact with an oscillating part of the climate system, such as ice sheets. Even so, other climate specialists are taken with the frequency-modulation idea. "I like very much the ideas of Rial," says paleoclimatologist André Berger of the Catholic University of Louvain in Belgium. "Orbital forcing is certainly the pacemaker." The fit between the predicted pattern of oscillations and the climate record is "intriguing," says geodynamicist Bruce Bills of the Scripps Institution of Oceanography in La Jolla, California, but "it would be even better if you could point to an obvious physical mechanism that would explain why the system works that way."

How the glaciation in the north got started in the first place 2.75 million years ago is another enigma. Earth had been cooling for 50 million years, perhaps because waning carbon dioxide was reducing the atmosphere's greenhouse effect—although that idea has recently been questioned (*Science*, 11 June, p. 1743). Another push toward glaciation could have come when the Isthmus of Panama closed about 4.5 million years ago, shutting the passageway between the Atlantic and Pacific oceans and redirecting warm ocean currents into the North Atlantic. That would have increased the supply of moisture to high latitudes and hence fostered the snowfalls that built the ice sheets. But sizable ice sheets still failed to form in the north for another 2 million years, suggesting that at least one more factor was still missing. Candidates have included a surge in North Pacific volcanism (*Science*, 10 January 1997, p. 161), whose airborne debris would have further cooled climate, and a change in Earth's nodding.

Now a hint of an astronomical trigger for Northern Hemisphere glaciation has turned up beneath a field of sunflowers in central Hungary: a high-frequency climatic "buzz" apparently excited by Earth's orbital wobbling. The sunflowers grow over the bottom sediments of a now-vanished lake, where Willis and her colleagues retrieved a 320,000-year climate record spanning the onset of glaciation. It is largely made up of annual layers created by minerals that precipitated out of the lake in summer, alternating with wintertime algal blooms. So far, the researchers have sampled the core at 2500-year intervals, extracting pollen whose species composition varies as the climate changes. They found an abrupt increase in pollen from plants of the cold, boreal forest that began 2.75 million years ago, the same time that marine sediment isotope records show ice sheet formation accelerating.

The pollen also shows short warmings and coolings lasting just 5000 to 15,000 years. Such cycles, also known from other records, are shorter than any astronomical cycle, and climate researchers think some may be overtones of Milankovitch oscillations created in the climate system, like the squeaking of an overblown clarinet (*Science*, 14 January 1994, p. 174). In the lake record, the buzz intensifies 2.75 million years ago, when the orbital wobbling intensified. That's just when the boreal forest raced southward and the ice sheets swelled; Willis thinks the intensified buzz could have been the trigger. She suggests that the quick bursts of cold could have fostered ice buildup, while the intervening warm periods would have been too short to melt all the ice.

Berger and others are impressed with the detailed view of climate afforded by the Hungarian lake core. "They clearly see sub-Milankovitch [climate] periodicities," says Berger, but he says the connection between Milankovitch forcing, the climate buzz, and the onset of glaciation is not yet so clear. The answer may still lie in a closer look beneath the sunflowers. **–RICHARD A. KERR**

CREDIT: (TOP) GRANT HEILMAN

PHYSICS

DOE to Review Nuclear Grant

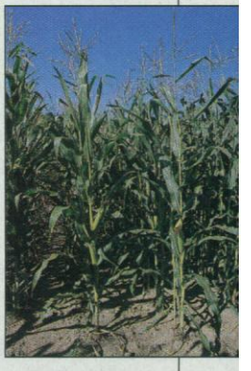
Cold shoulder. DOE is taking a second look at a grant to George Miley that critics say involves cold fusion.

The U.S. Department of Energy (DOE) is reconsidering a grant that critics say will fund "cold fusion" experiments. DOE officials this week announced that a special review panel will take a fresh look at the science underpinning the $100,000 project, which proposes to test a new method of transforming radioactive waste into harmless byproducts. The restudy represents a potentially embarrassing stumble for DOE's new $19 million Nuclear Energy Research Initiative (NERI), which DOE officials pledged would use top-notch external reviewers to pick the best projects (*Science*, 11 December 1998, p. 1980).

The grant, to George Miley, a nuclear engineer at the University of Illinois, Urbana-

ScienceScope

To GM or Not? Scientists from around the globe are planning a joint statement on the potential risks and benefits of genetically modified (GM) agriculture. Representatives from seven scientific academies last week attended a London conclave organized by the U.S. National Academy of Sciences (NAS) and the U.K.'s Royal Society to ponder the issues surrounding GM foods, which have sparked controversy in many nations. The delegates—from the U.S., the U.K., China, Brazil, India, Mexico, and the 76-nation Third World Academy of Sciences—agreed that each academy will focus on a topic, such as environmental concerns, then report back. The full group hopes to issue a statement by November. Developing nations should "take the lead" in writing the document, urged NAS head Bruce Alberts, saying it is a chance "for their voices to be heard."



Meanwhile, in the wake of reports that corn engineered to carry pesticides might harm butterflies and other wildlife, U.S. Agriculture Secretary Dan Glickman last week announced plans for "an independent scientific review" of the U.S. Department of Agriculture's process for reviewing the safety of GM organisms. The department also plans to launch eight to 12 research centers to do long-term studies of biotech farm products.

Disaster Scenario? Physicists want to dispel worries that a new particle collider will destroy Earth. This week, the *Sunday Times of London* published an 18 July story suggesting that experiments at the soon-to-be-completed Relativistic Heavy Ion Collider (RHIC) at the Brookhaven National Laboratory in New York could create rare particles or mini–black holes that would devour the planet. Lab director John Marburger quickly took to the Internet to respond (www.pubaf.bnl.gov/pr/bnlpr071999.html). "There is no chance that any phenomenon produced by RHIC will lead to disaster," he wrote. Still, just to be sure, he has asked "experts in the relevant fields" to prepare a report on the disaster scenario, which was first aired in a letter in this month's *Scientific American*.

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