

tral. The advertising will be "exquisitely" targeted to specific groups of readers, authors, and peer reviewers who use the company's services. Williams hopes to name an editor and editorial board soon.

—ELIOT MARSHALL

## TRANSGENIC FOOD DEBATE

### The Lancet Scolded Over Pusztai Paper

For more than a year, a study claiming to show that transgenic potatoes may make rats sick was at the center of a furious debate, even though its findings had never been published. Now, part of the controversial study by protein biochemist Arpad Pusztai has finally made it into the pages of *The Lancet*—only to drag the prestigious journal down into the trenches of the British war over genetically modified food.

Critics—including the Royal Society, which after a review of the raw data called the work "deeply flawed" in May—contend that *The Lancet* is exploiting the study's notoriety for its own publicity and that publication in a top journal lends the paper credibility it doesn't deserve. The U.K.'s Biotechnology and Biological Sciences Research Council called the journal "irresponsible." But *The Lancet* editor Richard Horton says that giving Pusztai's data a public airing finally allows all parties to draw their own conclusions. Besides, he says, the paper survived an even stricter scientific scrutiny than normal.

The study made headlines around the world in August 1998, when Pusztai, a scientist at the Rowett Research Institute in Aberdeen, announced in a television interview that a diet of genetically modified (GM) potatoes could stunt rats' growth and impair their immune system. Just days later, the institute suspended Pusztai and banned him from speaking to the media, saying his claim lacked a scientific basis—a verdict later repeated in an internal review. But an international group of scientists, after examining data provided by Pusztai, demanded his exoneration (*Science*, 19 February, p. 1094). Their stance fueled the British media frenzy over transgenic crops and turned Pusztai, who is now retired, into a hero for the anti-GM movement. But what his study had or hadn't shown, remained unclear.

In their paper in the 16 October *Lancet*, Pusztai and co-author Stanley Ewen, a pathologist at Aberdeen University, don't mention stunted growth or suppressed immu-

nity. Instead, they focus on abnormalities in the intestines of rats fed only potatoes equipped with the gene for GNA, a natural insecticide found in snowdrops. GNA and other lectins are thought to be potentially useful in helping crops fight off insects, but products engineered to express the gene haven't made it to the market yet. The researchers found that rats on the transgenic spud diet for 10 days had a thickening in the mucosal lining of their colon and their jejunum, a part of the small intestine, which didn't occur in animals fed nontransgenic potatoes or nontransgenic potatoes spiked with GNA at levels comparable to the transgenic ones. The findings suggest that the genetic modification of the potatoes—not GNA itself—is somehow responsible for the changes seen in the rats, the authors say. "Perhaps by introducing a gene you will activate or silence other genes in the plant as well," Pusztai explains.

But in a commentary in the same issue, three scientists from the National Institute for Quality Control of Agricultural

Products in Wageningen, the Netherlands, say the study has several flaws. For instance, the effects could have stemmed from nutritional differences between the potatoes that had nothing to do with genetic modification; with just six rats in each group, the sample size was very small; and the monotonous diet had made all the rats protein-starved—not a good basis to assess a substance's toxicity, they argue. As a result, the Dutch scientists say, the data don't warrant the paper's conclusion. Pusztai, however, points out that the diets were comparable in protein and energy content and that a sample size of six is perfectly normal in studies like this.

Nevertheless, critics say the shortcomings should have caused the journal to reject the paper. John Pickett of the Institute of Arable Crops Research in Rothamstead, one of the experts asked by *The Lancet* to assess the paper, last week cast off peer reviewers' traditional cloak of secrecy and publicly denounced the journal for ignoring his advice. "If this work had been part of a student's study, then the student would have failed whatever examination he was contributing the work for," Pickett railed in a BBC interview.

Horton responds that the journal put the paper through an unusually rigorous review, asking six instead of the usual three experts to examine it. Of those, only Pickett squarely opposed publication, he says; four others raised criticisms that Pusztai and Ewen addressed, while a fifth deemed the study

flawed but favored publication to avoid suspicions of a conspiracy against Pusztai and to give colleagues a chance to see the data for themselves. "When we had five out of six reviewers in favor of publication ... we felt we had very strong grounds to go ahead and publish," says Horton, who also justified his decision in a commentary. Horton denies that *The Lancet* sought to get mileage out of the media hype, insisting that he would have printed the paper even if it hadn't been mired in controversy. But Marcia Angell, editor-in-chief of *The New England Journal of Medicine*, a competing journal, finds that hard to believe. "When was the last time [*The Lancet*] published a rat study that was uninterpretable?" she asks. "This really was dropping the bar."

Horton says he sees nothing wrong with publishing a provocative paper: Arguments over a scientific study are "perfectly normal." "The problem is we are disagreeing about interpretation in this incredible crucible of public debate," he says. "I think everybody needs to cool it."

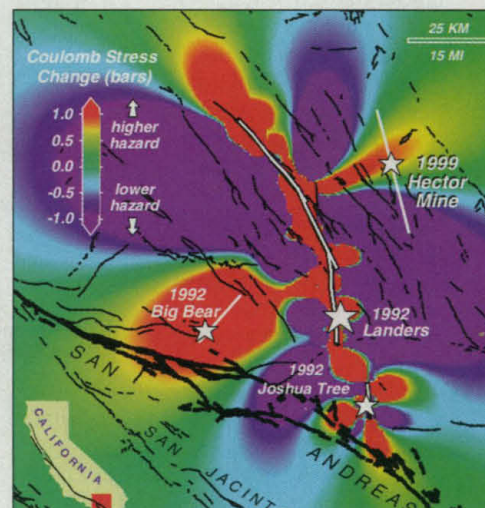
—MARTIN ENSERINK

## SEISMOLOGY

### Did One California Jolt Bring on Another?

No crustal fault is an island, seismologists are learning. Last weekend's Hector Mine earthquake, which struck the desert 160 kilometers northeast of Los Angeles, seems to support the idea that faults feel what happens to their neighbors. The magnitude 7.1 temblor—which did minimal damage because of its remote location—appears to have been triggered by the magnitude 7.3 Landers quake of 1992, which struck 160 kilometers to the east of Los Angeles. "There's clearly a relation" between the Landers and Hector Mine quakes, says seismologist Lucile Jones

SOURCE: R. STEIN/USGS MENLO PARK



**Nattering faults.** The Landers quake may have set off both the Big Bear and the Hector Mine quakes.



of the U.S. Geological Survey (USGS) in Pasadena, California, "but we clearly do not understand that relation. There are going to be a lot of hypotheses."

Geologists have speculated that faults can reach out and touch one another because earthquakes redistribute stress. When a fault ruptures, it reduces stress in broad zones to either side; their extent can be calculated from the way the fault broke. Great earthquakes like the 1906 San Francisco quake and the 1857 "Big One" in southern California reduced the stress over great swaths along hundreds of kilometers of the San Andreas fault, damping seismic activity in those areas for decades (*Science*, 16 February 1996, p. 910).

But stress can actually increase beyond either end of a ruptured fault. The Landers rupture produced prominent lobes of heightened stress across the Mojave Desert to the north and south across the San Andreas near Palm Springs and Riverside. One southward lobe, as calculated by geophysicist Ross Stein of the USGS in Menlo Park, California, and his colleagues, seemed to trigger the magnitude 6.2 Big Bear quake 3 hours after Landers struck 35 kilometers away.

Seven years later, the other shoe seems to have fallen. Early last Saturday morning, 40 kilometers of a previously unnamed fault, now dubbed the Lavic Lake fault, broke across the Twenty-Nine Palms Marine Base. The quake's epicenter and much of the rupture lie in what Stein and his colleagues calculate was one of the two northern lobes where the Landers quake intensified the stress. The match between the quake and the area of heightened stress buttresses the argument that "if you jack up the stress on a fault, you get a higher rate of earthquakes, big ones and smaller ones," says Stein.

Most of Stein's colleagues agree that faults do keep in touch with each other, speaking the language of stress. "There's clearly some relationship between the two earthquakes," says David Wald of the USGS in Pasadena. "There's no doubt stress triggering is happening."

But Wald adds that "the physics behind it is not clear." For one thing, he wonders why the small nudge from Landers would set off such a long-quiet fault. For another, stress changes depend to some extent on characteristics of the fault. Some faults, like the San Andreas, are thought to slip with essentially no friction, perhaps because of a claylike lubricating layer where the rock faces meet. Robert Simpson of the USGS calculated that if the Lavic Lake fault is also frictionless, the Landers rupture would not have heightened stress across the Hector Mine rupture. Stein argues that the Lavic Lake fault should have higher friction because it slips only infrequently and therefore hasn't developed a lubricating layer.

Whatever the physics, the Hector Mine quake, as well as the Turkey quake of last August, which might also have been triggered by an earlier quake (*Science*, 27 August, p. 1334), are persuading seismologists that an earthquake may heighten seismic threats elsewhere. For example, Stein and USGS colleague Tom Parsons estimate that the Hector Mine temblor has increased the chance of a big one on the San Andreas in the next 30 years from 41% to 44%. To understand seismic hazards of a fault, he thinks, all the chatter among its neighbors must be understood.

—RICHARD A. KERR

## ARCHAEOLOGY

### New Questions About Ancient American Site

Brad Pitt and his paramilitary protégés in the celluloid tale *Fight Club* aren't the only ones putting up their dukes and taking a swing this week. With a belligerence rarely seen in scientific spats, American researcher Stuart Fiedel has landed the first punch in a new battle over the authenticity of what may be the oldest archaeological site in the Americas: southern Chile's Monte Verde.

In the November/December issue of the popular magazine *Scientific American Discovering Archaeology* ([discoveringarchaeology.com](http://discoveringarchaeology.com)), Fiedel contends that the final report on Monte Verde is riddled with errors and omissions that make evaluation of the evidence all but impossible. The original authors counter that the errors are simply ones of bookkeeping, but it seems clear that clouds have gathered over Monte Verde once again. "The site is in limbo," says archaeologist Daniel Sandweiss of the University of Maine in Orono.

For decades, archaeologists have believed that the first inhabitants of the Americas were the spear-wielding, big game-stalking Clovis hunters, who migrated from northern Asia to Alaska along the Beringian landbridge and then trekked south between retreating ice sheets 13,500 years ago. But after 8 years of excavations in a peat bog 560 kilometers southeast of Santiago, a team led by archaeologist Tom Dillehay of the University of Kentucky in Lexington concluded that early humans had lived at Monte Verde 1000 years before the first Clovis site, building pole-frame houses and dining on mastodon, wild potatoes, and

medicinal herbs.

There are other hints of early, non-Clovis cultures, but Monte Verde's direct challenge to the Clovis-first theory fuelled intense debate. Then in 1997 a blue-ribbon panel of archaeologists visited the site and agreed in a public announcement that it was truly pre-Clovis (*Science*, 28 February 1997, p. 1256). But there were always a few skeptics, and now they are mounting a new assault.

Fiedel, a consulting archaeologist from Alexandria, Virginia, and the author of a primer on New World prehistory, wanted to know exactly where three hafted stone scrapers were found, as well as what the precise association is between these scrapers and the radiocarbon-dated materials that support a pre-Clovis date. But when he pored over the Monte Verde final report, he found dispersed and inconsistent descriptions that left him uncertain even about how many such scrapers were found. He says he was "peeved," and he began looking for similar data on the site's projectile points, cores, and other bifaces (stone tools flaked on two sides). He couldn't find it. In his article—which he says he published in a non-peer-reviewed journal so that it would be available quickly—he details 19 pages of errors, ranging from minor slips, such as individual artifacts bearing three different catalogue numbers, to more worrisome problems such as maps drawn to the wrong scales. "When I finally got an opportunity to look at the whole thing," says Fiedel, "I discovered that the report's just full of holes."

Dillehay readily concedes that errors crept into his team's massive 1300-page report, which won a 1998 Society for American Archaeology award "for the extreme care given to the site's excavation, analysis, and publication." But he says that some 85% of the glitches result from changes made in cataloguing when his team expanded test pits into large block excavations and later entered data in new computer programs. Those are common problems in large, multi-year excavations, agrees Jon Driver, an archaeologist at Simon Fraser University in Vancouver, British Columbia.

Dillehay suggests that the report is being subjected to impossibly high standards because Fiedel and other critics simply don't want to accept evidence contrary to the Clovis-first paradigm. "A colleague told me a couple of years ago that some card-toting member of the Clovis police would be stepping forward again with another blast," says Dillehay. "Well, here it is."



**Tracking the past.** Pre-Clovis people may have left these footprints at Chile's Monte Verde site.