of the business of operating vessels and retiring most of them. If that happens, much of the agency's $62 million annual ship operating budget could become available to spend on other ships, including those in the UNOLS fleet. "If we could get 300 days [of operating funds] from NOAA, that would cut the shortfall in half," says Betzer.

But not everyone agrees that supporting business as usual for UNOLS is the answer. "I think that we should go out for bids rather than have UNOLS institutions retain the right to operate [government-owned] vessels indefinitely," says Mary Hope Katsouros, the NRC ocean board's longtime executive secretary. "And I don't think that UNOLS is necessarily the most cost-effective way to run things."

Instead, the NRC is now asking whether consolidating all these vessels into a single national fleet—with a management structure yet to be determined—might be a better way to coordinate the resources of government, academic institutions, and commercial operators. The board hopes to win backing shortly from NSF, NOAA, and ONR for a 1-year study to examine the issue.

"The current system has served science well, and it's more capable than ever," says University of Texas geologist Paul Stoffa, a member of the board. "But all these issues have to be looked at in light of the anticipated shortfall." Adds Otis Brown, dean of the Rosenstiel School of Marine and Atmospheric Sciences at the University of Miami, "Right now we have a pastiche of approaches to fulfilling a national need. You can say there's strength in diversity, or you can say there must be a way to save money."

The question of whether the academic fleet could be operated more efficiently under some other mechanism is a difficult one to answer, however. Some operators point to the differences in the daily rates institutions charge NSF to operate essentially identical vessels as evidence of the potential for cost savings. Scripps runs the most expensive ships this year—the *Revelle*, at $18,000 a day, and the *Melville*, at $17,900—while the University of Washington charges $16,200 a day to run the *Revelle*'s sister ship, the *Thompson*. Woods Hole bills the *Knorr*, which is similar to the *Melville*, at $16,100 a day and the *Atlantis II*, in its last year of operation, at the bargain rate of $14,600.

### Shuffling the deck

Short of overhauling the entire system, some administrators, including Barry Raleigh, dean of ocean and earth sciences at the University of Hawaii, believe there may be potential savings in concentrating ships in fewer ports. His institution is competing for the chance to operate the NOAA's *Researcher* as the replacement for the *Moana Wave*, a 64-meter vessel based at Hawaii that the Navy is expected to retire within a few years. It's offered NOAA a package deal to operate one of its fisheries vessels, too. Raleigh estimates that by spreading the cost of shore support facilities over both vessels, Hawaii could lower the *Researcher*'s daily rate by $1000. "I don't see how you could avoid economies of scale," he says.

But other UNOLS officials says shifting vessels around won't solve the problem. John Bash, UNOLS executive director, points to a 10-year-old study showing that there are no economies of scale in operating more than one research vessel. And he notes that there are good arguments for encouraging geographic diversity: It gives more institutions a chance to benefit from having a ship on site, expands the potential pool of contributors, and spurs competition among operators to provide scientists with the best possible service and facilities. "Moving ships is not something you do lightly," adds Heinrichs, who last year suggested that UNOLS consider moving Scripps's 85-meter *Melville* to Hawaii to replace the *Moana Wave* and take advantage of Hawaii's proximity to prime research sites in the South Pacific. UNOLS's governing body deferred any action, and Heinrichs says he wasn't surprised: "In my entire career I have been involved in one such move, and the institution that lost a vessel had two left."

Raleigh, however, thinks UNOLS may have to consider a more drastic solution. "Should we bite the bullet and downsize the fleet?" he asks. "I think it may come to that, but everybody steps very gingerly around the issue out of fear that they may be the one to lose out."

Many UNOLS institutions don't agree that retrenching is a viable response to the new fiscal realities. "The issue of fleet reduction is something that needs to be approached most carefully," states the Betzer report, noting the accompanying loss of crew expertise and status for the affected institution, as well as the rapid deterioration of the asset itself. "Even in the face of [excess] resources, the UNOLS/science community should continue planning for new assets," it adds. The current budget shortfall could be a temporary phenomenon, says Bash, while pulling ships out of the water is a decision that's hard to reverse.

In the meantime, the clock is ticking. The *Atlantis* is scheduled to go out on its first cruise next spring, at a cost likely to be several thousand dollars a day higher than its predecessor's. "My biggest fear is that we won't come up with a plan, but we'll just go to sea less," says the NRC's Katsouros. "That would be a real shame."

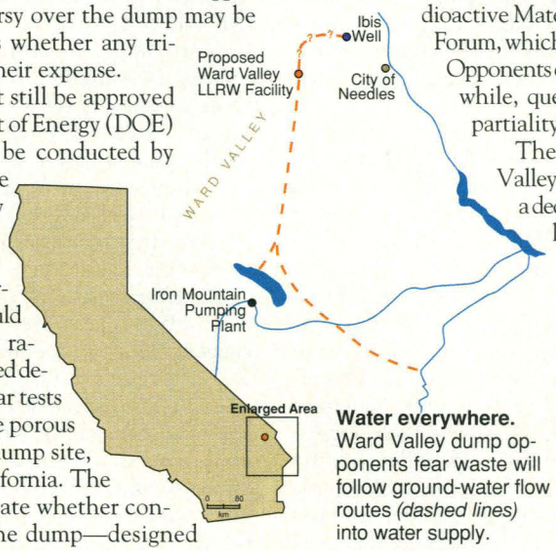
**–Jeffrey Mervis**

NUCLEAR WASTE

# Study Inflames Ward Valley Controversy

When the U.S. Department of Interior said last month that it wants yet another study of a proposed low-level nuclear waste dump at Ward Valley, California, some public officials hailed it as a triumph for public health and sober science. "We must proceed with caution and with science," declared U.S. Senator Barbara Boxer (D–CA) when the decision was announced. But scientists dragged into the controversy over the dump may be asking themselves whether any triumphs will be at their expense.

The study must still be approved by the Department of Energy (DOE) because it would be conducted by Lawrence Livermore National Laboratory (LLNL), a DOE-funded lab. If DOE gives the nod, Livermore scientists would examine how fast radionuclides deposited decades ago by nuclear tests are permeating the porous desert soil at the dump site, near Needles, California. The results could indicate whether contaminants from the dump—designed to hold waste from utilities, hospitals, and laboratories in California and other states—could seep into California's water supply. But instead of welcoming a possible resolution to doubts about the project, both sides in the controversy are assailing the study. "It's all part of a strategy of delay," charges Alan Pasternak, an LLNL chemical engineer who is technical director of the California Radioactive Materials Management Forum, which favors the project. Opponents of the dump, meanwhile, question LLNL's impartiality.




**Water everywhere.** Ward Valley dump opponents fear waste will follow ground-water flow routes *(dashed lines)* into water supply.

SOURCE: GEOSCIENCE SUPPORT SERVICES

The battle over Ward Valley has raged for nearly a decade. The U.S. Geological Survey, the Metropolitan Water District of Southern California, and the Environmental Protection Agency, to name a few, have all studied the site, and each has been lambasted for its findings, whether

or not they favored the project. Ward Valley, says Dan Hirsch, president of the Los Angeles–based Committee to Bridge the Gap, a leading dump opponent, is fast becoming "the third rail of American science."

But last May, it seemed the long battle was drawing to a close. The National Academy of Sciences (NAS) released a report declaring that even if the waste canisters leaked, radioactive contaminants were "highly unlikely" to migrate from the unlined Ward Valley trenches to either the water table or the nearby Colorado river (*Science*, 21 April 1995, p. 358). The Clinton Administration moved almost immediately to transfer 1000 acres of federal land in Ward Valley to the state for development.

The NAS left opponents an opening, however. Soil tests conducted at the site in 1989 had detected tritium, deposited on the surface by fallout from nuclear tests in the 1950s and 1960s, at depths of some 30 meters. At that rate, liquid radioactive waste could conceivably sink from the dump to the water table, 210 meters down, in about 200 years, said one member of the 17-person NAS panel, June Ann Oberdorfer, a San Jose State University geologist.

The majority of the NAS panelists downplayed the 1989 test, saying that the tritium detected in the bore holes was probably a contaminant carried down from the surface during the drilling. But just to be certain, the panel recommended more tests to see how fast radionuclides really are migrating through the Mojave soil. The tests could and should be conducted while the dump is being built, most panel members concluded.

Almost a year later, the Interior Department, which now owns the Ward Valley site, has decided to act on that recommendation—but not as a routine test during construction. Instead, at the urging of Boxer and other politicians with ties to California, the department postponed the land transfer for a year to allow time for the tests and enlisted LLNL to do the work.

In a study that would last 4 to 6 months and cost between $150,000 and $200,000, the Livermore researchers plan to monitor not only the migration of tritium but also other fallout constituents like chlorine-36 and carbon-14, which may give a clearer picture of waste migration. "We wouldn't have taken the job if it was just a tritium test," says Jay Davis, LLNL's associate director for environmental programs.

But Ward Valley proponents fear that contamination will skew the results against them in spite of LLNL's sophisticated study. Dump opponents, for their part, are worried because the University of California, which manages LLNL for DOE, is already on record supporting Ward Valley's development. They also wonder whether a nuclear weapons laboratory can be trusted to conduct an unbiased test. "We're a nuclear weapons laboratory," Davis says. "If we worked for University of Alaska, they'd say, 'You gave that answer because you're nuclear guys.' "

LLNL might still get a reprieve, because the laboratory can only proceed with the DOE's consent. Last December, Secretary of Energy Hazel O'Leary rebuffed Boxer when she requested a tritium test, saying that under regulatory law, it is up to the state of California to request such an assay. Governor Pete Wilson, a Ward Valley supporter, plans to make no such request. Earlier this month acting Energy Undersecretary Thomas Grumbly reiterated DOE's position, but said he would discuss the matter soon with Deputy Interior Secretary John Garamendi, a test backer.

If the order falls through, LLNL scientists may sigh with relief. "It's not our project, and we're not driving it," Davis says. "That's my bottom-line comment."

**–Jonathan Weisman**

*Jonathan Weisman is a science writer at the* Oakland Tribune.

CLINICAL RESEARCH

# New Zealand's Leap Into Gene Therapy

On 6 March, Matthew During, an expert in brain disease, announced that he had conducted New Zealand's first gene-therapy experiment. During injected a recombinant DNA molecule, which he designed while on a visiting professorship at Yale University, into the brains of two children with Canavan disease. (This progressive illness destroys the myelin sheathing of nerves in the brain; it figured in the movie *Lorenzo's Oil*.) The two

Hope in a New Treatment For a Fatal Genetic Flaw

By MATTHEW HAY BROWN

ROGER KARLIN and his wife, Helene, have not seen the movie "Lorenzo's Oil." Hollywood's account of the real-life efforts of a Washington, D.C. couple to find treatments for the rare disease that is ravaging their child. They know the 1992 film well enough to discuss its plot, refer to specific scenes, even quote characters. But they have been unable to bring themselves to watch it.

"It's funny," says Dr. Helene Karlin, biologist and the mother of three girls. "We haven't wanted to see it. I don't think we could handle it — even though we're living it."

The Karlins, of New Fairfield, are too preoccupied working to save their 18-month-old daughter from a rare form of leuko-dystrophy to spare even the brief emotional investment in a story so similar to their own.

Lindsay Karlin has Canavan's disease, a hereditary disorder named for Dr. Ruth Canavan, who identified it in the 1930's, in which the normal functioning and development of the brain are impaired. Roger Karlin, an internist with practices in Danbury, New Fairfield, and Ridgefield, has devoted their time and resources to organize and fund research to develop a cure.

Their efforts have led to new hope for their daughter. A team of gene therapists at Yale University now is working to develop a treatment to be attempted on Lindsay and 20-month-old Aymee Madole, the daughter of Mark and Eileen Madole of Derby. If this attempt to deliver healthy genes directly to the brain is successful, it will revolutionize the treatment of many of Canavan's, but also of children's disease, Parkinson's and other genetic [illegible]

**Informal notification.** *New York Times* story alerted federal regulators to the experiment.

patients, both girls under 2 years old and residents of Connecticut, flew to New Zealand earlier this year to receive the therapy at the Auckland Medical School. In a press release issued after the surgery, During and his colleagues announced that the therapy "could help delay the progression of a fatal neurological disease."

The experiment racked up several firsts, aside from being the first gene-therapy trial in New Zealand. It was the first use of recombinant DNA in humans to attack a disease of the nervous system (other than brain cancer), and it marked the first use in humans of a novel gene-transfer system. But for some regulators in the United States and New Zealand, it is noteworthy for another reason: It illustrates the pressures of regulating gene therapy across national borders when families are desperate for help.

The project began about a year ago, During says, when Roger Karlin, a Connecticut physician who is the father of one of the two patients, approached him at Yale seeking help for his daughter. During declined, he says, because he considered it unlikely any therapy would help. But Karlin persisted. During then "decided this was really quite a reasonable disease to use as a prototype to move the field forward."

Karlin and another Connecticut family raised funds to finance a gene-therapy experiment while During and Leaf Huang of the University of Pittsburgh worked on a vector. Their vector has three main elements: a human gene expressing aspartoacylase (which Canavan patients lack), an adeno-associated virus plasmid to insert the gene into human DNA and express it stably, and a low-risk artificial structure (including liposome and polymer).

During says he made a personal commitment to see the families through a clinical trial. The parents knew "from day one," he says, that they would have to go to New Zealand for therapy because he was due to move there in January. "I felt it appropriate to perform the procedure at the institution where I had jurisdiction," he told *Science*.

Until last summer, however, regulatory bodies were unaware of the impending therapy. During says he didn't notify U.S. authorities because the trial was to be in New Zealand, and in 1995, that country had no gene-therapy review committee. Robert Levine, who chairs a human subjects review panel at Yale, says he first learned of the project from a local paper, which ran a story on the Canavan families in June. Abbey Meyers, a patient advocate and member of the U.S. Recombinant DNA Advisory Committee (RAC), which monitors gene therapy funded by the National Institutes of Health (NIH), learned of During's project through a *New York Times* story in October. Meyers wrote on 16 October to RAC's executive director, Nelson Wivel, claiming that During planned to "ignore the rules that all American and European scientists are obeying." She argued that RAC has jurisdiction because NIH had funded the development of the vector. If RAC failed to intervene, she said, other researchers might also move clinical trials overseas.