borrowed a Geiger counter and was measuring everything." He found a hot spot in his former school. It turned out to be radium on a nasopharyngeal applicator—a device for treating nasal tumors. It was never explained why the device was in the school, but within about a half hour, Koeth had convinced a teacher to let him take the source home, gotten his parents scared that their house had become contaminated, and been exposed to 275 millirem—or nearly a year's worth—of radioactivity. "It was a pivotal moment," says Koeth. "I was a born scientist."

Like Koeth and Hanebuth's meeting, every aspect of the cyclotron has a story behind it. "Nothing was just purchased, right down to the red light on top of the machine, which we bought from US military surplus before we knew what we would use it for," says Hanebuth. Take the 200-amp, 40-V power supply. Says Koeth, "I called around, and found one for $1000. So we made a list of all the surplus we had and asked if we could trade." In exchange for some frequency counters and plug-in modules for oscilloscopes, they got the power supply. On the way home, adds Koeth, "my girlfriend started screaming that [the power supply] was falling through the car." It turned out that the 400-pound box was safe, but it crushed the jump seats in his mom's car.

The first magnet Koeth and Hanebuth scrounged up was only 9 inches in diameter. They got their first proton beam in September 1999. Says Koeth, "It was during Hurricane Floyd—I got off work early. The needle pegged, showing I had a beam." They worked on the 9- and 12-inch versions in parallel. With the 9-inch magnet, says Koeth, "I could only get 600 keV [protons]. You can demonstrate the principles at lower energies, but you need 1 MeV to do real experiments." Besides, he adds, he wanted to emulate Ernest Lawrence, who was the first to get 1 MeV and who received the Nobel Prize in Physics.

Later, Koeth found a 12-inch magnet at Argonne National Laboratory. It weighed two-and-a-half tons and had been the steering magnet for a 60-inch cyclotron that was scheduled for demolition. "Stu flew out and we rented a truck and drove it back to New Jersey," recalls Koeth. "The magnet came to us ugly," Hanebuth adds. "We stripped it and repainted it. It was a full-time job for us for quite a while." They swapped magnets and had the more powerful cyclotron working by early 2001.

The pair spent perhaps $15 000 on their creation. Koeth estimates that, had they bought new parts and "paid real money to the machine shop," it would have cost about $250 000.

Plans and projects

Relentless scroungers, Koeth and Hanebuth have already started collecting parts for their next project: a Farnsworth Fusor. Says Koeth, "It's a curiosity. It has no magnetic field, no superconducting coils. The idea is to use electrostatic confinement to produce fusion on a tabletop." The fusor was first proposed decades ago by Philo T. Farnsworth, a pioneer in developing television. But, says Koeth, "there are problems in making one. We think we have some technological innovations."

They began working on the cyclotron as undergraduates—Koeth in physics and Hanebuth in environmental science—and continued after Hanebuth went to work for the Con Edison electric company in New York City and Koeth became a health physicist and then an accelerator engineer for Rutgers. Koeth took graduate classes part time, but after returning to Rutgers from a stint at Fermilab and being hired on a project that required trips to CERN in Switzerland, Koeth says, "I realized that my course schedule was not conducive to traveling. I had an epiphany that I wanted to go back to graduate school full time." He started back in 2002. When he finishes, he says, he'd "like to pursue a career in accelerator physics, perhaps at a national lab like Los Alamos. But I'd prefer it not be weapons related." **Toni Feder**

LANL Resumes Work, Morale Stays Low

In response to a safety violation and a supposed security breach this summer, Los Alamos National Laboratory has fired four people and punished eight others. In a 15 September memo to lab staff, LANL Director G. Peter Nanos wrote, "It is now time to begin conscientiously moving forward in a safe, secure and compliant manner. The period of the last several months marks a new beginning for this institution." But many lab scientists, bitter about Nanos's handling of the safety and security lapses, are skeptical about how new the beginning really is. "Nanos sowed the seeds of discontent, and there is now a lush garden," says Rhonald Keinigs, a longtime LANL weapons scientist.

Nanos halted work across the lab in July, after two electronic storage devices containing classified data reportedly went missing and a student's eye was damaged by a laser (see PHYSICS TODAY, September 2004, page 32). Later in the summer, reports surfaced that the storage devices had never existed; the real error, it seemed, was one of inventory, not of mishandling sensitive information. By press time, LANL had completed its own investigation, but lab officials would neither confirm nor deny the existence of the storage devices. External investigations were still under way; David Cremers, a laser physicist, was preparing to appeal his firing in connection with the eye injury and an alleged cover-up; and lab staff were passing the hat for legal funds for other scientists.

As of early October, administrative tasks, much theoretical work, and some experiments at the lab had resumed. A lab spokesman said most activities would be back to normal by mid-October, and everything should be running by year's end. The work stoppage cost taxpayers $4–5 million a day; or, as the spokesman put

LANL

G. Peter Nanos, the director of Los Alamos National Laboratory, addresses employees at a lab-wide meeting.

it, "the focus on safety and security didn't cost anything above normal operating costs."

Despite being glad to be working again, lab scientists say morale remains low. Many say Nanos overreacted and that he insulted them. "We don't have what Nanos has characterized as a bunch of arrogant butthead cowboys at Los Alamos," says Brad Lee Holian, a theoretical physicist who has been at the lab for 32 years (see his upcoming Opinion piece in PHYSICS TODAY). With time on their hands during the work shutdown, Holian and a colleague compared safety records at various national labs and industries. "From 2000 onwards, Los Alamos took over the lead in safety performance among comparable labs in the DOE [Department of Energy] complex," he says. It might have been useful, he adds, "to have spent one day each on safety and security, but to shut down for two months just doesn't make sense."

As for security, Keinigs says, "there is always something one can do better. But the people with whom I work are all very cognizant of security issues. The idea that Nanos promulgated—that we have a scientific culture that led to these problems—is simply not true."

"The problems at Los Alamos are assuming the proportions of a national tragedy," says John Holzrichter, a retired Lawrence Livermore National Laboratory employee who is now president of the Hertz Foundation, a California-based organization that gives grants to graduate students in the physical sciences. "I cannot tell you how disturbed my colleagues and I are by all of this." Holzrichter and others worry that young scientists will shun LANL and other national defense laboratories, and that those who do come will lack mentors due to experts leaving or retiring early.

Concerns about both security and management at Los Alamos have been festering for a few years and have led to much talk among scientists there and beyond as to whether the University of California will continue to oversee the lab. DOE is expected to put lab oversight up for bid this fall. UC officials say the university will bid for the new contract—possibly, it's rumored, together with Bechtel Corp. Referring to the shutdown and firings, an observer familiar with all three weapons labs says that Nanos's "actions seem to be precipitous. We still don't know all the issues. But the lab has been rattled, and morale is damaged. The most significant questions the events of this summer raise are, Is Los Alamos a failed lab? And do you need to bring in a major culture change? The question that follows is, Is UC capable of it?"

Toni Feder

New Hughes Center a Biological Reflection of the Old Bell Labs

Geneticist Gerald Rubin sat in the nondescript conference room of a leftover building that once belonged to a now-defunct software company and talked like a scientist possessed by a vision.

"This is the mythical ivory tower," he said, referring not to his surroundings but to architectural drawings of a mammoth, $320 million laboratory building that is under construction a hundred yards away. "We'll have good coffee, and you just have to do science, nothing else. And that is the empowering thing—or frightening thing. We'll eliminate all of the excuses for not doing science."

Rubin, vice president of biomedical research for the nonprofit Howard Hughes Medical Institute, is, with a few notable colleagues and about $500 million in HHMI money, trying to create a biology-focused version of Bell Laboratories in its heyday. The new HHMI facility, called the Janelia Farm Research Campus after the historic farmhouse that still sits on the site in Ashburn, Virginia, will eventually be home to between 200 and 300 scientists who will have the money, equipment, and support to do high-risk science.

The laboratory, a three-layered, earth-sheltered curve of a structure being built into the side of a hill overlooking the Potomac River, will house 24 small research teams, none larger than six members, that will focus on two fundamental problems: how the human brain works and how to visualize what goes on inside living cells. Researchers are being recruited from the fields of neurobiology, molecular biology, chemistry, genetics, physics, computer science, mathematics, and instrument design. The first 50 are expected to begin work at the lab in the summer of 2006.

The scientists, regardless of background, age, or experience, will be signed for an initial six-year term, during which they will not be required to publish results. They will not be allowed to have outside grants of any sort. Nor will they get tenure. After six years, they will either be invited to stay for another five years or be asked to transition out of the lab over a two-year period. Departing scientists will be given HHMI research funding, which will make them attractive candidates to universities or other more traditional research organizations.

"The staff turnover will be high," said Rubin. "We want people to want to leave. They might stay for 10 or 15 years, but not 30. We want them here when they want to be real, working scientists." Many researchers eventually want to move into administration, teach, or do other types of work, he said. Great, he added, but not at Janelia Farm.

The lab is looking for risk takers, Rubin said, people who want "to do things that are too adventuresome for

When completed in early 2006, Howard Hughes Medical Institute's Janelia Farm Research Campus will consist of a laboratory building (left) with enough space for several hundred researchers, a hotel (right), and a small housing development. The 280-acre campus is on the Potomac River about 30 miles northwest of Washington, DC. (Artist's rendition courtesy of HHMI.)