pany was awarded $500 000 initially.

The effort by DOE has proceeded despite Congress's failure to explicitly authorize an agency program to stimulate domestic supply. A bipartisan bill, the American Medical Isotopes Production Act, was approved by an overwhelming margin of 400–17 by the House in 2009, but it was blocked from a Senate vote by former senator Christopher Bond (R-MO). The bill would have authorized DOE to spend $163 million over five years to help create a domestic industry and would have ordered an end to all US HEU exports over a 7- to 13-year period. Bond was worried that the measure might ban the importation of medical isotopes that were produced with HEU.

The University of Missouri operates one of the few remaining US reactors to be fueled with HEU. It is also the most powerful university research reactor in the US. It produced ^{99}Mo from 1967 to 1984 and is capable of meeting about half of US demand. While university officials have expressed interest in getting back into the business, they reportedly are unwilling to commit academic funding to obtain DOE cost sharing. Cost estimates to build a ^{99}Mo processing facility range as high as $150 million.

In Canada, the government is supporting development of accelerator-based production processes with a combined Can$35 million ($34.6 million). The government has said it is interested in meeting only Canadian demand for ^{99}Mo following closure of the NRU. The Dutch Nuclear Research and Consultancy Group, which operates the HFR, is planning a replacement reactor that could come on line around 2020 if funding can be found. That reactor, named Pallas after a Greek goddess, would be fueled with LEU and would accommodate either LEU or HEU ^{100}Mo targets.

David Kramer

Facilitating science in developing countries

Smart people are everywhere, but they need resources to realize their talents.

Need beakers? A computer monitor or hard drive? A −80 °C freezer? Or, is such stuff sitting dormant in your lab? Matching used equipment from US universities and companies with scientists in developing countries is part of a more ambitious goal held by a few technically savvy groups: to help universities in those countries become world-class science research institutions.

Perhaps the fastest growing among those groups, the Boston-based nonprofit Seeding Labs has outfitted labs in 16 countries with nearly $700 000 in reclaimed equipment. Another is the newer Tekla Labs at the University of California, Berkeley, which later this year will begin offering instructions for

SEEDING LABS

Seeding Labs founder Nina Dudnik (center) and Kenyatta University faculty, staff, and students celebrate the arrival of a 40-foot container of lab equipment sent last year by the nonprofit Seeding Labs.

scientists to build their own instruments for basic research.

From trash to treasure

Seeding Labs was started in 2002 by a few Harvard University graduate students who had noticed discarded equipment languishing in hallways. "It was still good. It had just been replaced by newer models," says Seeding Labs founder and CEO Nina Dudnik, who at the time was working on her PhD in genetics at Harvard Medical School. She had worked in a molecular biology lab in Ivory Coast; the other founding students had spent time in Africa, Asia, or Latin America. "We knew that the equipment could get good use elsewhere," says Dudnik. In 2008 she turned Seeding Labs into a nonprofit.

Student volunteers from five groups at universities in Massachusetts, New York, and Virginia collect some of the equipment. "We get one or two donations a month," says Tomi Amis, a senior majoring in molecular biology and co-president of the Seeding Labs student group at Harvard. "Sometimes we get lucky. Recently, a professor did not get tenure, and we were contacted by the group who took over his lab. We got an HPLC [high performance liquid chromatograph]. For the most part we get smaller stuff—water baths, centrifuges, hot plates, pipettes and other plastic ware." The student volunteers check that the equipment is working, inventory it, and eventually send it to the Seeding Labs warehouse. They also help prepare shipments to go overseas.

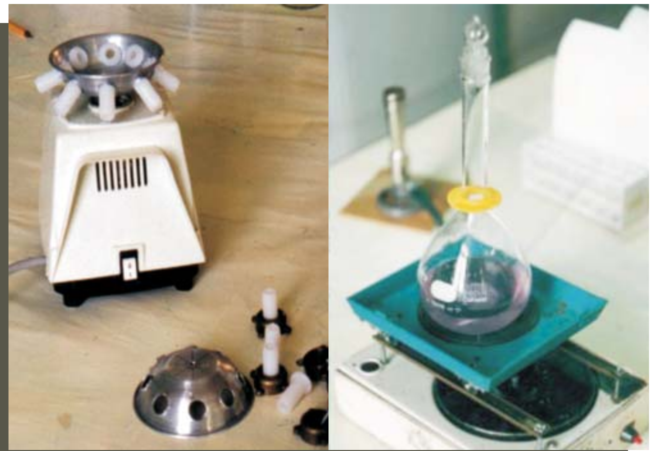
"We have inventory turning over all the time," says Dudnik. "It takes about two months to put together a shipment." Thanks to avid networking, most of the equipment Seeding Labs collects these days comes from companies, where the turnover tends to be higher than at universities.

Seeding Labs gets queries every week from scientists around the world who are in need of equipment, Dudnik says. The application process is under review, but the organization considers, among other things, scientists' research, likely social impact, and the support of the host university's administration.

Stimulating research

Early on, says Dudnik, "the physics department at Harvard was upgrading their teaching labs. We sent the old equipment to Congo Protestant University for a medical school they were starting."

And when microbiologist Hector Ricardo Morbidoni finished his US postdoc and returned home to Rosario National University, about 300 km from Buenos Aires, Argentina, Seeding Labs gave him microcentrifuges, a water bath, and other instruments. "By getting this used equipment, we could get started [with research] while applying for funds, which, from an idea to money, can take a year and a half," he says. Largely with equipment sent by Seeding Labs, his research group developed an affordable test that shortens the diagnosis time for drug-resistant tuberculosis from 40 days to 4 days.



Creative equipment like this centrifuge (left) made from a kitchen blender and this record turntable turned cell shaker (right), both by a researcher in Bolivia, served as inspiration for the Tekla Labs model of providing detailed instructions for building laboratory equipment. (Photos by Nataniel Mamani, Universidad Mayor de San Andrés, La Paz, Bolivia, courtesy of the Sustainable Sciences Institute.)

Last spring, Seeding Labs sent Kenya's Kenyatta University some $750 000 in equipment, including glassware and other consumables, a gas chromatograph, two HPLCs, a UV spectrophotometer, and a mass spectrometer—"the only one in Sub-Saharan Africa," says Kenyatta chemist Nicholas Gikonyo. "When I was introduced to Nina [Dudnik] I had started the department of pharmacy," he says. "I had made a strategic plan. The only thing we didn't have was equipment. Down here, even getting small things like test tubes is a big challenge." To cover the costs of testing, packing, and shipping the cargo, and as a sign of commitment to maintain the equipment, the university paid about 10% of the cost of buying the same equipment new.

The equipment is being used at Kenyatta for teaching and research. "For teaching, we used to sketch the equipment, because it was not anywhere here," says Gikonyo. "And we used to send samples to other countries. Now we can analyze locally." The main applications involve the isolation and identification of molecules and compounds in traditional medicine. But, says Gikonyo, "The presence of this equipment has stimulated new horizons of research. Scientists from neighboring universities are visiting us more to see how we can collaborate. The full impact is yet to be felt."

More than equipment

But equipment "is not the only ingredient for doing great science. Training, a strong institutional culture of science, and being an integral part of a network of scientists internationally all build on each other," says Dudnik. The organization is expanding into other activities to figure out "what universities in resource-poor settings need to become world class in teaching and research." For now, Seeding Labs has narrowed its attention to universities in Kenya and Ghana. "We are looking to develop programs that work and can work anywhere," Dudnik says. Eventually, she adds, Seeding Labs aims to again branch out beyond its current focus of chemistry and biology and into more countries.

Last summer, four Kenyatta faculty members spent 10 weeks working in Novartis research labs in Cambridge, Massachusetts; the pharmaceutical company is a donor to and works closely with Seeding Labs. Says Brigitta Tadmor, vice president and the global head of diversity and health policy at the Novartis Institutes for Biomedical Research, "It's a learning experience. We are trying to find out what these institutions need most, who are the people who can have the biggest impact. We are building relationships."

In October, two graduate students and a postdoc from Harvard went to Kenyatta as ambassadors for Seeding Labs. They gave presentations on such things as literature searches, data analysis, and open-source software. "I was going to give a presentation about presentations, but after I had talked to people, I expanded to include basic ideas of creating figures, organizing thoughts, and paper writing," says Millie Ray, a graduate student in genetics at Harvard. "A lot of students there take out loans to fund their own research. They are very dedicated. I learned what a luxury it is for me to do basic research as opposed to applied research, which gets funded more easily," says Ray. "There are so many progressive thinkers there. They want to work for change. But they need a little nudge in more areas than just finances."

"Scientists for scientists"

Another nonprofit organization with similar goals to those of Seeding Labs is the Sustainable Sciences Institute in San Francisco. Founded in 1998, SSI focuses on research related to public health and works mostly in Latin America and Africa. The two organizations cooperate; if, for example, SSI receives a donation of equipment on the East Coast, it redirects the items to Seeding Labs, and vice versa. But SSI is scaling back equipment shipments for now, says scientific director Maria Elena Penaranda. "Getting things through customs has become more difficult. And our finances are tight." The organization continues to hold training workshops, help establish collaborations among scientists, and give small seed grants.

A group of researchers at Berkeley is taking a different tack. They are creating a library of guidelines for building laboratory equipment. Tekla Labs is still getting started, but the plan is to make instructional videos and step-by-step manuals freely available online. Any researcher will be able to post comments or add to the list. Tekla Labs also plans to offer both remote and onsite training and support. "If you look up any piece of equipment online, someone has built it. But generally there is not a detailed explanation," says Lina Nilsson, a bioengineering postdoc, who, with a graduate student, founded Tekla Labs when their proposal won a local competition.

The inspiration, says Nilsson, came from seeing a friend from her graduate-student days at ETH Zürich return to Bogotá, Colombia, and build an atomic force microscope. Visiting a lab at the National University of San Marcos in Lima, Peru, also motivated her. "The big limitation to what science they can do is equipment. This professor had almost nothing, even though it was a flagship university."

Tekla Labs is focusing on lower-end equipment, says Nilsson. The initial list of build-it-yourself items includes a centrifuge, a spectrophotometer, and electrophoresis and sterilization equipment. "Basic microscopes and surface-plasmon resonance instruments are the top end of what we can imagine building," she says.

Next fall an engineering class at Berkeley is adding the option to design equipment for Tekla Labs. Writing detailed instructions is a big challenge, says Nilsson. "The two big components we are concerned about are ease of construction and quality control."

Many students are helping, says Nilsson. "They want to be not just good scientists, but good global citizens." This is a movement of "scientists for scientists," Dudnik adds. Success in bringing teaching and research to a high level, she says, would stanch brain drain from developing countries and strengthen the local capacity to solve local problems. **Toni Feder**

Funding for NSF underground laboratory is rejected

Citing dissatisfaction with an interagency management model, a National Science Board committee refuses to keep the South Dakota project going.

The Deep Underground Science and Engineering Laboratory (DUSEL), which proponents hope could provide a niche for the US particle-physics community, faces a shutdown as early as 1 April; the National Science Board (NSB) has rejected $19 million in funding needed to keep the project going through the fall of this year. The lab is housed in a disused gold mine in South Dakota's Black Hills.

The NSB's decision could mean layoffs for the 100 state employees working at the former Homestake Mine and an end to NSF-funded scientific collaboration involving 60 individuals. Also this spring, the lab's preliminary design is due to be submitted to NSF. Some $300 million of DUSEL's $875 million estimated cost has been spent or committed already, including a $70 million donation from credit-card pioneer and philanthropist T. Denny Sanford. South Dakota, which has named the lab in Sanford's honor, has pitched in $50 million from its taxpayers, and NSF, which prefers the DUSEL label, has awarded