BREAST CANCER

Army Doles Out Its First $210 Million

The Army is used to traversing mountains. But even experienced troops might balk at climbing this one: 2700 grant proposals averaging 60 pages apiece, copied 20 times—3 million sheets of paper, enough to fill a half mile of shelving in a warehouse at Fort Detrick, Maryland. Those are the dimensions of what may be the largest single peer-reviewing effort the U.S. Army has tackled—a breast cancer research program, created with a $210-million windfall from Congress in 1992. "The logistics have been a challenge," concedes Colonel Irene Rich, the program's director since March. But last week, with a touch of pride, the Army finished its year-long slog over a mountain of paper and announced 433 winning proposals.

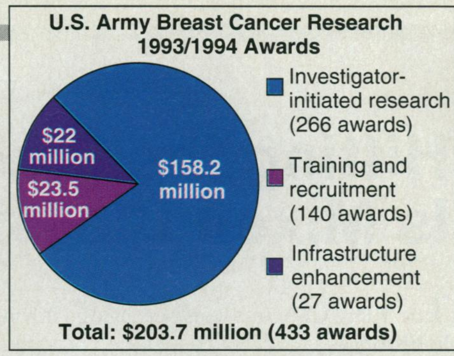
Scientists, even those who have said they would prefer to see the money channeled through the National Cancer Institute (NCI), are welcoming the results, which are heavily weighted toward investigator-initiated projects in basic cancer biology. Frederick Becker, a member of NCI's National Cancer Advisory Board and research chief of the M. D. Anderson Cancer Research Center in Houston, says he's "buoyed" by the award list. "These are really good projects. ... and the mix of people seems to be remarkable—some very well-known names but a lot of people I would have to guess are young or middle-level scientists," Becker says.

Becker's opinion is significant, given that some scientists had been concerned about how the interests of scientists and breast cancer activists would be balanced after the National Breast Cancer Coalition (NBCC), an advocacy group composed mostly of breast cancer survivors, got Congress to put the funds in the defense budget. Others worried that the money would go for mammography equipment rather than for basic science. But those fears were eased when the Army reacted favorably to an Institute of Medicine (IOM) study that recommended spending the bulk of the money on peer-reviewed biomedical research (*Science*, 21 May 93, p. 1068).

The Army then solicited proposals, and last winter, a contractor scrambled to organize 615 reviewers into 41 study sections to gauge the scientific merits of 2680 submissions. A 19-member integration panel organized by the Army narrowed the list to 408 winners. At least 25 more proposals on a wait list will be funded with the $24.2 million Congress gave the program for 1994.

The final breakdown matches the IOM plan quite closely. Investigator-initiated research grants make up 78% of the awards, with one third in genetics and the remainder spread among molecular biology, clinical, psychosocial, and etiological projects. Topics range from sequencing breast cancer genes to the role of radiation in causing breast cancer to a study of the cancer's effects on Puerto Rican women. Also following the IOM closely, another 12% will pay for training grants to support graduate students, postdocs, and midcareer scientists who want to switch to breast cancer studies. The remainder will fund "infrastructure" projects such as tissue banks and information networks. (About 7% of the total was spent on administration.)

Breast cancer activists also seem to have received much of what they wanted, according to University of Maryland epidemiologist Kay Dickersin, who is an NBCC board member, a breast cancer survivor, and a member of the integration panel. Dickersin says the Army has been "excellent to work with," and that the awards meet the expectations of



SOURCE: U.S. ARMY

Following orders. Distribution matches plan drafted by the Institute of Medicine.

NBCC. But, she says, next time her group would encourage more psychosocial and epidemiologic proposals. In addition, it wants activists to be included in the study sections, not just the final integration panel.

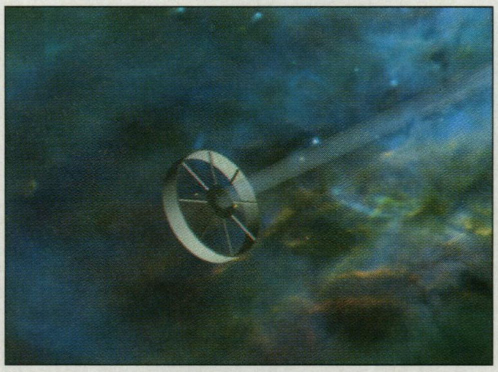
And it seems there will be a next time. Two weeks ago, Congress allocated $115 million in the Army's 1995 budget to begin the proposal process anew. That came as a surprise to researchers such as Becker, who thought the Army program was one time only. But "we didn't," says Dickersin. "The importance is, this is a whole new pie."

–Jocelyn Kaiser

SPACE EXPLORATION

Visionaries Swap Pointers on Star Flight

Most space scientists spend a lot of their time worrying about how to get their instruments into orbit around Earth. But a small band of nearly 100 scientists, engineers, and visionaries who gathered at New York University (NYU) in late August had a much bigger problem on their minds: how to fly a robotic probe to a nearby star. They discussed dozens of strategies—many, they argued, only just beyond current technology—and some daunting hurdles the venture would face.



High hopes. Riding a particle beam to the stars.

ILLUSTRATION BY ED BELBRUNO AND DAERON MEYER / THE GEOMETRY CENTER

Perhaps the biggest technical problem is a kind of Catch-22: A craft small enough and fast enough to satisfy the propulsion experts may be too small to send a detectable signal back home. And in interstellar flight, even small and fast does not mean cheap. But this was not a defeatist gathering. "There has been incremental advance in every aspect of this field," said Edward Belbruno, the University of Minnesota research associate who organized the meeting with support from NYU, the United Nations, and the Planetary Society. Added Lawrence Livermore National Laboratory physicist Jordan Kare, "We are within striking distance of proposing a precursor mission" that would fly beyond the solar system, if not to a nearby star.

To have any chance at all with funding agencies, participants agreed, a mission to the stars must last no longer than 50 years, so that prospective funders and participants would have some chance of seeing the results. Reaching a star such as Tau Ceti (11.4 light-years away) or Barnard's Star (6 light-years) on that schedule would mean traveling at up to a third of the speed of light. And that implies a probe weighing no more than a few kilograms.

Thanks to advances in microelectronics and sensor technology, building an instrument package that small may be a feasible goal, said Kare, who helped develop sensors for the lightweight Clementine mission to the moon and is now working on a Pluto mission called the Pluto Fast Flyby. And the propulsion system that accelerates the craft need not add much weight—because most or

*Practical Robotic Interstellar Flight: Are We Ready? 29 August–1 September.

all of it could stay back home. Like a ping-pong ball pushed along by a jet of water, the probe could be driven towards the stars by a beam of energy from a power source in the inner solar system. For example, Belbruno and Gregory Matloff of NYU suggested a beam of charged particles, which could propel a small spacecraft made of light, heat-resistant titanium.

Of course, particle beams or lasers powerful enough to drive even a small probe don't exist, and the energy requirements are staggering. According to Curt Mileikowsky, a retired ASEA power plant engineer from Sweden, as much as 650 billion watts of power—more than the total output of all the nuclear plants in the world today—would be needed to accelerate a 10-kilogram probe to three-tenths of the speed of light.

One way around that discouraging calculus is to shrink the probe still further. But Kare notes that there are limits. "The optical apertures [of cameras and sensors] are set by the laws of physics. ... You can do pretty respectable things in a kilogram or so, but I'm not sure what you can do in a gram, even with nanotechnology." And the demands of communicating with the home planet also set a minimum size for a stellar probe.

For now, lasers rather than radio transmitters offer the most efficient means of sending data back home, said Robert Cesarone, a Jet Propulsion Laboratory Deep Space Network manager. Cesarone speculated that on the Pluto Fast Flyby, a 0.5-watt laser and a 10-centimeter telescope could return data 50 times faster than the 3-watt radio transmitter currently planned. But again there's a catch: Phoning home from even a nearby star could require an onboard telescope with an aperture of 3 meters—a burden far greater than any of the visionaries at the conference know how to propel. And a 10-meter mirror in Earth orbit would be required to collect the data.

In the meantime, several speakers advocated embarking on a "precursor" mission well beyond the planets. Such a mission would serve as a test of the technologies needed for a true star mission and a chance to study the interstellar environment. It could also yield an early close-up of nearby stars, said Claudio Maccone of Alenia Spazio–Italy, who advocated a trip to the solar focus—the point 550 times Earth's distance from the sun where the sun's gravity, acting as a lens, brings light from distant stars to a focus.

Even such first steps toward the stars may sound visionary, but that doesn't faze Kare: "We could clearly do some of those missions, and we are very close to where they are the next sensible thing to do."

–Larry Krumenaker

Larry Krumenaker is a free-lance science writer in Hillsdale, New Jersey.

LABORATORY WASTES

Toxic Dispute Costs Stanford $1 Million

Stanford University has agreed to pay the state of California nearly $1 million to settle a protracted dispute over charges that the university has mishandled hazardous wastes, the bulk of which is chemicals from its research laboratories. The university has admitted some violations, but it says many charges were trivial, and it is complaining that the state's Department of Toxic Substances Control (DTSC) is holding the school to standards set for industry—standards that are far higher than other research institutions have to meet.

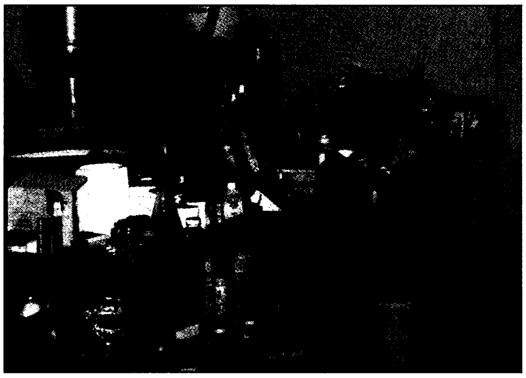
The settlement, announced by Stanford officials on 27 September, involves a payment of $460,000 to cover more than 1600 alleged violations of hazardous-waste regulations over the past 6 years. As part of the deal, Stanford will give an additional $300,000 to three groups that focus on environmental education, and it will pay DTSC another $235,000 for the costs of investigating the school and enforcing the regulations.

As stipulated by the settlement, Stanford has put its researchers on notice that they will face increased scrutiny for the next 2 years. In addition to attending training programs for handling hazardous wastes, researchers now must also be stricter about labeling chemicals. Abbreviations, such as "EtOH" for ethanol, are no longer acceptable. "It is really hard to comply in such detail," says Stanford Vice Provost Charles Kruger, stressing that the regulations were designed for oil refineries and the like: "I wouldn't wish it on other schools." That concern was echoed by Lawrence Gibbs, head of Stanford's Environmental Health and Safety Program. Gibbs, who came to Stanford from Yale University, says "I've not seen another state that looked this closely at the laboratory level."

In fact, however, Stanford brought such close inspection on itself. In 1983, it received a permit to store hazardous wastes for longer than 90 days in a central storage facility (other universities store wastes for less than 90 days). This long-term storage was supposed to save the school money by reducing the number of trips outside contractors must make to remove the wastes. But it also subjected Stanford to routine monitoring by the state agency; other schools typically are monitored by county health departments.

Stanford officials stress that none of the alleged violations involved environmental damage or injury to people. And while they admit to 40% of the 1600 violations they were charged with, they branded the rest "personal and idiosyncratic" readings of the regulations. A full 75% of the DTSC citations they received were "technical," contends a Stanford press release announcing the settlement, focusing on "process and record keeping, labeling issues, and failure to report to the agency."

DTSC spokesperson Allan Hirsch says his agency is pleased with the settlement but is "a little disappointed" about how Stanford has downplayed the seriousness of the violations. "They've been telling the public that we've been nitpicking," says Hirsch. "Stanford is not paying $995,000 because of some picayune violations that we found. ... These problems are as serious as any industrial site we've investigated." Hirsch ticked off a long list of problems found at Stanford, including illegal dumping of mercury, improperly



CALIFORNIA EPA

Cart it away. Overcrowded storage was one reason for Stanford's recent settlement.

trained staff, open containers of chemical wastes, and overly crowded storage facilities.

Gibbs concedes that before he took over in 1992, the university had "operational deficiencies" in its hazardous-waste handling. Gibbs says those problems mainly had to do with the school's central storage facility, and they were corrected by the time he took over. Gibbs said that if other schools were inspected with equal rigor, they would be learning the same painful and expensive lesson that Stanford is. Perhaps, but when the University of California, Berkeley's, hazardous-waste disposal program was inspected recently by the DTSC after a complaint, little was found beyond labeling problems. "By and large, the UC Berkeley hazardous-waste handling program is pretty good," says Hirsch.

Given the headaches caused by the long-term storage program, Stanford has decided it is more trouble than it is worth. The school recently asked DTSC to de-permit its long-term storage facility, and on 6 October it received permission to do so. But that won't end Stanford's headaches: DTSC still plans to conduct routine inspections of the school's labs for the next 2 years.

–Jon Cohen

With reporting by Marcia Barinaga.