to winning funds."

Social scientists are also unhappy because the report suggests cutting back their funding to support research in technology. Anders Jeffner, secretary-general of the Swedish Council for Research in the Humanities and Social Sciences, says that he personally does not agree with the logic of pitting social sciences and technology against each other. "If you increase technological knowledge, there also has to be an increase in knowledge about how to handle technology," he says. Boel Flodgren, rector of Lund University, says such a choice is regrettable, but increasing efforts in natural sciences and technology will be vital for Sweden, with its reliance on heavy industry. "We have realized that we are lagging behind in using and generating new knowledge on our own. We can't live off giving out Nobel Prizes," she says.

As for the independent foundations, the Hagström committee's options were limited: The government cannot close them down because they are protected by statute. But the committee suggests that their political independence be sharply reduced. The report advocates replacing the current boards—which are made up of a mix of academics, industrialists, and politicians—with boards that consist entirely of parliamentarians. That idea has drawn mixed reviews from the scientific community. A number of researchers who spoke to Science were guardedly supportive, as long as projects are also peer reviewed. Balancing resources among different fields should be the responsibility of politicians, says zoologist Dan-E. Nilsson of Lund University, the driving force behind an informal council of professors dedicated to preserving Swedish basic science.

The Hagström report is now being sent to interested parties for several months of consultation. If the initial reactions are anything to go by, the newly installed Social Democratic minister of education, Thomas Östros, will have plenty of opinions to work with when he draws up his plans this coming spring. The government hopes to put any changes in the structure of research funding into effect by January 2001.

–ANNIKA NILSSON AND JOANNA ROSE

Nilsson and Rose are science writers in Stockholm, Sweden.

SCIENCE FUNDING

Brazil's Budget Crunch Crushes Science

Two cuts in the 1998 science budget, followed last week by an announced cut in the 1999 budget, have brought many science projects to a halt

RIO DE JANEIRO—It's more than 90°F outside. But no one turns on the air conditioner in the stuffy room in the Brazilian Center for Physics Research (CBPF) here, where representatives of Brazil's science establishment are meeting to discuss how to save the nation's scientific institutions from collapse in the midst of Brazil's economic downturn. With a budget deficit expected to reach 900,000 reais ($750,000) in January, the research center can't afford to cool its offices or conference rooms. "Our fear is that we will have to pay our bills out of next year's budget allocation," says João dos Anjos, CBPF's assistant director.

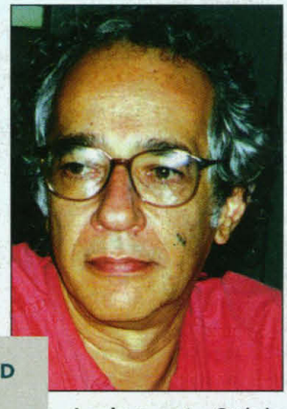
The physics center is not alone. Cutbacks in electrical use are common in cash-starved Brazilian universities and research centers these days. To meet the demands of the International Monetary Fund and other foreign lenders, who last week approved a $41.5 billion loan package, the free-spending Brazilian government cut its 1998 budget this fall, and it has agreed to slash its 1999 budget by $7.3 billion. As a result, on 10 November, the government announced that next year (the fiscal year begins in January), the science ministry will receive $619.4 million—18.7% less than it had requested.

The spiral began in earnest on 8 September, when the treasury department cut $160 million from the science ministry's already tight 1998 budget of $747 million. A second decree, issued on 30 October, trimmed another 5%. These cuts have pushed many universities and laboratories to the brink of insolvency, and with next year's budget now set well below the original 1998 level, little relief is in sight. The Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), the country's principal science funding agency, has distributed no new money for research in 1998. The only research funds available have come from the science ministry and from now-depleted state agencies. Only wealthy São Paulo still funds research, and the federal science ministry's direct support is limited to $50 million for multiyear, multisite projects.

FEDERAL EXPENDITURES ON SCIENCE AND TECHNOLOGY IN BRAZIL (1990–1997)
(Thousands of 1995 U.S.$)

Year	Expenditure	Percent of 1995 Expenditure
1990	2277.9	93
1991	2145.5	87
1992	1635.2	67
1993	2288.8	93
1994	2466.8	100
1995	2457.0	100
1996	2350.9	96
1997	2311.0	94

CREDIT: SOURCE: CNPQ; PHOTO: VALQUÍRIA DAHER/REVISTA CIÊNCIA HOJE



Losing out. Otávio Velho says science lacks political clout.

Several ministers have rallied congressional support to minimize cuts in their 1999 budgets, but the science minister has not been among the lucky ones. "It's at times like this that science loses out, because we have no lobby," says Otávio Velho, anthropology professor at the National Museum of the Federal University of Rio de Janeiro.

Particularly hard hit is the CNPq. The science ministry slashed CNPq's 1998 budget from $479 million to $361 million—a 25% drop. It's been 2 months since the CNPq has paid bills for electricity, water, cleaning and security services, and rent for its headquarters in Brasília, capital of Brazil.

The agency oversees 10 scientific institutes, and no program has been spared the knife. The National Observatory expects to end the year with a debt of $210,000, including unpaid utility bills. Brazil's observation time on the La Silla telescope in Chile is scheduled for December, and astronomers are planning to pay travel and lodging out of their own pockets. Failure to show up could break Brazil's agreement with the European Southern Observatory, which administers the telescope, and cost Brazil the right to take part in the project. The observatory lacks the money even to pay for the gasoline needed to travel by car to a local telescope.

The situation is not much better in many

of Brazil's universities. The Federal University of Rio de Janeiro, the second largest public university in the country, cannot pay its telephone and electricity bills. And other public universities report similar straits.

Especially galling to many scientists was a directive, issued on 16 October by CNPq's president, José Galizia Tundisi, freezing funds for most new research and postgraduate fellowships and requiring the return of airline tickets that had already been issued. The agency also canceled funding for about 30 scientific meetings planned for the coming months. These measures drew sharp protests from the scientific community, prompting the science ministry to issue a statement on 5 November to try to calm things down. "We guarantee the same number of fellowships in 1999 as we had this year, and grant payments will continue to be made on time," promised Lindolpho de Carvalho Dias, interim minister for science and technology. (Science minister Israel Vargas was out of the country.)

While researchers throughout most of Brazil are tightening their belts, they are casting envious glances at their colleagues in the state of São Paulo. The richest state in Brazil, São Paulo gives 1% of its state tax receipts to the Foundation for Support of Research of the State of São Paulo (known as Fapesp). As a result, from 1998 to 1999, Fapesp's budget will increase $16.8 million to about $295 million—the equivalent of 45% of the federal science ministry's entire 1999 budget. This has led some researchers to argue for a sharp reduction in São Paulo's share of federal postgraduate and research fellowship funds. But Carvalho Dias promised last week that São Paulo's fellowship funds will not be raided.

Carvalho Dias also offered some solace to scientists working in un–air-conditioned offices. Unpaid utility bills at the nation's premier research institutes and their libraries will be covered by the end of the year, he said. If so, the group that meets at CBPF each Tuesday to discuss the financial crisis afflicting the country's science may at least get some relief from Brazil's summer heat. **–CÁSSIO LEITE VIEIRA**

Cássio Leite Vieira is a science writer in Rio de Janeiro.

MICROBIOLOGY

Training a Molecular Gun On Killer *E. coli*

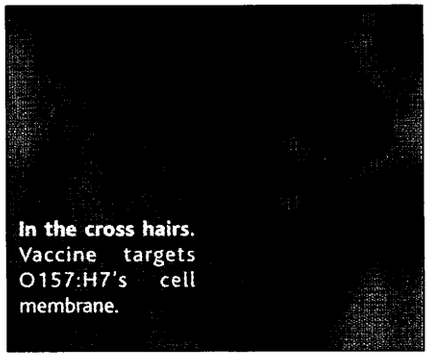
Scientists are hoping to add a vaccine to a thin arsenal against O157:H7, a bacterium that kills scores of people every year in the United States

Researchers at the National Institutes of Health (NIH) are closing in on the development of the first vaccine against *Escherichia coli* O157:H7, a pathogenic version of the common gut bacterium. Tests of an experimental vaccine showed promise in adults earlier this year, and the researchers are about to apply for approval to test it in young children. If the trial gets the go-ahead and the preparation passes further tests, experts say, a vaccine for people and one for livestock could be available early next century.

First identified in 1982, O157:H7 made headlines 5 years ago when contaminated hamburger meat sickened more than 500 people, triggering symptoms such as bloody diarrhea and kidney failure. Since then, the bacterium has turned up sporadically in everything from raw milk and apple juice to daikon radishes and drinking water. Some 20,000 cases occur each year in the United States, resulting in about 250 deaths; young children are the main victims. Moreover, O157:H7 shrugs off antibiotics with ease.

To tackle this daunting public health threat, a team led by NIH immunologist Shousun Szu is combining cutting-edge molecular biology with a method that dates back to Louis Pasteur. They homed in on O-specific polysaccharide, a molecule that studs the bacterium's cell membrane "like hair on the scalp," Szu says. Its structure is unique to O157:H7, she says, and thus serves as a good vaccine target.

The polysaccharide alone would make a poor vaccine, partly because it is too small for the body's immune system to notice. To solve this problem, Szu's group followed an approach developed 20 years ago by NIH pediatricians John Robbins and Rachel Schneerson. Szu bonded the polysaccharide to a carrier protein, which flags it for the immune system. In the future, Szu says, it may be possible to use a carrier similar to the O157:H7 toxin that triggers hemolytic uremia syndrome; this would create a powerful one-two punch against the organism.



In the cross hairs. Vaccine targets O157:H7's cell membrane.

CREDIT: CDC

The team tested the conjugate vaccine in adults. Within 4 weeks, all 87 volunteers had substantial blood levels of antibodies to the O157:H7 polysaccharide, with no observed side effects. More importantly, the subjects' blood serum contained enough antibodies to kill O157:H7 bacteria, even after being diluted at least 1000-fold. For the next step, Szu's group is preparing to submit to an NIH safety panel a protocol for a similar study in 60 children aged 2 to 4.

While clinical trials press ahead, Szu's team is hoping to design and test an O157:H7 vaccine in cattle—up to 2% carry the bacterium in the United States. In cattle, however, O157:H7 doesn't attach to the gut lining like it does in people, where it is easily reached by antibodies. It's unclear whether cow antibodies can reach the free-swimming bacteria in the intestines and stomach, says Mike Doyle, director of the University of Georgia's Center for Food Safety and Quality Enhancement in Athens. He's pursuing an alternative approach that involves feeding animals several harmless *E. coli* varieties believed to inhibit the growth of O157:H7. On another tack, Cornell researchers have found that in animals fed hay rather than grain for a few days before slaughter, gut conditions favor nonlethal *E. coli* (*Science*, 11 September, pp. 1578 and 1666). "The more control points we can develop, the better," Doyle says.

If researchers manage to create a working livestock vaccine, industry officials say they are keen to give it a try. "Assuming that the vaccination program would be no more expensive than some of the vaccinations they give cattle today, I believe people would use it," says David Theno, a vice president at the fast-food chain Jack in the Box. Restaurant groups, he adds, may insist that their meat come from vaccinated animals.

Scientists are trying not to raise public expectations too high, however. "No single intervention is going to get rid of this problem," says Phillip Tarr, a pediatrician at Seattle's Children's Hospital and Regional Medical Center who has treated hundreds of O157:H7 infections. "None are magic bullets. It's not going to be easy to eradicate: We don't have a sterile food supply and never will."

–RICHARD A. LOVETT

Richard A. Lovett is a writer in Portland, Oregon.