SCIENCE IN CANADA

Funding Crisis Grips Genome Research

Canada's genome program, which leapt out of the starting blocks with great promise 4 years ago, is suddenly struggling to stay on its feet. It was plunged into crisis this summer as the Canadian government followed through on a 4-year plan to cut research budgets, a policy that will extend through 1999. In keeping with the new austerity, the chief contributor to the Canadian Genome Analysis and Technology program (CGAT)—a ministry called Industry Canada—said it cannot give CGAT any more support. Without a big backer, the $22-million, 5-year program, which has funded everything from mapping of human chromosomes and sequencing mouse immune system genes to research on social issues, will soon run out of grant money.

CGAT's second largest contributor—the Medical Research Council (MRC)—has offered $5 million toward a renewed genomics program, but only if others put in twice as much. The Canadian National Cancer Institute has offered $1 million, as has the Social Sciences and Humanities Research Council, but so far, CGAT's leaders haven't found anyone with deep pockets willing to kick in the rest of the money. The result: An effort that rivalled the U.S. and British genome projects in quality is about to hit the wall. The first round of CGAT grants will expire next summer. And CGAT is already telling researchers not to apply for new grants.*

Half a dozen leading Canadian geneticists contacted by *Science* said they're concerned that if Canada allows the existing CGAT program to disappear, it may never regain the lost ground. For example, Peter St. George-Hyslop of the University of Toronto, a leading Alzheimer's geneticist, says, "It's very worrying not to have that expertise [in genomic technology] being cultivated within one's own country." Lap-Chee Tsui of the Toronto Hospital for Sick Children, a pioneer of human chromosome 7 research and a discoverer of the cystic fibrosis gene, thinks a cut in the genome program (which partially funds his work) could make it hard for Canadian researchers to get quick access to new technologies in the future. "It's like computers," Tsui explains. "If you're involved in developing a new computer, you get the newest model; if not, you have to wait for someone to give you an old one." Michael Hayden of the University of British Columbia, adds: "It's a very tough situation" affecting "the whole climate for research in Canada."

Ronald Worton, director of research at the Ottawa general hospital and chair of CGAT's management council, says he's been trying to round up new contributors, but hasn't "sorted it out yet." Worton is concerned that potential sponsors may be put off by negative news reports, and he insists the program has not been abandoned. He's hoping for a last-minute rescue this fall. But MRC president Henry Friesen says the "fiscal reality that we're in today" makes it "very improbable" that CGAT will continue in its present form. The funding promised so far isn't enough to sustain the old CGAT structure, says Friesen.

One "realistic option," Friesen suggests, would be for genome scientists to adopt an entirely new structure: a "centers of excellence" arrangement that links academic researchers with industry. To do this, he says, scientists would have to confederate into a "network" and apply "en masse" for funding as a single management unit. They would have to name a single management group, identify specific research goals, and sign up industry partners. This kind of partnership might appeal to the Natural Sciences and Engineering Research Council, which is encouraging industrial partnerships in other areas of research, says Friesen, and it would help provide a business-linked economic rationale for the genomics program. But, as Friesen notes, efforts to make this dramatic shift in management are coming "a bit late" to avoid disrupting some grants.

Even if it could be pulled together in a hurry, a network arrangement might not appeal to some of the scientists now funded by CGAT. For example, Ford Doolittle, the geneticist at Dalhousie University, Halifax, whose team is sequencing the archaebacterium *Sulfolobus solfataricus*, has qualms about shifting from the traditional academic style to this more corporate approach to supervising research. He and another Dalhousie scientist, Michael Gray, believe that peer review—rather than network-based goal setting—is more likely to produce excellent results.

As Canadian genome researchers continue looking for sponsors, some say their task is being made more difficult by leaders in the U.S. human genome program. The Americans have boasted so often that they're below budget and ahead of schedule that Canadians are beginning to believe that they can't keep up or that "everything's been done," says Tsui. That sends "exactly the wrong message" to politicians, Tsui believes. "Of course we can't compete with the U.S. and U.K.," Tsui says, but he adds that in certain areas of genomics, "we are world leaders."

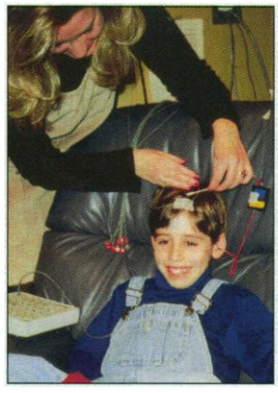
–Eliot Marshall

For a complete list of CGAT grantees, see http://cgat.bch.umontreal.ca/CGAT/projects.html.

NEUROSCIENCE

Learning Defect Identified in Brain

Researchers who study learning disabilities have known for years that many children who lag behind in language or reading skills have trouble distinguishing between certain spoken syllables known as phonemes. Now a research team led by Nina Kraus of Northwestern University has found what may be a biological basis of that problem. By recording brain waves, they showed that in at least some of these children the brain's auditory system simply doesn't recognize the syllables as different. The finding, which is reported on page 971, is exciting, says Purdue University speech pathologist Rachel Stark, because it is the first to "demonstrate neurophysiologically that these children are different from those who are developing language and reading normally."



Wired. A child is prepared for the hearing study.

It also dovetails with the recent discovery that computer games designed to teach language-impaired children to distinguish between certain rapidly delivered sounds can boost their language skills (see *Science*, 5 January 1996, pp. 27, 77, and 81). That finding, by Paula Tallal of Rutgers University in Newark, New Jersey, and Michael Merzenich of the University of California, San Francisco, grew out of earlier work by Tallal. It implied that children who have trouble distinguishing phonemes have a defect early in the brain's processing of sounds, before phonemes reach its special language centers. The current results support that notion by demonstrating a neurological defect in the early sound-processing pathway, and might lead to ways to identify children who would benefit from speech–sound training methods, including Tallal's and Merzenich's.

Kraus and her coworkers began their study by testing the ability of learning-impaired children to distinguish between different closely related phonemes. As expected, they found that the kids had a much harder time than normal children, although the effect was not uniform, and certain combinations, like "da" versus "ga," were more problematic than

others. Not all learning-impaired children had the problem, however.

To find the source of the difficulty, the team then compared the brain waves of children who had trouble with "da-ga" to those of normal children. With electrodes taped to their heads, the children sat watching and listening to a video on TV, while trains of sounds—either "da-da-da-da" or "da-da-da-ga"—were piped softly into their ears. The children weren't asked to distinguish between the sounds, and the soundtrack of the video probably kept them from noticing them at all. But their unconscious brains were tuned in, and in the normal children the brain waves of the auditory system, including the auditory thalamus and cortex, changed shape abruptly when "ga" followed a train of "da"s. There was no such change in the children who had trouble telling "da" from "ga." That, says Kraus, means that at this early step in sound processing, even before the child becomes consciously aware of the sounds, the brain has already failed.

That result, Tallal and Merzenich argue, strengthens their case against a competing idea: that the defect in learning-impaired children is in the language centers of the brain, rather than the auditory system. But pediatrician Sally Shaywitz of Yale University, an advocate of the language-center hypothesis, disagrees. "Learning disability is a broad term," she says, arguing that the children with the auditory defect may be different from the dyslexic children she studies. Kraus agrees that "some children may very well have learning problems that are more linguistic in nature." But her team's work, she maintains, shows that "there is a subset of kids with learning problems who really have difficulty perceiving speech sounds at a basic acoustic elemental level."

Among the unanswered questions is whether children with the auditory defects can benefit from training aimed at helping them to hear the phoneme distinctions. One reason for optimism is the Northwestern team's finding that the abnormal brain response isn't hardwired. In studies with normal adults they showed that the response of the auditory system changes when the subjects are trained to make finer distinctions between sounds. "This is an area of the brain that changes with learning," says Kraus's co-author, Therese McGee. Kraus and her colleagues are planning studies to see if the same is true for learning-impaired children, and if an improved auditory-system response correlates with better learning ability.

If it does, Tallal says, someday it may be possible to use the neurophysiologic testing to identify kids at risk for learning problems who would benefit from auditory training very early, even before their learning problems set in. That approach, she says, may be able to "keep the kids from ever getting impaired."

–Marcia Barinaga

INSTITUTIONAL PROFILE

Florida State's Magnet Lab: Attracting Funds and Hopes

TALLAHASSEE—Mention this Florida Panhandle city to most people, and condensed-matter physics isn't likely to be the first association they come up with. But to magnet scientists it's fast becoming the Mecca of their discipline. Physicists have been making pilgrimages here since 1993, when a new national laboratory opened its doors on the campus of Florida State University (FSU).

In a move that stunned many scientists at the time, FSU wrested a grant to establish the facility—the National High Magnetic Field Laboratory (NHMFL)—away from the Massachusetts Institute of Technology (MIT) in 1990. Vice President Albert Gore showed up to dedicate the lab in 1994, and earlier this year the National Science Foundation (NSF) awarded it a new 5-year contract worth $87.5 million. The award will raise the lab's funding level by about 45%—enough to keep its programs running smoothly into the next century.

MICHAEL DAVIDSON/NHMFL

Practical art. Organic superconductor with a 10.4 K transition temperature made by NHMFL.

That's an impressive coup for a rookie research center, particularly because the lab has won these funds from the federal government at a time when many academic departments are struggling just to stay afloat. But scientists are now wondering whether the lab's fund-raising feats will be equaled in coming years by similarly spectacular science. It's still too early to predict what NHMFL will achieve, but its staff recruitments, world-class magnets, and agenda suggest that it is already becoming an important player in areas ranging from high-temperature superconductivity to biology.

NSF decided in the late 1980s to bet heavily on magnet science because its leaders—including former NSF Director Erich Bloch—argued that the investment would lead to important breakthroughs in such critical technologies as semiconductors, magnetically levitated trains, and magnetic resonance imaging (MRI) machines. With higher magnetic fields, the rationale went, physicists would be able to understand and improve these devices to a degree never before possible. What's more, U.S. officials viewed magnet technology as vital to the competitiveness of high-tech American industries, especially in the face of increasing competition from Japanese and European magnet labs.

When NSF announced that it would award a grant to establish a national magnet lab, many assumed that MIT would win the competition hands down. MIT's Francis Bitter National Magnet Laboratory had for 30 years held a tight grip on U.S. magnet science and was an acknowledged world leader in the field. But FSU's Jack Crow, who had recently transferred from Temple University, decided he'd take a shot at the title.

After enlisting the University of Florida (UF) and Los Alamos as research partners, he secured $58 million in backing from Florida's legislature. Then he scrambled in 4 months to write an ambitious proposal that promised a world-class facility within 5 years. At the time, many independent scientists felt it would take the Florida lab that long just to catch up to the Bitter lab in magnet technology. But NSF was impressed. After it awarded the lab to FSU, the NSF's governing science board, in a letter signed by Chair Mary Good, responded to MIT's protests by arguing that the Florida team's enthusiasm and the state's matching offer demonstrated a commitment to magnet science not evident in MIT's proposal.

The state of Florida followed through by providing more than $80 million in capital funds—about $22 million more than it initially pledged. With such generous support, the lab had little trouble getting off the ground. This strong financial support was essential, but it was Crow, the lab's director, who made things happen. After muscling aside MIT, Crow began building a state-of-the-art facility from scratch. One of his first hires was chief scientist Robert Schrieffer, a Nobel laureate physicist who had recently retired from the University of California, Santa Barbara. Together, Crow, Schrieffer, and UF's physics Chair Neil Sullivan began recruiting with the zeal of college football coaches. "It's like starting from the beginning and hiring the