RESEARCH MANAGEMENT

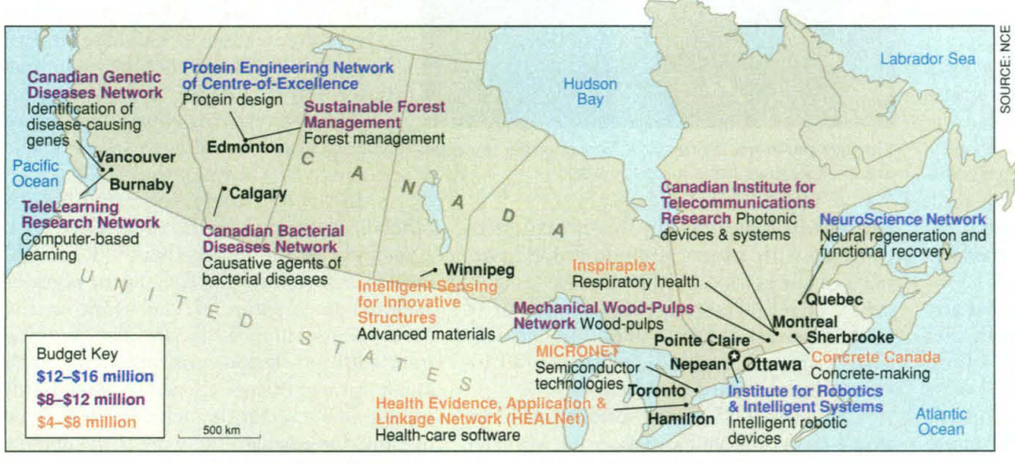
Spat Over Intellectual Property Threatens Canadian Networks

OTTAWA—The Canadian government, like its neighbor to the south, has been trying to forge stronger links between the nation's private companies and universities. But a new report on one such program warns that this relationship could fail to bear economically valuable fruit unless universities relax their grip on technologies with commercial potential. One research manager in the middle of disputes over intellectual-property rights calls the issue a "ticking time bomb."

The issue is coming to a head over an innovative program launched by the Canadian government 8 years ago: a network of university-based research centers aimed at strengthening industrial R&D through joint projects with private companies. The effort has worked well enough for the federal government to make the Networks of Centres-of-Excellence (NCE) program a permanent feature of its budget that comes out next week. But a report by an outside consultant warns that unless fundamental intellectual-property issues are settled, the program may not achieve its objectives. "It's becoming more awkward as we go along," says Andy Salama, an electrical engineer at the University of Toronto and scientific leader for MICRONET (Microelectronic Devices, Circuits, and Systems for Ultralarge-Scale Integration). "If we don't resolve it, it's going to blow up in our faces."

MICRONET is one of the 15 original network centers chosen primarily on the basis of scientific excellence. They link researchers from different universities and companies to form multidisciplinary teams to tackle research problems relevant to industry in disciplines ranging from protein engineering to wood-pulping processes (see map).

From the start, the networks—which conduct research on campus but are constituted as independent entities—were supposed to attract a small portion of their funds from companies. However, 4 years ago, Ottawa increased the pressure to generate outside financing by cutting the program's budget to $190 million from $240 million over 4 years and putting a priority on the ability to generate private-sector financial contributions. Four of the original networks were booted from the program for failing to generate adequate corporate interest. (Four new NCEs were added in that second phase, while a fifth dropped out, bringing the current total to 14.) The government's new budget will also ask the nation's three granting councils, which fund most university research in Canada, to chip in $7 million a year for the program from their shrinking budgets.



Spreading the wealth. Intellectual-property issues could hinder the ability of Canada's network of 14 campus-based research centers to strengthen the country's economy.

Thus far, the networks say they haven't done too badly at generating industrial alms. Current projections indicate industrial contributions to NCEs will double to $7.9 million in the second 4-year phase of the program, while in-kind support from companies will grow even faster, from $7.6 million to $17.1 million, over the same period. But network managers are worried that current university policies will inhibit further growth. "Why would companies invest a lot of money when they're not going to own the intellectual property?" argues Canadian Institute for Telecommunications Research scientific leader Maier Blostein. Adds MPB Technologies Inc. President Morrel Bachynski, "If we're just going to put in money to help our competition, it's not a smart way of doing business."

The problem stems from a quirk in the rules governing Canadian research that allows universities to set their own policies on intellectual property. About half retain ownership for themselves, while the rest vest it with the researcher, provided he or she pays all patenting costs and pays the university royalties on any profits. Ottawa makes no claim to the fruits of federally funded research, essentially providing its monies as a gift.

That laissez-faire attitude has led to some rather messy intellectual-property arrangements between NCEs and universities. Typical is one struck by the NeuroScience Network with its 18 participating universities. Manager Lewis Slotin says his network wanted the universities to cede the right of first refusal on any intellectual property to the network "on the basis that we were in the best position to develop it further." But only half of the 18 agreed to that. The other half—including such major research universities as Toronto, British Columbia, and Alberta—agreed only to allow "simultaneous" exploitation of technologies. The result was an entrepreneurial nightmare, says Slotin: "We could go ahead and try to exploit the technology. But [the universities] could do it at the same time."

Arrangements like this lie at the root of the looming conflict, says a preliminary evaluation of the NCE program conducted for the government by a consulting firm. "The universities and networks are coming into significant actual and future potential conflicts around issues of IP [intellectual property] ownership, contract negotiations, revenue sharing from licenses, royalties, and contract overheads," says the report, a copy of which was obtained by *Science*.

Gastops Ltd. President Bernie MacIsaac argues that universities now have too much control over intellectual property and too little ability to commercialize inventions. "Most of the universities never get anything out of it," he says, "but keep demanding rights of ownership."

Universities will have to relinquish some of that control before industry opens its vaults, adds Claudine Simson, Northern Telecom Ltd. assistant vice president for global external relations and intellectual property. She urges adoption of a new intellectual-property model that allows firms "royalty-free access" to NCE technologies if they contribute a specified percentage of research project costs.

The preliminary report on the NCE program also points a finger at financially strapped university administrators who seek

to turn a quick profit by selling or licensing commercial rights to new technologies as soon as possible, even if the highest bidder is a foreign firm. That approach conflicts with a "Canada first" clause that obligates networks to focus on creating new Canadian companies and new export lines that will sustain a more knowledge-based economy.

University officials say they try to encourage homegrown companies when it is feasible. "But sometimes, it's just not very sensible to go with something on a start-up basis," says University of Calgary Vice President (research) Cooper Langford. It's unreasonable to constrain a university's ability to generate revenue through intellectual-property sales, he says, given that they must often absorb all research overhead costs associated with the NCEs.

The network managers are hoping that the consultant's report will serve as a wake-up call to university administrators. "Big, old, entrenched, immovable universities are going to have to start taking this seriously," says Ellie Prepas, program leader for the Sustainable Forest Management network. What's needed, adds Health Evidence Application and Linkage Network manager Corey Wentzell, is consensus on a "national" intellectual-property strategy. But Dalhousie University Associate Vice President (research) Robert Fournier believes negotiations will do the trick: "I don't see [intellectual property] as an immovable object that will sink the ship of the NCEs."

–Wayne Kondro

Wayne Kondro is a writer in Ottawa.

DEVELOPMENTAL BIOLOGY

A Zebrafish Genome Project?

BOSTON—The National Institutes of Health (NIH) calls its massive genome-mapping and sequencing effort the Human Genome Project, but *Homo sapiens* isn't the only species whose genetic blueprint the program aims to decipher. From the outset, researchers have sought clues to human genetics by mapping more tractable genomes, probing such organisms as the bacterium *Escherichia coli* and baker's yeast (*Saccharomyces cerevisiae*)—whose genomes are already completely sequenced—as well as the roundworm *Caenorhabditis elegans*, the fruit fly *Drosophila melanogaster*, and the laboratory mouse. Now, if a small but intrepid band of biologists has its way, the zebrafish *Danio rerio*—a sleek, diminutive breed once known only to embryologists and aquarium hobbyists—will be the next species to hitch a ride on the mammoth project. Some 60 leading zebrafish geneticists and others gathered at Boston's Children's Hospital last week to lay plans for charting the zebrafish's estimated 2400 key developmental genes—and for persuading NIH to fund the effort.

Like humans and mice, zebrafish are vertebrates. But unlike our whiskered cousins, zebrafish produce thousands of transparent embryos, so researchers can watch the brain, heart, and other organs develop. And geneticists in the United States and Germany have already created hundreds of mutant strains with developmental flaws that could eventually shed light on related abnormalities in humans—once the affected genes are located and their functions known.

But isolating and cloning those genes will be a long, slow task, because the zebrafish genome is largely uncharted territory: Fewer than a dozen genes have been sequenced, and only rough maps are available. To make the most of their mutants, conferees agreed, they need a high-resolution map of genetic landmarks in zebrafish DNA, like those already completed for the human and mouse genomes. Such a project, they say, could be done cheaply, perhaps for as little as $350,000—a drop in the bucket compared to the genome project's 1996 budget of $170 million. "This could be of enormous value to the Human Genome Project," argues conference participant Christiane Nüsslein-Volhard, a Nobel laureate at the Max Planck Institute for Developmental Biology in Tübingen, Germany.

Research overseers at NIH—where the group plans to submit a detailed proposal this spring—will be asking hard questions about why the zebrafish should be one of the handful of organisms mapped, acknowledges Leonard Zon, a hematologist and geneticist at Children's Hospital, who co-organized the conference. "Their bias is going to be that they don't want just another model organism, so we're also going to have to justify the advantages of the zebrafish."

PHOTOS BY SAM OGDEN

Fishing for dollars. Zon and Postlethwait, and Nüsslein-Volhard, plotted strategy.

That's something at which Nüsslein-Volhard, a former fly geneticist, has had plenty of practice. In a field dominated by studies of *Drosophila*, zebrafish were small fry until 1987, when Nüsslein-Volhard set up her first fish tank. Under her leadership and that of her former student, Wolfgang Driever, now at Massachusetts General Hospital, researchers have created thousands of mutant zebrafish strains, with body and behavioral flaws traceable to disruptions in 600 previously unknown genes (*Science*, 6 December 1996, p. 1608).

Locating these genes without a detailed map, however, is like looking for a specific straw in a haystack, which explains why so few zebrafish genes have been cloned so far. But many of the abnormalities found in the new zebrafish mutants resemble—and could help researchers disentangle—specific disorders in humans. Fish carrying a mutation in the gene *gridlock*, for example, have a blood-vessel defect similar to a deadly human condition called coarctation of the aorta. And the developmental functions of many human genes could one day be explored by manipulating the corresponding genes in zebrafish.

At the conference, researchers discussed several likely methods for zeroing in on zebrafish genes. Most techniques locate genes by starting with landmarks in the genome, so combining the rough maps already compiled by University of Oregon biologist John Postlethwait and others, and peppering them with many more chromosomal landmarks, will allow researchers to find and clone genes much faster. Such a high-resolution map could be created for only $350,000, estimates geneticist Marco Marro of Washington University in St. Louis. "Even if it were twice that, it would still be a bargain," says Postlethwait, who co-organized the meeting with Zon and biologist Nancy Hopkins of the Massachusetts Institute of Technology.

NIH officials, six of whom sat in on the conference, said they were impressed. "A lot of model organisms are already being used for specific research purposes, but this one seems to have the potential to bring in something different," says David Badman, a hematology program officer at the National Institute of Diabetes and Digestive and Kidney Diseases. "Being able to look at gene function in developing organisms is really critical, and that hasn't been possible in other vertebrates. And it seems that a large number of organ-specific and disease-specific genes have already been found." And that, say conference organizers, is no fish story.

–Wade Roush