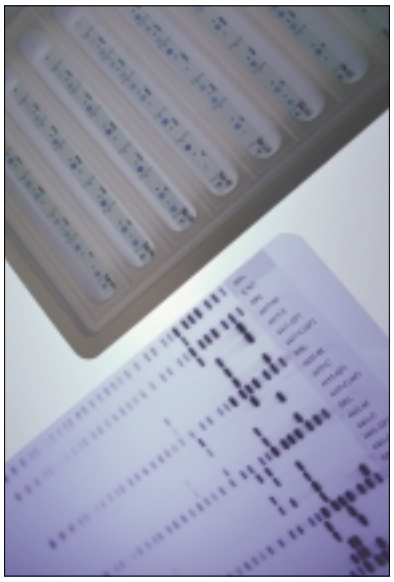
Canada hopes to climb the DNA ladder to success

Carolyn Brown

When Finance Minister Paul Martin announced $160 million in funding for genome research in Canada in his Feb. 28, 2000, budget, the timing could not have been better. The first human chromosome had just been sequenced. US President Bill Clinton and British Prime Minister Tony Blair were calling for a ban on patenting human genes. And the full genome of the fruit fly was about to be released.



Martin's announcement was the culmination of 3 years' work by Canadian players in biomedical research funding, biotechnology, genetics and resource industries on an ambitious plan to catapult Canada onto the world stage in genome research. The plan is to create an organization unique in Canada, dubbed Genome Canada, that will enable Canadian researchers to sequence the DNA of plants, animals and humans without having to go abroad, as they now do.

At first blush the idea of new facilities and money for DNA sequencing sounds like good news for genetic research, but reaction among Canada's medical genetics researchers is mixed. Those involved in the plan are enthusiastic; many others are cautiously optimistic, adopting a "wait-and-see" view. A few researchers contacted by *CMAJ* had not heard of the plan, and one who asked not to be named expressed scepticism about its usefulness to most "bench" researchers.

Because of its unique nature, it is difficult to define what Genome Canada *is*. Described sometimes as a "program," sometimes as a "genome science enterprise," sometimes as a "partnership," Genome Canada is supposed to put in place all the tools and people needed to start sequencing genomes of all types of organisms. According to the interim executive director, Dr. Martin Godbout, most of these projects will likely be part of large-scale international sequencing consortia, for which the Canadian centre will perform just a part of the work. Godbout says Genome Canada will harness existing facilities and staff in universities, federal labs and industry to process the massive amounts of data involved in any sequencing project. These facilities will constitute "genome centres." (The original plan was for 6 centres, but this has been scaled back to 5, and some observers think Genome Canada will be launched with 2 or 3.) The centres will apply for funding to run specific projects, such as sequencing a fish genome for fisheries research or part of the mouse genome for medical research.

Godbout, a medical biologist and genomist who worked in the US in the late 1980s, likens Genome Canada to the Wellcome Trust in Britain, which funds genome centres such as the Sanger Centre, and to Innovatech in Quebec, a venture capital firm that invests money from the Quebec government in biotechnology through an arm's-length relationship.

Observers involved in funding for biomedical research support Genome Canada's formation, but throw a little cold water on its ambitious scope. "The project's terribly important to Canadian science," says Dr. Barry McLennan, assistant dean of research at the University of Saskatchewan's medical school and the chair of the Coalition for Biomedical and Health Research, a nonprofit lobby group. "We have to be at the world table on these big-ticket items." McLennan has been involved in the metamorphosis of the Medical Research Council of Canada into the Canadian Institutes of Health Research (CIHR), and has watched the Genome Canada concept grow. Of the federal involvement, he says, "I'm concerned that it's not enough money." The organization's business plan called for $195 million to fund 6 genome centres over 3 years. It got $160 million, which Godbout hopes will last for 4 or 5 years, with additional funding needed to come from provincial governments, the Canadian Foundation for Innovation and private industry. But McLennan suspects that the number of centres may have to be limited. He sees Genome Canada establishing a partnership with the new CIHR to ensure that it fits within the new infrastructure for health research.

In the new genome centres, health research will compete with agriculture, aquaculture, forestry and the environment for facilities and funding. "We foresee that 50% to 70% of the use of these centres will be health," predicts Godbout. He cites a survey that shows that 70% of genetic research in Canada involves health.

Another issue is the difference between genomics and genetics. Genomics — described variously as a "science" and as a "technology platform" — is concerned only with sequencing DNA, including genes. (Genome Canada will also be involved in "proteomics," defining the proteins encoded by genes.) In terms of genetics research, the Genome Canada Web site gives the example of cloning genes for asthma: recruiting patients, ascertaining disease status and collecting samples would be funded through other funding agencies, while the genotyping

part of the project would be done through a genome centre.

In this way, the new organization is trying to fill the gaps in genome research not covered by other agencies, while being careful not to intrude on the turf of existing granting councils, universities and laboratories. Godbout says that the presidents of the granting councils have been included in the Board of Directors precisely to avoid overlap and duplication.

For the BC Cancer Agency, Genome Canada "fits perfectly" with the existing funding and facility infrastructure for research and with the agency's new genome centre, says Victor Ling, the vice-president, research. Genome Canada "was nowhere in sight" when the agency started its own genome centre 3 years ago with funding from the BC Cancer Foundation. This BC-based genome centre is directed by Nobel-Prize-winning geneticist Michael Smith, and has been able to recruit young Canadian researchers who had gone abroad. "The money that the government has committed will complement what the private sector will do, or the volunteer sector in our case." Ling thinks Genome Canada also sets an important direction for Canadian research.

Another booster is Dr. Thomas Hudson, an assistant professor with the Department of Medicine and Human Genetics at the Montreal General Hospital Research Institute. He has been involved with Genome Canada since it was first proposed by a Medical Research Council of Canada task force. Hudson's research is in the genetic analysis of common diseases such as asthma. "This requires high-throughput DNA analyses for thousands of genes in thousands of asthma families. Genome Canada centres will provide high-technology resources for this and other large-scale genetic projects." He believes that these resources, combined with the raw material of genes from Canadian families, will make Canadian genetics research very competitive.

Genome Canada is coming along too late to assist with the international Human Genome Project, which plans to announce the full sequencing of human DNA this spring. But other international projects are sure to develop. "There are still lots of things to sequence," says Heather McDermid of the University of Alberta, who led Canada's only team working on the sequence of chromosome 22. In terms of human genomics, "we'd be better off aiming at the postsequence world," she believes, including proteomics, the analysis of proteins encoded by genes, and functional genomics, which investigates what genes do. Animal genome sequencing is also very useful to human genetic research. "If I'm studying a human gene and they release the *Drosophila* [fruit fly] sequence, I would look at the homologues to the human gene in *Drosophila*. If [researchers] knock out that gene in the fruit fly it would be interesting to show what that mutation does."

McDermid's team used genomic resources in other countries to look at chromosome 22. She thinks developing Canadian genomic capacity "gives us an international profile. These resources can be immensely useful." However, she reserves judgement on Genome Canada until she finds out which projects will be funded.

On a more practical level, Dr. Robert Hegele hopes that Genome Canada will benefit not only Canadian researchers but also Canadian patients. "The thing I see with Genome Canada is that it may make it more likely to keep this research in Canada." Hegele, who is with the John P. Robarts Research Institute in London, Ont., has discovered a genetic mutation that causes abnormal fat distribution, and another that causes diabetes in native people. He says that keeping genomic research within Canada has been difficult to this point because of its cost- and technology-intensive nature. Like McDermid, he believes the jury is still out on Genome Canada. "To me, it's not very well developed — what is going to be funded and over what period. I'm going to wait and see how it develops."

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