



GenomePrairie



Annual Report
2001-2002

Message from the Chair

Dr. Pete Desai



“The journey for major genomic research in Canada has just begun. The challenge for Genome Canada and the Genome Centers is to build a strategic national genomic program that will put Canada at the forefront of this exciting field of genomics.”

For Genome Prairie, the past year has been one of adjustment: adjustment for researchers and for funding partners and institute management as Canada prepares to become a dominant R and D player on the Global scene over the next decade. For the first time in many years, Canada is investing significantly to reach its vision to be among the top five R and D players in the world.

The next decade is an exciting one for the Canadian research community as we embark on research platforms that will place Canada firmly on the global scene. Genomics, I think, will be one area in which Canada will excel. The Genome Canada sponsored research programs will be a significant driver in making this happen. In the Phase II competition, Genome Prairie fared well. Now we have the responsibility to deliver what the prairie scientists are capable of delivering. I have no doubt that we will.

The GP TEAM, under the leadership of Dr. Randy Johnston, President and CEO, has done an excellent job in preparing to manage one of the key requirements of GC funding, that of matching funds. Matching funds is an issue that all Genome Centers face, along with signing agreements to get the approved projects under way. The learning that has taken place during the past year will certainly help in getting the Phase II projects up and running quickly.

One of the challenges we face is that, even though we were very successful in the Phase II competition, we still have more excellent proposals that can put Canada in the forefront of Genomics research. Therefore, the challenge for the GP Board, besides matching the funds for the approved projects, is to find funds to support some excellent research proposals that did not receive approval in the GC Phase II competition. These are also world class research proposals and, for Canada to be recognized in the field of Genomics, we should be embarking on this exciting research as well. One of the top priorities for the GP Board and its President will be, therefore, to find innovative ways to fund these genomics proposals in order to add them to the already approved GC projects. This will demonstrate that GP adds value to the scientific community and is instrumental in developing a culture that will help build research capacity in the prairie provinces.

The journey for major genomic research in Canada has just begun. The challenge for Genome Canada and the Genome Centers is to build a strategic national genomic program that will put Canada at the forefront of this exciting field of genomics. I am convinced that we can establish this strong genomics program by having experts in institutions across the country develop projects using cross-functional teams.

I am looking forward to working with the Board, its President and CEO, and the other Genome Centers to establish Canada as a key player in genomics research.

A handwritten signature in white ink on a blue background. The signature is stylized and appears to read 'P. Desai'. Below the signature is a horizontal line that ends in an arrowhead pointing to the right.

Pete Desai
Chairman of the Board

President's Report

Dr. Randal N. Johnston



"The past year has been one of remarkable change, growth and opportunity for Genome Prairie."

This report will briefly outline the major events of this period and will focus on how we have been establishing a strong foundation for our future activities.

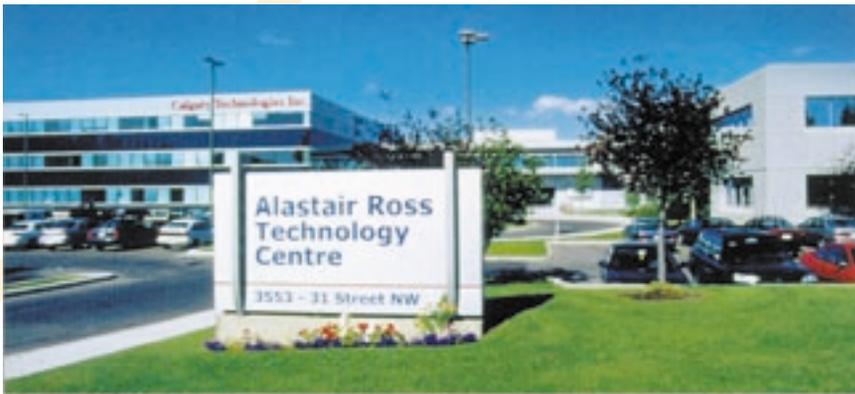
Our beginnings...

Early in 2000, under the leadership of the Interim President, Dr. Dennis Fitzpatrick, Genome Prairie was established as a not-for-profit corporation with the goal of promoting research in genomics, proteomics, bioinformatics and GELS (Genomic Ethical, Legal and Social impact research) in the Prairie region. Genome Prairie worked with teams of Investigators to develop a series of research and technology platform proposals that were submitted to Genome Canada in January, 2001. These were evaluated by an international review panel, resulting in the approval of two that were announced as our fiscal year was beginning in April, 2001. Including anticipated matching fund contributions, the value of these projects was targeted to a level of \$23 million:

- ***Functional Genomics of Abiotic Stress***, led by Dr. Graham Scoles of the University of Saskatchewan and
- ***Commercialization and Society: Its Policy and Strategic Implications***, led by Dr. Edna Einsiedel of the University of Calgary

Funding was also announced for the establishment and operations of the corporate office of Genome Prairie, for a total investment (including projects) targeted at almost \$30 million. The role of the corporate office in these activities was not only to encourage the preparation of research proposals of international quality, but also to engage in communications and public outreach efforts, to help find matching funds for the projects, to facilitate recruitment and training of qualified staff, to help to manage the projects and ensure accountability, and finally to establish strong linkages with other similar projects across Canada and abroad.

A new corporate office



While these funding announcements were being made, Genome Prairie's Board of Directors was in the midst of searching for a President and CEO, resulting in my appointment for a three year term, effective September, 2001. The rapid pace of activities continued with the establishment of the corporate office in Calgary in September and the recruitment of key staff members so that we could refocus our operations.

A new round of proposals was solicited for Genome Canada's second competition and with the aid of our Scientific Advisory Board was refined and strengthened.



New projects...

The polished proposals were submitted to Genome Canada in December for evaluation as before and results were announced just as our new fiscal year was beginning. Three projects and one technology platform were approved, for a total value (including projected matching funds) of \$60 million:

The Development of Enabling Technologies for Proteomic and Genomic Research, led by Dr. Bill Davidson of MDS Sciex and co-led by Drs. Jed Harrison and Liang Li of the University of Alberta;

Functional Pathogenomics of Mucosal Immunity, led by Dr. Lorne Babiuk of the Veterinary Infectious Diseases Organization at the University of Saskatchewan and co-led by Dr. Bob Hancock of the University of British Columbia;

Enhancing Canola through Genomics, led by Dr. Wilf Keller of the NRC Plant Biotechnology Institute in Saskatoon;

An Integrated and Distributed Bioinformatics Platform for Genome Canada, led by Dr. Christoph Sensen of the University of Calgary.

With a total of \$90 million in funds committed or projected for Genome Prairie and its six projects, this is an excellent record of accomplishment, for which thanks are due to the many people who contributed their efforts to this success. We now have the highest average level of funding per project of any Genome Centre in Canada.

Project highlights...

Among many highlights are the fact that our *Pathogenomics* project, led by Drs. Babiuk and Hancock, received the largest award in Canada in the second competition. Our GELS project, led by Dr. Einsiedel, and the Enabling Technologies project, led by Dr. Bill Davidson, received the largest amounts of funding in their categories as well. We are seeing wonderful interest among corporate partners for our new projects, including MDS Sciex, Inimex, Pyxis and SUN Microsystems. A clear area of focus is emerging in agricultural genomics, with secondary strengths in technology development, bioinformatics and GELS research. Among all of the Genome Centres in Canada, it appears that our proposals have the greatest level of participation from researchers across the country, maximizing the strength and impact of the studies we have undertaken. Collaborative efforts with other similar projects across the country are

beginning to emerge in several sectors, with Genome Prairie researchers adopting leading roles in the agricultural, GELS and bioinformatics sectors. Much effort is being devoted to the rapid activation of these projects, and for several of them we anticipate the early emergence of products with significant market potential.

Next steps...

Clearly we are establishing a strong foundation for our research and development programs, but just as clearly much remains to be accomplished over the next months and years. Our priorities over the coming period will be to:

- **Secure remaining matching funds for existing projects**
- **Negotiate final agreements with host institutions & corporate partners**
- **Activate projects, recruit research staff**
- **Renew corporate governance and management structure**
- **Secure additional funds & international partners**
- **Promote research training & project integration**
- **Promote public awareness & communication**
- **Promote translation, commercialization, company creation**
- **Encourage new project development & funding**

If we can achieve these broad goals we will be in an excellent position not only to sponsor world-class genomics research, but also to see the emergence of economic, medical and social benefits for the Prairies and Canada.

This has been a great year for Genome Prairie. Next year promises to be even better.



Randal N. Johnston
President and CEO





GenomePrairie

Projects

Over the next few pages, we are pleased to provide brief descriptions of each of our five approved research projects and one technology platform. In order of presentation, these are:

- ***Functional Genomics of Abiotic Stress***, led by Dr. Graham Scoles of the University of Saskatchewan. With total projected funding at \$19.5 M, this project includes researchers in Vancouver, Lethbridge, Calgary, Edmonton, Saskatoon, Winnipeg and Montreal. This project is being conducted in partnership with Genome Quebec.
- ***Commercialization and Society: Its Policy and Strategic Implications***, led by Dr. Edna Einsiedel of the University of Calgary. With total projected funding at \$3.3 M, this project includes researchers in Calgary, Edmonton and Saskatoon.
- ***The Development of Enabling Technologies for Proteomic and Genomic Research***, led by Dr. Bill Davidson of MDS Sciex and co-led by Drs. Jed Harrison and Liang Li of the University of Alberta. Funded at a level of \$17 M, this project includes researchers in Edmonton, Winnipeg, Toronto, Kingston and Quebec City.
- ***Functional Pathogenomics of Mucosal Immunity***, led by Dr. Lorne Babiuk of the Veterinary Infectious Diseases Organization at the University of Saskatchewan and co-led by Dr. Bob Hancock of the University of British Columbia. Funded at \$27 M, this project includes researchers in Vancouver, Burnaby and Saskatoon. This project is being conducted in partnership with Genome BC, Pyxis and Inimex, Inc.

- **Enhancing Canola through Genomics**, led by Dr. Wilf Keller of the NRC Plant Biotechnology Institute in Saskatoon. Funded at \$7.5 M, this project includes researchers at the NRC Plant Biotechnology Institute and the Agriculture and Agri-food laboratories in Saskatoon.

- **An Integrated and Distributed Bioinformatics Platform for Genome Canada**, led by Dr. Christoph Sensen of the University of Calgary. Funded at \$10 M, this technology platform includes researchers in Calgary, Edmonton, Saskatoon, Winnipeg, Toronto and Halifax, in partnership with SUN Microsystems and BioTools, Inc.

Our projects are part of a nation-wide program of international quality. This chart illustrates how the Genome Canada projects are distributed across the country according to region of origin and sector of application:

Region Sector	BC	Prairie	Ont.	Que.	Atlan.	Total #
Agriculture		3	2		1	6
Environment	1			1		2
Technol Dev.		1	2		2	5
Fisheries	1					1
Forestry	1		1	1	1	4
GELS	1	1	2	1		5
Health	6		9	12		26
Platforms	1	1	2	1	1	6
Total (\$ M)	100	91	190	172	31	584

From this we can conclude that Genome Prairie has the highest average level of funding per project in Canada. Nevertheless, it is clear that some sectors of application, most notably the Health sector, are not yet represented among our funded projects. This is a high priority for future development.

We are very proud of the broad geographic spread among the researchers funded through our projects. Our investigators sought out the best people in Canada to participate in our studies as part of our nation-wide program. The next two pages provide detailed descriptions of the projects approved in the first Genome Canada competition. The map on pages 10-11 provides a dramatic representation of the regional distribution of our research programs, followed by the remaining projects from Genome Canada's second competition.





Functional Genomics of Abiotic Stress

The primary objective of the project is to understand how plants respond to various environmental stresses, particularly cold, but also heat, drought and nutrient stress. Two crops of importance to Canada, wheat and canola, and *Arabidopsis*, a distant relative of canola whose genome has been sequenced, will be used as the experimental systems.

Through a genomic approach, the genes that respond to the various stresses and increase the ability of these plants to withstand these environmental stresses will be identified. Through a proteomic approach, the proteins that appear in various tissues in response to stress will be isolated and analyzed. An integral component of the project is a bioinformatics platform that will be used to analyze and interpret the data collected. We are also interested in finding out whether these two very different plants utilize similar strategies and also whether there is any commonality in the strategies used for different stresses.

Environmental stress is the primary factor that limits both the range of crop plants that can be grown and the yield and quality of those crops. The knowledge gained will find application primarily in plant improvement, through both conventional and genetic engineering approaches. This knowledge will also be able to be applied to other crops, not just wheat and canola, and lead to a more sustainable agricultural system. In addition, the genes and proteins identified by the project may have application in areas as diverse as frozen foods and cryopreservation.

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Commercialization and Society: Its Policy and Strategic Implications

While commercialization of Genomics research promises many benefits to society, it also raises many societal questions about risks, ethics, environmental impacts and sustainability and the appropriate incentives for innovation. These, in turn, have important implications for effective regulatory and legal approaches and the role of public groups in technological decision-making. The Genome Prairie GELS project focuses on these commercialization challenges by examining the public, commercial, and public policy responses to genomics issues through the analysis of public perceptions, media representations, regulatory approaches, and intellectual property concepts and practices.

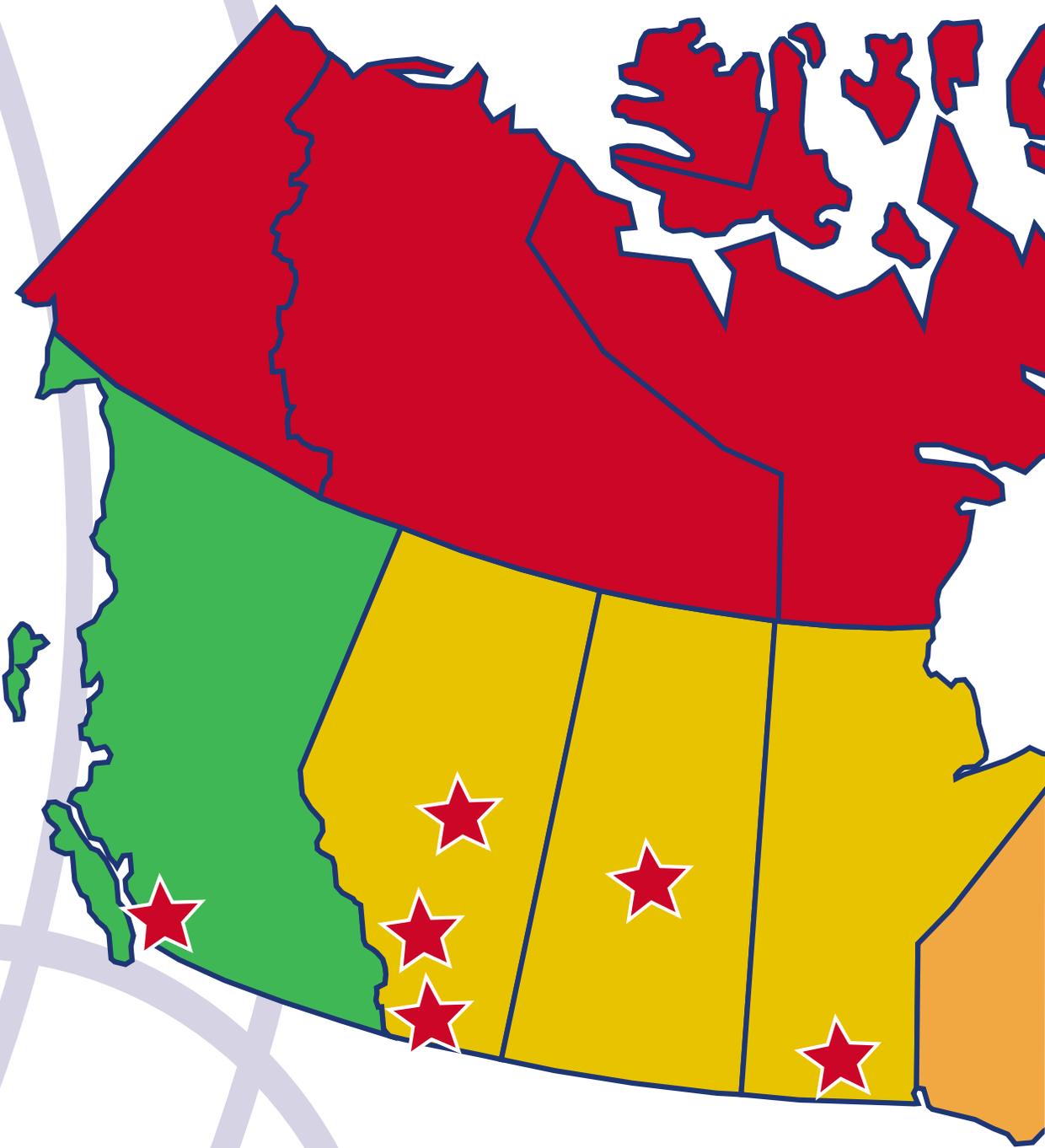


Four sub-projects are incorporated in this GELS program. The first under Dr. Edna Einsiedel (Faculty of Communication and Culture, University of Calgary) examines the nature and role of social controversy in genomics innovation through in-depth analysis of two agricultural and two medical genomics applications. The second sub-project directed by Prof. Timothy Caulfield of the Univ. of Alberta Health Law Institute seeks to identify the public's major socio-political concerns associated with genomic technologies and the law as a basis for developing appropriate regulatory policy. This involves a comparison of media representations of gene discoveries and the representations of these discoveries in scientific journals. Prof. Michele Veeman of the Dept. of Rural Economy at the University of Alberta is investigating the impact of information on consumer decision-making on genetically modified foods. The concept of intellectual property is being analyzed by Dr. Peter Phillips (Dept. of Agricultural Economics, Univ. of Saskatchewan) and his co-investigators at the universities of Saskatchewan, Alberta and Calgary by examining the nature of IP regulations, the role of IP rights in providing incentives for or creating barriers to commercialization and the ethical questions around ownership and rights of use.

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Genome Prairie Research



Researchers Across Canada



The Development of Enabling Technologies for Proteomic and Genomic Research

The theme of this project is best described by this quotation¹ from Sir Humphrey Davy: “Nothing tends so much to the advancement of knowledge as the application of a new instrument”. Research groups from MDS Sciex, the University of Alberta, the University of Manitoba, Queen’s University, Laval University and AIMS will create innovative tools that extend the bio-analytical capabilities of scientists in the fields of genomics and proteomics. This includes providing very high performance mass spectrometry products, as well as products based on emerging micro-fluidic technologies. The project involves interaction with leading research groups in the United States and Germany. A key feature of this proposal is the high level of interaction among all of the participating academic and industrial research groups.

The first set of technologies to be developed relates to new methodologies and reagents for processing low levels of proteins. Much of the activity in this area will be focused on the use of micro-fluidic platforms in a highly parallel manner to process biological samples prior to mass spectral analysis. The second set of technologies is based on expanding the power of mass spectrometry in proteomics and genomics research. Very high performance mass spectrometers will be developed with the goal of having greater sensitivity, mass range, and resolution than any system presently available. Scientists at research establishments throughout the country will have access to these state-of-the-art technologies to support their research applications. The capabilities provided by these tools will advance scientific research in how cells function and hopefully lead to more effective therapeutics and diagnostics in a reduced time frame. The success of this project will help establish Canada, and Canadian research establishments, as leaders in bio-analytical research.

¹ Thomas Hager, “Force of Nature”, Simon and Schuster, New York, 1995, p 86.

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Functional Pathogenomics of Mucosal Immunity

Mucosal immunity represents the broad range of host defences that prevent the attachment and invasion of infectious disease agents at the body surfaces of the respiratory, digestive, and reproductive tracts. The Functional Pathogenomics of Mucosal Immunity (FPMI) program is utilizing the power of genomics and bioinformatics to increase current understanding of how mucosal immunity to infectious agents operates, and how it may be enhanced to enable the rational development of new and effective strategies for improving human health, animal productivity and welfare, food safety and the economic viability of the livestock industry in the Prairies, Canada and elsewhere. Unlike other efforts in this field, the FPMI program is investigating mucosal immunity using genomics approaches in a range of hosts, including humans, chickens and cattle, and thus straddles the fields of agriculture and health. This permits very broad conclusions to be made about the mechanisms of immunity in these hosts, as well as measures that will enhance immunity. The program addresses important social and financial issues since infectious diseases cost the livestock industry billions of dollars annually, while human infectious diseases cause one third of all deaths on the planet and are the major cause of loss of productivity in our society. The FPMI project team brings together the internationally recognized livestock health research excellence of the Veterinary Infectious Diseases Organization, the R&D capacity of two Canadian companies Pyxis and Inimex, and a network of world-class genomics, bioinformatics, microbiology and immunology experts from Western Canada, who have been involved in major scientific advances in understanding host:pathogen relationships.



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Enhancing Canola through Genomics



We are undertaking a comprehensive initiative to develop and employ functional genomic tools in the characterization of seed development and composition in key crop groups including cereals, pulses and brassica oilseeds. The current project is focused on applications in canola (i.e. oilseed brassicas).

The research will be undertaken by investigators from the National Research Council of Canada and Agriculture and Agri-Food Canada. Under the theme of seed development, long-term objectives include canola seeds that: (1) are tolerant to heat stress; (2) mature more rapidly and avoid frost damage; (3) mature synchronously; and (4) have seed coats of reduced thickness or that are more amenable to mechanical separation, allowing an increase in meal quality through the removal of relatively indigestible complex carbohydrates.

Under the theme of seed composition, research will be targeted to the production of canola seeds that: (1) have carbon partitioning modified so as to over-accumulate the most valuable seed storage compounds; (2) accumulate novel or improved proteins to high levels; (3) accumulate specific fatty acids, triglycerides or complex carbohydrate profiles ideally suited to high value niche markets; (4) have increased levels of desirable micro-nutrients; (5) have reduced levels of anti-nutritional compounds; and (6) accumulate novel compounds of commercial value.

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An Integrated and Distributed Bioinformatics Platform for Genome Canada

Our Bioinformatics platform builds on existing infrastructure, including the Canadian Bioinformatics Resource (CBR) and the Calgary-based Sun Center of Excellence for Visual Genomics. The main industrial partners are SUN Microsystems of Canada and Biotools Inc. (Edmonton).

The main scientific research goals of the project focus on data standardization (BioMOBY) and the visualization of complex genomic features (Bluejay and Genquire). A computing GRID, in which networked computers from many sites in Canada will appear to function as a single computer, will provide user-friendly access to the networked Bioinformatics infrastructure in Canada. A help desk and custom programming facility will assist other genomics research projects in Canada on a cost-recovery basis.

The project features a major training component. Two Bioinformatics workshops (approximately 50 students each) are planned per year (one in Eastern and one in Western Canada). These workshops will be aimed at researchers working in Genome Canada science projects. The goal will be to create Bioinformatics “power users” who can efficiently deal with the analysis and organization of the massive amounts of data that will be produced in the currently more than 50 Genome Canada projects.

The Bioinformatics platform can be compared to the first service module of the International Space Station, which connects the other ISS components. The Bioinformatics project will enable other Genome Canada projects to similarly interface and connect via the platform.



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Annual General Meeting

October 5th, 2001, Calgary, Alberta



Our thanks...

Our progress so far has been the result of a remarkable team effort. Thanks are due to Genome Prairie's Chairman, Dr. Pete Desai, and the other Board members for their excellent guidance, Dr. Dennis Fitzpatrick as the Interim President and his Assistant Chris Picken, Genome Prairie staff and consultants who have worked heroically to achieve our goals, our Scientific Advisory Board members who provided outstanding expert advice, our funding partners who make this world-class effort possible, and most importantly the researchers whose creativity and hard work led to such outstanding proposals.

We have a great deal of work remaining, but the foundations for our growth and future success are now in place.







GenomePrairie



GenomeCanada