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Harnessing a Climate of Change



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anada along with much of developed world is being thrust into an era of renewed industrial growth powered by the knowledge and application of the comparatively young science of genomics.

Since the completion of the DNA sequencing of the human genome a

decade ago, the influence of genomics has surged across all aspects of the life sciences. Nowhere is this more true than in Canada where abundant natural resources and vast areas of food production provide the fuel for rich scientific activity, which will lead to increased productivity in these key industries.

Genomics is the study of all biological information contained in an organism from the DNA coding to the biochemical activity at the cellular level. Already this research is yielding applications in areas as diverse as food safety, security and surveillance; environmental monitoring; tree breeding, and ,of course, significant inroads into the development of new diagnostic tools and therapies in health care.

Over the past decade, through support from the Government of Canada, provinces and many other research partners from both the private and public sectors, Canadians have developed a world-class capacity in the genome sciences. We are now poised to reap some of the economic benefits including highvalue job creation and industrial growth that the genome sciences have promised.

Today Canadian researchers and industrialists are using genomics to develop a large array of tools that have the potential solve real world problems.

The following examples illustrate how the genome sciences are equipping Canada to meet that challenge:

• Energy systems are gradually shifting to make use of biomass resources as a sustainable contribution to energy needs while improvements to efficiencies of bitumen extraction using biological means are developed. Microbial processes informed by genomics are making all of this possible. A new science called "metagenomics" which looks at the biochemical functions of microbial communities is a driving force in this regard.

• Food production techniques are evolving to ensure the security of livestock, cereals, other food sources – even honey bees that are so crucial to the pollination of Canada's multibillion-dollar fruit and canola crops. The dairy cow breeding industry has embraced the results of the Bovine Genome Project, where Canadian scientists played a leading role.

• Technologies are being applied to assure safer foods with advanced means of analysis and surveillance of pathogens that threaten the health of consumers

• Wild fisheries and the aquaculture industry are employing genomics-based evidence to help safeguard an important food source

• Environmental management and better mining practices through development of natural biochemical processes are helping to remediate toxic waste sites. Small companies are being created around some of these new applications

• Transforming the forestry sector from a pulp, paper and lumber focus to a bioproduct industry will require the integration of new technologies into the traditional landscape

• Diagnostic tools are being developed and commercialized so that cancer and heart disease patients can benefit from more targeted treatments that show increased clinical benefits while at the same time reducing harmful side effects.

Along with this genomics technology comes the challenge related to the capture, storage and analysis of a massive influx of data coming from genome sequencing and analyses. All of this underscores the need for new computational tools and information hardware in studying modern biology.

These will be essential for ana-

lyzing and integrating complex data sets and to better understand the underlying biology.

To fully exploit this research, Canada requires investment mechanisms for technology to move more efficiently from the academic laboratory into industry. Only through these mechanisms and other policy changes will Canada occupy the place it deserves in the new world bio-economy, which is expected to reach over 4% of OECD country GDP by 2030.

Canada should have a disproportionally large piece of that pie given its substantial footprint in the life sciences.

For all these reasons, Canada is forging a path towards future economic prosperity with a strong foundation of research in the genome sciences.

Now, with our best foot forward, there is much work ahead yet as Canada builds a solid new scientific platform upon which to expand industry, enhance development and production, and exploit the knowledge-based economy to the benefit of all Canadians.