

systems, combined with advances in bio-informatics and biochemistry to create innovative processes and products in a number of sectors including health, environment, forestry, agriculture, mining, fisheries and many other allied industries.

A thriving biotechnology industry in the future will be built largely on genomics research, which is the study of genetic information: an organism's genes form its "genome". Knowledge of genomes is required to study disease resistance, or susceptibility in humans, plants, animals or pathogens. International experts agree that genomics will provide new methods for addressing environmental concerns, result in new methods of disease diagnosis, treatment and prevention and in managing natural resource and food supplies. Genomics and bio-informatics technologies and techniques are fundamentally changing the way products and services are being discovered and developed – genomics will allow not only for more accelerated drug development and regulatory review time, but will also improve the efficacy of the drugs. In Budget 2000, the federal government approved \$160 million for large-scale program funding to establish a multidisciplinary centre to co-ordinate Canadian genomic research and development – operating on a cost-recovery basis for industry, while serving as a funding mechanism for Research & Development (R&D) done by non-profit entities. The commitment to excellence in the biotechnology sector will help Canadian firms thrive in a competitive global environment. Already, Canadian research and development firms have established themselves at the forefront of the sector in some promising areas.

While the majority of Canadian biotechnology activity in Canada is in the health sector, some exciting discoveries are being made in the areas of agriculture, environmental restoration, forestry, and aquaculture.

OVERVIEW OF THE CANADIAN BIOTECHNOLOGY SECTORS

Biopharmaceuticals

Biopharmaceuticals promise major social and economic benefits, and already, products of biotechnology such as medicines, vaccines and other health-related devices, have helped to reduce or eradicate many diseases and improve life expectancy.

As one of the world's fastest growing sectors, sales of biopharmaceuticals have grown more than seven-fold over the past decade and should exceed US\$18 billion by 2003. Canadian firms have developed three of the 24 biopharmaceuticals approved for sale on the world market. A January 2000 survey by Canadian Institutes of Health Research indicates that selected Canadian biopharmaceutical firms have more than 400 products in the pipeline. The Canadian biopharmaceutical sector represents 46 percent of the companies, 87 percent⁴ of the R&D and more than \$800 million in sales. It is estimated that 30 to 50 percent of new therapeutics will be biopharmaceutical products.

Agriculture

Agri-food research and development is another strong Canadian biotechnology sector, where 22 percent of the companies, 5 percent of total biotechnology R&D and \$131 million in sales. There are two major ag-biotechnology clusters in Saskatoon and Guelph. Smaller clusters are developing around Quebec City, Montreal, Ottawa, Winnipeg, Calgary and Edmonton. Agri-food biotechnology builds on Canada's traditional agricultural strength by adding high value jobs, products and services.

Environment

Another burgeoning field of innovation is in the area of the environment. Through diligent research, environmental scientists have been discovering ways to use biological organisms to provide early warning of pollution and using plants to "remediate" or to detoxify polluted industrial sites. Other advances have led to more energy efficient and cleaner industrial processes by using microorganisms in place of traditional chemicals at certain stages of production in mining and other industries, or by converting the by-products into useful products (such as bioplastics).

Forestry

Advances in biotechnology forestry applications are providing ways to ensure that Canadian forest products can be produced using more cleaner and more environmentally benign processes – such as by substituting biological organisms for chemicals,

⁴ Based on a Statistics Canada's survey published in 1998. Statistics Canada is currently expanding and updating this survey which will be published in 2001.