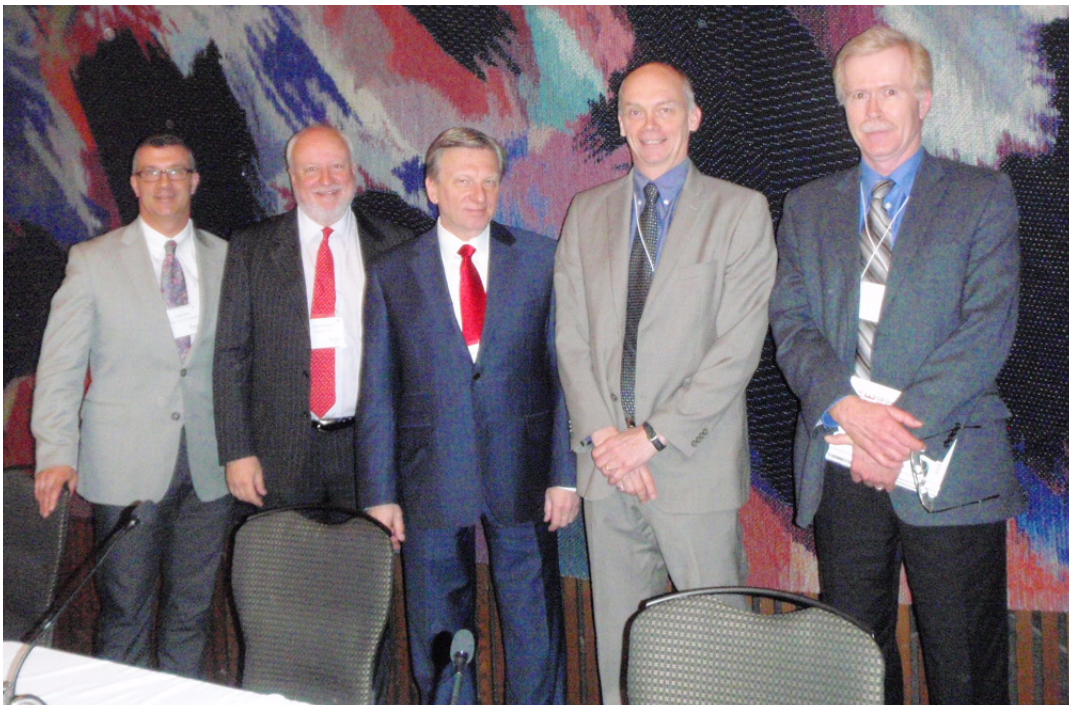
Budget 2014: Re-balancing Innovation Support Programs
The 13th Annual RE$EARCH MONEY Conference
National Arts Centre, Ottawa 22-13 April 2014
Day 2 - 23 April 2014

Panel Discussion

Building New Industries from Disruptive Technologies



Moderator: **Bert van den Berg**, Acting VP, Research Programs, NSERC

Pierre Meulien, President & CEO, Genome Canada
Marc Pecen, CEO, Approach Infinity Inc.
James Price, Founding President & CEO, Canadian Stem Cell Foundation

Price began with a description of the remarkable features of stem cells, which have established a new paradigm for looking at how we approach various types of diseases, especially those regarded as incurable or chronic. "This is an area with tremendous potential," he said, noting that there are already proven clinical examples of this technology at work, such as bone marrow transplants to treat various types of blood-based cancers. Nevertheless, he suggested that the commercial potential of this field has yet to be realized. "But that's about to change," he added. "We're at a major inflection point and over the next 10 years we'll see a lot more therapies moving toward clinical trials." Currently, there are about 4,000 early-stage clinical trials being conducted, and some 40 products approved for the market, most of them having just been approved in the last five years.

Meulien explained that our ability to analyze genomes has improved by many orders of magnitude over the past decade, which has had a profound effect in all sectors of the life sciences, and in particular becoming a powerful way of seeking new medical applications. In Canada, not only has human health become a priority for genomic analysis, but so too have possibilities affecting agriculture, forestry, fisheries, and environmental remediation. "As soon as we talk about bio-anything," he said, "it means that we have genomes to decode, genomes to read, and information to use in order to innovate." By way of example, he described the sequencing of the bovine genome, which is employed by dairy cow breeders. One such cow came up for sale at $140,000, with the only criteria determining its price being its list of genomic features. "Those dairy industry players that did not adopt the bovine sequence into their breeding program no longer exist," he observed. "That's what I call disruptive." Similar changes are under way in a variety of other areas, such as pig breeding and tree planting.

Pecen offered a business school definition of "disruptive", as anything that creates a new market segment by displacing an old one. Quantum computing is promising to have just this kind of impact, since it will soon be poised to break all existing public key cryptography. This will pose challenges for everyone with a stake in databases that are currently regarded as secure, such as the ones holding credit card information, which will now become accessible to anyone with a quantum computing capability.

The panelists described how the development of these disruptive technologies is taking place in collaboration with a number of different partners. Meulien said genomics is establishing an interface between academic investigators and prospective industry partners. "We ask users to define what problem they have and what solutions genomics can bring to that problem, then link those up to academic groups who can work very intimately with them," he said. "We have the most amazing industries coming forward, that you wouldn't believe have problems that genomics can solve. It's just extraordinary, the breadth and depth to which genomics will be a part of everybody's lives." He added that among the most interesting questions raised by this activity is that

of who the follow-on investor will be, which could be the key to building entirely new industries in Canada.

Price pointed out that stem cells were in fact discovered in Canada and the country remains a top player in research in this field. This has also resulted in a highly collaborative and cohesive research community, which has been sustained and reinforced by federal government support. He pointed out that his own foundation was spun off the Stem Cell Network two years ago, leading a group of like-minded organizations to come up with a Canadian strategy for this field. Meanwhile, other jurisdictions that have more modest stem cell research programs are fast-tracking their own efforts in this area, as he suggested Canada should be doing. The first draft of the Canadian Stem Cell Strategy, which should be ready this summer, will examine the next steps Canada should be taking. “We're looking at how we try to unlock investment from a number of different sources,” he said, adding that new infrastructure should be installed that will yield the greatest benefits for the country.

Pecen’s firm has worked with developers on fundamental aspects of the technology, as well as its commercialization, including a demonstration for the federal government, which is interested in the critical mass of quantum computing talent that Canada hosts. He outlined his major challenge at the moment as that of instructing researchers on the importance of determining the value chain for the innovations or the capital structure of new firms. He added that much of this interest has come from the government itself, which wants to take advantage of the considerable resources being assembled by his firm.

Meulien said larger corporate players in the genomics industry are well established in the US, where many of them were prominent in the Human Genome Project of the 1990s. Since then, however, smaller firms have been emerging with disruptive technologies that are starting to attract the attention of these major interests. In the case of Canadian start-ups, this has often led to acquisitions that remove these firms from Canada, though sometimes they do maintain operations here. Looking beyond the existing suite of industries with an interest in genomics, though, he foresees the emergence of entirely new classes of firms. “We have a huge energy and mining sector in Canada, which has created environmental issues,” he said. “There’s a huge potential for a biological solution. It’s not a magic bullet; it will be biology, engineering, and chemistry, but I believe companies should be created here to deal with this.” By taking advantage of the knowledge and talent already established in Canada, he argued, we could build up companies to export these solutions to other countries facing the same environmental challenges.

Genome Canada is looking forward to facilitating the emergence of these ventures, and as such are launching a program in 2015 dedicated to genomics, natural resources, and the environment. “We’ve done a lot of work over the last 18 months trying to better understand the sectors where we believe we can add value,” he said, noting that prospective partners such as mining firms must often be educated as to what genomics can do for them. “We cannot do enough in that do-

main, and we love bringing these groups together to educate ourselves about what the problems are and whether genomics can be part of a solution."

Price returned to his earlier description of how his foundation is trying to cultivate the commercial potential of research being conducted in Canada. He gave the example of one of the country's leading success stories in this field, Vancouver-based firm STEMCELL Technologies. The firm has some 500 employees, doing $100 million worth of business every year, almost all of which is exported. "It is in the supply segment, providing tools, reagents, media — the types of things you need to properly grow and produce these cells," he said. "It's a great Canadian success story, 100% privately owned and very much committed to staying in Canada." Price suggested that stems cells are simply too broad a topic to consider as a whole, and commercial success will come as it has for this firm, by focusing on areas of strength. As a couple of examples of where this could occur, he mentioned work that could alter the basis of all blood transfusions by producing blood directly from stem cells as well as work that may fundamentally alter the treatment of diabetes by using stem cells to grow essential pancreatic tissues for transplantation. "Our challenge is trying not to be all things to all people," he said, recalling that early drafts of the Canadian stem cell strategy have reinforced this perspective. "It's not just about research for the sake of research. It's saying let's pick some areas where we can harness our expertise. Let's look at the type of regulatory changes that need to be made to encourage more clinical trial development in Canada."

With regard to international competition in quantum computing, Pecen focused on the concept of security, which is intimately linked with cryptography and privacy when the future of information technology is being discussed. According to surveys of users, security is regarded as being important, but there is a resistance to paying directly for it. He traced this to aspects of Canadian culture that he has witnessed as an immigrant from the US, specifically an unwillingness to make critical decisions on matters such as security.

Meulien said Canadian geography plays a part in the nature of Genome Canada's work, in particular the dominant economic platforms of different regions, such as agriculture on the prairies and fisheries on the coasts. Potential users of genomic applications are located in these places, as are the researchers who could develop those applications. While the network is coordinated nationally from Ottawa, there are regional offices that can drive what is happening at the local level across the country. "These communities play a key role in what we do," he said. "They'll come to us with ideas."

Similarly, while a great deal of the leading research in quantum computing is taking place in the Waterloo region, Pecen insisted that the commercialization of this work could happen in a much more dispersed way. "Now it's just good engineering, bringing the stuff up to product level in the next few years," he said.

With regard to stem cell work, Price pointed to several places across the country that have strengths in both research and development, although the various parts of this process are not necessarily co-located. "You may have the biology of neural stem cells at the University of Calgary, but you've actually got the bioengineers that can scale up production at the University of Toronto, and then you've got a world-leading neurosurgeon who happens to be at the University of Saskatchewan, transplanting those cells in the brain to treat Parkinson's disease," he said. Nevertheless, Canada does have the ability to link these individuals and their work. "Canada's probably one of the few jurisdictions in the world that could create and support those types of collaborations," he said, adding that the commercial specifics of that support are still rudimentary. "The traditional VC market is starting to move into this area. There are pockets. But in Canada our investment is very low. Part of what we're doing with the stem cell strategy is recognizing that, looking at ways of encouraging more outside investment in Canada and putting together funding vehicles that allow investors to participate with government to move the technology forward."

A questioner from the audience asked what needs to happen in order to turn a disruptive technology into a competitive advantage. Pecen insisted that partnering with the US was crucial, since so much of the development work in his field is taking place there. Meulien saw the future of genomics in different terms, as something that could be married with industries that are already well established in Canada, taking their performance into new spheres. "Some of this is already happening; it varies from sector to sector," he said. "But we need to find tools to encourage it, and make sure that what is created in Canada remains here. Canada is a world leader in dairy cow breeding. We should have world leadership in the forestry sector, the fisheries sector, because we know that we have the best genomics in these areas. We just need to build on that."

Nor should it only be the government that is responsible for ushering in this change. Meulien argued that industry should be highly motivated to embrace these genomic solutions to many of their problems. By way of example, the National Research Council is assembling partners to collaborate on superior wheat strains.

In this context, Price returned to the subject of clinical trials, where Canada is recognized as a world leader. "We could be a benchmark country for rigorous, safe clinical trials using cell-based therapies," he said, reiterating that this would need a review of the regulatory approval process. Complicating this prospect is the fact that such approval takes place at the federal level, while health care reimbursement takes place at the provincial level, and varies significantly from one province to the next, which is why commercial development of some cell-based therapies have left the country. Regulatory changes that resolved this disparity, he concluded, would move this kind of commercial development forward.

Another questioner suggested that the potential of some of these technologies is so profound that they must be handled by established, larger enterprises, as opposed to start-up firms. From this

perspective, the more pertinent question is why that should happen in Canada as opposed to somewhere that these enterprises already exist.

Price insisted that stem cell technology is as advanced in Canada as anywhere else. “I would argue that we are on the verge of really big change,” he said. “We’re seeing all kinds of investment. Our question is whether we’re going to make the types of things that we need to do so that we’re actually there when the technologies get commercialized.” In this respect, the strategy on stem cells is not directed at growing start-ups, but attracting established entrepreneurs to use this technology to create wealth. “The game is not lost,” he argued. “It’s not lost to Japan, it’s not lost to the UK. But ask me that question five years from now if we don’t make the kinds of bold changes that we’re going to be advocating for. The game will be lost then.”

Meulien did not want to draw distinctions between the virtues of big versus small enterprises, but instead discussed Genome Canada’s work on bioremediation in the energy sector. This work, which features a $10 million project to study the bacteria that take up waste products from oil sands extraction, is half-funded by the five largest energy companies in Alberta, which have applied no claim on any resulting intellectual property. “They have this problem that’s across the industry, and they’re willing to try and solve it,” he said. “This is just the beginning of this kind of model.” A similar approach has won the support of pharmaceutical companies looking at genomics to augment drug discovery.

A follow-up question picked up on the point that regulations may have to change for commercialization of this research to succeed, raising a question about whether researchers need to be more actively engaged in this part of the process. Meulien said his researcher have become quite active in regulatory affairs.

Ron Freedman suggested that the larger issue is asking whether Canada will actually derive any value from the technologies that are being developed here. People do not pay for technology, he insisted, but they do pay for goods and services, and he wondered how those goods and services will be identified. Meulien responded that this circumstance will vary from one case to the next.

Price offered the example of a product that was developed to treat diabetic ulcers, which was ultimately commercialized in the US because no one in Canada would pay for it. Despite such counterexamples, though, he maintained that it is still early days. “Do we have a large Canadian company right now delivering cell-based therapies?” he asked. “No we don’t. But no one else does either.”